2015

The ongoing faculty development system: A case study exploring content methods teacher education faculty technological, pedagogical, content knowledge development

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THE ONGOING FACULTY DEVELOPMENT SYSTEM: A CASE STUDY EXPLORING CONTENT METHODS TEACHER EDUCATION FACULTY TECHNOLOGICAL, PEDAGOGICAL, CONTENT KNOWLEDGE DEVELOPMENT

An Abstract of a Dissertation

Submitted

in Partial Fulfillment

of the Requirements for the Degree

Doctor of Education

Approved:

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July 2015

ABSTRACT

Society has changed from manufacturing to information-based, resulting in an emphasis in different knowledge and skills. When entering the profession, new teachers will be expected prepare learners for key 21st century skills using digital technologies. At a time when near technological ubiquity exists, development of these skills using digital tools has become an expectation. As teacher education programs have responded to the demands for more new teachers that can leverage technologies to develop 21st century skills, much of this preparation has occurred in instructional technology focused courses. However, in recent years attention has shifted to developing these skills in content methods courses, which have the potential to more deeply contextualize the use of digital technologies within individual disciplines. As faculty have requested more faculty development support, often decontextualized technology-focused workshops have been the misguided response. This has resulted in faculty disenchantment with development offerings due to a lack of applicability within their courses. The purpose of this study was to explore a different approach to faculty development grounded in Technological, Pedagogical, Content Knowledge (TPACK), social constructivism, adult learning theory, and systems theory.

An embedded mixed method exploratory case study was used to examine a cohort- and design-based faculty development experience, how faculty implemented TPACK-based instruction, and changes to faculty and preservice teacher TPACK. Data was collected using faculty interviews, participant observation, and a candidate survey and was analyzed using Grounded Theory and Constant Comparison, as well as descriptive and inferential statistics. Results indicated the emergence of an ongoing faculty development system where faculty progressed through the entire instructional design process while engaging in development activities throughout the study. Key themes identified were the differences faculty described between “one shot” and ongoing faculty development, as well as the value of faculty developer support as being both personalized and dispositional in nature, allowing for more faculty comfort and risk taking. There were also increases in faculty TPACK, as well as statistically significant increases in some candidate TPACK domains. Given the ongoing nature of faculty development that emerged in this study, attention is given to the implications of this phenomenon within higher education.

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DEDICATION

I dedicate my dissertation to my wife, Katie, who has supported me throughout this entire experience. Thank you for taking care of our children on the many nights and weekends when I had to seclude myself to study and write. Without your love, support, and encouragement, I would not have gotten this far. This is as much my dissertation as it is yours. Thank you for helping me achieve my dreams. I am so lucky to be able to spend my life with you.

I also dedicate my dissertation to my children, Henry, Nora, and Violet. You each have been the shinning light at the end of my tunnel that has inspired to keep going. I hope that in time you too will have the opportunity to reach for your dreams. I have a special place in my heart for each of you. I love you all so much.

Finally, I dedicate my dissertation to my family, especially my parents, Don and Sue, and my grandmother, Ellen. Each of you instilled within me the value of education that has provided the foundation for where I am today and where I will be tomorrow. Everything that I have done stems from you. I can never thank you enough.

ACKNOWLEDGEMENTS

I want to acknowledge my dissertation chair, advisor, and friend, Dr. Mary Herring, for the constant support and feedback she has given to me throughout this journey. Her guidance and expertise helped me take an idea and turn it into a career, for which I will be eternally grateful. Her support for my writing and the many hours she spent editing my work helped me become more articulate and artful in this dissertation. I also want to thank my other committee members for their support over the past many months: Dr. Sohyun Meacham, Dr. Sarah Montgomery, and Dr. William Callahan.

I also want to acknowledge Maryam Rod-Szabo for helping me with my data analysis, as well as being a friend throughout this entire process. Her help and kind words and assistance were instrumental in completing my dissertation.

Finally, I want to acknowledge Denise, Sarah, Wendy, Stephanie, and Lynne. I have learned so much from each of you. I can never thank you enough for all that you have done.

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CHAPTER 1

INTRODUCTION

Society has changed from a manufacturing based economy to information based, and with it so too have the skills required for success (Darling-Hammond, 2010; Greenhill & Petroff, 2010; Wagner, 2012). As U.S. jobs are automated or moved to other countries, the results have been devastating (Darling-Hammond, 2010; Wagner, 2012). Wagner described: "People who may once have made $30 an hour on the shop floor now consider themselves fortunate if they find a $7-an-hour job sweeping the Walmart floor" (p. 1). There is a supply and demand problem; the skills people have are no longer in demand and the skills needed for the future are in short supply. Successful individuals in the future will be problem-solvers, creative, collaborative, critical thinkers, globally aware, civic-minded, technology literate, and effective communicators, among a slew of other critical skills and dispositions (Darling-Hammond, 2010; Greenhill & Petroff, 2010; Kay, 2010; Wagner, 2012). Gardner (2010) described these skills in terms of the types of minds people need to have and have cultivated. Yet, in order to prepare today's youth, the millennial learner for the 21st century (DeBard, 2004; Pearlman, 2010; Vie, 2008), a traditional approach to education is not enough (Herring et al., 2015).

The millennial generation, those born between the early 1980s and the early 2000s (DeBard, 2004; Pearlman, 2010; Vie, 2008), enter school with "unbounded imagination, curiosity, and creativity" (Wagner, 2012, p. 18). That is, as Wagner explained, until they realize that being able to answer the question right is valued more by the current education system than their own ideas. Prensky (2001) referred to millennials as digital natives, describing them as preferring graphics, interaction with others, access to information, and would rather engage in gaming than what older generations would otherwise term serious work. Sander, Stevenson, King, and Coates (2000) found the learning experiences preferred most by these students are more active, including interactive lectures, student-centered learning, and group work. Sander and his colleagues also found the least preferred learning experiences were student role-play, formal lectures, and student presentations. As these children have progressed through school, often their teachers, which Prensky called digital immigrants, complain about their lack of engagement and work ethic. He explained

that rather than looking at the lack of learner engagement as the problem, perhaps the true cause is the type of learning students engage while sitting in school?

Marsh and Willis' (2007) definition of curriculum unpacks Prensky's (2001) assertion about the disengagement of the millennial generation in school. They explain that curriculum is inextricably connected to instruction and should be based on the following areas: (a) the subject matter to be learned; (b) the needs of the learners; (c) the needs of society. Therefore, the disengagement that Prensky describes is likely the result of a curriculum that has yet to respond to both the needs of the learner and society. Gardner (2010) stated that throughout history there have been major changes in the education system that fundamentally altered how learning occurred, such as when learning shifted from auditory to written approaches. He believes the early 21st century is another one of those defining moments in history where learning will again undergo major shifts that alter how individuals learn, due to the globalization of society that has occurred in recent years. This globalization has partially been due to the reliance on science and technology, as well as the need for individuals to connect to different people, cultures, and information. The question now is how do educators move forward to develop new curricula that support 21st century learning?

Berry (2011) suggests the first step is to "imagine a future that departs from the past" (p. 1). Some have indicated that to develop the skills needed to be successful, the way in which students learn must change to become more personalized through project- and problem-based learning combined with performance assessments (Christensen, Horn, & Johnson, 2008; Herring et al., 2015; Pearlman, 2010). A key component of enabling this type of learning will be the use of the same digital technologies that have pervaded our society to enable complex problem solving situations for learners that connects them with people, other cultures, and information (Darling-Hammond, 2010; Gardner, 2010; Herring et al., 2015; Iowa Department of Education, 2010). To educate the children of the 21st century, teachers will need to take steps to move away from the educational practices that have served them well in the past (Gardner, 2010).

There are no simple solutions for educators as they prepare for the 21st century learning environment and the issue is compounded as more and more veteran teachers enter the twilight of their

careers and begin leaving schools en masse. Duncan (2009) estimated that approximately one million new teachers would fill these positions as the Baby Boomer generation exits the classroom. The Bureau of Labor Statistics (2013) has indicated that by 2022 about 470,000 new elementary school teachers will be required. While this number is lower, it does not account for the number of teachers leaving the field early in their careers. The literature suggests that the attrition rate is as high as 50 percent of new teachers leaving within the first few years of being in the profession (Clandinin et al., 2015; Ingersoll, 2001). Given the demand for new teachers, the issue of preparing PK-12 learners for the 21st century no longer is limited to local education agencies, but rather is an issue teacher education programs have had to wrestle with as well (Bransford, Darling-Hammond, & LePage, 2005; Duncan, 2009; Greenhill & Petroff, 2010). As the consensus continues to build about the vision of PK-12 education, teacher preparation programs are able to begin aligning programs to better meet the needs of their learners. What becomes problematic, then, is ensuring that teacher educators have the appropriate knowledge and skills to meet this changed landscape. A critical aspect in meeting that demand will be effective faculty development.

Overview of the Problem

Just as PK-12 institutions have had to make fundamental changes in how they operate over the last few decades to meet the demands of the 21st century, so too have teacher preparation programs, which can be seen in the way faculty development in higher education has evolved during that same period. Prior to the early 1970s, the goal of faculty development was to develop the capacity of faculty members as scholars, not teachers (Sorcinelli, Austin, Eddy, & Beach, 2006), with the underlying assumption at the time that faculty were capable of teaching with little training since they were experts in their content area (McLean, Cilliers, & Van Wyk, 2008; Tiberius, 2002 as cited in Sorcinelli et al., 2006). However, by the early 1970s faculty development programs emerged seeking to enhance faculty teaching due to increasing demand for improved educational quality, while still sustaining faculty status as researchers. By the 1990s the goals of faculty development expanded to more theoretical knowledge about teaching and learning, as well as preparing faculty to respond to varying student needs, including expectations students have for more active, student-centered learning experiences through the use of educational technologies, and as a

result, during the early 2000s more organized units on campuses became charged with faculty development (Sorcinelli et al., 2006).

While higher education institutions have come to recognize the need for faculty development to improve the instruction in college classrooms, this does not mean that the approaches to faculty development have evolved to reflect the demands of the 21st century. Centra (1976) found that the most common forms of faculty development were unpaid leave, workshops, seminars, sabbaticals, reduced course loads, conferences, and summer grants. These same faculty development practices have continued to persist into the current century (McKee, Johnson, Ritchie, & Tew, 2013; Sorcinelli et al., 2006), which begs the question, do these practices continue to be effective in supporting the development of faculty instructional practices? To answer this question it is necessary to examine the nature of the faculty development and the approach taken to develop faculty skills.

As digital technologies continue to become more central to how individuals live and society operates, requiring the development of different skills, institutions of higher education have responded in kind by beginning to target the integration of digital technologies during faculty development (Sorcinelli et al., 2006). What has become problematic is the content and means by which faculty learn about new opportunities afforded by digital tools. Mishra, Koehler, and Zhao (2007) state that the emphasis of faculty development has been on what faculty need to know rather than how they need to learn it, which has resulted in faculty development opportunities best characterized as skills only based workshops. That is, the focus is on developing the capacity of faculty to use technologies, rather than how those same technologies can be used within the faculty's course. However, "merely introducing technology to the educational process is not enough" (Mishra & Koehler, 2006, p. 1018). Mishra and Koehler argue the focus should not be on how to use the technology in isolation, which would be what Papert (1987) refers to as a technocentric approach. Rather, it should be on how the technology can be used during the learning process. Focusing on the use of digital technologies within a specific context allows educators to learn how to situate technologies for use during instruction, as well as how to operate the technology in terms of its basic function.

The problem with a technocentric approach to faculty development is the way knowledge of technologies develops. Often, knowledge of technologies are developed in isolation (Mishra & Koehler, 2006). Faculty learn about new technologies and how to operate them, but are often left to figure out how to implement that technology into their coursework. Simply put, "there is no single technological solution that applies for every teacher, every course, or every view of teaching" (Mishra & Koehler, 2006, p. 1029). Yet this is how may higher education institutions have approached faculty development. What has resulted are perceptions of faculty development opportunities as not being beneficial, and therefore faculty choose not to attend (Kukulska-Hulme, 2012). Given the pressing state of the current educational system early childhood through post-secondary (Darling-Hammond, 2010; Duncan, 2009; Greenhill & Petroff, 2010; Kay, 2010; Wagner, 2012), faculty disengagement is problematic. Therefore a new faculty development approach is needed that considers the complex interplay of content, pedagogy, and technology in order to contextualize the potential of digital tools as a means in meeting the demands of the 21st century.

Statement of the Problem

Current faculty development systems and practices throughout many institutions of higher education are likely inadequate to meet the demands of developing faculty knowledge about the dynamic and interactive nature of technology, pedagogy, and content. As a result, teacher education faculty will likely find it increasingly difficult to meet the demands of society and learners as they prepare new teachers for teaching in the 21st century, not just those faculty teaching technology-based courses. While it may seem logical that educational technology courses should be tasked with the development of preservice teacher knowledge in terms of using technology effectively, Koehler, Mishra, Hershey, and Peruski (2004) contend that this should be viewed as all teacher education facultys' work. They refer to the current division between content methodology courses and educational technology courses as the SEP syndrome (Adams, 1979); it is Somebody Else's Problem to teach preservice teachers how to integrate digital technologies effectively. However, given the projected demand for a large number of new teachers over the next few years, preparing new teachers for new and different learning environments behooves teacher preparation programs to move beyond introductory instructional technology courses to further contextualize the use of digital technologies during the learning process. Therefore, a new approach for

teacher education faculty development is required that addresses the dynamic and interactive nature of technology, pedagogy, and content. This knowledge is referred to as Technological, Pedagogical, Content Knowledge (TPACK; Mishra & Koehler, 2006), which is a knowledge all educators have, but needs developing as new technologies emerge that have implications for how teachers teach content. This study explored this issue through a cohort- and design-based approach to faculty development, where the faculty development experience persisted throughout the entire instructional design process.

Conceptual and Theoretical Frameworks

Guiding this inquiry are multiple conceptual and theoretical frameworks. These include Technological, Pedagogical, Content Knowledge; Social Constructivism; Adult Learning Theory; and Systems Thinking. While each of these frameworks provide a unique perspective individually, taken together, they provide a lens through which faculty development can be grounded within that moves beyond more traditional technocentric approaches.

Technological, Pedagogical, Content Knowledge

Contrary to the beliefs of some, teaching is a complex activity (Shulman, 1986). While subject matter experts have a single area where they must be proficient, teachers have a number of domains they must master in order to be effective. Teacher knowledge encapsulates a number of different domains, including: subject matter knowledge, knowledge of teaching and learning (Shulman, 1987), and with the emergence of ubiquitous digital tools, technological knowledge (Mishra & Koehler, 2006). Shulman (1987) states:

> There are four major sources for the teaching knowledge base: (1) scholarship in content disciplines, (2) the materials and settings of the institutionalized educational process...,(3) research on schooling, social organizations, human learning, teaching and development, and the other social and cultural phenomena that affect what teachers do, and (4) the wisdom of practice itself (p. 8).

Shulman's conceptualization of teacher knowledge became known as pedagogical content knowledge (PCK), where teachers needed to have knowledge of both content and pedagogy, as well as an understanding of how to effectively leverage both together during instruction. As digital technologies emerged, Shulman's PCK was expanded by Mishra and Koehler to include a

technology domain. To explore the nature of educator knowledge inclusive of digital technologies, each of the TPACK domains will now be described.

Pedagogical knowledge. Pedagogical knowledge (PK) is the understandings teachers have that are external to those of the subject matter to be taught (Shulman, 1986). Mishra and Koehler (2006) described PK as the knowledge of the processes, practices, and methods of teaching and learning that is a generic form of knowledge, encompassing issues such as: student learning, classroom management, lesson planning, instruction, and evaluation, in addition to knowledge of learning theories and how to apply them in context. Shulman (1987) described this knowledge as content that transcends what might be viewed as disciplinary knowledge.

Content knowledge. Content knowledge (CK) is the knowledge of the actual subject matter that students learn (Mishra & Koehler, 2006). The components of this knowledge domain vary in terms of the actual discrete pieces of knowledge depending on the subject area focus of a teacher. Shulman (1986) explained that CK is the "amount and organization of knowledge per se in the mind of the teacher" (p. 9). He stated that CK can be represented in a variety of ways, such as Bloom's Cognitive Taxonomy (Bloom, 1956) or Gangé's (1985) varieties of learning. Shulman (1987) described teacher CK as the depth of understanding of a subject area, as well as a broad liberal education that serves as a foundation for prior learning and facilitates new learning. Shulman went on to state that the teacher serves as the primary resource of students' understanding of the subject matter.

Pedagogical content knowledge. Pedagogical content knowledge (PCK) in its basic form is the confluence of pedagogical knowledge and content knowledge (Shulman, 1986; Shulman, 1987; van Driel, Verloop, & de Vos, 1998). It is the knowledge teachers have of both teaching and learning combined with the teacher's subject matter knowledge. It is this intersection of pedagogy and content knowledge, which is most representative of teacher knowledge, because content knowledge alone is just as useless as pedagogical knowledge free from content knowledge (Shulman, 1986).

The blending of pedagogy and content knowledge is of interest, because it represents "an understanding of how particular topics, problems, or issues are organized, represented, and adapted to the diverse interests and abilities of learners, and presented for instruction" (Shulman, 1987, p.8). In other

words, the blending of pedagogy and content knowledge is important, because it operationalizes content into a package for students to consider in the learning process. This allows the teacher to transform their knowledge of the content in ways that make it easier to teach and subsequently learn (van Driel et al., 1998). However, the emergence of widespread digital technologies throughout society has added another set of knowledge for the teacher to transform.

Technological knowledge. "The advent of digital technology has dramatically changed routines and practices in most arenas of human work" (Mishra & Koehler, 2006, p. 1017). Indeed, technology has penetrated nearly all aspects of our lives, necessitating a number of changes. However, change has been slow to develop in education, with Mishra and Koehler pointing to the emergence of a new teacher knowledge domain as a possible reason. This new domain is called technological knowledge (TK).

Traditionally, the role technology has had in the teaching process has been separate from any interaction with content and pedagogy. Typically, technology is used in the classroom, not as a way to interact with the content or instruction, but as a disconnected entity. Technology has been seen as a content base to be learned rather than applied, consisting of specific hardware and software skills (Mishra & Koehler, 2006). True, there is a knowledge base about hardware and software that is required to functionally use the technology, but that knowledge does little in terms of making use of technology in a meaningful way during the learning process. However, intersecting technological knowledge with PCK creates new forms of teacher knowledge: technological content knowledge (TCK), technological pedagogical knowledge (TPK), and TPACK.

Technological pedagogical knowledge. TPK "emphasizes the existence, components and capabilities of various technologies as they are used in teaching and learning settings" (Koehler, Mishra, & Yahya, 2007, p. 743). This understanding is crucial when considering how instructional decisions will be made based on what the technology does or does not allow. With the varied affordances of digital technologies, the deeper understanding of TPK a teacher has, the greater flexibility in using the technology in different ways to achieve different ends within the educative process (Koehler & Mishra, 2009).

Considering the give-and-take relationship that TK and PK inherently have with each other, TPK provides a path forward for creating new learning experiences for students, which are radically different

than what many may be familiar. TPK requires a different thought structure than non-TPACK technology use in a lesson, because when the role of each the technology and pedagogy are considered from the beginning, new types of learning experiences emerge that otherwise may not be available without the technology (P. Mishra, personal communication, October 17, 2011). Shulman (1987) spoke of transforming the content knowledge a teacher has in ways to make it pedagogically powerful. This same concept rings true when considering TPK (Mishra & Koehler, 2006). The TK a teacher has can be used in ways that allow for new types of pedagogy, ultimately leading to the transfer of content knowledge in powerful ways.

Technological content knowledge. TCK is the knowledge about how technology and the subject matter are reciprocally related (Mishra & Koehler, 2006). This knowledge represents the skills needed by teachers to know how a certain technology is going to not only interact with the content being taught, but also how the content can be expressed using the technology (Koehler et al., 2007). Koehler and Mishra (2009) state "Understanding the impact of technology on the practices and knowledge of a given discipline is critical to developing appropriate technological tools for educational purposes" (p. 65). As the technology is integrated into a lesson, it is necessary to examine the relationship between that which is to be taught and the potential technologies available to teach through.

Technological pedagogical content knowledge. TPACK is the overlap of technological knowledge, pedagogical knowledge, and content knowledge (Harris & Hofer, 2009) and constitutes good teaching in the 21st century (Mishra & Koehler, 2006; Nore, Engelien, & Johannesen, 2010), because technology, pedagogy, and content are considered equally as they dynamically interact with each other during lesson design through instruction. TPACK is the knowledge base teachers need in order to teach content using technology (Schmidt, Baran, Thompson, Mishra, Koehler, & Shin, 2009). This knowledge domain, therefore asserts that there is no single technological solution for all subject areas (Mishra & Koehler, 2006). Different courses have different requirements and ways of teaching, which means that the technologies used to teach those courses, need to accommodate those requirements. Without this knowledge, teachers will struggle to use technology in ways that lead to deeper student learning.

In the context of this study, TPACK represents the knowledge being targeted for growth by development activities for both participating faculty and teacher education candidates. As developers have

sought to develop the capacity of faculty to effectively use digital technologies to teach content, as the review of literature will support, socio-constructivist approaches are a common approach. Therefore, a similar faculty development approach was used in this study. Social constructivism embodies a collaborative learn by doing philosophical approach to learning, which is almost necessary when it comes to developing a deep understanding of the dynamic transactional relationships that exist between content, pedagogy, and technologies.

Social Constructivism

The social nature of constructivist learning is grounded in the ideas of Vygotsky (1978). He asserted that speech was a key component in attaining a learning goal. Through the use of language with others in the learning environment, individuals are able to not only verbalize their actions, but rather the speech itself is an action in the problem solving process. In addition, as the task becomes more complex and the solution less obvious, the role of speech becomes more important. He refers to this speech as egocentric speech, which focuses on the individual and his needs. This is contrasted with communicative speech, which is used to communicate with others beyond the individual.

As learners engage in problems and leverage their language with others, both communicatively and egocentrically, reflective capacity is developed as part of that process. Learners use their language in metacognitive ways to consider possible solutions and in the process reflect on their experiences. This use happens when the learner begins to guide himself through possible solutions. The result of this process is cognitive development. This development occurs not only through the experiences with the problem in the learning environment, but also through their experiences with the dialogue they have with others that is projected inward as they make sense of the problem (Vygotsky, 1978).

Intellectual development increases significantly when speech and practical activity are combined (Vygotsky, 1978). Vygotsky described this in young children when a child used speech to describe the action he was unable to perform, and in doing so knowledge was built through the use of that language. As the child continued to complete the action, he also learned through his experiences. This is in addition to the learning that continues to occur through his interactions with others and himself using language. “As a rule this speech arises spontaneously and continues almost without interruption throughout the experiment.

It increases and is more persistent every time the situation becomes more complicated and the goal more difficult to attain." (Vygotsky, 1978, p. 25).

Another aspect of social constructivism is the zone of proximal development. The zone of proximal development is best described as the concepts within grasp of being fully developed, but have yet to come to full fruition within the individual. A learner may be starting to understand a difficult concept, but still has not attained its complete function. Learning is often a matter of imitation. A child may imitate an adult in doing a task and by doing so the child learns how to do the task. Through the zone of proximal development that the child may not master the task on the first try, but given time, the child would learn the task. However, a key caveat exists, which is that the task, concept, or skill must be close enough within the ability of the learner to imitate, which is represented by the zone of proximal development. If that task is beyond the zone, then no matter how many times the learner attempts, mastery will not occur. The underlying issue here, then, is that as learners are engaged in problem solving experiences, it is necessary to ensure the task is appropriate (Vygotsky, 1978). This is the progressive education argument Dewey (1938) explains as a criticism of a traditional education. Simply put, in a traditional education, the knowledge gap between the teacher and the learner is so great that the content being taught is beyond the zone of proximal development for the learner.

Social constructivism informed this study at the onset by providing a framework within which development activities needed to meet in terms of providing faculty with both opportunities to learn within their own zone of proximal development, but to also develop their reflective capacity. Yet, while social constructivism represents the general process of active participation in learning, it does not fully embody the needs of adult learners. Rather, adults are unique in that they have a wealth of experiences that come to bear during learning experiences, including faculty development opportunities.

Adult Learning Theory

Knowles (1973) explained that, "…our traditional educational system is progressively regressive. The best education…takes place in the nursery school and kindergarten, and tends to get progressively worse on climbing up the educational ladder, reaching its nadir in college" (p. 41). He highlighted the ignorant nature of the educational system, where educators know what constitutes effective practice, such

as the constructivist education found in many preschools. Yet they fail to implement such experiences throughout higher education where adults are often treated as if they were children during learning experiences. In response to the needs of adult learners, andragogy emerged, which was not a major change in the way instruction occurred, but rather in the assumptions about learners. As individuals age, they become more self-directed, know when they are ready to learn, and engage in learning activities that surround authentic problems they face in the real world. Yet, as people age, the educational system fails to foster and enable this type of learning. The result is the development of a gap between what the learner desires and what the education system offers through instruction. With this in mind, it is incumbent upon faculty developers to heed the assumptions of andragogy.

The first assumption of andragogy is that adult learners are self-directed. Therefore when the adult learner encounters situations when self-directed learning is not possible, tension develops where unpleasant feelings emerge and become directed toward the learning experience. The second assumption of andragogy asserts that the experience of an individual accumulates over time and is a rich source for learning, while also allowing for new learning to be assimilated. As a result of these prior experiences, experiential learning situations are preferred since the learner will be able to leverage prior knowledge and integrate the new experience into their knowledge structures. In doing so it causes the learner to reflect on his prior experiences. The third assumption focuses on when the adult learner is prepared to learn, which is less when pressured to do so by others and more when the learner identifies a need to do so in order to perform a social role. In other words, the learner decides to learn something new, because there is value in knowing at that time, not because someone believes it is prudent to do so. The fourth assumption relates to the problem-based orientation towards learning adults have given their experiences. Adults choose to engage in learning experiences because of the value in knowing the content in order to solve an issue they are facing (Knowles, 1973; Knowles, 1980).

In conjunction with the zone of proximal development and the role of speech as a reflective metacognitive process, adult learning theory provided the conceptual means by which to engage faculty in development activities that met the pedagogic demands they experienced in their courses. Given the nature of frustration many faculty experienced while participating in development activities, this study sought to

respect the self-directed nature of faculty by allowing them to use their prior knowledge and experiences as a starting point for development activities. The goal in taking such an approach was to avoid the frustration described in the literature that prompted this study. The faculty development experience therefore, had to change from being compartmentalized to an isolated topic for all faculty participants to needing to be more holistic in nature. Systems theory provided another perspective for approaching this study.

Systems Theory

Senge (2006) states that individuals are taught to break down problems into smaller units in order to make problem solving easier. However, in the process of doing so the individual components become too isolated and disjointed to be reassembled in a holistic way. A system is anything that functions due to the actions of the parts that make it up (Senge et al., 1999). The parts of the system have a common purpose and act in a regular way with each other, because they are interrelated. Over time though, systems have become more complex, leading many people to fall into a state of hopelessness and despair. Using systems thinking provides a path for making sense of the world, because it requires us to take a step back to examine the whole system. In doing so, we are able to visualize patterns, which in turn makes change and problem solving easier (Senge, 2006).

Developing faculty TPACK represents a system that often is disassembled as evidenced through the arguments made by Mishra and Koehler about isolated TK development opportunities that fail to target the full TPACK construct. Faculty development that only focuses on TK does not consider the dynamic interactions among the TPACK domains necessary for effective technology integration where content and pedagogy are considered in conjunction with technology. As a result, faculty learn about various technologies, but may not know how to use them during instruction as they teach about the subject matter. Therefore, a systematic approach to faculty development was used in planning this study, so that participant knowledge was developed holistically where each technology, pedagogy, and content were considered as equal partners, while also seeking to minimize faculty frustration with development activities.

Research Questions

Given the nature of the problem and the various theoretical and conceptual frameworks, the research questions for this dissertation are as follow:

1. How can the faculty development experience be characterized?
2. How did faculty, while engaging in a cohort- and design-based faculty development program, implement TPACK-based instruction in their course?
3. Was there a change in faculty TPACK as a result of a design-based faculty development experience?
4. How did faculty and teacher education candidates perceive changes to candidate TPACK after the implementation of TPACK-based instruction?

Conclusion

This chapter overviewed and described some of the paradigmatic changes that are currently taking place in society that have implications for the education system. Driven by new areas of emphasis in terms of the knowledge and skills individuals need to have to be successful in the future, the role of technologies in the educative process will likely be paramount at a time when there is high teacher demand and attrition. As a result, teacher education programs have had to grapple with how to better prepare teacher education candidates for success in the contemporary classroom where technologies have a more prominent role than in the past. To respond to these changes faculty development has become vital for institutions to ensure faculty have the appropriate knowledge and skills necessary for teaching effectiveness with technologies.

As development opportunities in higher education institutions have transitioned to being more technology focused, faculty have become disenchanted with these opportunities, finding them of little value. Therefore, a new approach to faculty development is needed that transitions away from experiences that result in frustration and minimal changes to practice. TPACK represents a logical first step in this process, because in order to take advantage of technological affordances, faculty need to know about how those affordances interact with both content and pedagogy. By itself though, TPACK is insufficient and should be further grounded in the principles of social constructivism and adult learning theory where

faculty can learn about the dynamic interactions among the TPACK domains as they collaborate with their peers to solve problems of practice. As faculty development activities are grounded in these conceptual ideas, a more systematic approach to faculty development can occur. In Chapter 2, the literature review will show how others have approached TPACK development, with special attention to the specific approaches that were used in this study. In addition, the nature of faculty development in general will be explored.

CHAPTER 2

REVIEW OF LITERATURE

Technological, Pedagogical, Content Knowledge Development

Technological, Pedagogical, Content Knowledge (TPACK) represents the overlap of educator knowledge about the dynamic interactions among technologies, pedagogical approaches, and content that is necessary to teach content effectively with technologies (Mishra & Koehler, 2006; Schmidt, Baran, Thompson, Mishra, et al., 2009). There has been a considerable effort among researchers to determine how best to approach the development of TPACK across multiple populations and contexts. The focus of this section is to describe the approaches and processes used by educators to develop TPACK for both experienced educators and preservice teachers. Due to a lack of empirical research on TPACK development with higher education faculty members, those studies conducted with teacher educators will be discussed under the umbrella of experienced educators.

Experienced Teacher TPACK Development

The development of experienced educator TPACK has occurred through a variety of mediums, including online or blended approaches, as well as face-to-face approaches (Alsofyani, Aris, Eynon & Majid, 2012; Blocher, Armfield, Sujo-Montes, Tucker, & Willis, 2011; Doering, Velesianos, Scharber, & Miller, 2009). In addition, the length of TPACK development opportunities has varied from a few days to several months (Guzey & Roehrig, 2009; Jimoyiannis, 2010; Niess, van Zee, & Gillow-Wiles, 2010). This section will explore the results of these studies, beginning with online and blended contexts.

TPACK development in online and blended contexts.

Online and blended contexts were a common medium for developing TPACK with experienced educators. Alsofyani et al. (2012) used Short Blended Online Training courses where learners were engaged in TPACK development experiences over three days as they learned about how to implement e-Learning. They found that participants highly accepted and valued the experience in terms of its usefulness and ease of use.

Harris and Hofer (2011) engaged seven practicing educators in online professional development surrounding the use of Learning Activity Types (LATs). They found that teachers began to use

technologies to engage students in more intellectually rigorous tasks. Before the professional development, they had focused on more affective ways of engaging learners through technology. As the teachers in this study expanded upon this phenomenon, they explained that they had become more intentional with the instructional approaches they used and the role technology had during the learning experience. Niess et al. (2010) engaged learners online through a master's course using online discussions and other design-based activities. Teachers in their study explained that they valued being able to see how to use spreadsheets to teach math and science content, which resulted in some changing their approach to how they taught with spreadsheets. However, not all teachers in their study experienced this shift in practice.

There were also instances that were of a blended nature where some development took place in an online environment, in addition to a face-to-face learning environment. Mouza and Wong (2009) used this approach through case development where teachers identified a problem of practice, developed a plan to use technology to solve the problem, implemented the plan, and then wrote a case study report on the cycle they had experienced. As a result of case development activities, learners made "significant progress towards the development of TPACK" (p. 187). They went onto explain that teachers were able to combine technology, content, and pedagogy to help their learners develop a deeper understanding of the content.

Guezy and Roehrig (2009) had an online component for their learners. However, they conducted development activities primarily face-to-face, while teachers also were enrolled in an online action research course. They found that each of their teacher participants' TPACK developed to varying degrees and that the extent of TPACK development could be related to the level of access their students had at their schools. While there were differences in the extent of TPACK development they observed, they indicated that teachers were able to reflect upon their teaching and set goals for future development. As a result, the teachers began taking steps to reform their instructional practices in order to reach their goals.

Koehler et al. (2011) engaged a group of inservice teachers pursuing a master's degree in design-based activities in a blended format. In their study, participants enrolled in a summer course were engaged in two weeks of face-to-face instruction, which was followed up with a month of online learning. Activities during the course were based on three types of design activities:

1. Micro-design activities that introduced teachers to the design process.

2. Macro-design activities that sought to have teachers make design decisions about the interactions of each of the TPACK domains.
3. A project that required teachers to reflect on TPACK in a holistic way as they solved a problem of practice.

They found, as a result of the design-based activities, that teachers perceived increases in their knowledge in each TK, TCK, TPK, and TPACK (Shin et al. as cited in Koehler et al. 2011).

TPACK and face-to-face contexts. Face-to-face learning experiences characterized a number of studies. Blocher et al. (2011) had 20 inservice educators work as a community of learners over the span of three years where they engaged both individually and collaboratively in technology-based activities that were authentic to their careers as classroom teachers. Teachers met periodically throughout the year on Saturdays in addition to a four-day weeklong experience during the summer of each year of the study. They found that teachers had significant increases in their technical competencies as well as their students' use of those technologies.

Jimoyiannis (2010) conducted a four-month program with six inservice teachers where learners engaged in two types of modules: (a) general theory of PK and TK, and (b) information communication technologies in science education. The author found that teachers' TPACK developed in ways that changed their perception of how technology should be used in the classroom experience. Teachers explained that technology integration should move beyond skills-based learning to be more deeply integrated into the curriculum.

Shafer (2008) also conducted a face-to-face program with a classroom teacher using a mentor and mentee model. She mentored the teacher in TPACK for an entire school year. At the end of her study, Shafer found that her mentee changed in two ways. The first was in achieving the communication goal he had for students about the content. The technology he used afforded him and his students the opportunity to discuss the learning processes as they engaged in various mathematical activities. The second was the instructional approach he used. Specifically, the mentee shifted to an inquiry-based approach, which came as a result of using the technology, because the technology allowed his students to take a more active role in the learning process.

Koehler et al. (2007) conducted a study where teacher education faculty enrolled in a faculty development course and collaborated with graduate students who were enrolled in an educational technology Master's degree program. Faculty and their design team of masters students met once a week for three hours throughout a semester as they developed an online course and found solutions to pedagogic problems faculty were experiencing throughout the development process. Participants in this study moved from considering each of the TPACK domains as independent constructs to thinking about TPACK as one unified framework. As faculty and graduate students shifted their thinking, they recognized the interactions between each of the domains and began applying it to their course development. They explained that this change in perception of the knowledge domains occurred as a result of the design talk participants had as they engaged in design activities.

At the opposite end of the spectrum in terms of length, Doering et al. (2009) engaged a group of teachers in a one-day workshop where there were detailed discussions about the TPACK construct. In addition, teachers also engaged in the use of a content-specific, module-based technology solution. During the workshop teachers completed one module and then taught three of the modules to their students after the workshop once they returned to their schools. A majority of the teachers in this study indicated that their knowledge of the TPACK domains changed over time. Teacher TPACK was the domain that had the largest changes from pretest to posttest. While only a one-day experience, the authors believed that the conception of knowledge development during professional development needed to expand beyond a single domain, where TPACK provides the framework for diversifying the nature of development activities.

While not examining TPACK, Baab and Hu (2013) studied a cohort approach to faculty development as a way to improve online course development. Their cohort consisted of both faculty and a faculty developer with each having specific roles. Faculty had three different roles that they served. The first was as a student learning about how to develop an online course. The second role was as a course developer where faculty developed the actual course they would use in a subsequent term. The final role was as a peer reviewer where they provided feedback to other faculty on the development of the online course. The faculty developer's role was as a facilitator during the first six weeks of the 16-week program where they would introduce new topics, assist faculty, and plan for the following week's activities. After

the initial six weeks faculty began working directly with faculty developers to finalize the development of their online course. As a result of the development experience, faculty were able to finish their course design. In addition, the cohort model helped keep faculty accountable for the development of their online course, as well as served as a positive reinforcement by recognizing the good work faculty had done. A final finding was that the one-on-one assistance from a faculty developer was helpful to ensure faculty made progress and helped solve problems faculty encountered during the latter part of the program.

Preservice Teacher TPACK Development Contexts

Preservice teacher TPACK development has been largely studied in face-to-face formats. However, a few studies have examined TPACK in online formats (Albion, 2012; An, Wilder, & Lim, 2011; So & Kim, 2009). In each of these studies, the online course was on educational technologies and their implementation within curriculum and instruction. However, TPACK development contexts have also occurred in a variety of other face-to-face contexts, such as: educational technology courses, content methods courses, and concurrent courses in both educational technology and content methodology.

Educational technology courses appear to be a logical home for TPACK development for preservice teachers. Angeli and Valanides (2005) explored the development of TPACK through the design and development of instruction where TK was developed independently as needed. They found that this instructional design approach that they used was more effective at developing candidate knowledge than a case based model that had previously been used. Angeli and Valanides (2013) examined within an educational technology course design tasks where preservice teachers established the connections between technological affordances, content, and pedagogy in relation to learner content related difficulties. They found that the more complex a task, the less TPACK development occurred. Figg and Jaipal (2013) engaged their educational technology students in the creation of TPACK development workshops for inservice teachers. They found that developing and implementing the workshops engaged candidates in a situational learning experience where they had to think more deeply about the role technology had in enhancing student learning. Hu and Fyfe (2010) studied preservice teachers as they worked on collaborative, problem centered design tasks where learners reflected on their actions. The approach they took appeared to increase candidate confidence in selecting appropriate technologies, while also increasing

their ability to combine and think critically about the TPACK domains. Kramarski and Michalsky (2010) conducted an experimental study examining an educational technology course taught surrounding the use of hypermedia and hypermedia with metacognition. In this study, preservice teachers were randomly assigned to one of two sections of the course where the experimental group learned about the TPACK construct and then engaged in design activities meant to develop their TPACK. While candidates in both groups experienced development in their TPACK in terms of comprehension and design skills, the hypermedia with metacognition approach was more effective than the hypermedia only approach.

Content methods courses have also been a context for preservice teacher TPACK development. Jang and Chen (2010) conducted a study where participants learned about the TPACK construct and then observed it in action. This was followed by the opportunity for preservice teachers to practice developing and implementing TPACK based instruction, which they then reflected upon. The results of their study indicated that candidates thought they had learned how to integrate technologies, as well as had a deeper understanding of the content knowledge they were teaching through technologies. Lee and Hollebrands (2008) took a different approach where students interacted with video based curricular materials designed to develop their TPACK as they learned about teaching statistics and probability. Findings indicated that after modifying the curricular materials that students were slightly more able to make appropriate interpretations of learner understanding when graphing calculators, in addition to written work, were used. Özgün-Koca, Meagher, and Edwards (2010) emphasized content specific technologies and candidates subsequently designed and implemented technology enhanced lessons. They found that candidates had a better understanding of technologies, which resulted in thinking of technology as a tool for developing content knowledge. Koh and Divaharan (2011) conducted a study where faculty modeled the use of a technology tool to promote student acceptance of the tool. Then the students engaged in activities that developed their competency with the tool prior to creating any lessons that would utilize it during instruction. The final stage of their development model was to engage learners in lesson development. This approach was effective in increasing candidate confidence related to the use of the tool.

Preservice teachers' TPACK development was also examined as they were concurrently enrolled in educational technology, content methods, and field experience courses. Hofer and Grandgenett (2012)

examined TPACK development across a fifth year teacher certification program. In this study, preservice teachers developed their TK directly in an educational technology course, but then extended their knowledge within content methods courses and field experiences. Candidates experienced the largest growth in TPACK during the semester when candidates took their educational technology course. However, that growth persisted through the following semester of student teaching as well, which indicated that their knowledge was reinforced during practical learning experiences. In a study by Mouza, Karchmer-Klein, Nandakumar, Ozden, and Hu (2014), a similar approach to TPACK development occurred across the same three types of experiences. In this study, varying degrees of TPACK development occurred in the three different courses. A challenge highlighted by the authors, however, was the need for additional faculty development for non-educational technology faculty, as well as technology-rich field experiences. Niess (2005) studied mathematics and science preservice teachers as they moved through a fifth year licensure program where learners engaged in content specific problem solving activities, lesson development and implementation, and video based reflection. The results indicated that only some candidates identified the interactions that occurred between the science and the technologies, which the authors hypothesized, could have been related to candidate comfort with technologies as well as prior learning experiences where technologies were used.

Synthesis of TPACK Development Approaches

Educational technology contexts.

TPACK development has occurred through a number of approaches in educational technology contexts. The design and development of instruction was a common approach (Angeli & Valanides, 2013; Figg & Jaipal, 2013; Hofer & Harris, 2010), which promoted the value of having coursework that models the authentic work of practicing teachers. In addition, creating instruction aligns very well with the principles of social constructivism and adult learning theory by engaging faculty in active learning processes that leveraged their knowledge and skills. While instructional development was the common approach, the embedded qualities of each varied in its own unique way. For example, Angeli and Valanides (2013) used a process called Technology Mapping where candidates learned about the affordances of a technology and then saw them modeled within a content area. Then candidates had the opportunity to transfer what they had initially learned to a new situation as they created

their own lessons that applied the affordances of the technology. While Angeli and Valanides found that candidate TPACK did increase, they also learned that there appeared to be a negative correlation in terms of the complexity of the technological affordance and candidate TPACK development. According to Koehler, Mishra, Kereluik, Shin, and Graham (2014) it is probable that the existence of this correlation is due to the lack of knowledge candidates have within each of the TPACK domains, which is due to their lack of teaching experience.

The LATs approach used by Hofer and Harris (2010) on the other hand, took a different approach to lesson development. In this approach, candidates examined a number of lessons developed with different LATs. Candidates then created their own lessons using LATs, as well as a planning guide that assisted candidates as they constructed their lessons. Figg and Jaipal (2013) built on the LATs in their development approach. As part of the TPACK-in-Practice Workshop, candidates created professional development opportunities for practicing teachers on specific technologies, which were grounded in the LATs. In these opportunities, candidates modeled technological affordances, facilitated discussions, and assisted teachers as they created their own instruction using what they had learned. Unique of this development approach was the experiential nature of the learning experience that increased the authenticity of the project. Not only did candidates have to design the lesson for the teachers, but they also had to teach it, thus providing them with both teaching experience as well as informal leadership opportunities as they collaborated with their more senior peers.

Content method contexts. Lesson planning was a common TPACK development approach in content methods courses as well, which is unsurprising given the heavy focus on blending pedagogy and content together in these contexts. However, unique to these contexts was the role of faculty modeling. For example, Jang and Chen (2010) used the TPACK Comprehension, Observation, Practice, and Reflection, or TPACK-COPR, approach where faculty modeled how to effectively use a technology to teach the subject matter. Modeling the effective uses of technology to teach content is important due to the apprenticeship of observation (Lortie, 1975) that occurs. Regarding effective teaching with technologies by preservice teachers, Ertmer and Ottenbreit-Leftwich (2010) explain, “although today’s students may be fairly knowledgeable about a variety of ICT tools, they have little to no knowledge about how to use these tools

to facilitate student learning" (p. 268). Therefore, faculty modeling is likely an important factor when developing candidate TPACK.

Koh and Divaharan (2011) used a similar approach. In their TPACK-Developing Instructional Model, faculty model technologies to their candidates that targets candidate TCK and TPK, which Pamuk, Ergun, Cakir, Yilmaz, and Ayas (2013) identified in their study as the two TPACK domains that influence TPACK development the most. Koh and Divaharan thought that the modeling specifically, in addition to the candidate exploration that occurred in the learning experience, was important in developing the instructional strategies candidates had that could take advantage of digital technologies. This again, reinforces the Lortie's (1975) idea of the apprenticeship of observation.

Faculty modeling extended to Ozgun-Koca et al. (2010) TPACK development approach. In their study, faculty modeled how a technology could be used to create many different lessons. In doing so, faculty were making explicit the connection between PCK and TK. Redmond and Lock (2013) also used modeling as they engaged candidates in experiences related to creating diverse, digital learning environments. Faculty in this study modeled effective technology integration through contemporary issues, such as cyber bullying. They found that there were perceived TPACK increases in each domain except TK and PK.

The studies reviewed in the preceding section provided an overview of TPACK development approaches. However, two TPACK development approaches emerged from the literature that aligned well with adult learning theory. Specifically, the LATs and learning technology by design approaches fit well with adult learning theory due to the focus on creating instruction. When creating instruction, faculty are able to guide instructional development to meet their specific needs, which is one of the key assumptions of andragogy. Therefore, as faculty engage in both of these approaches, they experience the dynamic and interactive nature of TPACK.

Approaches to TPACK Development

In examining the specific strategies used to develop TPACK in both preservice and experienced educators, a common approach is through lesson design, which is often implemented within varying contexts depending on the educator. However, there currently are very few empirical studies that examine

the process educators move through as they develop TPACK based lessons. Two approaches have been described in detail both through anecdotal and empirical works.

Learning Activity Types

One approach to TPACK development has been through the use of LATs (Harris & Hofer, 2009). LATs are conceptual planning tools that assist teachers with the design of instruction that leverages the use of technology. In contrast to beginning with the technology's affordances and constraints in mind and making curricular decisions from this perspective, teachers, both preservice and inservice, are able to begin from the content and pedagogical needs of their students prior to any decisions to use certain technological tools. Harris and Hofer explain that by doing so teacher TPACK is developed more authentically rather than technocentrically, because the interplay between each knowledge domain is still considered by the teacher. This approach to TPACK development does not presuppose any particular pedagogical approach as being more effective than another. Rather, all instructional approaches for a particular content area are included by design (Harris et al., 2010).

Implementing LATs and TPACK development. LATs are the specific actions learners are engaged during a learning experience, with multiple LATs comprising a lesson plan. TPACK development can occur with the use of LATs, because each type of activity within a subject also includes a list of technologies that can be used to enhance the learning that occurs (Harris et al., 2010). These suggested technologies are referred to as being grounded, due to the contextualized and content-specific nature of the activity type. As teachers make practical decisions about which suggested technology to use for a given LAT based on the pedagogical and contextual appropriateness and subsequent incorporation into a lesson, TPACK development occurs (Harris & Hofer, 2009; Harris & Hofer, 2011; Harris et al., 2010).

There are a number of LATs within a subject-area, and are categorized into subcategories, such as knowledge building activities and convergent knowledge expression activities (Harris & Hofer, 2009; Harris & Hofer, 2011). The subcategories, however, are different for each content area. Each content area LAT subcategory is aligned with potential technologies, thus creating a taxonomy for teachers to use during lesson and unit planning (Harris & Hofer, 2011; Harris et al., 2010).

LATs and inservice teachers. Due to the recency of LATs, few empirical studies have been conducted. Harris and Hofer (2011) found that the use of LATs by social studies inservice teachers allowed participants to became "more conscious of the multiple options available for technology-enhanced learning activities and therefore expect to incorporate a broader range of both learning activities and technologies into their planning in the future" (p. 226). They also found that with these participants, when a certain technology tool did not fit with the planned instruction, the technology was not used as opposed to using the technology for technology's sake. At a deeper level, the concept of fit between CK, PK, and TK was, according to the authors, how participants conceptualized and operationalized TPACK. In addition, the experience of struggling with making each knowledge base fit with each other is how these teachers developed their TPACK.

When working with inservice teachers, Hofer and Harris (2010) often engaged them in experiences where the teachers could focus on different types of learning activities. They had participants write down three to five curriculum topics. Then the participants were provided a number of pedagogical techniques, such as: reading a text, discussion, etc., and instructed teachers to create activities based on their own learning preferences. In doing so, teachers began to explore how PK and CK overlap to make a learning activity grounded in PCK. Upon creating the PCK-based activities, they received cards with various technologies listed on them and asked participants to combine them into groups that integrated technology, pedagogy, and content. As teachers did this, they discussed "how well the three 'fit' together" (p. 3859). Hofer and Harris offered that exploring whether the combinations created by the teachers fit well together was an important element in the process. By doing so, teachers were able to develop an awareness of the "deliberate process of selecting learning activities to support a particular curriculum topic" (p. 3859).

After exploring the dynamic interactions of TPACK, the LATs taxonomies were introduced and the structure of the LATs were examined in depth so teachers could develop a familiarity with particular LATs. While planning for instruction, teachers created instructional objectives and procedures for assessment. Then technology considerations were made. Examining the role of technology at the very end of the planning process was central to the LATs implementation process, so as to avoid approaching technocentric lesson design where the technology was considered void of any content or pedagogic

affordances or constraints. Inservice teachers indicated two primary benefits to the LAT approach to TPACK development. The first was the ability to re-familiarize themselves with the full range of activities associated with a content area. This often prompted them to change their own approaches to teaching their courses, allowing them to create more varied lessons and units. The second benefit was the narrowing of the possible technology tools available for use. Since each LAT has a very limited number of suggested technologies, the teachers had only a few options to work with in terms of technologies. When using LATs with preservice teachers, more scaffolding was required due to the lack of classroom experience, as well as the lack of knowledge novice teachers had about content and pedagogy. The approach taken in an educational technology course was to have students examine three lesson plans with very different content and instructional approaches. The preservice teachers identified the LAT used in the lesson and then brainstormed alternative activities that could be used in place of the original with the same or increased efficacy. The key understanding sought to establish in preservice teachers was that there is no single LAT that is a preferred starting point. Rather, LATs should be selected based on purposive use and be varied (Hofer & Harris, 2010).

LATs and preservice teachers. In similar way that Hofer and Harris (2010) described for inservice teachers, preservice educators then moved onto developing lessons based on the LATs. One difference, however, was the level of scaffolding preservice teachers experience. An example of this is the planning guide students go through that prompted them on various aspects of lesson planning, such as activating prior knowledge. Once preservice teachers had developed their lessons, they then considered the role technology could have by examining the potential technologies for the activity types they selected.

While there have been few empirical studies on the LATs individually, there have been some that integrated them as part of a larger TPACK development approach. Albion (2012) found that these taxonomies were useful for developing preservice teacher TPACK, although they required additional support with understanding the idea of the LATs due to their inexperience and lack of knowledge with combining content, pedagogy, and technologies.

Figg and Jaipal (2013) used the LATs in the first of the four phase TPACK-in Practice Workshop, where preservice teachers prepared and led a TPACK-based workshop for inservice teachers. During the

first stage of this model, the LATs set the stage for the workshop. The instructor modeled the LATs as well as one of the suggested technologies, which provided the essential activity learners would be learning how to implement within their own classroom. The second stage of their model was pedagogic dialogue where participants engaged in discussion about how the technology fit within the activity type that was modeled in the previous stage. The authors state: "Without this conversation, teachers are merely participating in the technology-enhanced activity and not making connections between TK and TPACK-in-Practice knowledge" (p. 5042). The next phase was a demonstration of the tool, where the learners are taught a very limited number of skills. The skills that are taught are specific to enacting the LAT that was modeled in the initial phase of the workshop. The final stage provides participants the opportunity to design their own activity based on the modeled LAT. Findings indicated that participants thought the essential activity that included the use of the LATs, in addition to other aspects of the TPACK-in Practice Workshop, was helpful during planning and implementation of TPACK based instruction (Figg & Jaipal, 2013). Multiple participants indicated increasing confidence as a result of the experience. One participant explained how engaging in the workshop allowed him to consider the role technology had with enhancing student learning and how it could help implement course curriculum. While LATs were not the only variable, this study does point to the ability of teachers "being able to implement a tech-enhanced activity within instruction" (p. 5045) as a result of engaging in learning experiences using LATs as the foundation.

Learning Technology by Design

Teaching how to teach with technologies in an effective way must be done by considering the interconnectedness of technology, content, and pedagogy "to go beyond simple *skills instruction* (emphasis in original) view offered by the traditional workshop approach," (Koehler & Mishra, 2005, p. 95). The authors assert that the Learning Technology by Design (LT/D) approach is one way to create the learning context where this kind of cognitive interconnectedness can occur. The traditional approach to learning to teach with technologies puts technology as an afterthought however, with the authors insisting that technology is a key factor in the act of teaching due to the affordances and constraints that technologies bring to the lesson design process. When new technologies emerge, often they provide new and unique learning opportunities that otherwise would not be possible. If content and pedagogy were always

considered prior to technology, then these new and different ways of teaching and learning will always be out of reach. Most technologies have not been designed with teaching and learning in mind; therefore, often teachers will need to modify the use of the technology during planning and instruction for it to be effective. This can only be done if teachers are engaged in experiential situations where they practice in each domain of the TPACK framework (Koehler et al., 2011).

Background. Based on the design studio model where the majority of learning takes place through design activities (Cossentino & Shaffer, 1999; Hoadley & Kim, 2003; Ronen-Fuhrmann & Kali, 2008; Shaffer, 2002 as cited in Koehler et al., 2011), LT/D learning experiences rarely engage learners in any direct instruction. Instead, learners work either individually or as part of a group to develop their knowledge as they create educational technology artifacts (Koehler et al., 2011). Koehler et al. explained: "We…rarely specify the tools or computer programs students ought to use. Instead students are expected to learn how to use these tools as and when required by the task at hand" (p. 152). According to Vygotsky (1978) speech is a critical component in learning, because as learners negotiate the intricacies of a problem, our speech is a psychological function that is also part of the problem solving process. As the difficulty and complexity of the problem increases, the role of speech becomes more prevalent and if no opportunity for dialogue with others about the problem at hand emerges, it may impede solving the problem itself. Therefore, within LT/D, the social nature of learning is critical and direct instruction on how to use specific technological tools could serve to hinder the development of TPACK based instructional solutions to pedagogic problems of practice.

The key component of LT/D is engaging in design activities at the intersection of content, pedagogy, and technology, which can only be done through personal experience and experimentation at various points in the design and development process (Koehler et al., 2011). Another perspective of experimentation is play. Vygotsky (1978) explains in play, the learner "begins to act independently of what he sees" (p. 97). The notion of deep-play is for learners to use their creativity to develop new ways to approach the problems they face in the classroom as they seek solutions that are informed through the use of technologies. Combined with design activities, learners become active creators of technologies as they work through design tasks that require the repurposing of the original intent found in most technologies in

order to develop technology enabled solutions. (Koehler et al., 2011). Metacognition has a central role in this process, because it gets at the heart of what Vygotsky meant when the learner begins to act independently of what he sees.

The LT/D process. The LT/D approach for TPACK development is composed of three major components. The first of these components is referred to as micro-design projects. This initial stage is a way for learners to warm up to the idea of design and to learn the design process itself, as well as to experience deep-play. While the micro-design projects are less focused on TPACK as a whole, the goal is to develop learner comfort and prepare them for the nature of learning through play. Beginning with these types of design projects, the learner is able to foreshadow the more complex experiences they will undergo in future activities. These projects are characterized through the example activities incorporated into work with faculty. One such example was the Véjá du activity, which was a play on the more common Déjá vu people experience when something foreign quickly becomes familiar as if they have experienced it before. The goal with this activity was to approach something that was familiar and make it less familiar as if it was the first time experiencing the object or situation. The process by which learners engaged in this varied, but one such method was by having learners take digital pictures of common objects, but from different perspectives. Photos were then shared with all the learners in the cohort, which ultimately led to interesting conversations. Thus a community of learners developed, while learners developed knowledge and skills that would ultimately be transferred to new situations later. This was especially true of any interactions with technology, as the learners began to understand the affordances a particular technology had for enhancing creativity in both general and specific contexts (Koehler et al., 2011).

The second phase of the LT/D approach was referred to as macro-design projects. The goal of this stage was to engage learners in experiences where they began to take on the identity of a designer of technology, pedagogy, and content. Each of the TPACK domains were targeted during this phase of learning experience as the design tasks required learners to explain their logic for the decisions they made, as well as reflect on their own learning from a long-term perspective. An example of this stage is the design project that engaged learners in challenging deep-seated knowledge and beliefs about topics that typically interfered with how they were taught in school. This collaborative task was essentially a mini-research

project, where groups of learners reviewed literature on misconceptions and alternative conceptions on a topic of their choice. They then developed research and interview questions for various populations of students. After interviewing students, they created a video that demonstrated the different understandings that existed on their topic and concluded the design task by creating a web page that summarized both their topic and what was learned. Through this process, participants experienced the connections among the TPACK framework as they solved authentic problems in their practice (Koehler et al., 2011).

The final stage of the LT/D process was composed of TPACK reflection projects. In these projects, the emphasis was more on taking a broader overview of TPACK and the implications for their own practice The knowledge and skills developed in the prior micro- and macro-design projects came to bear in reflection projects, but was done in a way where the learners applied what they had learned to problems of their own practice. This represents one of the goals of these projects but another and equally important goal is sharing their solutions with the larger audience represented by the cohort of learners they have been learning with throughout the entire experience. While it was unlikely learners would develop fool proof solutions to the pedagogic problems they encountered in their classrooms, it was possible that they would develop the capacity within themselves to examine these types of problems from a TPACK perspective. It was through this process that learners developed their TPACK, because they were actively engaged in designing technology, pedagogy, and content solutions for their specific contexts (Koehler et al., 2011).

Design-based learning is not without challenges. Ronen-Fuhrmann and Kali (2008) explained a number of challenges their students experienced when engaged in design-based learning activities. The open-ended nature of the learning task proved to be the biggest barrier students faced in their study, which took place over three semesters. Students in the first semester found the lack of guidance to be insurmountable, requiring the authors to restructure the course to provide additional scaffolding for learners, which learners in the subsequent two semesters found to be crucial for their success. In other words, the cognitive load for the students was too much for them to cope, which could be explained in terms of a novice-expert dynamic. In addition to the desire students had for more structure, the authors also found a disconnect between the theoretical and practical actions of the learners. More pointedly, the

students often spoke theoretically about their design decisions, but rarely followed through to create the socio-constructivist learning experiences they espoused. The students often relied on their intuition to guide much of their decisions, yet, due to a lack of deep theoretical foundation and experience with designing within an open-ended framework, students were unable to transfer their theoretical knowledge into a practical design.

LATs and LT/D represented effective approaches to TPACK development aligned with social constructivism and adult learning theory, given the social, reflective, active process where faculty leverage their experiences in lesson design. Yet, in reviewing the literature, little was yielded related to how these approaches could be used as part of a systems approach to faculty development. This was likely due to the emphasis on instructional development within these approaches, where this study has placed a greater emphasis on the faculty development process seeking to move beyond instructional development. With systems theory in mind, instructional design models provide a logical framework for engaging faculty in development activities as most models include an analysis, design, development, implementation, and evaluation phase (Dick, Carey, & Carey, 2009). However, outside the instructional designer community, formal instructional design models are rarely used (Morrison, Ross, & Kemp, 2007). Given the systematic nature of instructional design, it is important to explore how faculty development activities could embody the overarching phases of most instructional design models.

Supporting Faculty Development in Higher Education

Supporting faculty and their development was thoroughly documented in the literature, where the role of peers in the development process, as well as the ongoing support for faculty as they moved towards new instructional approaches and innovations emerged as two important characteristics.

Role of Faculty Peers

The role of faculty in supporting their peers took two forms. The first was the role of faculty as mentors for other faculty members. In highlighting the value of mentoring, Luna and Cullen (1995) stated: "Mentoring embraces a philosophy about people and how important they are to educational institutions" (p. iii). Angelique, Kyle, and Taylor (2002) explained that faculty peers are relatively common throughout higher education. The basic premise in most institutions where traditional mentoring occurred was that

experienced or veteran faculty mentor their inexperienced or novice faculty peers (Angelique et al., 2002; Luna & Cullen, 1995). As veterans worked with their mentees, they gave advice, recommendations, and other guidance. However, whether as part of a formalized or informal process, this arrangement did not always prove to be successful. Rather, this approach allowed faculty mentors to instill the same ideas and actions in new faculty members, thus create a system of perpetuity. As a result, peer mentoring emerged as a way to encourage faculty with similar demographics to collaborate and support each other (Angelique et al., 2002).

According to Angelique et al. (2002) "peer mentoring promotes information sharing, career planning, and job related feedback" (p. 199). While this approach to mentoring differs from the traditional approach in terms of the mentor's experience and wisdom, peer mentoring does provide a sense of empathy or in it togetherness (Smith et al., 2001). As these relationships are built, they usually develop in response to a common interest in achieving similar goals (Angelique et al., 2002). Therefore, while peer mentoring is limited in terms of providing guidance from experience, it does promote relationship development among faculty peers, which is a critical aspect of supporting faculty emotional development.

Ongoing Faculty Support

As faculty peers continue to work together, mentoring each other along their way towards achieving a goal, ongoing faculty support emerges. This form of support is based in faculty peers working together as cohorts. In an ongoing approach, faculty learn together as part of an ongoing learning community. While called a number of different terms, communities of faculty are peers who engage in a common interest with the goal of learning as a collective (Wenger & Snyder, 2000). Often when faculty form learning communities, the goal is to collaborate with others to examine instruction in an effort to better meet student need (DuFour, DuFour, Eaker, & Many, 2010). Cox (1999) defined faculty learning communities as "cross-disciplinary group of ten or so teachers who engage in an extended (typically year long) planned program to enhance teaching and learning and which incorporates frequent activities to facilitate learning, development, and community building" (p. 40). Cox went on to describe two forms of faculty learning communities. The first were cohort based where faculty participants engaged in activities targeting their abilities as an instructor and the learning needs of their students. The second were issue-

based communities where faculty participants target a specific teaching and learning topic, which could include topics like diversity, equity, and technology. As faculty engage in learning community activities, reflection is a central component.

Knowles, Holton, and Swanson (2005) describe one of the assumptions of adult learning theory as the desire to engage in learning that is increasingly self-directed. Critical reflection is the keystone of reaching self-directed learning (Cranton, 1994; Knowles et al., 2005). Yet self-directed learning does not automatically occur during adult learning experiences, but rather is what those opportunities should strive to achieve. Self-directed learning does not transfer to new topics or situations and therefore adult learners need to be supported regularly as they continue working towards control over their own learning. Reflection therefore is the necessary ingredient when learner values are challenged, because it is through reflection that behaviors are changed (Cranton, 1994). As faculty participate in communities of learning, they are able to support each other through their dialogue in ways that promote reflective thinking (DuFour et al., 2010; Wenger & Snyder, 2000).

Faculty development opportunities of any kind, require ongoing support. Cranton (1994) and Wlodkowski (2003) both identify that changing instructional practices, especially through reflection takes time. Therefore, to adequately support faculty, support needs to be provided in ways that can sustain the changes faculty make in their courses over the long term (Bell & Bell 2005; Cantrell & Hughes, 2008). A popular approach to providing support in a sustained manner is through consultations (Centra, Fink, and Bauer as cited in Watson, 2007). While consultations require considerable time investments, if structured with the client or faculty needs in mind, they prove to be worthwhile (Bell & Bell, 2005). While faculty may provide a necessary lens for their peers to engage in reflection, faculty developers represent the individuals who are uniquely equipped to support faculty needs as they engage in development over long periods of time.

Lewis (as cited in Watson, 2007) described how faculty developers have many roles as they support faculty. These roles included “data collector, data manager, facilitator, support system, counselor, and information source” (Watson, 2007, p. 82). Johnson found that faculty developers viewed their primary roles as supporting effective instruction, as well as scholarship of effective teaching and learning, and

faculty member research agendas. Given the many roles that developers tend to have, Dawson, Mighty, and Britnell (2010) advocated for faculty developers to be change agents within institutions. With the time demands for faculty to make systemic changes in their instruction, having a faculty developer that also serves as a change agent would appear to make good sense, especially in terms of issue-wide communities of learners where participation is sometimes a requirement (Cox, 1999). In these situations, faculty are often at all levels of adopter categories, which include the following categories:

1. Innovators;
2. Early adopters;
3. Early majority;
4. Late majority;
5. Laggards.

These categories represent the willingness of faculty to take risks as they adopt an innovation, ranging from innovators who are the most willing to take risks, to laggards, the least willing, (Rogers, 2003). However, in these situations, faculty developers can be the change agents that are needed to support faculty as they move through the adoption process.

Encouraging and motivating faculty to participate in faculty development is critical, because if faculty do not elect to participate, then change cannot occur. Yet, to properly motivate learners to engage in development opportunities, the learning experience itself needs to be constructed to promote their involvement in ways that are safe and encourage respect. This is often one of the many roles faculty developers have as facilitators of faculty development. Wlodkowski's (2003) Motivational Framework for Culturally Responsive Teaching provides a lens through which learning experiences can be constructed. This framework consists of four constructs.

- The first seeks to establish inclusion where there is respect among participants.
- The second is the development of positive attitudes towards the learning experience through "personal relevance and choice" (p. 40).
- The third focuses on engaging participants in activities that challenge them while also respecting their opinions and values.

- Finally, there is a focus on developing within learners the understanding that they are able to learn something they value.

By constructing faculty development with this framework in mind, the basic tenets of adult learning theory could be leveraged to engage faculty in development activities where they have a genuine interest in participating. When adult learning theory is combined with the TPACK development approaches previously reviewed, there is the potential for a powerful experience where faculty can experience success in the implementation of TPACK-based instruction.

CHAPTER 3

METHODOLOGY

This study utilized a case study methodology, which sought to engage content methods teacher educators in a cohort-based (Baab & Hu, 2013) faculty development process consisting of design-based activities (Koehler et al., 2011) that resulted in the creation of Technological, Pedagogical, Content Knowledge (TPACK) based projects. This study also sought to take a systematic approach where faculty development occurred beyond the development of instruction, extending through implementation and evaluation where faculty received support from their peers as well as a faculty developer. The goal was to increase both faculty and preservice teacher TPACK.

The demand placed on a case study design due to the number of variables often requires additional data collection methods (Yin, 2009), which is why this study followed a mixed methodology research design where both qualitative and quantitative measures were implemented to gain a more complete understanding of the phenomenon. Specifically, this study followed an embedded mixed method design (Creswell, 2008), where quantitative data was used to support qualitative data. This chapter will overview the methods of assessment data collection used in this study, as well as the specific procedures that were implemented.

Methods of Assessment Data Collection Overview

A number of approaches exist in the literature for collecting and analyzing data. This included both qualitative, quantitative, and mixed methods approaches. This section provides a brief overview of those approaches.

Qualitative Approaches

Grounded Theory is an approach to systematically developing a theory based on empirical research (Glaser & Strauss, 1967). Glaser and Strauss stated that a theory is a "strategy for handling data in research, providing modes of conceptualization for describing and explaining…provid[ing] clear enough categories and hypotheses so that crucial ones can be verified in present and future research [and] be clear enough to be readily operationalized in quantitative studies" (p. 3). Contrasting Grounded Theory is using non-evidence based theories to guide data collection and analysis. The robustness of a theory generated

inductively from data due to the strong connection to the evidence it emerged from makes it more difficult to be refuted (Glaser & Strauss, 1967). Yet, having and using previously developed theories found in the literature is not inappropriate in Grounded Theory, but rather it should only be used if the theory emerging from the data is closely aligned to the theory found in the literature (Corbin & Strauss, 2008). Glaser and Strauss (1967) refer to this as having the right fit between the grounded theory and the existing theory instead of forcing the data into the existing theoretical framework.

To make sense of the data collected, the constant comparative method for coding data is used. This method is meant to assist in the development of a grounded theory that is "integrated, consistent, plausible, close to the data—and at the same time is in a form clear enough to be readily…operationalized for testing in quantitative research" (Glaser & Strauss, 1967, p. 103). The constant comparative method helps researchers find the meaning of events that may initially seem trivial. In addition, the constant comparative method sensitizes the researcher to characteristics of the data that are present but overlooked by the researcher. In doing so, the researcher is forced to examine his or her assumptions and biases, as well as those of participants (Corbin & Strauss, 2008). The constant comparative method occurs over four stages that culminate in the development of a theory grounded in data.

Comparing incidents applicable to each category. The first stage consists of the initial coding of data to develop categories that can be compared. Data should be coded into as many new or existing categories as possible as these categories eventually become the properties of the theory. The coding process consists of writing one or two word notes in the margin of the data document, such as field notes or interview transcriptions, to establish categories. A category is established through the grouping of different incidences that are common to each other. Category development can be constructed in two ways: the category is created by the researcher that captures an idea found in the data, or is developed directly from the language from the data (Glaser & Strauss, 1967).

After coding a document for categories, the researcher then begins to analyze them through memos. Memos are a way to capture the researcher's ideas about categories that emerged while actively analyzing data. Researchers are then able to make theoretical propositions, as well as reduce any internal conflict he or she may have based on the data. Simply put, memos allow researchers to make sense of the

data just coded, ultimately leading to logical rather than speculative conclusions, a critical component of grounded theory development (Glaser & Strauss, 1967).

Coding and memos should be completed on the actual data document. This is a critical component in the analysis process, because it forces the researcher to identify the instance within the data from which the category was developed. Doing so protects against the same evidence being used multiple times in the creation of a category that might not actually exist beyond the researcher's own biases (Glaser & Strauss, 1967).

Integration of categories and properties. The second stage in constant comparison is the integration of categories and their properties. This process begins with the comparison of incidences during the initial coding stage. However, once categories are established, instances can be compared with the attributes of a category. Proceeding in a manner where the analysis continues to build on prior analysis allows for more in depth analysis. This is due to the accumulation of knowledge and the integration of that knowledge that begins to unify the various attributes of a category as a single whole. When this occurs, the theory emerges (Glaser & Strauss, 1967).

Delimiting the theory. The third stage in the constant comparative method is delimiting the theory. Delimiting occurs at two different levels. The first is at the theory level where the theory becomes more developed and fewer changes to the theory occur as analysis continues. This results in the reduction of category properties and the inclusion of additional properties of interrelated categories that further clarify the theory. Reduction is when the researcher discovers "underlying uniformities in the original set of categories or their properties, and can then formulate the theory with a smaller set of higher level concepts" (Glaser & Strauss, 1967, p. 110). Doing so delineates the language used to represent the theory, which permits generalization to larger groups (Glaser & Strauss, 1967).

The second level of delimitation occurs with the reduction in the number of categories available for coding. The reduction is in response to the initial level of delimitation, because as the theory is reduced to more tightly focused categories, other categories not related to this smaller focused group are no longer needed. As categories not aligned with the theory are eliminated, the researcher commits to the theory and

begins to use it to guide further development of the theory via additional coding related to those few categories that remain (Glaser & Strauss, 1967).

Once categories are reduced, data collection and coding occur until theoretical saturation is reached. Theoretical saturation is the point where collecting additional data no longer adds to the development of the theory and only increases the amount of data already coded to a particular category of the theory. Theoretical saturation is helpful when new categories emerge after the theory has been well established with a few central categories. Rather than recoding all data for the new category, coding of the new category takes place from when it emerged and on. If through further coding the category is theoretically saturated, then it is not necessary to go back through prior data. At the same time, if the category fails to develop, then it is reduced from the theory. Theoretical saturation also assists in remembering incidents that were not recorded. If incidents relate to established categories, then they can be ignored. However, if the incident is something new, then further data collection and analysis is necessary (Glaser & Strauss, 1967).

Writing the theory. Writing the theory is the final stage of the constant comparative method. According to Glaser and Strauss (1967) two critical requirements of a theory are "(1) *parsimony* of variables and formulation, and (2) *scope* in the applicability of the theory to a wide range of situations while keeping a close correspondence of theory and data" (emphasis in original, p. 110-111). Memos become the major themes of the theory that describe the categories in a formal abstraction of the theory.

Quantitative Approaches

One method in the literature for measuring TPACK was through self-report surveys. The Survey of Preservice Teachers' Knowledge of Teaching and Technology was one such instrument cited frequently in the literature. This survey was designed for use with early childhood and elementary education preservice teachers and asked participants to respond to statements aligned to each of the seven TPACK constructs. Content area based items were also aligned to mathematics, literacy, science, and social studies content. The survey also included open-ended items where respondents were asked to describe experiences when their professors, cooperating teachers, and when they themselves combined content, pedagogy, and

technologies. This survey also includes a demographic section (Schmidt, Baran, Thompson, Mishra, et al., 2009).

The Survey of Preservice Teachers' Knowledge of Teaching and Technology underwent extensive validity and reliability testing. The instrument has an internal consistency range of 0.75 to 0.92 (Schmidt, Baran, Thompson, Mishra, et al., 2009). George and Mallery (2003 as cited in Gliem & Gliem, 2003) indicated this range to be acceptable to excellent. A panel of three nationally recognized researchers with expertise in TPACK established content validity. The panel assessed the survey items using a 10-point scale and provided suggestions for improvement. Due to the small sample size, Schmidt and her colleagues were not able to conduct factor analysis on the entire survey instrument. Factor analysis was used, however, to establish construct validity for each subscale on the survey independently. All of the TPACK constructs each had one factor, except for CK, which had four aligned with each of the four content areas targeted through this instrument (Schmidt, Baran, Thompson, Mishra, et al., 2009).

Other researchers (Koh, Chai, & Tsai, 2010; Shinas, Yilmaz-Ozden, Mouza, Karchmer-Klien, & Glutting, 2013) have conducted similar replication studies with modified versions of the instrument, which have led to uncertainties of the seven TPACK constructs in practice. Archambault and Barnett (2010) using a different survey instrument found similar inconsistencies between the TPACK construct in theory and in practice. Koh et al. (2010) found with 1,187 preservice teachers in Singapore that five factors emerged with items crossing the different theoretical constructs of TPACK from the initial Schmidt, Baran, Thompson, Mishra, et al. (2009) survey. Shinas et al. (2013) used the instrument with 365 preservice teachers and eight factors emerged. These factors included four of the theoretical constructs: TPK, PK, TK, and TPACK. However, four additional factors emerged surrounding content knowledge: mathematical, science, literacy, and social studies.

Pamuk et al. (2013) created another valid and reliable TPACK self-report survey. Unique from the Schmidt, Baran, Thompson, Mishra, et al. (2009) survey, Pamuk et al.'s survey was content neutral and had more robust validity testing completed. The survey consisted of 37, four-point Likert-type questions aligned to the seven TPACK constructs. Content validity was substantiated through a panel of expert reviewers with construct validity established for the entire instrument through exploratory factor analysis.

The instrument had an overall internal consistency of .950 with individual TPACK domain ranging from .759 to .916.

Beyond the use of self-report survey instruments, such as those of Pamuk et al. (2013) and Schmidt, Baran, Thompson, Mishra, et al. (2009), performance based assessments have also been developed. One of these instruments was an interview protocol and rubric. The instrument underwent content validity testing with a panel of both content area and educational technology experts located throughout the United States. Reliability testing was completed using a different group of educators with experience and expertise in technology integration, where inter rater reliability was established through the use of intraclass correlation. The rubric consisted of four criteria:

1. Curriculum goals and technologies;
2. Instructional strategies and technologies;
3. Technology selection(s);
4. Fit or the degree that content, pedagogy, and technology combined well in the instructional plan.

The rubric had a four level rating scale with descriptors for each scaled criteria (Harris, Grandgenett, & Hofer, 2012).

Mixed Methods Approaches

Mixed methods approaches combine both qualitative and quantitative research methodologies. There are multiple mixed methods approaches, one of which was the embedded mixed methods approach. An embedded mixed methods approach has three general steps. First, either qualitative or quantitative data is given priority over the other. Once priority is established, both types of data are collected simultaneously. Finally, secondary data is used to supplement the primary data form during analysis. In doing so, Creswell explained that additional understandings about the phenomenon can be established. Given the breadth variables often of interest in case study designs, a mixed method approach is often desirable (Creswell, 2008).

Johnson and Christensen (2008) defined case study research as “a detailed account and analysis of one or more cases” (p. 406). Yin (2009) provided a more in depth, two-part definition of case studies. He

stated: “A case study is an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident” (p. 18). The second part of Yin’s definition:

> [A case study] copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result relies on multiple sources of evidence, with data needing to converge in a triangulating fashion, and as another result benefits from the prior development of theoretical propositions to guide data collection and analysis. (p. 18)

In situations where there are a number of variables that could be studied, the mixed method design becomes all the more valuable in approaching the examination of those variables.

Yin (2014) described five components of a case study. These components included the case study questions, the propositions if any exist, the unit or units of analysis, the logic connecting data to the propositions, and the criteria for interpreting findings. While each of these components is critical to a case study, the unit of analysis defines the case (Yin, 2009). There are multiple types of cases that can be investigated through case study research methodology. Often, a case study will follow an individual, such as a special needs child (Johnson & Christensen, 2008; Yin, 2009). However, case studies can also follow larger bounded systems, such as a classroom, school, or a specific program.

Research Questions

Given a mixed method case study research design, the research questions for this study were:

1. How can the faculty development experience be characterized?
2. How did faculty, while engaging in a cohort- and design-based faculty development program, implement TPACK-based instruction in their course?
3. Was there a change in faculty TPACK as a result of a design-based faculty development experience?
4. How did faculty and teacher education candidates perceive changes to candidate TPACK after the implementation of TPACK-based instruction?

Propositions

Prior to the start of the faculty development experience, the researcher made a number of propositions related to the predicted outcomes of this study. The first of these propositions was that faculty

would target a project within their course that they were already doing. In doing so, they would enhance their instruction and the overall project experience through the use of new or different technologies, or they would change something about the instructional approach.

The second proposition of this study was that faculty would collaborate with other faculty participants and the faculty developer while they implemented their projects. This was predicted to occur in a very informal way where as faculty had questions or needed input from their colleagues and the faculty developer, they would seek them out. Further, each group would provide unique perspectives given their knowledge and experiences. For example, since all faculty participants were content methodology instructors, faculty might have a different understanding of a situation than the faculty developer due to the experiences of each.

The third proposition was that faculty would perceive that they experienced success with their projects. This success was predicted to vary by faculty participant. In addition, how faculty defined success in their project was also predicted to vary participant. The fourth proposition was that after the faculty development opportunity came to an end, faculty participants would continue to find ways to continue their development as an instructor. The fifth proposition was that the faculty developer would be an important support as faculty finalized their project planning, as well as during implementation. The sixth and final proposition about faculty was that the level of faculty participant TPACK would increase to some degree by the end of this study.

Propositions were also made about the faculty development process at the onset of the study. It was proposed that the faculty development process would be ongoing for faculty beginning at the design stage of faculty projects and then would continue through the implementation of faculty projects in their courses. The final proposition made prior to the start of the study was that candidates would experience a positive change in their TPACK and TPACK related domains. In particular, the TCK domain would have a positive change, likely at a statistically significant level.

Unit of Analysis

The faculty development experience participants had, was the bounded system or the case for this study. Therefore, there was a large focus on the faculty development process and the experience faculty

participants had while they engaged in development activities. Faculty development activities took place over three general phases. These phases included:

- Project development;
- Project implementation;
- Post-project reflection;
- Evaluation.

In addition, given the embedded nature of this case study, each faculty member became an embedded unit of analysis. Specifically, the focus of each embedded unit of analysis was how each faculty participant implemented the projects they developed during this study.

Participants

Participants for this study were recruited from ABC University's non-educational technology methods courses. ABC University is a Midwest comprehensive university. This was the only requirement for eligibility for participation in this study. Each of the five recruited faculty participants had previously worked with the researcher in various faculty development capacities. Faculty participants were not compensated for their participation.

The undergraduate teacher education candidates (candidates) enrolled in the participating faculty's courses were also recruited for this study. There were a total of 284 candidates enrolled in these five courses with 50 candidates attending two or more of those classes. Of the 284 candidates in the five courses, 156 completed the pre-TPACK survey (55% of total enrollment) at the beginning of the semester, while 123 candidates completed the post-TPACK survey (43% of total enrollment) at the end of the semester. Of the candidates who participated, 101 completed both the pre- and post-TPACK surveys (36% response rate) and were reported in this study.

Candidate responses to demographic items on the survey indicated that most were traditional college aged females, majoring in elementary education. Specifically, there were 89 candidates aged 18-22, 7 aged 23-26, 1 candidate aged 27-32, and two candidates older than 32, with two candidates not indicating their age. There were 94 females and seven males that were almost entirely all Juniors

(36) or Seniors (62) with one sophomore candidate, and two candidates not indicating their year in college. There were 43 candidates completing a double major in either elementary and early childhood education (21) or elementary and middle level education (22). There were also 53 elementary and five secondary education majors. Candidates also indicated a number of subject areas they would be certified to teach upon completion of their programs. See Table 1 for certification summary.

Table 1

Candidate Anticipated Certification by Subject

Subject	Frequency
Art	4
Early Childhood Education	23
English, Language Arts, Reading, Literacy	69
History/Social Studies	43
Mathematics	43
Science	47
Special Education	14
World Languages	1

The majority of candidates (77) completed a field experience during the semester with 24 students indicating they did not have one. A majority of candidates (79) also had previously enrolled in an instructional technology course, while 22 had yet to enroll in such a course. Only four students reported that they were currently completing an instructional technology minor.

Data Collection and Analysis

Due to the embedded mixed method design to this study, both qualitative and quantitative data were collected. Qualitative data was the primary form of data collected with the quantitative data providing further enrichment of the qualitative data.

Qualitative Data Sources

Qualitative data was collected through a variety of sources during the study, including: semi-structured faculty interviews, participant observation, faculty developer journaling, and course documents. The following section provides a brief description of these data collection procedures.

Semi-structured faculty interviews. Three semi-structured interviews were conducted throughout the study with faculty participants. Prior to the summer workshop, the first interview was conducted. The goal of this interview was to establish a baseline of faculty TPACK, which used a structured interview protocol (Harris et al., 2012). In addition to these structured questions, other questions during the interview asked about the typical experiences of candidates in the course, faculty comfort using technology personally and in their instruction, ways they have engage in faculty development opportunities in the past, as well as what faculty hope to gain from this experience. While this second set of questions was established prior to the interview, additional follow up questions were asked as needed to better understand faculty comments. See Appendix A for questioning protocol.

The second interview took place after faculty had completed the implementation of their TPACK reflection projects. This semi-structured interview included questions based on data from the previous interviews, field notes, and faculty developer journal entries taken during the implementation of the project. The protocol also used the Harris et al. (2012) TPACK Interview Protocol. Follow up questions were also asked to deepen the description of faculty comments. The purpose of this interview was twofold. The first was to have faculty describe how they implemented their course projects with the second focused on collecting the data to allow for faculty TPACK analysis. See Appendix C for questioning protocol.

The third and final interview took place at the end of the study. This semi-structured interview included questions based on data collected throughout the entire study. Unstructured follow up questions were also used. The purpose of this interview was to gather evidence on faculty perceptions of the entire

faculty development experience. This included questions related to each faculty development activity, as well as on any aspect of the program faculty chose to highlight. See Appendix D for questioning protocol.

Participant observation. Participant observation (Creswell, 2008) was used to collect data throughout the study. Participant observation took place during the kickoff workshop, throughout the implementation of faculty projects in their classrooms, and during the final faculty meeting. Detailed field notes were taken. The role of the researcher was a blend of participant and observer. This was due to the faculty developer role the researcher had during the workshop.

Member check. A member check (Creswell, 2008) occurred with each faculty member prior to the third interview. This member check included a synthesis of field notes and interview data collected from the first two interviews. The member check included the major emergent themes of how faculty implemented their projects. During the member check, faculty participants identified of any irregularities or incomplete areas in the data.

Faculty developer journaling. To further account for the participation of the researcher in this study, a detailed journal was kept of researcher's involvement in the faculty development program. Entries were related to the development of specific activities for the summer workshop, interactions with faculty prior to, during, and after the workshop, as well as during and after the implementation phase of the study.

Workshop survey. A faculty survey was used after the kickoff workshop, providing faculty the opportunity to reflect upon the workshop experience. The survey was structured using data from faculty developer journal entries, and also designed to allow faculty to describe their experiences as a participant in the workshop, which included their interactions with other faculty. See Appendix B for survey.

Course documents. Course documents were collected to further enrich the case study description. These documents included any formal descriptions of faculty projects, course syllabi, and applicable eLearning environments. The researcher worked with faculty participants to identify appropriate documents for analysis. Therefore, course documents varied by faculty participant.

Qualitative Data Analysis

Qualitative data analysis was conducted using Grounded Theory and Constant Comparison method (Corbin & Strauss, 2008; Glaser & Strauss, 1967). All qualitative data was analyzed using open coding. During open coding, inductive codes were created for segments of data. Axial coding then took place to identify the relationship between the inductive codes created during open coding, which culminated in the development of themes for the study. In addition to open and axial coding, process coding was also used to identify and describe the faculty development experience, including how faculty implemented their TPACK-based projects in their teacher education courses.

Quantitative Data Sources

While quantitative data was a secondary form of data for this study, it was critical in order to answer the research questions. The TPACK survey instrument developed by Pamuk et al. (2013) was used in this study to measure candidate TPACK at the beginning and end of the faculty projects implemented in their course. The survey consisted of 37 four-point Likert-type questions aligned to the seven TPACK constructs, which were not modified from the original survey instrument. Cronbach's Alpha was used to analyze the internal consistency of the survey, which had an overall internal consistency of .923 on the pretest survey and .959 on the posttest survey with individual TPACK domain alphas ranging from .761 to .910, which were similar to what Pamuk et al. found. See Appendix E for survey.

In addition to the Likert-type questions developed by Pamuk et al. (2013), an open-ended question was added to the post survey that asked candidates to describe how their knowledge of combining content, technologies, and instructional approaches changed as a result of the instruction they received in their course. Candidates were also asked to respond to a series of demographic questions, some of which came from the Schmidt, Baran, Thompson, Mishra, et al. (2009) survey. These questions had candidates report their gender, age range, major, subject areas they will be licensed to teach, year in college, current and prior enrollment in instructional technology courses, if they were completing an instructional technology minor, and if they had completed a field experience during the Fall 2014 semester.

Procedure. This survey was disseminated in a pre/post manner. Faculty were emailed the survey to forward to their students prior to beginning their TPACK-based projects. Four reminder

emails were sent to candidates following the same process. Then at the conclusion of the faculty's project, students were emailed the survey again following the aforementioned protocol.

Quantitative Data Analysis

Quantitative data analysis took place for two different sets of data, the TPACK-based faculty interviews and preservice teacher candidate survey results.

Faculty TPACK analysis. The Technology Integration Rubric was used to analyze faculty TPACK based on their responses to the questions asked in the first and second interviews (Harris et al., 2012). See Appendix F for the rubric. A trained assistant with experience in the use of educational technologies in teacher education courses assisted with the assessment of faculty interviews. Prior to assessing faculty interview transcripts, the trained assistant and researcher discussed the seven TPACK domains and used a common definition for each domain. Together, they reviewed the interview questioning protocol, as well as the assessment rubric to ensure they had similar understandings of both items. Once calibration was established, they each independently assessed transcripts of faculty participant responses to interview questions and then compared scores. Differences were negotiated which resulted in a single score for each criterion on the rubric (Creswell, 2008). Scores from each faculty participant were analyzed using descriptive statistics; specifically mean scores and standard deviations were used.

Preservice teacher TPACK analysis. The TPACK Survey (Pamuk et al., 2013) was analyzed using descriptive statistics, including mean scores and standard deviation. A paired sample t-test was also used to determine if there were any statistically significant differences between pretest and posttest responses as a result of completing the project developed by their instructor. This was similar to the process followed by Schmidt, Baran, Thompson, Koehler, Mishra, and Shin (2009). The open-ended question was coded using Constant Comparison method (Glaser & Strauss, 1967).

CHAPTER 4

FINDINGS

Faculty Participant Contextual Information

Five faculty participants were recruited to participate in this study, all of who were female and were born prior to 1980. During the initial interview with faculty before the faculty development experience began, faculty talked about the following: their comfort using technology in general, their level of expertise with using educational technologies, how they learned about how to use new technologies in their instruction, if they had reflected on their instruction with other faculty in the past, and their aspirations for this faculty development experience. In addition, faculty participants were asked some general demographic questions, which are also summarized in the immediate sections that follow. All names are pseudonyms.

Alice

The first participant, Alice, taught an elementary and middle level methods course. She had been a professional educator for 34 years and spent the last 28 years employed at ABC University. She has taught this course for 15 years. Prior to coming to the university she worked in K-12 education as an elementary teacher. Alice holds a Master's degree and the academic rank of instructor at the university.

Alice offered that she had a basic level of comfort with using technology in general. She explained:

> I'd say I'm about 30% compared to most people you know. I don't feel stressed about it, but…I went to college and didn't have a computer so (laughs) I've had a big learning curve in my 30 years of teaching. But I feel open and I feel aware of most of the things and the devices now that I [use]. (Interview 1)

Alice went onto explain that she used technology on a "very basic level" (Interview 1), which she defined as being able to complete various tasks using technologies, such as taking pictures or searching on an iPad. She continued to explain that there likely was more that she could do, but was unaware of what those activities could be.

As she reflected on her comfort, she indicated that she attended a lot of faculty development opportunities, but unless she had the chance to "immediately apply" development topics, she did not

retain much from the learning experience (Interview 1). She described that regardless of her own level of excitement and interest in the faculty development content, that application was a necessary. She indicated that when she has had success as a result of faculty development, it was when she could apply what she learned at the time of the opportunity. The conundrum she faced has been with post-faculty development follow up. She explained:

> The things I have trouble with are sort of the extra things that would be fun to know how to do but they sort of get pushed to the side and then if there's no follow up by the time I'd decide to go back to do it, I've forgotten how to do it and then that's just going to be even more time for me to do it. (Interview 1)

Yet, in terms of her comfort, she said that she was not afraid to learn something new and that she continued to attend as many faculty development opportunities as possible. She also considered herself an intermediate in terms of her educational technology expertise, since she thought there were others who were more novice than her.

Of the faculty development opportunities that Alice had participated in, the focus had never been specific to the content she taught, which had required her to make the connections from what was presented to how she might apply it in her course. However, she had participated in a couple of faculty development programs that had a component where she reflected with other faculty members about how to improve her instruction. She described the focus of one program as having a large focus on technology, project-based instruction, and flipped instruction. The other program she referenced had a cultural competency focus.

In anticipation of the faculty development experience she was about to embark upon, she explained how her prior experiences working with the faculty developer had been positive and that she hoped that would continue. In terms of her aspiration of her own knowledge and that of her candidates, she hoped to "become familiar with a few more tools that would be good to introduce to my students" (Interview 1). Therefore, going into the faculty development experience, she had a very technocentric perception of what she wanted to achieve.

Bernice

Bernice has been a professional educator for the last 17 years, with the last four at ABC University. She was an assistant professor and teaches a PK-12 content specific methods course. She has

taught this course since she started at the university. She previously worked as an assistant instructor at another institution of higher education.

Bernice explained that she was moderately comfortable using technology. She described that she had done a "lot of different things, but I still feel like it's kind of the easier things. Like things that take me a long time to figure out I just don't do. I don't have time for it" (Interview 1). Of the technology experiences she has had, she described her need to use Google Docs and Dropbox due to the need to interact with colleagues at a distance. She also mentioned that she was an editor of a podcast. However, she also explained that she knew how to use a variety of technologies that she did not find overly useful, such as Twitter and Pinterest. She discussed at length her opinion of Pinterest, a social media site, which she felt was a shallow place for her candidates to conduct their research on pedagogy, because "it's just too limiting. It's not a pedagogy" (Interview 1). In particular she felt there was an evaluation aspect to their use of the tool that was missing, thus limiting the depth of candidate knowledge. Bernice considered her educational technology expertise to be intermediate, because she can teach others how to do things with technology, but she has never "coded" and does not "understand how things work," which she felt would be more indicative of a faculty member with an advanced expertise. She also explained that an advanced expertise would be refined in terms of the use of digital media to interact and instruct candidates.

Bernice was part of a professional learning community or PLC, prior to beginning this project. She explained that during her discipline specific faculty meetings that the faculty often shared about their instruction. She also worked one-on-one with a doctoral candidate, which was focused on using technology more in her course. In addition, she has been working with a small group of educators on developing a literature review on technology and literacy education. Conferences were another venue that she has learned about how to use technologies in her instruction, however she explained that at the conferences she has attended that there are very few sessions on technology and preservice teacher education.

When Bernice had sought to learn about how to use technologies, she "typically read about it" (Interview 1). She also preferred to see the technology in practice, but not in terms of the process of using the technology. Bernice was very specific that while the process was important, she wanted to see the "purpose behind it" before getting into the specifics about how to facilitate the technical aspects of the

technology in her instruction. She commented: “I do not like step-by-step things. I resist that” (Interview 1). Her resistance, she explained, was primarily because she did not want to be “pigeonholed” into a single approach to using the technology (Interview 1).

Bernice’s aspirations for this faculty development experience was to increase her comfort, as well as have:

> A better way of communicating to my students that [content] and technology are one and the same and that if you can just open your mind a little bit to many possibilities of how to use it, it won’t become such a barrier. (Interview 1)

Bernice felt that the changing dynamic of learners in elementary and secondary schools was going to necessitate a need for a varied approach. She explained that many of her candidates, as well as young children, were “invested in gaming or they are chatting online, they know how to use Skype or Zoom and all these things because they talk to their grandparents in wherever” (Interview 1). She wanted her candidates to use many of the same technologies that they use outside of the classroom in their instruction, because “you just have to realize that that is part of the child now and so I think that’s important to me now to understand how to do that and how to share that with our students” (Interview 1). She indicated that working with different faculty who go about using technologies in different ways would be a way to go about achieving her goals.

Cara

Cara is an assistant professor of elementary education where she primarily teaches a content specific methods course. At the time of the study, she had been a professional educator for 16 years. Over the last four years, she has worked at ABC University. Prior to her current position, she worked as a counselor at a K12 school at an urban school district.

Cara explained that while she was comfortable using technologies, she did not know it all. She suggested that she was willing to learn, and that her comfort was increasing as she learned to do more with technology. Her increased comfort was driven by her recent move to the state and the high saturation of technologies in schools throughout the state, especially in terms of one-to-one learner to computer ratios in many schools. This was in contrast to the access her and her students had in her previous position at an

urban school on the East coast. Cara described her educational technology expertise as being moderate, since she could use technologies at a functional level, but "certainly not advanced" (Interview 1).

Cara shared her prior opportunities to reflect on her instruction with other faculty members, which she described as being something that was more informal with colleagues in her department and division than being a formalized activity. She explained that she reflected on her instruction regularly, especially in the context of how she taught her methods course. She has structured her course so that approximately half of her instruction was focused on developing candidates' content knowledge and the other half was spent developing their pedagogical knowledge. Yet, while she had limited opportunities to reflect in a formal way on her instruction, she explained that when she was interested in knowing more about a particular technology that she felt very comfortable approaching another individual to ask how she could proceed. In looking forward, she hoped this opportunity would "add to my repertoire" (Interview 1). She explained that in addition to learning more about how to use technology herself, she wanted to help her candidates learn how they could use it too once they entered the classroom. Hopefully beyond what they learned in their educational technology course, which for many them "that's all they get" (Interview 1).

Debbie

Debbie is an instructor who had been a professional educator for 35 years. For the last 20 years she worked at ABC University where she taught an elementary and middle level education methods course. She has taught that course for the last eight years and prior to teaching that course she worked in a K12 school as an elementary teacher.

Debbie explained that she was "not comfortable" with using technology and that she was never trained in how to use it (Interview 1). She explained that when she used technologies in her instruction that she often felt like she was going to "look stupid" since her students knew how to do more so than she did (Interview 1). Yet, she described those moments as teachable moments during class, because, she presumed, that if she did not know how to do a particular task with technology that other students might not know either. She said this showed that she's "not alone" in her lack of understanding about how to use technologies, and that her and her candidates can all learn together. She described her educational

technology expertise as being at a novice level, where an intermediate level would mean she had more comfort and the ability to show her students how to do different tasks using technology.

Debbie explained that she had only reflected on her instruction informally with other faculty. She mentioned that the faculty she worked with did not typically use much technology in their instruction, which limited the number of opportunities she has had to have those kinds of discussions with her colleagues. She did, however, explain that she attended a lot of workshops, although she expressed frustration with these opportunities. She stated: "the problem is that they cover too much and then nobody is there to help you to implement it" (Interview 1). She indicated that she would prefer to learn one task at a time and then implement it so she could become more comfortable, at which point she would be ready to move onto learning something new. Her goal for this experience was to develop her comfort and ability to use technology so that it could benefit her candidates more.

Erica

Erica is an assistant professor and taught a PK-12 content specific methods course. She has been a professional educator for 17 years and had spent the last seven years working at ABC University. Prior to her university employment, she was a teacher in a K12 school.

Erica explained that she was not "super comfortable" using technology, but that she was always willing to try to learn how to use it, even though it did not come easy to her. She believed she was working towards becoming an intermediate in terms of her educational technology expertise. A barrier she described was the number of other commitments she had to attend to as an education professor in her discipline. For example, where a non-education professor only was required to be an expert in one area, she in contrast had to be an expert in multiple areas while also remaining up to date on contemporary issues in education. "Survival" was how she described her experiences using educational technology, which she said had forced her candidates to learn on their own, as well as learning with her when she did not know how to do a certain task.

Erica had worked with another faculty member to reflect on her instruction using iPads in her courses. She also referenced her attendance at conferences where she has had conversations with her peers on her discipline. In addition, when she has needed to learn how to use technologies to teach content, she

often relied on her observations of practicing teachers. She referenced one teacher with whom she had worked with that had given her a number of ideas on how she could use iPads in her course. Erica explained that she was hoping this opportunity would lend itself to solving problems that emerged during the semester that she otherwise would not be able to resolve until after the semester ended. She said: "Maybe this will be an opportunity to kind of work out the bugs while we are in it more. To try some things that I wouldn't normally, because there's someone else to talk to about it" (Interview 1).

Cohort- and Design-Based Faculty Development Experience

The results presented in this section are related to the first and second research questions of this study. These questions focused on the faculty development experience, as well as how faculty implemented TPACK-based instruction. As the faculty development program began, faculty participants and the faculty developer engaged in a number of different experiences, which are shown in Figure 1**.** The majority of these experiences took place over the course of the Fall 2014 semester. The kickoff workshop began the week prior to the start of the semester with the final experiences concluding in the weeks after the semester ended.

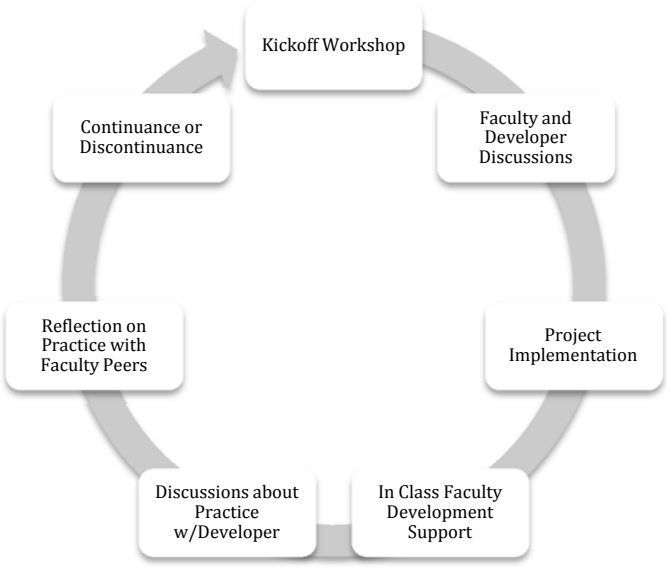

Figure 1. The faculty development experience represented as a continuous cycle.

Kickoff Workshop and Faculty Comfort

The faculty development experience began with a kickoff workshop with each of the five faculty members as well as the faculty developer. There were three goals for this workshop. The first was to help faculty become more comfortable using technology. During the initial interviews, faculty described their level of comfort in terms of using technologies in general. Debbie explained:

> I'm not comfortable with it…I was never trained in it. In college I used a manual typewriter, so everything's new and sometimes I feel like my students know more than I do and that I'm going to look stupid out there. (Interview 1)

Alice had similar feelings, indicating that she was "about 30% compared to most people," yet she was not "stressed about it" (Interview 1). She went onto explain that she wanted to "become familiar with a few more tools that would be good to introduce to my students" (Interview 1). Erica too felt that she was not "super comfortable with [using technologies]" although she was "more than willing to try…I don't feel like it naturally comes to me" (Interview 1). Bernice and Cara were more comfortable with their ability to use technologies. Bernice explained that she knew "how to do some things," and that she was "moderately comfortable" (Interview 1), while Cara stated that she was "comfortable with it. I don't know it all. I'm willing to learn more and try things out" (Interview 1). Therefore, while faculty comfort varied amongst all participants, each had additional room for growth.

Additionally, the workshop sought to develop faculty awareness and understanding of the TPACK framework. This was specifically targeted due to the TPACK-based nature of instruction that faculty were being encouraged to create. The final goal of the workshop was to provide faculty an opportunity to articulate their project ideas, receive feedback, and have time to begin planning and designing the supporting materials they would use during implementation. All the faculty participants attended the workshop, although Debbie arrived late, near the end of the TPACK game, due to another commitment.

Micro-design project. The workshop began with a micro-design project, intended to help increase faculty technological comfort. In partners, faculty used technologies of their choosing to spell the word "Panther" using pictures of everyday objects**.** The faculty developer modeled an example final product using pictures that spelled the word "Hoot" (see Figure 2). Faculty then explored their environment as they searched for their letter pictures. Once all letter pictures were collected, faculty compiled them so that the

entire word could be viewed at once. As faculty completed this final stage of the project, they were required to collaborate together to create their final product. As they did so, both groups experienced technical difficulties that slowed their progress. Bernice jokingly said, "We are going to need extra time," while Erica stated that "this is one of the things I hate about technology" as she struggled to manipulate the technology to order her pictures.

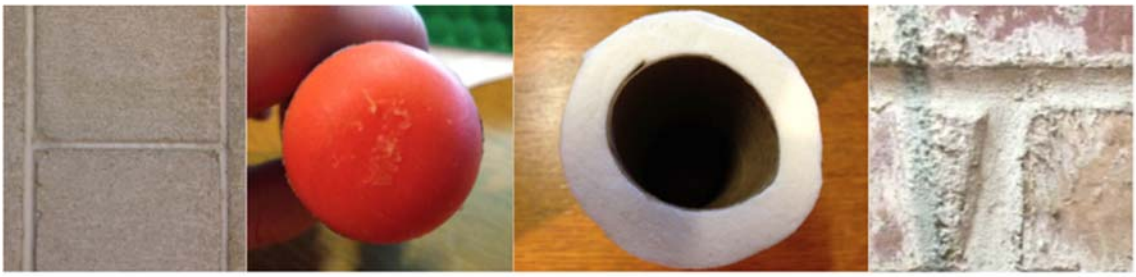

Figure 2. The word Hoot was show as an example for faculty during the micro-design project in the kickoff workshop.

The goal of the micro-design project was to help faculty develop comfort with technology by seeing the world from a different perspective, while also helping the faculty learn more about each other. Bernice reflected on the value of this experience:

> I think that one of the other things that was great about that workshop was that you know when we were going around with the iPad taking photos and doing all that like, I think that kind of thing puts you in a place of like learner, which I'm sure you intended, which I think is really great. More of that is good. Sometimes those things can feel forced or whatever, but it's not like an icebreaker. It has a purpose and so it's a good place to be in and to remember and that we are learning. (Interview 2)

As Bernice accurately pointed out, the activity was specifically designed to put the faculty in the role of the learner where they were required to use technology, thus forcing faculty to have a hands-on experience with something they had varying degrees of comfort.

TPACK game. After the micro-design project, faculty were introduced to the TPACK framework. The purpose in doing so was to ensure faculty understood TPACK as a conceptual framework that they could use as they developed their instruction, which hopefully targeted candidate TPACK. TPACK was initially introduced in a very short lecture and discussion format, where the faculty developer explained

how the individual components in TPACK interacted together and how the framework represented the type of knowledge teachers needed to have to effectively leverage technology during instruction (see Appendix G). To reinforce the dynamic nature of TPACK as a framework for teacher knowledge, where no single technology solution existed for all content areas and instructional approaches, faculty played the TPACK game.

During the TPACK game, faculty were given three types of cards: (a) content, (b) pedagogy, and (c) technology (see Appendix H). The content cards were general cards used by the faculty to identify a topic from one of their courses. The pedagogy-based cards had a single instructional approach listed. The technology cards included a variety of common instructional technologies. As faculty played the game, they picked a pedagogy and technology card at random and stated what content they were teaching. They then had four questions to reflect on with their partner:

1. What do I gain or lose combining CK with TK?
2. What do I gain or lose combining PK with TK?
3. What do I gain or lose combining CK, PK, and TK?
4. Do they fit? If not, make it fit by changing PK or TK.

The first three questions sought to engage faculty in reflections about the affordances or constraints related to each of the TPACK domains. The final question sought to have faculty consider the unique interplay between each domain by considering how well each card fit with the others. Fit in this context was the extent to which if they had to design a lesson using those three cards would the lesson work or would there be flaws that would be problematic. If the cards did not fit, they had to explain what they would change in terms of the pedagogy or technology to make them fit. Two rounds were played, where faculty picked another set of cards and went through the same four questions. Once the second round was completed, as a large group, the following question was considered: “Was responding to these questions easy or difficult and why?” (Faculty Workshop PowerPoint).

The overall reaction to the TPACK game was positive. Although Bernice seemed to struggle the most with trying to make poorly matched cards fit together, she felt the TPACK Game was an “excellent way to contextualize the concepts and chat about them” (Post Workshop Survey). Cara stated, “The activity

where we changed strategy and technology was something I liked" (Post Workshop Survey). Alice highlighted the value the game had in evaluating her own instruction: "The game helped me evaluate which types of technology might work well with the method of instruction and content knowledge. It was really helpful to me to be able to use content knowledge that I actually teach" (Post Workshop Survey). Upon completing the discussion, faculty were given a link to the Learning Activity Types, which included content-based taxonomies of technologies and instructional approaches that could serve as a support as they began developing their projects. It was unknown the degree to which faculty actually used this resource during this study.

TPACK reflection project. After finishing the TPACK game, faculty began working on articulating their project idea. Using whiteboards, faculty identified the following about their projects:

- What is the content to be learned?
- What instructional approach will be used?
- What technologies will be used?

After each faculty member had time to respond to these prompts, they provided a one-minute description of their projects for the other faculty as a way to contextualize the project in more detail. Faculty then had time to provide feedback on each of the faculty projects using the following guidelines:

- How well does the content, instructional approach, and technology fit together?
- What stands out to you about the proposed project that is a real strength?
- Suggestions for further consideration.

As faculty provided feedback to each other, they engaged in informal conversations about each other's project. The feedback in general was positive. Faculty mostly identified the strengths of the projects, but in some instances did provide some questions for their colleagues to consider, such as "will the 8th graders provide feedback?" and "any confidentiality concerns?" (Comments from Whiteboards). After providing feedback, faculty then reviewed their feedback and were instructed to pick one comment that could impact the design of their project and explain why. During this debrief, there was a great amount of discussion of ethics, technology, and media. After the discussion ended, faculty began working on

developing their projects for the remainder of the workshop, both with the assistance of the faculty developer and their colleagues.

At the end of the workshop, the faculty developer met with Debbie to discuss her project. The focus of this conversation was twofold. First, Debbie was concerned if she was doing a project that fit the parameters of the faculty development program. The second area of discussion centered on the use of Poll Everywhere. Together, they began exploring the various affordances of Poll Everywhere for several minutes. While Debbie and the faculty developer collaborated on how to use Poll Everywhere, Alice and Erica spent a considerable amount of time talking with each other about their projects and the new content area specific education standards that had just recently been released. Bernice during this time worked independently on her project, while Cara had to leave to attend another meeting.

Intimidation. An unintended side effect of the kickoff workshop was that one of the faculty members had feelings of intimidation. Debbie explained during the second interview, after she had implemented her project in her course, that she "felt a little intimidated by everybody else's project" (Interview 2). She explained: "I thought those [other faculty projects] were more involved and in depth and mine was, we're doing just this one thing. But that's what I needed to do for me. I'm like I hope this is okay. I'm doing this one thing" (Interview 2). She continued to explain that she was comfortable with her project and what she was going to do, but some of the other projects were "really involved" (Interview 2). She stated:

> They just seemed to have these layers of I'm going to do this [and then] I'm going to do this. And their plan was so thought out and I just came with well, I think I want to learn to use Poll Everywhere, but I wasn't sure how or much about it yet. (Interview 2)

Yet, Debbie explained that she thought the kickoff workshop was a good planning session for her, since she was able to "think about how to develop it and put it into the course" (Interview 2). Even though she felt intimidated, the experience was valuable she explained, due to the faculty developer.

Debbie explained that the faculty developer "validated what my idea was" (Interview 2). She continued: "You [the faculty developer] were not intimidating to me. You weren't that intimidating factor in that," indicating that she was comfortable working with the faculty developer (Interview 2). As they continued to explore her intimidation, she explained that when everyone had to write down their project

ideas on the whiteboards, that was what made her feel intimidated. She described how her project did not have as many details as the others, which likely was due to the other faculty participants enhancing a current project and therefore had a vision of where they wanted to go. Debbie, on the other hand, had not yet explored Poll Everywhere and, therefore, would not have as many details to share.

Faculty and Faculty Developer Discussions

Once the kickoff workshop ended, the faculty developer followed up with faculty to offer assistance on the continued development of their projects. In meeting with Cara, she explained her idea and the faculty developer provided some general feedback on what she had developed. She overviewed what she hoped to accomplish with her project, but explained that she still had additional refining to do before moving forward with candidates. Throughout the meeting, the faculty developer provided general feedback and listened to her plans.

When meeting with Alice, she explained how she wanted to change the documentation from being something that was printed off and given to students, to being something that could be digital and designed with an educator audience in mind. After listening to what Alice wanted to accomplish, the faculty developer gave feedback on the role technology could have in her documentation project. During the dialogue, the faculty developer described how the medium of the lesson would have a large factor in how it was documented. For example, to document learners singing a song or playing an instrument, the candidate would need to record either audio or video of the learner's performance. This would be in contrast to taking a picture of the learner singing the song, which would have poor alignment since there would be no way for the candidate to assess and evaluate the learner's performance. As the conversation continued, Alice explained that she was interested in knowing of some technology-based options candidates could use to create their documentation, to which the faculty developer shared a variety of options that were readily available.

This process of listening and providing feedback to faculty was used again when meeting with Debbie. Debbie explained that she "started with no knowledge [and then] had sessions with [the faculty developer] where we sat down and you showed me basically how to get into it, open it up, create the Poll Everywhere" (Interview 3). In these one-on-one settings, Debbie asked questions so that she could "obtain

what I needed in terms of the technical stuff," indicating "It wasn't that difficult once you showed it to me. It didn't take a lot of time, which was nice" (Interview 2). Debbie found this experience valuable. She explained:

> Taking the time, and sitting down with me, and showing it to me was very simple. You were very patient and no question was a dumb question for me…being that support when I was first trying it out as really huge. (Interview 3)

Debbie continued to seek out the assistance of the faculty developer outside of her class as she implemented her project. After seeing her candidates use Poll Everywhere in a way she had never seen before, she asked to meet with the faculty developer to explore that particular affordance in more depth. As the meeting started, Debbie again explained what she wanted to do and then the faculty developer explained how and why to do it, which resulted in a brief discussion on the implementation of her project.

While all faculty could meet with the faculty developer to continue discussing their projects, there was no obligation or expectation to do so. As such, neither Bernice nor Erica met with the faculty developer before they implemented their projects. This was likely due to neither faculty exploring a new project, but rather enhancing a project they had previously implemented within their courses. For both faculty, their projects had been implemented multiple times in the past and therefore they likely were only making slight adjustments.

Project Implementation Overview

Faculty each created projects that required the use of technologies to achieve learning goals. These projects included:

- Alice: Digital Documentation;
- Bernice: Video Strategy Presentations;
- Cara: Trail of Tears Virtual Maps;
- Debbie: Presentation Engagement with Poll Everywhere;
- Erica: Virtual Field Experience.

Each of these projects will be described in detail in this section.

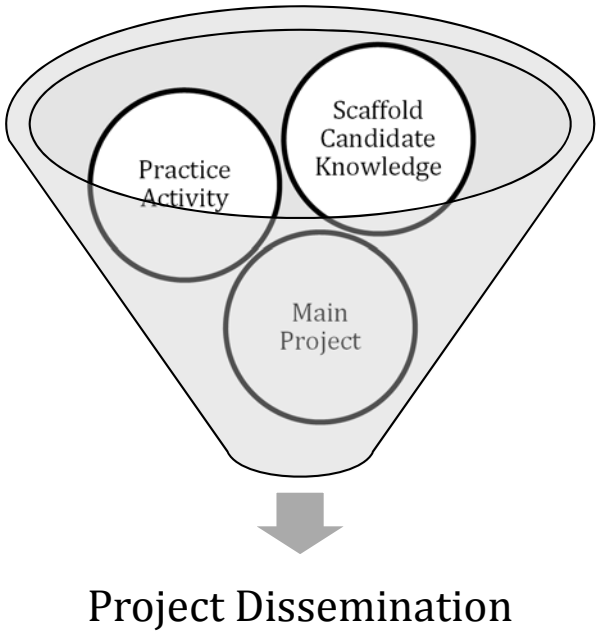

Figure 3. Representation of how faculty implemented TPACK-based instruction in coursework while participating in a cohort- and design-based faculty development program.

After completing analysis of all qualitative data, it was found that faculty implemented their TPACK-based projects in what can best be described as a four part linear process where each faculty member integrated each component in a different order. One of the four components, as Figure 3 shows, occurred when faculty engaged candidates in activities initially focused on scaffolding their knowledge that would be needed to successfully complete project tasks. This included classroom activities where project expectations, exemplar projects, and other resources were shared with candidates. A second component present in each of the faculty projects was a practice activity where candidates had the opportunity to practice some aspect of the project. The third component in each project was the main project candidates were expected to complete, which were unique to each course. Then as part of the final phase, the output of the candidates' projects were disseminated in some fashion to others, such as peers, the faculty, and cooperating teachers, among others. While it was found that each of the five faculty projects followed this linear model, each experience was unique, and as such will be described in detail based on analysis from participant observation field notes and interviews with faculty participants.

Project Implementation: Alice and Digital Documentation

Alice's project was focused on developing documentation with data collected from prior field experiences. This was a project Alice had done for multiple semesters where the audience of the portfolios were PK-5 students, their parents, and educators. However, Alice had been hesitant to make the transition to a digital format for the documentation portfolios due to the lack of access many families had to digital technologies and the Internet. As this project began, Alice made the decision to change her documentation project by splitting it into two separate assignments based on the audience of the documentation portfolios. Therefore, during this semester she had candidates create a more abbreviated documentation and thank you product for the PK-5 students and their parents that was non-digital, while also having candidates create a digital documentation portfolio meant for an educator audience. This latter assignment is the focus of the findings that are presented in this section (see Figure 4)

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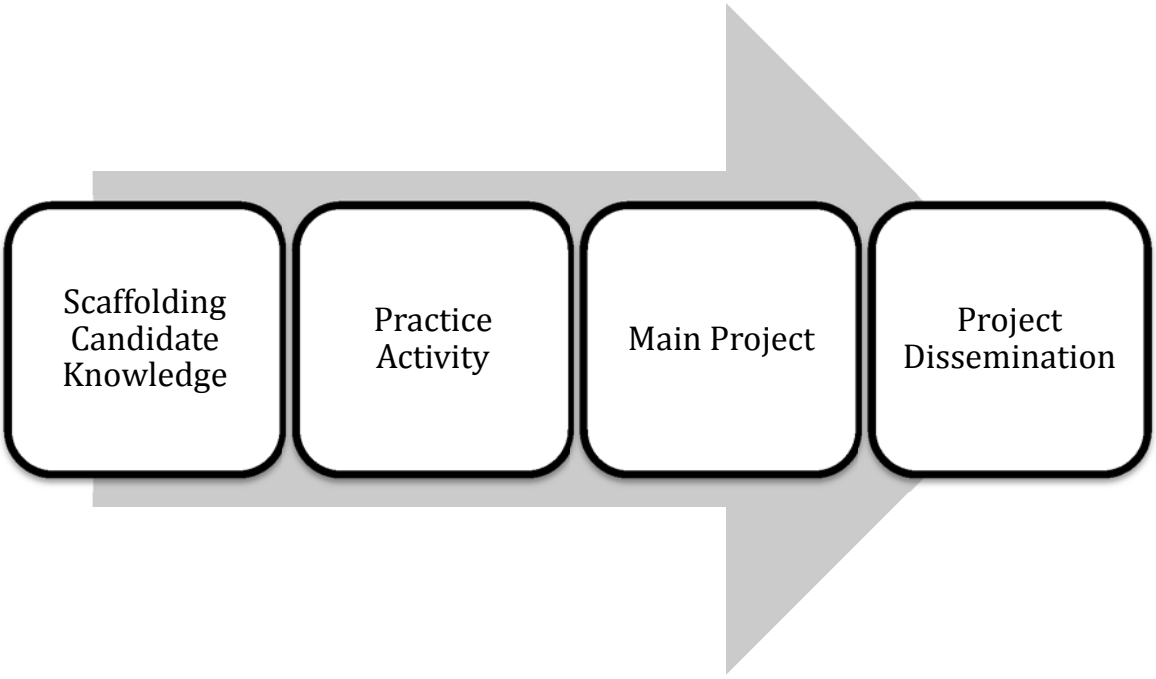

Figure 4. Representation of how Alice implemented her Digital Documentation project.

Scaffolding candidate knowledge. The project spanned several weeks during her class and began with an overview of the project candidates would be completing and the expectations related to the assignment. Specifically, candidates were expected to create a digital documentation portfolio that detailed each of the lessons they taught during course field experiences throughout the semester. For each lesson, candidates needed to describe the connection to the standards, both the content standards and the arts standards, as well as show and describe the learning that occurred by showing the process elementary learners progressed through as they used an art form to learn about content.

During this phase in her project, Alice completed a presentation on the different approaches to assessing student learning. This included both formative approaches, as well as summative approaches. As Alice described and drew contrasts between formative and summative assessments, she described the differences as formative approaches being "assessments for learning" versus summative "assessments of learning" (Field Notes 9/17/14). During the presentation, Alice highlighted the role that the faculty developer would have during this project, which as she described would be primarily to support the technical aspects of documenting the various art mediums. After being invited to participate, the faculty developer offered suggestions to candidates about how they could document student learning through various technologies that fit a particular artistic form. One example of this interaction between the faculty developer and teacher candidates was when candidates were asked to brainstorm how they could capture the four different types of media (text, audio, still images, video) and students responded with technologies that could support each medium.

Once the presentation was completed, Alice moved to showing candidates exemplars of both past student projects, as well as documentation of arts integration completed by a professional organization. Alice showed a couple examples from each source. She also explained to candidates how their portfolios would be different than the exemplars shown due to the emphasis on an educator audience for this assignment, rather than the PK-5 student and their parents. She explained that the documentation was to "make it clear so that someone reading it would understand [how the arts can be used to teach content] and their audience was to be parents or principals or other teachers that they had to share the information with" (Interview 2). As Alice concluded her brief overview of the different exemplars, she offered the faculty

developer as a technical resource for students as they completed their documentation project. The faculty developer also explained how candidates could find support for their technical needs at times when he was not available. The support structures recommended were primarily through the use of Google searches and by viewing videos on the campus Lynda.com site, which had numerous tutorial videos on how to use various software applications.

Practice activity. The practice activity that Alice engaged students in during this project was an exploration activity during class before candidates met as their teaching teams to complete the documentation project. The practice activity comprised of two tasks. The first task was for candidates to explore the exemplars that Alice had highlighted earlier in the semester. This included exemplars from prior students as well as the professional organization. Exploration of the exemplars was an independent task candidates completed. The second task candidates engaged in with Alice was a discussion about what the candidates had discovered as they explored the exemplars. Candidate responses included observations such as objectives, pictures, reflections, and process steps from the lesson. Alice explained as the discussion came to a close, "As you look through all these documentation [portfolios], you'll see that they are all different and that there's no right way to do it" (Field Notes 11/19/14), which thus supported her desire for having candidates have more creative license in how they created their documentation portfolios.

Once exploration ended, Alice encouraged candidates to ask the faculty developer any of the technology-based questions they had before they began making their portfolios in their teaching teams. These questions were technical in nature, such as how to download a Google Slides presentation into PowerPoint or questions related to copyright. Alice also responded to the candidates' needs as well. For example, she explained that Google Drive would be a good way to share pictures with their teaching team, and that the documentation could have multiple pages per lesson. During the discussion with candidates, Alice asked the faculty developer to explain the different technological platforms they could use to put their portfolios together. Potential platforms for the documentation that were shared by the faculty developer included: video-based technologies (iMovie, MovieMaker, WeVideo), web-based technologies (infographics, Google Sites), document-based technologies (Microsoft Word, Google Docs), and

presentation-based technologies (Microsoft PowerPoint, Google Slides). After the discussion ended, candidates began working on the project.

Main project and candidate autonomy. Class time was devoted to completing the development of the documentation portfolios. Over multiple days, candidates had time in class to develop their documentation portfolios. Alice explained her reasoning for providing so much class time for candidates to work on this project:

> It was kind of like on the flipped version because rather than having that being an outside of class assignment, they were supposed to be looking at the documentation you know outside of class and coming in and working on it when they had access to you and I and I think that really helped them. First of all putting quality time and also make it kind of a collaborative project. I think if it was outside of class I think one person takes charge and the others contribute some, but it's not as collaborative when they're all right there in class…I would give them some ideas of how they could split up the roles and give them suggestions and this is how some groups have done this. But we talked a little bit about making sure, because one of the aspects I was looking for was making this aesthetically pleasing to look at, and making it consistent from one page to the next. So that way when they were all together they could talk back over what the template was going to look like. I think that really helped in terms of scaffolding and making them better. (Interview 2)

As candidates collaborated on their projects during class time, they had a large degree of control and autonomy over how they completed their documentation portfolio. Alice explained:

> I really left the creation open to the students so that I didn't have one way that I was looking for this to come across. Because I did want them to be able to make a document that they had some ownership for and it wasn't so prescribed so that everyone's looked the same if we all had to use the same tool. (Interview 2)

Candidates, therefore, had the opportunity to pick the technological tools they wanted in this project. While a number of tools were previously shared as possibilities, a large number of candidates chose to use a presentation-based technology, such as PowerPoint. Yet, there were other candidates that, as Alice explained, took risks by exploring "some different technology tools that I hadn't obviously modeled [through the exemplars]" (Interview 2). These included technologies such as iMovie, websites, and infographics.

Alice described the nature of the risks candidates were taking by choosing a different technology platform for their portfolio:

> So they reached out from PowerPoint and wanted to try to capture some things that were a little more live. They had a video that they had taken they wanted to find a tool that matched that really well. So I think the iMovie came from that, because in the middle of their iMovie they had a dance

> where you could see the students moving. That risk was really an important one, because when you are trying to document something like dance or music, seeing the performance is a huge plus rather than seeing a still picture of it. So that was really neat. Other students just didn't go the easy route like maybe one person in the group knew it, knew the tool, but others didn't so they did some teaching, so that was nice. It might not have been as risky for one of the students but the other three or four were willing to really learn something new to make it look really cool. (Interview 2)

Yet, Alice explained that taking risks was not a focus of this project. She explained that given the early stage with which the candidates were in the teacher education program that she liked "to give them some options that are somewhat safe since the whole experience is new to them" (Interview 2). Therefore:

> The ones that really wanted the prescribed method probably fashioned theirs really close to after the student models that I had given because I saw some that had the same, they took the same template form PowerPoint, the same color scheme and everything. So they felt safe in that, so this is how someone else did it…But then I had some that were phenomenal where they got their back screens, the theme was fall, and they had beautiful falling leaves. They really worked hard to make their documentation match the theme, which is again is something you want to do as a teacher if you are going to make it public for others to see. It really gives a feel for what the project really was. (Interview 2)

The researcher observed this risk taking during class when candidates were in the planning stage of the project where Henry asked Violet, "Are you good learning that [creating a website]?" with Violet responding, "Yeah, that's fine" (Field Notes 11/19/14). This kind of negotiation was common during this very learner focused experience where candidates had autonomy over their decisions.

During the early planning phase of their portfolios, candidates engaged in a number of negotiations within their groups. For many of the groups, negotiations revolved around the design and look of the portfolio, as well as the process of completing the portfolio. For example, Katie commented, "I'm getting sick of PowerPoints. I've been doing them the last three weeks," while in a different group, Amy said "I think if we get the basics together now we can do the template together later" with Sam agreeing, stating "PowerPoint goes together fast" (Field Notes 11/19/14). In another group, candidates went through the expectations Alice had for the project and began looking at how they could distribute the requirements throughout the portfolio. Through these negotiations, an informal leader of the team emerged. Alice explained:

> I will say that in each group there was a strong leader that emerged and took over the delegation role or opinions on how we should do things. But that was probably the same person who may have taken on the role of the leader in the lesson plan if they needed to. Not always though since

> this involved technology there might have been someone else that came forward, I know how to do this, let's do it this way. (Interview 2)

Alice went onto explain how the leadership demonstrated by some candidates was informal. She stated:

> Because they knew how to set something up where they just took the lead to get it started. I don't think they ever really like took over the project but where groups might be sort of just sitting there muddling over what to do, if someone stepped forward and said, what about this, we could try this, just use this background, because really the template really set the scene for the rest of it…the content of the actual portfolio they have already spent time gathering, working on, doing so this was more of a design element in my mind. It was a way to rearrange it, to showcase it and to make it so to make it clear so that someone reading it would understand and their audience was to be parents or principals or other teachers. (Interview 2)

Once groups had a negotiated plan in place, candidates worked together to complete the project.

During observations, the researcher witnessed what could be best described as a division of labor. For example, in one group, some candidates worked on uploading pictures to Google Drive and sharing them with their peers, while other candidates were inserting the pictures to their portfolio. As the candidates worked to complete their projects, the researcher noticed how well the students appeared to be working together on their projects. Only a few students asked him questions related to the technology they were using. Alice, too, noticed that candidates seemed to be working well. She explained that the questions she received were "technical questions" (Field Notes 12/1/14) about the objectives and whether or not to include certain artifacts. The researcher also noticed that when candidates did experience a difficulty, their peers often supported them. For example, Harry asked the researcher a question about Google Slides and then Emma said, "I know how to do it. It's super easy," and proceeded to help him (Field Notes 11/19/14).

Although Alice provided class time to complete the project, there was some work that candidates completed outside of class on their portfolios. Evidence of this was pulled from the second interview completed after the project had been implemented. Alice reflected:

> Some of them I don't really know from watching them in class, how they ended up with the end project they did. It had to have been collectively outside of class as well, via Google Docs or whatever. Because what I saw them doing in class was far from what they turned in. So they must have done some kind of editing or revision outside of class. (Interview 2)

As Alice continued to reflect, she discussed how the exploration and risk-taking candidates took could have been a factor for some groups needing additional time outside of class to complete their portfolios. She stated:

> The one group that took the iMovies surprised me. I did not see, I didn't see them taking initiative to do something that was going to take a little bit more time, because to me coordinating songs, and photos and all of that's complex and there may have been somebody in their group who knew how to do that really well and that felt comfortable to them, but they did surprise me a little bit but I think it was their interest in wanting, they had this very adorable video and they wanted it embedded in a way that just flowed in and so they were that was pretty impressive when they presented. (Interview 2)

Alice continued to explain that she believed that the students who had taken more risks and take more time to plan out what they wanted to do in their portfolio were higher performing students. She thought that these candidates were not "as worried about how they were doing in the course because they had a pretty solid understanding of how they were doing" (Interview 2). She continued to explain that these candidates saw this project as "an opportunity" and that it was not seen "as just another assignment to do" (Interview 2).

Project dissemination. As students completed their projects, they submitted them to Alice for evaluation and a course grade. However, the portfolios were not shared to external audiences. Alice explained that in the past that candidates would share the portfolios with the elementary students they taught during their field experiences. Due to printing costs however, she decided to "use [the portfolio] as an assignment to be shared with just me" (Interview 2). Instead, the candidates also created a one-page thank you letter that was given to their elementary students.

Alice did explain though that the portfolios candidates created could be shared with their cooperating teachers. She was unsure if parents would want to have access to the portfolios since the candidates were only in class for a short amount of time. Although, she did indicate that documentation portfolios would be something candidates would want to share with parents once they eventually began teaching fulltime.

Project Implementation: Bernice and Video Strategy Presentations

Bernice had completed this project in her course over the past several semesters. Beginning as a lecture oriented experience she completed when she first arrived at ABC University, each semester she has modified the project slightly to enhance the overall learning experience. In recent semesters she had been focused more on improving the dissemination experience within the project by trying various technologies that facilitated sharing of candidate videos to their peers. During this semester, she also targeted candidate

knowledge of how to create videos more so than she had in the past. Figure 5 represents how she implemented her project during this study.

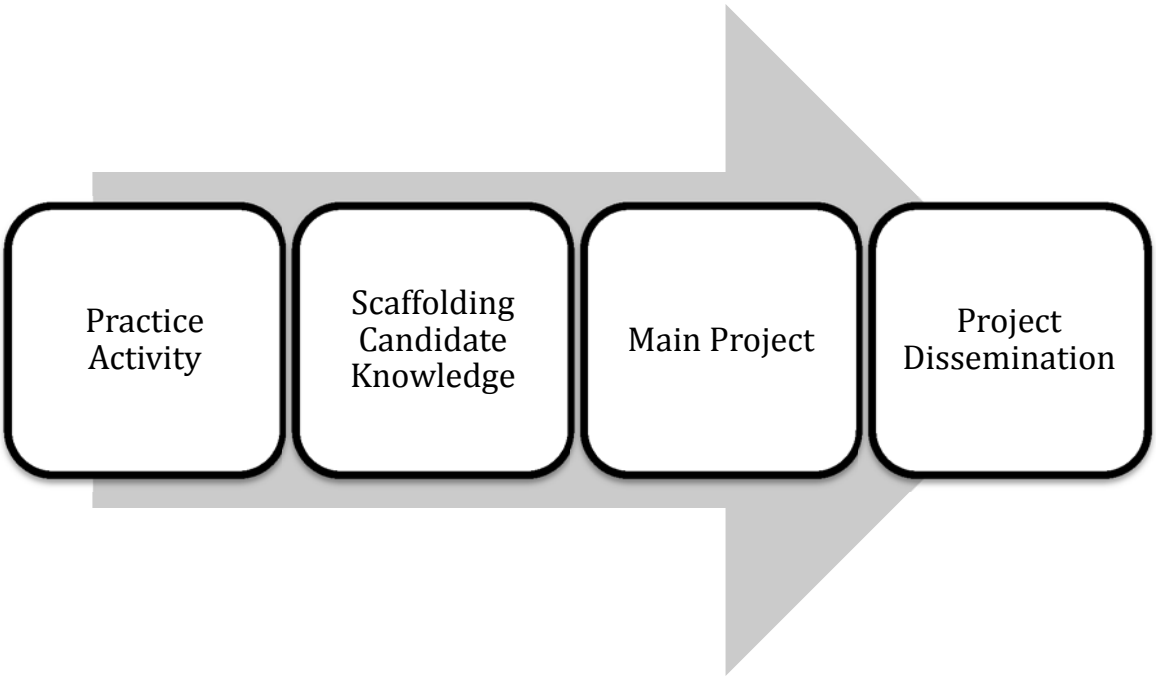

Figure 5. Representation of how Bernice implemented her Video Strategy Presentation project.

Practice activity. Bernice began her project with the practice activity. In doing the project in prior semesters she had learned that candidates needed more exposure to video. She stated that candidates needed "just to do it once to get rid of the anxiety about it" (Interview 2). Therefore, Bernice had candidates complete a video journal article review prior to introducing them to the video literacy strategy presentation project. Individually, candidates created a simple recording of themselves talking about a journal article, which was then uploaded to YouTube and shared with the rest of the class. Bernice explained that the activity was individualized intentionally. She explained, referencing a conversation with a colleague, that:

> If you work with a peer who's more talented or knows more about the digital piece they are going to take control of that most likely. And what I wanted was every student to actually be able to do it, because they are going to use the video clips and flip cams or the iPads, however or whatever tool they are going to work with, with their students. (Interview 2)

The expectation of the journal review video was pretty minimal in terms of the technological demands. As Bernice described, candidates "didn't really need to have a lot of additional information, like clips or music or anything. I suggested they could do that and show them like what an opening credit looked like. And they had to include a citation" (Interview 2). Yet, many candidates did not use digital technologies to do these tasks. Instead, they used non-digital technologies, such as holding up a handwritten citation, which Bernice said, "counts, but they didn't really integrate it right" (Interview 2). After completing this activity, Bernice then introduced the video literacy strategy presentation project to her students.

Scaffolding candidate knowledge. Bernice introduced her project to candidates by explaining in class that in groups of two to three, candidates would create video presentations of a reading or writing strategy. Before going into the details of what was expected in the project, Bernice showed a video from a past semester. The video was on a specific literacy strategy and how it could be implemented during instruction. Humor was used throughout the video, including a blooper reel at the very end, where at points Bernice was visibly enjoying the experience as she smiled throughout the video.

After viewing the exemplar video, Bernice led a class discussion about the content of the video. She explained: "[We] talked about how that strategy was a pro and what was a con and what they liked about it, that kind of thing. Both from a content and…technical side of it. Like what makes this a good video?" (Interview 2). As Bernice did this in her classroom, she asked candidates, "What did you see?" (Field Notes 9/16/14) to which candidates stated qualities such as:

- Students in video knew how to edit videos;
- They tried to keep it engaging;
- They used humor;
- The video was good quality in terms of audio and video;
- They used examples. (Field Notes 9/16/14)

After each suggestion, Bernice would add additional background on the video to deepen candidate understanding about the exemplar. Bernice also frequently said "what else" (Field Notes 9/16/14) after each

response, encouraging continued participation from candidates. As the discussion about the exemplar began to wane, Bernice explained that the video "is going to take time, but not forever" (Field Notes 9/16/14).

Transitioning away from focusing on the exemplar video, Bernice began to review the video literacy strategy presentation assignment requirements. As she began, she highlighted the importance of being able to provide, as a Title I teacher in a PK-12 school, professional development to other teachers. This provided a level of authenticity for candidates, because upon completion of their degrees they will be endorsed to teach Title I reading. Bernice explained:

> It's the idea of being a professional teacher, like a leader is, you have to own it. You have to know what you're doing and you have to be willing to try stuff, make mistakes, learn better resources. You have to do that work and come into it doing that instead of hoping for a basal reader that's going to tell you what to do. You know. So I don't want that… so when you are a teacher leader, you're a title one teacher you might be doing professional development. Here's how you might do it. You can share these strategy videos or do something like this with your staff. That's professional development. You could do these things. Like I try to put that vision, that futuring as a possibility. Not everyone in the group will be a reading coach, but there are some who will be really good at that so I want them to kind of see these things can transfer to their next setting. (Interview 2)

However, many of the candidates in her course did not understand what a Title I teacher was or that they would be able to be a Title I teacher by earning their Literacy Education endorsement. Bernice exclaimed:

> They're doing their Lit Ed endorsement so that they can be a Title I teacher…and I will tell you that three people knew what Title I was coming into the class. This is their minor level, right, like what's going on! (Interview 2)

Bernice concluded the discussion by explaining the requirements for the video. It needed to be a reading or writing strategy that could be used in a teacher to one PK-12 student tutoring learning experience. The total length of the video could be no longer than five minutes and during their video they needed to teach how to implement the strategy. Videos would be created and shared throughout the semester and were to be posted to a Google Doc so everyone in the course could view the videos before coming to class. The next day, the class would have a discussion on the strategy for approximately 10 minutes. Finally, Bernice shared resources to assist candidates as they created their videos. These resources were content and instructional, as well as technical in nature.

Main project. Once the project was described to candidates, they began forming groups to begin planning their videos. The initial focus within groups was to determine the literacy strategy they wanted to

focus on and when they would present to their peers. While Bernice explained that candidates did not need to determine their strategy on the first day, nearly all did so and added the strategy to a class Google Doc. Yet, even though the candidates picked their strategies, some did not feel an urgency to make this project a priority. Lily said to her group that they "don't really need to talk about this until two weeks before" (Field Notes 9/16/14).

Over the remainder of the semester, Bernice used "workshop time" (Interview 2). Candidates had workshop time once a week for part of a class period, which Bernice explained provided for two opportunities. The first was that candidates had an opportunity to ask Bernice questions about any aspect of their course. Bernice explained she was not always the supervisor for candidates in the co-requisite field experience course where candidates applied their knowledge in a tutoring program with struggling readers and writers. Bernice explained:

> So when I don't supervise directly I don't give feedback on lesson plans, I'm not doing formal observations, I do informal observations when I'm at the school. So it's kind of, it becomes a little disconnected between what the supervisor is doing and what I'm doing…So the workshop time is a way to get rid of that a little bit, so if they are working on a lesson plan I can just quickly give them some feedback or give a comment or if they have a question I can answer it. Or if they want to talk about their student, like if they are struggling with some kind of spelling need or something, we can just quickly talk about that as we're moving around. (Interview 2)

Workshop time also provided candidates with more time to collaborate. Bernice explained that time was always difficult for candidates, because of a number of factors, such as taking "a lot of time to write these lesson plans, plan their strategy presentations, we have other group projects, it's a lot of, they just need time" (Interview 2). She went onto explain that she can give them some time and by doing so she can "offer structure and feedback" (Interview 2) on their work. Bernice also identified active engagement as another reason for having workshop time. She stated:

> If I'm just sharing information or presenting or talking or whatever, they are so passive. They just sit there and it's not that engaging. I don't find that very interesting, so I want them to be more engaged. So that's part of why I have workshop time. Sometimes I dictate, you have to do x, y, or z or make sure you finish this before you do anything else. And sometimes it's just totally open and it's a work time and you can just come in and work and I don't care what you're working on. Just make sure it's related to the class. (Interview 2)

During classroom observations, the researcher noted the variety of work candidates were completing during workshop time, which resulted in a lack of participant-observation field notes completed

during class time. Bernice explained that she assumed candidates would work on their videos during this time, but that by-and-large, "very few of them chose to actually do that. Some of them talked about it but they didn't do any of the filming, they didn't use the materials." She continued to explain that using workshop time to focus on the video was not a requirement. She also explained that once she introduced the project that she did not do much with it, because "I want them to make the decisions" (Interview 2). Therefore, most candidates completed the majority of their videos collaboratively outside of class.

Project dissemination. Throughout the semester, as candidates completed their videos, they were discussed during class. The discussion activity began with Bernice asking the class, "Who wants to lead the discussion?" to which Mia exclaimed, "Not going to be me!" (Field Notes 9/25/14). Candidate reluctance to take on the role of the discussion leader continued, which prompted Bernice to ask candidates, "Why doesn't anyone want this role? Why is this undesirable?" (Field Notes 10/2/14). Bernice later expanded in private to the researcher:

> It's like the dumbest thing. That role, they were so nervous about that. All that is, is calling on people. Literally. Like you don't have to ask questions. You just call on people and I don't know. I think confidence [is an issue], but I also think it's about being right. They don't want to do it wrong…they don't even know the possibilities. They can't even choose to try it. It's really frustrating. That is really frustrating to me, because that role, like in a staff, like think of teachers in a staff meeting, right. Are you going to just sit there? Are you not going to ask questions? Are you not going to prompt? If you're going to be a reading coach, you have to direct your colleagues. You have to learn how to do it [and] they don't know that yet. They haven't seen that so much. So I think it's hard for them to make the leap. (Interview 2)

Bernice continued to explain that candidates "have to mess up" (Interview 2) if they are going to be able to make what she described as a leap. However, she explained how, as an instructor, when she highlighted mistakes she had made, that it "discredits you some level and that's really frustrating," because only a few students in the course recognize the learning process through failure, where the rest think, "she doesn't know what she's doing" (Interview 2). However, Bernice was firm in her belief that only through "messing up with them and talking through it is the only way" (Interview 2) to develop this capacity in learners.

During discussion, as candidates engaged in dialogue about the literacy strategy being presented by their peers, they asked about the literacy strategy itself. For example, during one discussion, candidates were confused with how to implement the literacy strategy, which led the presenters to explain in more detail. In another presentation, candidates were interested in how the presenters had used the strategy with

their tutoring students in their field experience. Candidates also asked about the technical aspects of the video. In one presentation, Nora asked, "How did you do the transitions? They were awesome!" (Field Notes 9/25/15). Bernice also asked questions related to the technical aspects of the video, such as "How did you conceptualize it before creating the script?" (Field Notes 10/2/15).

During class discussion on the literacy strategy videos, Bernice frequently asked questions. Typically she would wait for candidates to ask questions before asking her own. She explained it was her way of modeling the behavior she wanted candidates to do during the discussion. She stated:

> I expect you to have questions. Start engaging [Bernice laughs]. It's like I don't, I don't know if I say that explicitly. I do say that to them like, 'You notice the questions I ask, these are things you can ask in the future.' Those are definitely things I have said. Things like that, because I think that silence is viewed as it was good. It was applauding the students. I'd say it's the flip. That's a negative. You want to spark conversation by your presentation, by what you share in your whatever. You don't want dead silence. You want people to engage. So I'm trying to get it going that way.

She described that by modeling for candidates and encouraging their participation in discussion that it created a collaborative classroom environment where candidates are comfortable asking each other questions. That by having that type of classroom culture, candidates can have a "conversation about an approach or a strategy or a child and walk away with different interpretations and it's okay to have that conversation" (Interview 2).

As the discussions ended, Bernice helped debrief by providing additional information and context about the literacy strategy that was discussed. At the conclusion of the discussion, the project was completed in terms of creating the video and having the discussion. However, the videos continued to have utility that persisted beyond the classroom discussions. Bernice explained that a goal of this project was to create a repository of literacy strategies that candidates could access, both during the co-requisite tutoring field experience course, as well as in the future. The idea, according to Bernice, was to create an accessible place where candidates could come to learn about research-based literacy strategies and apply them in their instruction to meet the needs of learners. She explained her frustration with web-based resources that candidates used where it was ambiguous as to whether or not the strategy was grounded in empirical research. She stated: "It's not to say that that's not good [web based resources]…but there are other tools

that are accessible that you don't need to spend five hours Googling something, you've got it" (Interview 2). This was facilitated through the use of a Google Doc, which had links to all the completed videos. While it is unknown the extent to which candidates returned to these videos, there was the capacity for this to occur.

Project Implementation: Cara and the Trail of Tears Virtual Map

Cara's elementary social studies methods course was grounded in accomplishing two broad principles, where there was a "balance between teaching methods for elementary social studies and helping to fill in some of the holes in [candidates'] own understanding of the social studies" (Interview 2). This project embodied both of these principles. The first goal of the project was to expand the content knowledge of candidates surrounding the removal and relocation of Native Americans during the first half of the 1800s. Cara explained:

> Typically many students associate the Trail of Tears with the Cherokee experience. However, there were a number of indigenous groups who were forcibly relocated and some of them do describe their experience as the Trail of Tears. So wanting to expand the conversation we looked at the quote, unquote five civilized tribes. The Cherokee, the Chickasaw, the Creek, the Choctaw, and the Seminole Indians where they originally were and where it was they were relocated to. (Interview 2)

Therefore, deepening candidate knowledge was a key component of this project. In addition, the second goal was to model different instructional strategies for teaching the social studies, specifically targeting history and geography. This was done concurrently as candidates gained new content knowledge. Cara explained:

> As we walk through history, we stop at the Trail of Tears and so every stop that we make there's some activity, maybe not as in depth as this one was. In the spring semester they created brochures so it, every stop is not as in depth. But it's a stop. So I knew going in that this was going to be a stop on our march from 1492 to 2014. (Interview 2)

As the course stopped at certain points in history, the activities candidates engaged in were experiential from the perspective of an elementary learner. In other words, the candidates took on the role of an elementary learner as they completed the activities at each stopping point. Figure 6 represents how she implemented her Trail of Tears Virtual Map project.

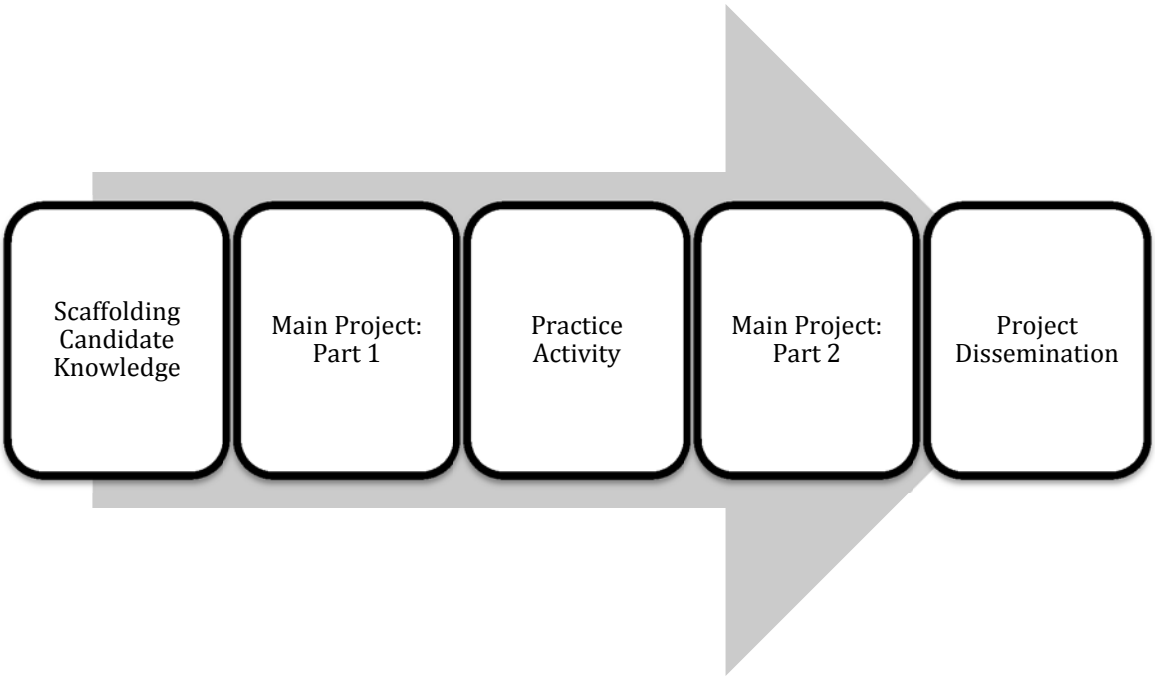

Figure 6. Representation of how Cara implemented her Trail of Tears Virtual Map project.

Scaffolding candidate knowledge. As Cara engaged her candidates in learning about the Trail of Tears, she did so through the modeling of a number of different instructional strategies that engaged candidates in various tasks. The project began with a class discussion focused on the question, "What do you know about the Trail of Tears?" (Field Notes 9/30/14). As Cara probed candidate content knowledge, she used a Know, Wonder, Learn, and Question (KWLQ) chart to document and make visible candidate understandings about the content. While Cara began addressing gaps in candidate content knowledge, she leveraged the use of children's literature and continued class discussion. During the story, she stopped regularly to ask the candidates questions, probing their understanding of the content, such as, "What questions do you have?" (Field Notes 9/30/14).

Given the geographic nature of the Trail of Tears and Native American relocation, Cara next focused on reinforcing the content through the use of maps. In doing so, she also began targeting candidate knowledge of maps, usually by asking candidates what five components should be included on all maps. As the class continued to learn about Native American relocation, Cara pushed candidates to analyze the differences in climates as they moved from one region of the U.S. to another, asking questions like, "What

are the advantages of taking the water route?" and "What are the advantages and disadvantages of taking the northern route?" (Field Notes 10/9/14). As the candidates, presumably, achieved an understanding of why the Trail of Tears was so named, due to the loss of life and property, as well as the extremes in climate that they faced as they were removed from their original lands, Cara introduced the virtual map activity that candidates would work on throughout the remainder of the semester.

As she introduced the project, she explained that the Cherokee were not the only Native American nation to experience the Trail of Tears, and that other tribes had similar experiences. She explained that candidates, in groups, would be creating virtual maps about other nations who experienced a similar situation. She identified the additional nations that had similar experiences and explained that they would, as a group, be researching and creating a virtual map that described this experience for one of these nations.

Main project, part 1. Cara described the learning experience the candidates went through as a "step by step" process (Interview 2). This process was a combination of independent and collaborative work. Candidates began researching their nation independently using web resources, both those provided by Cara and others they may have found on their own. Their goal was to, "Pay specific attention to…the history (before forced relocation and the current existence) and culture of the tribe" (Excerpt from eLearning). Candidates were also to, "List/describe three things you learned you consider necessary to share with your group members" (Excerpt from eLearning). After researching their nation, candidates discussed their findings with the members of their group.

Practice activity. Once the initial research had been completed, candidates needed to create the virtual map that showed the removal and relocation of their nation. However, before they began creating their virtual maps, they explored a number of cartography technologies that were freely available on the Internet. Cara had found a website with links to 20 map-making tools and directed candidates to explore multiple tools to find the one they thought would be best for their project. This activity followed a similar process as the research on the Native American nation. Candidates explored the map-making tools independently and were instructed to "make a choice to pick one and review it, not only with your project in mind, but you as a future teacher in mind. What's the ease? Is it easy for you? Would it be easy for students? What's the product?" (Interview 2). After independent exploration, candidates returned to their

groups to "sell your map so that they will kind of buy into, because you know you are going to select one for your group project" (Interview 2). Once each group had decided on a map-making tool, they moved into the last stage of the project, which was to "piece together that historical bit and this map making bit and put it together" (Interview 2).

Main project, part 2. Prior to candidates creating their virtual maps, Cara shared a sample student project with candidates that she had created. She used a different nation than what candidates were using and modeled the narrative they would need to write to synthesize their research. She explained:

> I said to them, you've got three to six people in your group, that's a lot of information. How do we pick what, so let's, you not going to be able to use it all? Let's write a narrative using the information that you have. Not necessarily that you need to go out and find some more, because you all did that already. So put that together in a narrative. (Interview 2)

As she shared her example, she described where the tribe was and where they now reside, highlighting the map-making tool she used and how it afforded her the opportunity to include some of her narrative on the map itself. She explained that

> It just depends on the map tool that you use, how much you are able to use and I did share with them the tool I liked and then that tool did have some drawbacks and I did share that with them. (Interview 2)

After sharing her example, candidates began working in class to develop their virtual maps.

As candidates began working on their virtual maps, they started out very quietly in their groups. Overtime, the candidates began to collaborate within their groups more. As they collaborated, they used a variety of technologies, including laptops and Google Drive, in addition to their map-making tool they had selected as a team. Cara described that as candidates worked together, they had "a real division of labor" (Interview 2). She explained that the individual who "sold" (Interview 2) the rest of the group on the map-making tool took the leadership on constructing that portion of the project, while the rest of the group completed other tasks. The other tasks, according to Cara, included organizing the information that the team had researched on their tribe, and then writing the narrative, which they then posted to the class blog.

Project dissemination. Once projects were completed, candidates posted them to the class blog. Cara explained that she hoped to share candidates' work with a larger audience, as well as have her next semester course create the "what's next" (Field Notes 12/2/14) of this project by creating lesson plans that

could go along with the resources candidates created through their virtual maps. Cara explained her measure of success with this project as transcending the experience she created for her students to have utility for others in actual classrooms. She stated that, "If I ever get any emails, hey I did that map making tool with my fourth graders," that would be an indicator of success resulting from this project.

Project Implementation: Debbie and Engagement via Poll Everywhere

Debbie's project was focused on helping candidates use an online audience response software called Poll Everywhere to increase engagement in her course. Unlike the other faculty participants, Debbie's project was more focused on a specific technology and how it interacted with instructional strategies. There was a connection with course content, but it was less emphasized. Figure 7 represents how she implemented her Engagement via Poll Everywhere project.

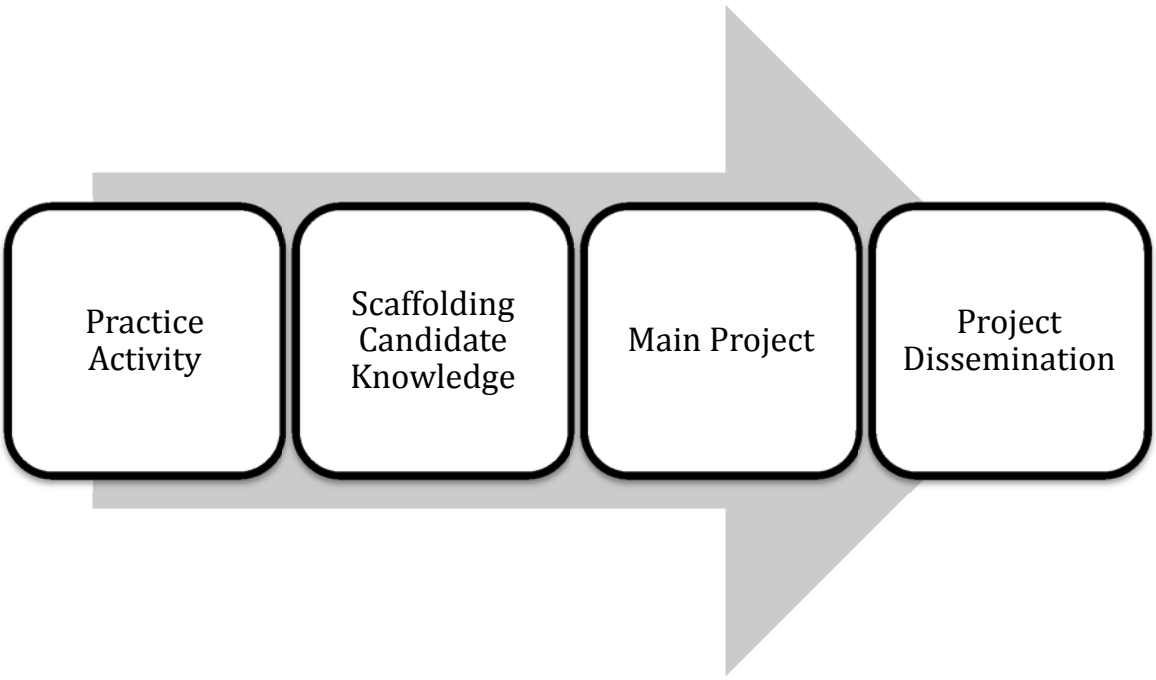

Figure 7. Representation of how Debbie implemented her Engagement via Poll Everywhere project.

Practice activity. The project began with Debbie conducting a Poll Everywhere poll with candidates. This was the first attempt at using the software in her course and she began by asking about the

level of candidate knowledge using both Poll Everywhere and Promethean Boards. Before Debbie explained the purpose of the polls, she told candidates to get their cell phones out, which made candidates clamor with excitement. Debbie later explained:

> Well first of all, the students were a little surprised. It was interesting maybe because not many of them knew about it. And cause I had asked them about how many of you have used it and not many hands had gone up. But I think they were a little surprised when they could take their phones out and use it and that engaged too, but I told them that this, I told them this was something that I had learned and that it was new to me and that I was going to be demonstrating it to them and the reason why because I was going to be requiring them to use it. Which I think motivated them to pay attention [laughs] and watch me model it and how to do it. (Interview 2)

As they moved through this first experience using Poll Everywhere, Debbie kept candidates focused on the task, exclaiming, "Keep going!" and "We have more than 10!" (Field Notes 9/2/14). She explained to the researcher that candidates were able to catch on quickly, "because I think they are more [familiar with using] their phones for everything. I mean, you say text this number to this, put this text, this number and they know exactly what to do" (Interview 2).

Scaffolding candidate knowledge. After completing the first poll with candidates, Debbie asked, "How much fun would this be for middle school students?" (Field Notes 9/2/14). Multiple candidates mentioned that middle school students would love to use their phones in school. Another candidate explained that students could use an iPad or computer to respond too, since not all schools lets students use their phones during school hours. Debbie also asked, "Why would I use this? Would this be engaging? What are some questions you might ask your students?" which prompted further discussion (Field Notes 9/2/14). As the discussion on the uses of Poll Everywhere came to a close, Debbie asked the researcher some technical questions about how to use Poll Everywhere, as well as the logistics of using it with other devices during class. In talking with Debbie later, she explained:

> I liked to model that teachers are always learning as well. I believe I did that in this, because I told them that this is new for me and because it is something you will enjoy using out in the [schools], it's a tool that you can use in your teaching. So they knew that it was new to me and saw that I was modeling it. All through the course it's like you don't have to know everything. You can ask someone…and that doesn't mean you're a bad teacher. That means you're a learner and the students, they're scared to death. They don't know science content in fourth grade, say sound. And I say to them do you know everything there is to know about sound. Well, no. I said, no you don't. You have to do your homework and you have to figure it out as you go along. You're not going to know everything. (Interview 2)

Debbie ended the discussion by briefly touching on the uses of the information that they can collect through Poll Everywhere. She explained, "As an instructor, this information helps me know how I can help you," and then explained the usefulness of formative assessment data to improve instruction (Field Notes 9/2/14). Before moving onto the next item on the agenda, Debbie encouraged her students to use Poll Everywhere in their chapter presentation assignment they would complete throughout the semester.

According to the syllabus, the expectation for the chapter presentations were to, as a group, research the topic of one of their assigned chapters in their text and then do a 30-minute presentation on the topic. The presentations were split evenly between content delivery and active participation by the entire class. Visual aids and technology were required components for all presentations. While the use of technology was required, there was no specific mention of requiring the use of Poll Everywhere in their presentations. Although, Poll Everywhere qualified as a technology they could use.

Main project. Throughout the semester, candidates completed their chapter presentations. According to Debbie, in nearly all of the presentations, candidates used Poll Everywhere. Debbie explained that typically:

> What the students did for the presentation, they would start off their presentation with a question based on their chapter topic. So say the chapter topic was setting up their classroom, their question would have something to do with classroom environment. Like what do you think is the most important to include in your classroom environment and they'd have an A, B, or C kind of thing and the students would respond. And then sometimes they would end with a Poll Everywhere to see what they thought after their presentation. See if their presentation had changed their thoughts on that. (Interview 2)

The researcher observed this as well. During class sessions when the researcher conducted observations, candidates began their presentation with a poll. Yet, the type of poll candidates conducted varied from multiple choice to open-ended response polls. For example, in one of the first groups to present, candidates began their presentation with an open-ended poll where the candidates in the class texted in written responses, while in the next day another group used a multiple choice response format.

The researcher did notice that in the observed uses of Poll Everywhere by candidates that their use of questioning was generally very superficial in terms of the depth of knowledge. For example, during one presentation (Field Notes 9/11/14), the researcher noted that there was multiple instances where the candidates could have used Poll Everywhere to engage the rest of the class in the content of their

presentation by having them share more about their experiences with the topic. However, candidates did not do so and after their initial poll, they discontinued their use of polls and conducted an otherwise traditional presentation.

A few days after the researcher noted the superficial use of Poll Everywhere by candidates in Debbie's course, Debbie utilized Poll Everywhere to facilitate a class discussion on classroom rules. Debbie began the poll stating, "I feel there is a negative connotation with the word rules," which led to her asking the question, "What other words can you use beside rules?" (Field Notes 9/16/14). As candidates submitted their answers, Debbie directed them to discuss at their tables what they submitted. During small group discussion, Debbie moved around the room responding to candidate inquires and listened into their discussions. As the class came back together, they began sharing their responses and had a whole class discussion about rules and how to put a positive spin on them, rather than a more negative, controlling perception. Once the discussion ended, Debbie said to the class, "See what Poll Everywhere can do and the creativity it can generate. Look where it took us and I wasn't even planning on it" (Field Notes 9/16/14).

As the weeklong field experience associated with the course neared, Debbie discussed the final preparation for the experience with candidates. One of the topics that were discussed was the role Poll Everywhere could have in their instruction. As the role of Poll Everywhere emerged during class discussion, Edward stated, "It would be cool if they had an iPad cart that it might be something you could do to engage the students," (Field Notes 10/21/14). As the discussion shifted from topic to topic, Poll Everywhere emerged again as a focal point when Debbie explained that using Poll Everywhere to collect and use formative assessment data could be one way candidates met one of the requirements of the field experience. Mavis, a candidate, asked whether or not they could access the data they collected from Poll Everywhere, to which Debbie deferred to the researcher to respond. The researcher explained that yes it was possible to access data collected through the software and that formative data collection was the primary purpose of this technology. He also provided a short overview of what formative assessments were and why they are useful. As the researcher concluded his comments with candidates, Debbie stated that she "Loves it when Dan comes to class" (Field Notes 10/21/14). In following up with candidates after their

field experience, only one candidate used Poll Everywhere, although many candidates had the opportunity to use a wide variety of technologies during their field experience.

Project Dissemination. Dissemination of the candidates' efforts took place consistently throughout each of the chapter presentations that used Poll Everywhere. Through their presentations, candidates modeled varied approaches to using the different features of Poll Everywhere. This knowledge was further disseminated, albeit to a much lesser extent, during and as a result candidate field experiences. Although only one candidate shared about the use of Poll Everywhere with elementary learners, it did provide the other candidates in the section the opportunity to witness one way Poll Everywhere could be used within an authentic instructional setting. In addition, dissemination of candidate knowledge also extended to Debbie as well. In a reflection conducted at the close of the semester, Jenna, a candidate stated: "I especially enjoyed the use of Poll Everywhere. This may be a useful tool to find out where students were in their understanding of the content. Information can then be used to alter teaching style or alter content taught" (Interview 2). While the extent to which this sentiment can be generalized is unknown due to insufficient data, for Debbie, it provided one instance of candidate understanding of the uses of Poll Everywhere as a formative assessment tool, which for her, provided some credence of efficacy even if in a very limited way.

Project Implementation: Erica and the Virtual Field Experience

In Erica's art education course, she engaged candidates in a virtual field experience with ABC Middle School art students. Through a partnership with the art teacher at ABC Middle School, Erica's students created art lessons using an iPad where the iPad became the "art medium" (Interview 2). The essence of the project was that candidates created a lesson that taught middle school students how to create art using various apps on the iPad. Erica described how in the past the students "could make it however you wanted. You could use PowerPoint and put it into iMovie and do voiceover with QuickTime and all these different ways" (Interview 2). However, she went onto say that "this semester…we have the iPads, so let's do it completely on the iPad" (Interview 2). She explained that in the past that she had not had the access on her iPads to the appropriate apps that would allow her students to only use the iPad. However, this semester all her students were "all on iMovie and all on Keynote" (Interview 2). She explained that she liked this approach of giving students more structured guidelines, because "when we had problems, we all

had the same problem," (Interview 2) which allowed her to better support her students and for her students to better support each other. Figure 8 represents how she implemented her Virtual Field Experience project.

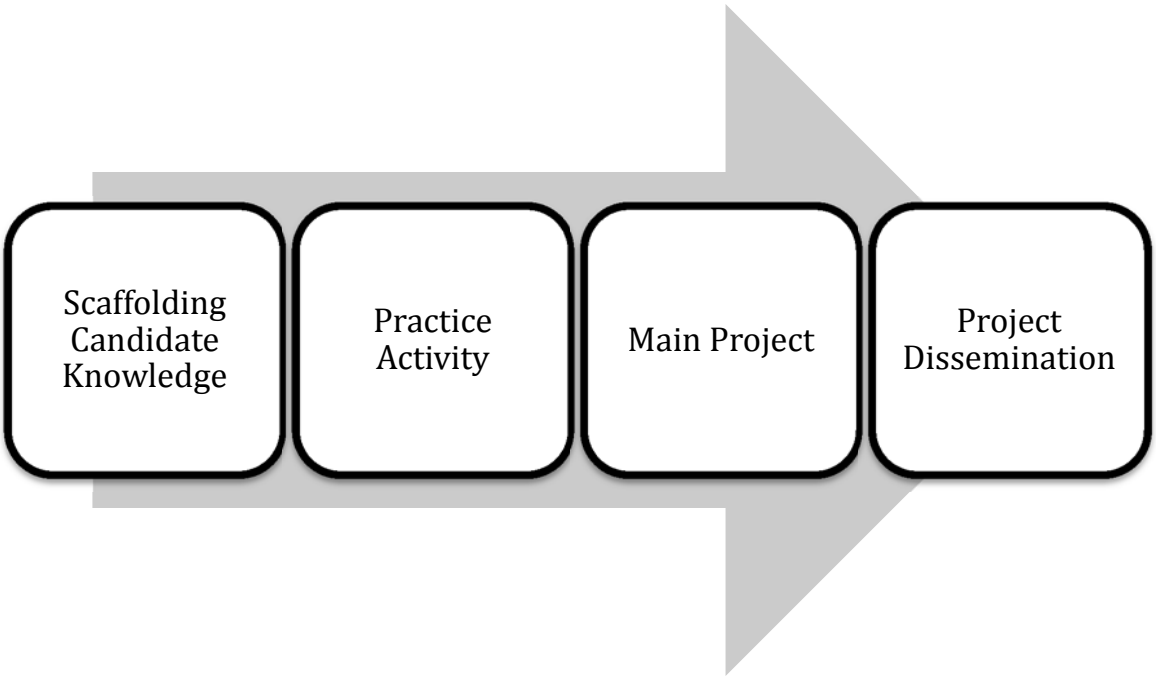

Figure 8. Representation of how Erica implemented her Virtual Field Experience.

Scaffolding candidate knowledge. Erica began the project by sharing project expectations and the process candidates would follow as they progressed through the project. She relied heavily on discussion throughout this part of the project. Discussions provided context for the candidates about why they were creating iPad lessons. A driver of these discussions, and the project, were the number of schools in the state with a one-to-one computer initiative. Erica explained:

> One-to-one schools are up and coming. There's more every year and I think that's going to be something they're going to be coming into contact with while they're interviewing. So I want them to know right away that there's a reason it's relevant in their future career. (Interview 2)

ABC Middle School was a one-to-one school, which further contextualized this project for candidates as an authentic learning experience. During class discussion, Erica explained that while ABC Middle School

students had iPad skills that did not mean they had art skills. Therefore, in the lessons they created there needed to be a strong focus on art skill development.

Erica showed multiple prior student examples and helped her students reflect on the positive and negative qualities of each example during class discussion. She prompted student reflection through statements such as "What does she do right away?" and "See how she shows good and bad examples and points it out to the students," while also asking "What's good about this lesson?" and "What are some ways to improve on this?" (Field Notes 8/28/14). As the discussion unfolded, Erica actively tried to get students to consider the role of assessment in these examples and how they could be enhanced.

Practice activity. As Erica continued to scaffold candidate knowledge, she spent time targeting the use of iPad apps. This activity took place in two parts. This first occurred through in class discussions where Erica often demonstrated how to use specific iPad apps. The apps she demonstrated were the primary apps that candidates used to create their lessons. As she conducted demonstrations, candidates explored with Erica, asking questions about features and the processes they would use as they created their lessons.

During the demonstration, Erica explained that, "Sometimes we get excited about apps" and asked how many students had used a specific non-art skill based app. A few students indicated they had, but one student explained that the app "doesn't teach a skill" (Field Notes 9/2/14), which was Erica's goal. She continued to support the need for art skill development, as well as the development of technology and critical thinking skills. As Erica facilitated the discussion, she asked, "What skills could you develop" to which students described a number of different art skills (Field Notes 9/2/14). Erica added to the discussion stating, "It's not so much the app that can do these things, but the skills that allow you do it," which further supported her expectation that candidates target both art and technical skills (Field Notes 9/2/14).

After discussing skills and the affordances of apps and how candidates could leverage their skills to create art through the app, candidates explored additional apps available on their iPads. While not all the apps Erica wanted candidates to explore were installed, they had the opportunity to explore those that were installed and asked a number of questions about the iPad. These questions were mostly of a technical nature, such as if they should use the onscreen keyboard or find a wireless keyboard, or if they could use a

stylus. Erica continued to do demonstrations for candidates as needed, showing them how to use features, such as zooming in and out and how that "lets you get super close and accurate" (Field Notes 9/2/14). As candidates continued to explore the iPads, Erica spent time checking for understanding in terms student knowledge of how to use the iPad and continued to fill in candidates' technical knowledge gaps through demonstrations.

As the discussion continued, it evolved into an overview of the expectations that Erica and the cooperating ABC Middle School art teacher had for the lessons the candidates were to create. She explained that the cooperating teacher was a very big proponent of learner choice in her projects and that this was what she wanted the iPad lessons to promote. Erica also explained that the cooperating teacher did not teach an iPad-based lesson to her students and that these would be the only lessons like this the ABC middle school students engaged in throughout the school year. Erica continued to explain that they had decided to do only one lesson per ABC Middle School art section. She explained that it was hard for the cooperating teacher to have multiple art lessons going at once within the same section. Erica also indicated that they were going to need to be more focused this semester with the theme they used in terms of the art skill they develop. This was due to a change in the scheduling at ABC Middle School, where with the new schedule, if a common theme was not used, there would be an uneven implementation of the art curriculum.

Main project. The next phase of the project focused on determining the genre of their art lessons. Each candidate brainstormed three separate possible iPad art lessons that they could do, which candidates then presented in class. As candidates presented their ideas, Erica helped facilitate a discussion on the different ideas. For example, she asked questions like, "What could you do with that?" which prompted others to give feedback and either expand and build upon an idea or eliminate it as a possibility (Field Notes 9/2/14).

Eventually, the class agreed upon portraiture as the art genre for their lessons. The seven students in Erica's course were organized into three groups based on common themes they had shared. After forming groups, candidates negotiated with their partner(s) the theme of their portraiture lesson. During candidate driven negotiations, Erica provided feedback on their ideas, primarily as a devil's advocate when

their ideas were not feasible, especially with regards to ensuring an art skill was being targeted. Overall, she was very supportive of candidate ideas and let them come up with their own unique final plans.

Once each group had determined their project focus, Erica provided additional information about the project that would be important. This included information such as how the lessons would be implemented with the assistance of the cooperating teaching using a flipped instructional approach. Erica also described that videos would need to be created to use this instructional approach and that they would be using the Keynote app. During this phase of the project, candidates had the opportunity to visit ABC Middle School. During the trip, they were able to interact with the middle school students and gain a better understanding of middle school students' abilities.

Lesson development from this point on transitioned to being very candidate driven, where candidates had a great deal of autonomy. As they began their collaborative lesson development, they shared their ideas with their peers and engaged in what could best be characterized as TPACK-based discussions. For example, a group of three students had a discussion that began focused on more TCK and how the iPad app they wanted to use allowed for changes to color and tone, which in this context was the content of the course. They then explored how that worked before moving onto pedagogical concerns they had at which point they asked Erica for feedback.

As candidates began working on their lessons in their groups, Erica consistently used feedback during the entire project. She was available to answer questions and provided feedback on student progress as needed. For example, early on in the project, Erica said to students, "The most important thing right now is to start transferring your ideas to Keynote" (Field Notes 9/16/14). Erica explained to the researcher that candidates were really stressed about completing the project and that she has had to establish due dates to ensure they completed all the aspects of the project. Erica's feedback often highlighted areas of concern, which she usually asked candidates to reinforce and clarify in their lessons. Erica also pushed candidates to be more creative in their lessons, both in terms of lesson design and the activities middle school students would complete as part of the lesson. Erica explained:

> I'm looking for a good cohesive lesson. I want one that has the same things. It's the same things I'd look for in any lesson…I look for like if they are good objectives, did they check for understanding, do they connect with student interests, and you know, are they high quality, and

> easy for middle school kids to understand, because they play them [lesson video] themselves. So it has to be able to be understood by the middle school student. I think that's an important part, because the cooperating teacher is there to guide them, but it's not her lesson, it's their lesson. (Interview 2)

Erica continued later to describe the importance of her feedback to ensure a quality lesson was developed:

> They [middle school students] need to see artists. They need to have your teacher model example and your thought process in there. I think that's really important and if you're not going to be there to teach that and you are going to send that virtually I really want that thought process in there. (Interview 2)

Erica's feedback, while always supportive of candidates, their ideas, and their learning needs, varied depending on the situation. In some situations, her feedback sought to ensure that candidates were completing the project within her expectations. For example, early on in lesson development, a candidate, Fred, asked if they could do part of the lesson on a computer. Erica said no, stating, "It's best if you do it on the iPad, because you learn how to do it anyhow!" (Field Notes 9/16/14). Later, Erica elaborated in private to the researcher that she had to be firmer with candidates as they "get lazy" explaining:

> Part of it is that we are sending it to an actual school and that's what I want them to see, because I want them to be quality and they are sharing it with another teacher and it's part of her curriculum and so it's important. And I want them to see that it has to be quality before you send it out and just like when you're teaching it has to be a high quality piece so that the students are learning. And also I think for them in this process especially, they need this experience to be a good experience so they can learn from it, reflect from it, grow from it, so that they can take it independently. So when I'm the Mother Hen now, [that is because] they're on their own now. (Interview 2)

Yet, in addition to "Mother Hen" situations that were observed, Erica often tried to diffuse student stress with comments such as, "I don't think it's going to be that bad" (Field Notes 9/30/14). In one situation, Fred was discouraged about the amount of work his group had to do to finalize their iPad lesson. Erica continued to use feedback in a more diffusive way, again with Fred, as his group continued to struggle, with Fred stating at one point that he was "never going to do another iPad lesson again. I'm frustrated at how things that are easy to do on a computer are so difficult to do on the iPad. I don't know how to use these machines anyway" (Field Notes 10/2/14). To which, Erica responded: "Well, you're never going to learn until you spend time trying to do it" (Field Notes 10/2/14), at which point, the researcher provided assistance to help solve a minor technical issue he was facing.

Erica also provided technical feedback on the technologies candidates were using. While Erica often had the expertise to solve technical problems candidates had, there were times when she did not. In these instances, candidates became a resource both for their peers but also for Erica. An example of this happened when all of Erica's candidates were struggling with the Ken Burn's Effect in iMovie. Erica had shown a solution that was somewhat cumbersome to do well and during the last day of class dedicated to working on the project, Lois, a candidate, showed Erica how to turn the Ken Burn's Effect off. Lois explained that "there was also a way to stretch a clip rather than duplicating it like you showed us in class" to which Erica stated "We tried that the other day but it didn't work" (Field Notes 10/2/14). Erica reflected on her and her students' struggles:

> I hadn't taught it in so long and I went back and I always practice and refresh my memory, but I could not remember how to do it from last semester and no one could figure it out. And so, at that point I just have to throw it out and someone will come up with it and someone did. Someone figured out how to do it and I quickly had to go around and teach that to everyone. (Interview 2)

She went onto explain that then she "had to go around and teach that to everyone" (Interview 2).

Project dissemination. Once candidates completed their lessons, they were sent to ABC Middle School where the cooperating teacher implemented them in three of her sections. The cooperating teacher implemented the lessons with minimal changes to each lesson. Once ABC Middle School students had completed the lesson, they posted their artwork to their class blogs, which served as a portfolio of their work throughout the entire course. At this point, Erica's candidates assessed and provided feedback to each student via the middle school student blogs.

In Class Faculty Developer Support

As faculty implemented their TPACK-based projects in their courses, the faculty developer provided in class support during implementation. The faculty developer attempted to make it to as many class sessions as possible. However, Erica, Bernice, and Cara each had overlap between their courses. Therefore the faculty developer attended the courses that made the most sense given where faculty were in the implementation of their projects. The faculty developer was also unable to attend class due to other obligations beyond his control that required him to travel regularly for a period of about three weeks.

The nature of faculty developer support. The faculty developer often arrived at the beginning of class or when the faculty member indicated that the class would begin working on their project. The faculty developer typically had the role of a passive observer. Specifically, the faculty developer was available for questions and support if needed. For example, after observing in Erica's course one day, the faculty developer checked in to see if she had any questions using the following prompts: "How are things going? Anything I can do to help?" (Field Notes 9/4/14). When the faculty developer made these inquiries, the primary goal was to make sure faculty had an avenue to ask questions should they have any. Although the faculty developer spent the vast majority of time as a passive observer, there were a number of moments when he became a more active participant.

The developer was an active participant during class when he interacted with faculty and candidates. In Alice's course, there were two dates during the semester when the faculty developer was more active. The first was when candidates were first learning about the project. The faculty developer came to class with the intent to observe how Alice launched her project. However, as Alice introduced the assignment, she often referred to the faculty developer for input, and at one point directed the developer to interject as necessary. When the faculty developer did engage during discussion, his contributions were focused on supporting the connection between candidate knowledge of assessment or PK, and candidate knowledge of technologies and how they could be used to collect assessment data or TPK.

As the faculty developer contributed in each of Alice's sections, his contributions became less and less. In the first of five sections, the faculty developer discussed at length how candidates could use technology to complete their documentation project. With each subsequent section, Alice added more and more of what the faculty developer shared during her discussion with candidates. By the last section, the developer had a very minimal role in discussion, primarily indicating where candidates could find support online and in person should they need it as they completed their projects.

This phenomenon of Alice integrating more of what the faculty developer shared into her own dialogue did alleviate the faculty developer's concern about the extent to which he was helping or hindering Alice's knowledge development. During the first session the faculty developer wrote the following observer comment: "Wondering if I'm a crutch? Will she share more and then ask for my input

or will she turn it over to me to lead?" (Field Notes 9/17/14, Section 1). The nature of the concern was related to wanting to help Alice develop her own knowledge rather than have her use the faculty developer to implement the technology-based portion of her project. During the second section however, the faculty developer observed: "She starts integrating some of what I said in the first session…Alice continues to integrate my comments from the 8am section to this section" (Field Notes 9/17/14, Section 2). Then, by the final section, the faculty developer was no longer concerned about her knowledge development. He noted: "Should check with Alice to see if I'm needed in every section when they do the documentation project in November" (Field Notes 9/18/14, Section 5).

The faculty developer followed up with Alice later about the extent to which she integrated his comments into her own dialogue with students. Alice explained:

> I think yeah, I'd get more comfortable and because you brought that up I just assimilated it. I found that with the other things we've done together before, the more I experience it, oh okay, yeah I can talk about that, because this is what I heard Dan say or this makes sense to me and I hadn't thought about it myself and you bring it up in a way that makes sense. (Interview 2)

While she indicated that she was integrating what the faculty developer initially shared in the first sections and why, she went on to explain that it was not necessarily a conscious effort on her part, but rather more of a management task to ensure common instructional experience across sections. She explained:

> I didn't really notice it but I probably just sort of filled in the blanks as I heard you know say things and I may have known it but it wasn't something that came to mind but it was something that was organized. And I try to keep things very similar from one section to the next to the next. So that's probably something made in me that I told this to the first section so I need to be sure to tell it to each section in the same kind of way so that they are, everybody knows what they need to know. (Interview 2)

The other instance when the faculty developer took an active participant role in Alice's project was when candidates returned from their field experiences and began constructing their documentation portfolios. In contrast to the prior instance described, the faculty developer took a very technical support role for candidates during these learning experiences. Just prior to beginning the development of their portfolios, Alice stated: "What questions do you have for Dan?" (Field Notes 11/19/14). The typical questions candidates had were about the layout in a specific software application or how to do a specific task, such as downloading a presentation from Google Drive. Once candidates began working on their

portfolios, the faculty developer made himself available in the classroom to candidates for questions as they needed. The questions the faculty developer continued to respond to from candidates still remained very technical in nature, such as how to reorder pages on a website.

The faculty developer also had a more active role in Debbie's project. The support the faculty developer provided during Debbie's project was more technical in nature, mainly related to the logistics of Poll Everywhere. For example, Debbie asked during the first lesson in the first section, "Does it matter which I use?" in reference to the web browser she used to do the poll (Field Notes, 9/2/14). She also asked why the number of responses was not increasing when she had yet to start the poll. As she asked her questions, she modeled for candidates her learning process. She commented: "If you need a friend to help you that's okay. I needed a friend to help me" (Field Notes, 9/2/14). In the subsequent sections of her course during this initial lesson, Debbie experienced a similar phenomenon as Alice where her reliance on the faculty developer decreased. The faculty developer observed that "her confidence is much higher than this morning" as she used Poll Everywhere during her last section (Field Notes, 9/2/14).

Later during Debbie's project, just prior to the candidates' field experiences, the faculty developer took an active role again during the learning experience. During this experience, the faculty developer was taking field notes as Debbie was sharing about the requirements for their field experience. In the course of the discussion Debbie explained how Poll Everywhere could fulfill one of the requirements. At this point a candidate turned to the back of the room where the faculty developer was sitting and asked him if she would be able to access the data collected through Poll Everywhere after the class had ended. The faculty developer explained that she would have access and further explained how that data would, once collected, be formative assessment data that she could then use to modify her instruction. The candidate said, "Oh, okay," and through her facial expression appeared to understand how Poll Everywhere could be used for formative assessment purposes.

The faculty developer had an active role in Erica's project as well. Early in the project, Erica deferred to the faculty developer for technical support when all of her candidates experienced difficulties downloading iPad apps. After brief exploration, the faculty developer discovered that Erica's technical support personnel configured the iPads so that no one but authorized individuals could install new apps.

Neither Erica nor the faculty developer were authorized users and upon learning this, Erica became visibly upset and explained to her candidates that they would have "work with the apps you have" installed on the iPads (Field Notes 9/2/14). It was unclear as data collection ceased several months later if the app installation issue had been resolved.

Another instance where the faculty developer took on an active participant role was during the trip to ABC Middle School. During the trip, candidates were to interact with the middle school students for whom they were developing virtual lessons. As the middle school students began working on their projects during class, multiple candidates appeared very uncomfortable interacting with them. For some of those candidates, they appeared to actively avoid interacting with the middle school students, such as Katie who used her iPad to take pictures, video, and notes of the classroom and what middle school students were doing rather than interacting with the young learners. However, the faculty developer became an outlet for avoidance for one of those candidates, Fred. His avoidance during the field experience emerged through his continual engagement with the faculty developer. Fred routinely during the first half of the field experience asked the faculty developer a number of questions about this research study. As Fred asked questions, the faculty developer attempted to respond as quickly as possible so that he could re-engage with the middle school students. However, every time the faculty developer would answer a question and move to another part of the classroom to observe another candidate, Fred routinely found his way back to the faculty developer with additional questions. Eventually, Fred stopped asking questions and did engage with the middle school students.

Erica reflected on candidate behavior during the trip and their interactions with the middle school students, indicating that she likely should have prepared them more for the experience, and also that candidates were intimidated. She stated:

> I didn't think my students exactly knew what to do when they were there and maybe I should have frontloaded that more and given them an assignment. Like I want you to interview a student, but I just didn't feel like I needed to because they are all seniors, they're ready to graduate. They should be pretty comfortable with middle school students, so I don't know why that happened. I definitely noticed that they were, but I also think they're intimidated because the students were very comfortable with their iPads and they saw all the things they were doing and most of the students [candidates] coming in this semester hadn't used an iPad. (Interview 2)

Therefore, it was conceivable that due to a lack of clear direction, as well as witnessing first hand the technological skills of the middle school students, some candidates felt intimidated and sought out ways to mitigate those feelings. For some students that meant using their iPad to document their classroom visit, while for Fred, it meant engaging with the faculty developer.

Near the end of Erica's project, as candidates were putting the final touches on their lessons, the class experienced difficulties with the iPad app they were using, at which point, they turned to the faculty developer for support. The faculty developer, not knowing how to solve the technical issue they were experiencing with the Ken Burns Effect in iMovie, explained to the candidates and Erica that this was likely going to be a constraint they would need to problem solve in order to complete their project. Erica and the candidates discussed their options and Erica ultimately explained to them how they could overcome this particular barrier. Eventually, one of the candidates in Erica's course discovered how to solve the problem with the Ken Burns Effect, which she shared with Erica who then taught the rest of the candidates.

The following day of class, the faculty developer again had an active role in supporting candidates and Erica. During this class, candidates were putting the final touches on their lessons and it was the final day to work on them before they were sent to ABC Middle School. As the class started to near the end, Fred and Cathy's group had yet to finish. Fred, who with Cathy, were working in a room near the classroom, came to get the faculty developer for help. Erica followed and after Fred shared his frustrations with using the iPad for this project with Erica and the faculty developer. He then explained his problem to the faculty developer regarding his transitions between clips in his video. The faculty developer explained how transitions worked and pointed out his misunderstanding. He then helped him and Cathy solve their problem, at which point he appeared to be more relaxed.

Discussions About Practice with Faculty Developer

During post project interviews, as individual faculty participants and the faculty developer engaged in dialogue with each other about faculty projects, the discussions often became a form of faculty development as faculty evaluated their projects in search of how they could be improved upon for next time. For example, when interviewing Bernice, she was comparing and contrasting the videos she felt were effective with those that were not. During her analysis, she talked about how the effective videos were "like

a little story" (Interview 2). She also mentioned that as a class they had talked about what made a good video where one candidate mentioned that they should make "it tell a story" (Interview 2). Yet, not all candidates created videos with a story perspective, which appeared to frustrate Bernice a little. Picking up on her desire to make a change to her project, he faculty developer asked, "Would storytelling be something you capitalize on more next time?" to which Bernice responded, "Definitely, yes, and I would show those examples" (Interview 2).

As Bernice continued to critically evaluate her own project, she described another area needing improvement. This was related to how the videos were stored and shared. She explained that the idea behind the project was so her candidates, upon entering student teaching and the profession, could have a place where they would have access to research-based literacy strategies. Bernice explained her situation:

> I just don't have the best way of organizing materials. I want them to walk away with 19 strategies that I could look at these videos and I have this bank of research that's organized like by fluency and word sorting or whatever it is and actual articles and resources and strategies that they can pull when they are teaching. Or let's say that that they are doing professional development and they need a resource, or an administrator says why are you teaching writing process instead of using their little kit. Well, look at all the research. (Interview 2)

She continued to explain that since new teachers are busy that most likely they are not going to take the time to find the research that supports the practices they are using in the classroom, and likely would fall back on what they have in their curriculum guide or whatever was readily available on Pinterest or Google.

As Bernice and the faculty developer continued to discuss her conundrum, the faculty developer said:

> What if you just changed it into being completely student driven final product so instead of you collecting it, you just say okay, this is where we are going to post stuff, even if you do it the same way. Then as a final something for the strategies, whatever was all included in there, have them come up with a way to organize it so they have that set thing that's accessible and then have very broad guidelines that it needs to be accessible for everyone…it needs to include the appropriate whatever. (Interview 2)

Bernice was accepting of the idea and how if it was done in groups, that it would be similar to setting up a classroom or library. As data collection ended, Bernice did choose a different technology for organizing the strategy videos based on the recommendation of the faculty developer, but it is unknown the extent to which the new platform met her needs.

Cara experienced a similar evaluative faculty development experience as she reflected on how she fit her Trail of Tears Virtual Map project into her course curriculum. As she reflected on what she had done during this study, she looked forward to the next semester and how she could reinforce map making. She explained:

> What's interesting in thinking about this now, I may, because we had stopped along our timeline as we marched through history is how to do something else. How to again get them to look again at the map-making tools. This semester they did the Iowa VoiceThreads. I'm wondering if they could do the map, could I have them recreate the map of various stops as far as Iowa's role in the underground railroad using those map tools. That's just something that would piggy back, for this upcoming semester that would piggy back on something that was done this semester, but then bringing now those two, those, both of them together. That's just something else that's going through my head. (Interview 2)

As the discussion continued between Cara and the faculty developer, they discussed the duality of Cara's course where there was a focus on elementary pedagogy, but also on supporting the lack of content knowledge that candidates have. As they discussed, the faculty developer explained how adding a map-making component to another project could help take the content development to a deeper level without adding a lot more work or tasks to the learning experience. Cara agreed and stated that she was "definitely going to repeat that" in reference to doing more with map-making (Interview 2).

Erica too was very evaluative as she reflected on her project. She referred frequently to the technical aspects of her project that she wanted to improve for next time, specifically the struggles her and her candidates had with the audio. Without prompting from the faculty developer, Erica discussed how the audio changed very suddenly in the candidates' videos when it switched from one person to the next. She showed the faculty developer what she meant as they viewed one of the completed videos her candidates created and explained:

> All of a sudden Cathy, the other student who was working on this, was recording it in here and it got kind of a bad echo and the room changed the sounds, which made the quality not as good. That happened in another group too. They were working together. One person would record and then another person would record and it got kind of choppy. So I have to figure out how to make that work better. (Interview 2)

The lack of quality audio in candidate videos appeared to bother Erica, since she continued to refer to it throughout the remainder of the interview.

Alice also focused on an area where she could improve her project for the future during the interview. She explained that some students failed to document elementary student learning sufficiently during their field experience. She explained:

> They had some clip art kinds of things that they put on but they didn't get the points because they hadn't done that aspect of it. It wasn't as clearly, it wasn't documenting as clearly as I was hoping it would. (Interview 2)

The faculty developer asked how this issue some candidates experienced would change how she approached the project in the future. Alice explained that she did plan on making changes to her instruction so that candidates did not have this problem in the future. However, she described how, during the field experience, it was easy for candidates to forget to do certain tasks, such as taking pictures and documenting student learning. Alice stated:

> Even though I talk about it a lot, it's like in the moment there's a gap. They're new to teaching so when they get into the classroom they're just on emergency mode to get through the lessons so they don't know what to do. (Interview 2)

She did state that as she supervised her candidates in the field, she tried reminding them to take pictures, so she was a little unsure why these candidates did not have many in their portfolios. Regardless, Alice explained that documenting elementary student learning was "something they need to be prepared for" (Interview 2).

During the post project interview with Debbie, she did not reflect on her project experience in a way that evaluated the project in terms of improving it for the future. However, during a member check near the end of the study and after the following semester had already started, Debbie did indicate an area where she needed to be more specific with her instruction. As she began her project with her spring semester candidates, she was reminded of a technical issue that she needed to target better. Debbie explained:

> One thing that really needed to be instructed that they didn't know, and I had to do it with each section, they had a difficult time when it says text to, text this number to. They didn't understand which to use and they had to put in the text box that number and then their text. So I found myself re-teaching that this last week to some sections and it reminded me that they had that problem last [semester] too. The actual how do you actually text this. Teaching them how to use this was one thing and how to create it, but then the people who were doing the Poll Everywhere had to be instructed, what to put in the textbox, that kind of thing. I think that was a whole another piece.

Debbie was a little more unique, therefore, in that she needed to experience the technical difficulties of using Poll Everywhere with her candidates a second time before she became more evaluative of the instructional experience.

Reflections on Practice with Faculty Peers

Upon learning that Debbie had experienced some intimidation during the kickoff workshop, the faculty developer asked Debbie what she hoped to gain or do during the final workshop with the other faculty participants. She explained:

> It may be helpful to hear the rest of them share what was the piece of technology that they used and did it work well and would they use it again. I want to know if they would do it again and if they thought that their students would benefit and if it would pass it onto their classroom someday. There might be some other things that they may have done that I haven't even heard of that they've done and it's been a success and I'd like to know that. (Interview 2)

This aligned with what the faculty developer had already planned, which included the following three tasks: (1) faculty described how they implemented their projects in their course, (2) their perceived efficacy of their project, and (3) describing their next steps. Due to scheduling constraints, Cara was unable to attend this final meeting.

During the meeting, faculty participants shared about their project in a very general sense that provided the other faculty an overview of the learning experience. As faculty members shared about their projects, they talked about both what went well, but also areas they felt they could do more. For example, Alice explained how the majority of her candidates used PowerPoint as the platform for their portfolios, yet she felt there was more that they could explore in terms of the technology candidates used. Bernice also discussed an area she wanted to improve, which was related to how the strategy videos were organized and shared with her candidates. She explained: "The hardest part of my vision is I have a bunch of things I can click on," but that they do not have a good way to facilitate it in a user friendly way that is organized (Field Notes 1/30/15).

As faculty discussed their projects and opened up about areas they wanted to improve for the future, the other faculty members became a resource, often asking questions and offering potential solutions. Erica was especially active during the meeting and offered a number of ideas to her colleagues. For example, she suggested to Alice that she limit the candidates in the technologies they use for their

portfolio platforms so that they could not use certain tools, such as PowerPoint. She had suggestions for Bernice as well. She suggested that she use a blog to try to better organize her resources and strategy videos for candidates. Common amongst all the faculty participants during the meeting was interest in knowing more about what each other did in the classroom as they implemented their projects. They all, at different times, asked a colleague if they were planning on continuing their projects into the future.

As the meeting drew to a close, the faculty developer asked if any of the faculty had any "minor victories" that happened during the project that they wanted to share (Field Notes 1/30/15). Erica was quick to share how her candidates and her overcame the issues with the Ken Burns Effect. Debbie explained that she was so hesitant to use technology and that to have it work was a victory. Erica supported her comment by noting how it was helpful that they had to do the work to figure everything out. Alice explained: "I think for me it was figuring out that I didn't need to tell them everything that needed to be in this documentation, but I could show them really good examples and they could figure it out" (Field Notes 1/30/15). Bernice shared two victories she experienced. The first was that she was excited to see some of her candidates starting to use video as part of their tutoring instruction. While video-based instruction was not her focus, through her project the candidates learned a lot about how to use video, which some then transferred to their teaching. The other area she was excited about was how a candidate that was not excited about the video project ended up enjoying the experience.

Continuance or Discontinuance

As this faculty development program neared its end, all teacher education faculty at ABC University, including the participants in this project, were invited to participate in another faculty development program facilitated by the faculty developer. This opportunity, while not focused on TPACK-based instruction, followed a very similar structure as was described in this section. Of the five faculty participants in this study, four of the five continued to participate in the same genre of faculty development, while only one participant did not continue to do so. However, upon beginning the new faculty development program, which was also cohort- and design-based, the four faculty participants from this study maintained their cohort and continued to work together in the new program.

Faculty Development Experience Themes

During the third interview, faculty participants were asked about the overall faculty development experience. They each talked about a variety of topics related to the faculty development experience. Of those topics, the following themes emerged: one shot versus ongoing faculty development, and the value of the faculty developer's support.

Theme 1: One Shot Versus Ongoing Faculty Development

As faculty talked about the faculty development experience, they compared it to their prior faculty development experiences. For Alice, who had "attended a lot" (Interview 3) of other faculty development experiences, she explained that in her past experiences whether it was a workshop on campus or a conference session she attended, she often would struggle with implementing what she had learned. She explained:

> I would go to and listen and learn and I would implement it that day. And then when I would be off on my own, off in my office, something would happen that something wouldn't work. Or I would forget something or a couple weeks would go by and I would forget the steps for how to do something and I just didn't follow through on it. It would be something I really did want to use, but it was going to take me a lot of time in order to go back and figure it out. So the one shot kind of deals never really worked super well. (Interview 3)

However, during this faculty development experience she described a different experience. She explained:

> This project was good, because I mean I have an idea and I want to follow through on it and there's that support system that I want to say, we're going to make this happen. Here's some ideas on how you might, almost like some hand holding a little bit to help you get over that step and to figure out how it might work, so that when you do run into those glitches, you don't quit. (Interview 3)

Of value, therefore, was having the support during implementation that she had not had during prior experiences.

Cara felt similar to Alice and highlighted the ongoing support available during this faculty development experience. She stated:

> Well the other things are kind of one shot. So you go and you learn and you leave. There's no check up or follow through or check in. So that's a great benefit to this. That there's the constant checking in from the beginning to the end. The follow up and follow through where as that doesn't happen in other. (Interview 3)

Cara explained that this faculty development experience was similar to a professional learning community or PLC she had participated in the past, in terms of the format, which for her was a benefit.

Personalization. Debbie, in addition to the ongoing nature of the program, discussed the value with being able to focus on one topic, where in other faculty development opportunities, such as conferences and workshops, multiple topics were discussed within a very short time span. She explained:

> Well the huge thing is that it's more than one. I feel like I have your undivided attention when I need help. You're readily available and it's not overload mode. When you go to a conference and you go to a technology session there are like 50 things thrown at you and I come back and I don't remember any of them. Just show me one or two that you showed us. Let us practice cause usually you don't get to practice at those things. They throw everything at you and they expect you to go back on your own computer or whatever to figure it out and that's not how I learn. So that's what been really good about this development. (Interview 3)

Therefore, for Debbie, this faculty development experience allowed her the opportunity to try one approach using technology, which she was then able to implement in her course.

Bernice discussed the practical characteristics of this faculty development program as well. She explained that when she typically has attended conferences, she was more involved in other aspects of her knowledge and skills beyond her classroom instruction. With this experience, however, she thought it was "more focused on practice…so that was really good to think about it in that way. How can I take one project or one assignment and really make it better or change it in a very public way" (Interview 3). She continued to explain:

> The collegial, conversational facilitation kind of thing should be what is professional development, in particularly colleges of education. I just think that it works better. I think people are invested more. It raises professionalism. It changes who is the expert. It does so many things in a productive way. (Interview 3)

Bernice continued to explain that having access to a series of development opportunities or being required to participate was "not going to help me. Just having access doesn't mean you're going to do it you know," (Interview 3) which again highlighted the value she felt an ongoing process had over more one time opportunities.

As Erica described the differences, she felt the level of personalization was what was stood out. She explained:

> It was focused on exactly on what I was doing rather than attending or participating in something that was a general topic and I have to pull out how it fits to me. This was more catered towards what I wanted to do, so in that aspect it was really good. Especially in the arts I feel like when you take a lot of trainings for things it's a general idea. It's more concentrated on core subjects and you have to kind of figure out your way; how it fits you. So this was nice because it was like, this is what I want to do. Now you figure out how to help me do it. So that was good. (Interview 3)

Alice also thought the faculty development experience was personalized, indicating that it "really fit my project really well and it was immediate kind of help" (Interview 3). Rather than having a general topic, much like the experiences that Debbie described where multiple topics were shared during the conference or workshop session, this opportunity allowed the faculty member to customize what and how she wanted to do in her course using a more self-directed approach.

Intimidation. Faculty also talked about how they had experienced feelings of intimidation during faculty development opportunities. Two of the five faculty participants talked about the intimidation they had experienced in past opportunities, while one faculty member talked about the intimidation she experienced as part of this faculty development opportunity. Alice explained the nature of the intimidation she had experienced. She explained:

> I don't ever think they mean to be intimidating, but they end up being intimidating, especially when someone makes assumptions that you know more than you know or that you should know more than you know. I've been at one where I attended and the person basically said that I'm not going to show you how to do this. I'm going to assume you can do it on your own. I want to go on to the next step. I understand that, but the next step didn't make sense to me because I didn't have the first step. (Interview 3)

The lack of connection between faculty goals for their development and available opportunities appeared to be out of alignment. As Alice explained, she did not believe the facilitator in the example she shared wanted to create an intimidating environment, but by being out of alignment with what faculty knew and wanted to do, this type of environment was created.

Bernice made similar comments regarding intimidation in past faculty development opportunities, but also highlighted how a misalignment between faculty goals and the structure of the opportunity wastes time. She stated:

> I have participated in things on this campus where you are in like a tech lab and someone is leading it and I don't want to participate, I don't want to ask questions, because it's going to be a joke or it's going to be not taken as a serious issue or something to consider or I've seen, or just the intention of the workshop or whatever it is, is there's. It's not even yours. It's not negotiated. So I think those things I tend to tune out and I don't want to participate. On some level that's intimidating, but on some it's just not worth my time and I'm just sitting here wasting my time. It's just frustrating. (Interview 3)

Bernice's comments target the potential pitfalls of having misaligned faculty development, especially if faculty chose not to participate, because they failed to see the value. Therefore, Bernice advocated for a negotiated experience as being of more value for faculty.

Debbie, during this faculty development experience, indicated during the second interview that she "felt a little intimidated by everybody else's project" (Interview 2). The nature of her intimidation was in comparing herself to her colleagues, which was similar to a statement Alice made about a prior experience. Alice stated:

> Sometimes I feel intimidated by other colleagues that are in those workshops sometimes, because they know more than I do or they seem, they talk like they know more than I do. I don't know if they do but they use sort of their knowledge to kind of showcase what they're doing in a way that makes me feel as if I should do more. (Interview 3)

Just as Debbie had experienced during this program, Alice had experienced it in a prior opportunity. Therefore, the faculty developer followed up during the final interview to see if the intimidation persisted in the final faculty meeting where participants shared about their projects. When Debbie was asked if she still felt intimidated, she stated, "No, not at all" (Interview 3). She continued to explain:

> Well I think first of all I met the goal I made for myself. I felt good about that. I felt successful in what I took on to do. I really didn't need to compare myself with what anybody else was doing. What they were doing was specific to their course and where they are in their development. (Interview 3)

Debbie realized that she did not need to compare herself to her colleagues, because it was her goal for her course.

Debbie went onto describe why she did not need to compare herself to her peers, because of the relationship she had with all of them. She said, "I know all those people and I feel quite comfortable with them…I just realized that everyone is doing what they wanted to do" (Interview 3). While Bernice did not experience any intimidation in the current faculty development approach, she explained that it was because

the faculty were "very open people. Giving feedback is a non-issue for them" (Interview 3). While there appeared to be a collegial and open relationship amongst the faculty participants, Alice too reflected on how she compared herself to others in the group. She explained:

> When you hear your peers and what they're doing, you just automatically size up what you're doing and say gosh, that seems like that's a good idea. Maybe I could [do that]. There was one particular person that I feel like is very innovative and so I look at those ideas and go whoa!!! But I thought, I saw just lots of different ideas and so, nothing that I worried too much about. It was more about myself wanting to go, oh what's next? What else can I be doing? (Interview 3)

The instinctiveness of faculty to compare themselves to others appeared to be unavoidable, and in this case, how the faculty interpreted that comparison may or may not have resulted in intimidation. Yet, with what both Alice and Debbie expressed in their comments, their focus, while initially comparing themselves to others, needed to be more on their own goals and how they could improve. For Debbie, the only faculty participant in this study who felt intimidated, she eventually reached the point where she was only concerned with her own growth.

Theme 2: Value of Faculty Developer Support

As faculty reflected on the faculty development experience, they described the value of the support provided by the faculty developer. Specifically, faculty dialogue centered on two general areas. The first was how the dispositional qualities of the faculty developer helped develop a positive relationship that was necessary for developing and implementing faculty projects. The second was related to how the faculty developer helped faculty feel more confident in their knowledge and skills specifically related to technologies, which for some faculty opened them up to taking more instructional risks they otherwise may not have done.

Dispositional qualities. In terms of the dispositional nature of the faculty developer, faculty described him as very supportive of what faculty wanted to accomplish in their instruction. Alice for example, explained that he helped "brainstorm what we could do" and that he "validated" her ideas as she shared her project idea with the faculty developer (Interview 3). Debbie explained that the faculty developer was "very patient and no question was a dumb question" (Interview 3). Bernice and Cara both described the sense of availability they felt they had to the faculty developer. Bernice said that she felt could approach the faculty developer if something was not working or if she had questions. However, she

said that "it was just if we needed it. It was just a reassuring kind of support" (Interview 3). Cara explained that she "knew that if I had a question that you would be the one that I'd ask…I did feel that if I needed to ask that you would answer or find the answer if you didn't know the answer yourself" (Interview 3). Erica described the dispositional support as:

> [More of] an advocacy and emotional support. Like you can do this advocating for me to do things…I think that was really important for me to take that next step and say yep, we're going to do it and I'm not going to worry about what my support says. (Interview 3)

Taking each of these comments together showed how the faculty developer sought to support faculty in ways that promoted what faculty wanted to accomplish. Sometimes it required brainstorming with faculty and other times advocating for faculty by finding the answers they had and providing them the encouragement to take a risk and step outside of their comfort zone to try something new.

Alice talked about how the faculty developer supported her risk taking. She explained that she wanted her candidates to have more creative license in their portfolios, but she "was afraid they were going to ask me how to do it and then I wouldn't know how to do it" (Interview 3). She explained that she "could share with them what I do know and help them problem solve, steer them towards the resources that are available" (Interview 3). Yet, "with [the faculty developer's] encouragement, I was able to take that risk and follow through on it and end up with a very dynamic way to document for my students" (Interview 3). She continued to say that she realized "how important a person, like the role [the faculty developer] played in this project, really is" (Interview 3), because they helped support their knowledge development and areas where they could use further development.

As faculty continued their dialogue, they explained how the support of a faculty developer helped fill in the gaps they felt they had. Alice explained:

> The faculty developer makes connections. They may see ways to approach a task differently because of their expertise and what I might see and sometimes the gap is so big that I may not try it if I did not have that intermediate person to help me see it. (Interview 3)

Debbie had a similar opinion in that without a faculty developer helping her, that she "wouldn't even know where to start" (Interview 3). Bernice explained how the faculty developer helped "negotiate and navigate through [problems]," which was what Erica also reflected on. Erica explained that "technology is a hard

thing to figure out, but sending directions via email is not an effective way, because it's hard to translate that" (Interview 3). The email she referred to was how her college technical staff had supported her during this project, which as her comments suggested was not successful. She continued to explain, "You need someone to physically be there," which multiple faculty highlighted as being a valuable characteristic of the faculty development support they received.

As can be seen through both Erica's and Alice's comments, they both felt more confident, which enabled them to take more risks, primarily because there was another individual available to support them and their candidates.

As faculty talked about their knowledge, they explained that they did not necessarily need to have much technical knowledge to create TPACK-based learning experiences for their candidates. Bernice explained that

> Some knowledge is important. Not just what it could do, but what are some of the possible affordances of these tools. That's what you need to know, not so much that you turn it on, you click here, because you can figure it out or the students will. (Interview 2)

Alice explained that in her project, she did not know about all the technologies candidates were using and indicated that candidates "did a lot of investigation on their own" (Interview 2). She went onto explain that candidates have to do this type of inquiry individually or as part of a group because "you're giving them the experience that someone didn't give you" (Interview 2). Yet, as Cara explained, as the instructor, there is a certain level of knowledge required of faculty to do a TPACK-based project. She stated, "You have to be knowledgeable, because students will run into problems. It's not necessarily that you have to solve them, but you have to have some sense of where to go" (Interview 2). Cara described this knowledge as "foundational," where Debbie explained that " I don't think I need to know it all" but that knowing the basics was necessary in order to create the learning experience so that candidates can have the opportunity to expand their knowledge and skills. Therefore, as an outgrowth of the faculty developer's dispositions and the relationships that developed, the opportunity emerged to help faculty feel more confident using technologies.

Supporting faculty confidence. Helping faculty feel more confident was the other area faculty reflected about in terms of the value of the support the faculty developer provided. Debbie stated:

> Having you coming [sic] to my classroom when I was first using it was a huge help because it gave me the confidence to go ahead and do it, because if I had a problem I could go DAN HELP!! And you were right there. So you came in more than once, which is really great because I have to use things more than once to build confidence in using them and right now if I were to go in a classroom to create one of these, I could sit down and feel pretty confident that I could pull it off without anybody else being in the classroom to help me. So I took baby steps, I did the learning, I did the using myself, and modeling for my students and then actually having them use it. (Interview 3)

Over time, as Debbie worked with the faculty developer and he was present during the learning environment, she perceived her confidence increased, which led her to believing more in herself and her abilities to carry out instruction that leveraged technologies.

The confidence that Debbie described was of a similar nature to that of what Alice described. Alice explained that the faculty developer "brought in some of the aspects [of the project] that I didn't feel as confident about, but then I could then quickly learn and maybe the next time I would be able to do it more independently" (Interview 3). Yet, for Erica, just having the faculty developer believing in her idea helped with her confidence. She explained when talking about her independence within the faculty development experience to focus on her interest area that the faculty developer "seem[ed] to think that it would work. And I seemed to think it would work, but having someone else say that makes you feel a little more confident" (Interview 2).

Debbie reflected on the nature of the relationship that had been established between her and the faculty developer:

> You…are very approachable and like I said there's no question that's a dumb question. So I'm not afraid to say okay Dan, how do I do this? Can you show me one more time? Or whatever. That's been nice. Because not all tech people are like that and not all tech people will break it down in small pieces so I can understand it. (Interview 3)

Debbie also explained how it was not just her who had found value in the faculty developer being present in the classroom. She explained that candidates "felt comfortable with you in there," (Interview 2). She later stated:

> When you were in the class and students [candidates] were starting to use it, they looked to you for questions and advice too. Like hey Dan. It was like awesome! I loved it! Because it was like you were part of our class community and they weren't afraid to ask you or ask me. We were all part of the learning community together. It was awesome. So you were a support to me and the students when they first started using it as well. (Interview 3)

By developing a relationship with the faculty, the faculty developer was able to help them take what they termed as risks and as they did so, the faculty developer became a resource for both faculty and their candidates.

Faculty TPACK Characterization

This study sought to characterize faculty knowledge and any changes that occurred while participating in a cohort- and design-based faculty development program. Initially, the primary focus area of interest was in determining if there was a change in faculty TPACK and TPACK related domains, such as TPK or TCK. However, upon analysis of qualitative data, two other areas emerged. The first is the degree to which faculty perceived their confidence as increasing. The other emergent area was the limits faculty participants had in terms of their knowledge. Each of these themes will be discussed in the following sections.

Faculty TPACK was assessed prior to the start of faculty development activities and then again at the end of the project after faculty development activities had ended. A structured interview protocol was followed where, in the first interview, faculty described a project they had implemented in the past that required the use of technologies (See Appendix A). Responses were then assessed using a four point rating scale (See Appendix G).

Table 2

Descriptive statistics of faculty participant knowledge by TPACK domain

	Pretest		Posttest		
Criteria	Mean	SD	Mean	SD	Mean Difference
Curriculum Goals and Technologies	2.6	1.342	3.6	.548	1.0
Instructional Strategies and Technologies	3.0	.707	3.2	.837	.2
Technology Selections	2.4	1.14	3.8	.447	1.4
Fit	2.4	1.14	3.4	.894	1.0

Note: N = 5

Analysis of faculty participant responses from the first interview found mean scores below three, where a three indicated proficiency, for three of the four items assessed in the protocol (see Table 2). These items included: ability to align technologies with curriculum goals, ability to select appropriate

technologies for use during instruction, and ability to fit technologies together with curricular topics and the instructional approach used in the instructional plan. The first item aligned with TCK with the latter two items aligned to TPACK. Mean scores below three on these three items indicated that at the onset of the faculty development program, faculty knowledge and ability to create TPACK-based instruction, as well as their ability to integrate technologies into the curriculum goals they established were each still developing. The final area measured by the protocol was the ability to use technology to support instructional strategies. On this item, faculty had a mean score of three, which indicated proficiency for the item. As Table 2 indicates, for the pretest scores, the three items where further development could occur, there was a greater amount of variance than with the TPK item where faculty were more proficient. Thus, variance among faculty individual scores on the three lower mean scored items was heterogeneous, indicating larger differences between each of the faculty participants' scores.

Faculty TPACK was assessed again at the end of the faculty development program using the same protocol. However, this time, faculty participants were directed to describe the project they implemented during this faculty development experience in the interview. As Table 2 indicates, mean scores for each of the four items assessed were above three, with one item approaching four or exemplary. The item approaching the exemplary level was faculty ability to select technologies that were compatible with the curriculum goals and instructional strategies they used. Variance among faculty participant scores was homogeneous for each of the items, indicating small differences in faculty participants' scores.

Due to the small sample of faculty participants, mean differences were computed rather than a paired samples t-test. Analysis of pretest to posttest scores found a positive increase on all four items. On each of the three items that initially scored below a three, each had a positive increase of at least one point on the rating scale. For TPK, which initially had a mean score of three, there was only a very small positive increase. Faculty scores were also more homogeneous on three items with the largest mean differences, while on the TPK item there was a slightly greater variance, although scores were still homogenous.

Candidate Knowledge Characterization

This study examined the extent to which candidate knowledge of TPACK and TPACK associated domains changed as a result of their enrollment in one of the faculty participants' courses. To capture a

more comprehensive description of candidate knowledge, both candidates and faculty were asked about candidate knowledge.

Faculty Perceptions of Candidate Knowledge

Faculty reflected on the extent to which they thought their students were, after completing this project, able to enhance K-12 student learning and understandings about content in specific ways. Each of the faculty thought that candidate knowledge had changed to some degree, such as their awareness of technology-based approaches that they could use to teach their future students. For example, Alice explained that her candidates "have a new tool that they could use that would be very dynamic in their teaching career," (Interview 3) while Cara stated that candidates left with "tangible products" (Interview 3) that they could use in the future. Erica was excited that her candidates gained new knowledge about how they could use the iPad as an art medium, much like a paintbrush and canvas. She explained: "Actually using it to make art, that was something really new to most all of them" (Interview 3).

Faculty also discussed instances where some candidates transferred what they had learned to new situations. Bernice described how some of her candidates began using video as part of an instructional approach. She explained that candidates did this "of their own volition in other projects later on," (Interview 3) which she explained added value to her project and the approach she had taken. Erica too had an instance when candidates demonstrated transfer. During another project when candidates needed to create a written document or a public service announcement and they asked if they could make a "keynote and put it into a YouTube video and put it on a webpage," (Interview 3) which was the very same process they had used in their original project. Thus candidates were able to identify ways they could use what they had learned in a new situation.

Finally, Erica and Debbie both thought that their candidates had a level of increased comfort and confidence with their use of technology. Debbie explained that she felt "pretty confident that most of them won't be afraid to use it in their classrooms," (Interview 3) while Erica explained: "I definitely think that they're more comfortable using technology as a tool in the art room. Like as an art media, not as a tool. Like as an art media for making art" (Interview 3). Erica continued to explain that her candidates were comfortable using the iPad as a teaching tool, but in terms of using it to make art, she did not think that any

of them had prior experiences doing that, which she felt was more of a task graphic arts majors experienced. So from that perspective, developing their comfort broadened candidate knowledge of what was possible through technology, as well as how to do it.

Candidate Perceptions of Knowledge

Candidates were also asked about their knowledge of TPACK using a pretest and posttest TPACK survey, which included both scaled and open-ended items.

Scaled TPACK survey items. Scaled pretest and posttest TPACK survey results were analyzed using descriptive statistics and paired samples t-test for each survey item, which is summarized below. The survey asked questions about each of the seven TPACK domains as well as open-ended items that asked them about TPACK. On the scaled items, candidates responded using a four point Likert-type scale where a one equaled strongly disagree and a four equaled strongly agree.

Table 3

Technology Knowledge Descriptive and Inferential Statistics for Averaged Domain and Survey Item

	Pretest		Posttest			
	Mean	SD	Mean	SD	df	P
TK (Averaged)	3.00	0.425	3.04	0.438	100	0.332
I can learn technology easily	3.14	0.548	3.20	0.490	100	0.202
I can easily solve some of the technical problems I encounter	2.82	0.573	2.88	0.553	100	0.275
I know how to seek technology help	3.20	0.530	3.13	0.658	100	0.264
I have sufficient knowledge and experiences with the most recent technologies	2.85	0.536	2.94	0.580	100	0.129

Notes: N = 101, * = Statistical Significance at P ≤ .05, Cronbach's Alpha: Pre: .781, Post: .761

Table 3 shows that on the pretest survey candidates agreed that they could learn technology easily and they knew how to find technology help. However, candidates did not agree that they could solve their own technology problems or that they had sufficient knowledge and experiences with the most recent technologies. Variance on these items was also homogeneous, indicating that there was not a great amount

of variability in candidate responses. Candidates responded similarly on the posttest survey with positive mean differences on three items, but there were no items with statistically significant differences. Yet, when scores from each of the items were averaged, candidates reported agreement on the TK items.

Table 4

Content Knowledge Descriptive and Inferential Statistics for Averaged Domain and Survey Item

	Pretest		Posttest			
	Mean	SD	Mean	SD	df	P
CK (Averaged)	3.11	0.348	3.26	0.399	100	<.001*
I have sufficient knowledge in my field	3.11	0.422	3.26	0.483	100	0.005*
I know basic concepts such as formulas and definitions in my field	3.15	0.410	3.31	0.524	100	0.007*
I understand the structure (organizations) of topics of content I teach	3.14	0.470	3.29	0.497	100	0.011*
I can present the same subject matter at different levels	3.02	0.583	3.25	0.537	100	0.002*
I can explain background details of concepts, formulas, and definitions in my field	2.97	0.577	3.13	0.462	99	0.009*
I have adequate knowledge in explaining relations among different concepts on the subject matter	3.01	0.574	3.14	0.491	100	0.032*
I can explain why a specific topic is important	3.18	0.555	3.30	0.558	100	0.039*
I can make connections with content I teach and daily life.	3.34	0.496	3.43	0.517	100	0.140

Notes: N = 101, * = Statistical Significance at P ≤ .05, Cronbach's Alpha: Pre: .863, Post: .910

Table 4 shows that candidates on the pretest survey indicated that they agreed with nearly all the survey items related to CK. One item, I can explain background details of concepts, formulas, and definitions in my field, was very close to agreement at 2.97 on the scale. Variance on these items was very homogeneous for each item, indicating very little dispersion of candidate responses. On the posttest survey, mean scores were higher on each of the CK questions, with each item above 3.13 on the scale. Variance was still very homogeneous as it was with the pretest. Paired samples t-test indicated statistically

significant differences for each item but one: I can make connections with content I teach and daily life. When averaged, the mean scores were similar, but paired samples t-test indicated that there was a highly positive statistically significant difference of less than .001.

Table 5

Pedagogical Knowledge Descriptive and Inferential Statistics for Averaged Domain and Survey Item

	Pretest		Posttest			
	Mean	SD	Mean	SD	df	P
PK (Averaged)	3.27	0.405	3.32	0.396	100	0.306
I can use different approaches to teach.	3.36	0.540	3.39	0.489	100	0.642
I can select appropriate teaching styles for students from different backgrounds	3.17	0.567	3.23	0.508	100	0.368
I can use a variety of tools (approaches) to assess students' learning	3.31	0.543	3.32	0.468	100	0.874
I can motivate students to engage with the content	3.27	0.467	3.36	0.502	100	0.118

Notes: N = 101, * = Statistical Significance at P ≤ .05, Cronbach's Alpha: Pre: .763, Post: .819

In terms of candidate PK, candidates indicated on the pretest survey that they were in agreement with each of the four survey items (see Table 5). Dispersion was homogeneous for each of the items. On the posttest, candidates reported very similar responses with each survey item positively increasing at the agreement level on the scale while dispersion still remained very homogeneous. The average of the PK items was at similar levels. Given the very slight positive increases in mean scores, it was no surprise to see that none of the items had any statistically significant differences.

Table 6

Pedagogical Content Knowledge Descriptive and Inferential Statistics for Averaged Domain and Survey Item

	Pretest		Posttest			
	Mean	SD	Mean	SD	df	P
PCK (Averaged)	3.06	0.357	3.19	0.373	99	0.002*
I can effectively develop a plan of teaching a specific subject matter in my field	3.14	0.510	3.28	0.473	99	0.030*
I can select teachable content of the subject matter appropriate to the students' level	3.12	0.407	3.22	0.484	99	0.070
I can teach the same subject matter to students at different levels	2.99	0.538	3.26	0.505	99	<.001*
I can identify students' preconceptions and misconceptions on the subject matter	2.96	0.508	3.09	0.524	99	0.038*
I can adjust my teaching according to level of ease and difficulties with learning of specific subject matter	3.14	0.510	3.21	0.456	99	0.239
I can identify difficult sides of the subject matter and find ways to explain them	3.01	0.520	3.10	0.482	99	0.129

Notes: N = 101, * = Statistical Significance at P ≤ .05, Cronbach's Alpha: Pre: .808, Post: .860

In terms of candidate PCK, all but two of the items were at the agreement level on the pretest (see Table 6). The two items that were not in agreement were very close to the agreement level. Dispersion of these items was homogeneous. On the posttest, each of the items had a positive increase in mean score with dispersion remaining homogeneous. Three of the items had positive statistically significant differences, two of which were the items that were just below the agreement level. The averaged items also were at the agreement level on pre and posttest surveys with very little dispersion. In addition, there was positive statistically significant differences overall at a p-value of .002.

Table 7

Technological Pedagogical Knowledge Descriptive and Inferential Statistics for Averaged Domain and Survey Item

	Pretest		Posttest			
	Mean	SD	Mean	SD	df	P
TPK (Averaged)	3.04	0.482	3.17	0.432	100	0.008*
I can use technology to assess students' learning	2.99	0.608	3.19	0.467	98	<.001*
I can use technology to identify individual differences among students	2.85	0.609	2.95	0.606	99	0.124
I can use technology to advance my teaching and students' learning	3.24	0.553	3.32	0.509	99	0.252
I can use technology to bring students' individual differences (learning preferences, content background, and academic level) into the classroom	3.09	0.588	3.22	0.522	99	0.052

Notes: N = 101, * = Statistical Significance at P ≤ .05, Cronbach's Alpha: Pre: .838, Post: .835

Candidate TPK was at or very near the agreement level on three of the four survey items (see Table 7). One item, I can use technology to identify individual differences among students, was nearing agreement, but was well within the disagree level on the scale. Dispersion on each of the items was homogeneous. On the posttest, analysis indicated positive increases in mean scores for each item, with three of the four items above the agreement level. The lowest rated item from the pretest continued to be the lowest rated item on the posttest as well. However, this was the only item that has statistically significant differences, which was positive at a p-value of less than .001. When each of the TPK items was averaged, the pretest had a mean score at the agreement level with a positive increase in mean score on the posttest. The averaged means were also had statistically significant differences at a p-value of .008.

Table 8

Technological Content Knowledge Descriptive and Inferential Statistics for Averaged Domain and Survey Item

	Pretest		Posttest			
	Mean	SD	Mean	SD	df	P
TCK (Averaged)	3.30	0.486	3.32	0.440	99	0.791
I can use technology to present the content in different ways	3.36	0.542	3.34	0.515	99	0.733
I can use technology to enrich the content	3.34	0.590	3.36	0.540	99	0.870
I can use technology to demonstrate unobservable facts, concepts, and principles of the content	3.13	0.562	3.24	0.513	99	0.105
I can use technology to access additional resources about content that may otherwise not be available	3.38	0.546	3.35	0.478	99	0.495

Notes: N = 101, * = Statistical Significance at P ≤ .05, Cronbach's Alpha: Pre: .893, Post: .883

Candidate TCK was well within the agreement level on both the pre and posttest surveys with homogeneous dispersion as well (see Table 8). However, from pretest to posttest, there were not positive increases on each of the survey items. Rather, two of the items had slight decreases in mean scores of less than .05. These items focused on using technology to present content in different ways and using technology to access additional resources about content that otherwise would be unavailable. While there were decreases in mean scores, neither were at a statistically significant level, which was also true of the items with positive mean score increases. Overall, candidate TCK still remained well within the agreement level on both pre and posttest with very homogeneous dispersion. While overall there was a positive increase in mean scores, this increase was not significant.

Table 9

Technological Pedagogical Content Knowledge Descriptive and Inferential Statistics for Averaged Domain and Survey Item

	Pretest		Posttest			
	Mean	SD	Mean	SD	df	P
TPACK (Averaged)	3.06	0.407	3.15	0.411	100	0.028*
I can use technology in teaching the specific content within the defined pedagogical approach in a given context	2.83	0.530	3.02	0.469	100	0.001*
I can use technology ease students' learning of a specific content	3.07	0.534	3.11	0.527	100	0.549
I can use technology in such a way that students feel its positive impact in their learning of specific subject matter	3.10	0.539	3.19	0.524	100	0.150
I can use technology to organize my teaching and students' learning of specific subject content	3.21	0.535	3.30	0.481	100	0.129
I can select specific technology for teaching specific content	3.01	0.592	3.10	0.592	100	0.200
I can use technology to bring real-life experiences, examples, and analogies about specific content	3.25	0.573	3.28	0.550	100	0.657
I can use technology to identify learners' individual differences on understanding of the content	2.92	0.560	3.07	0.495	100	0.016*

Notes: N = 101, * = Statistical Significance at P ≤ .05, Cronbach's Alpha: Pre: .860, Post: .899

Candidate TPACK was at the agreement level on all but two of the items on the pretest survey (see Table 9). These two items were: I can use technology in teaching the specific content within the defined pedagogical approach in a given context, and I can use technology to identify learners' individual differences on understanding of the content. For both of these items, candidates were approaching the agreement level, but were still in disagreement with the statements. Dispersion was homogeneous on the pretest. On the posttest survey, candidates experienced positive mean score increases for each item, where each item was at the agreement level. Dispersion was remained homogeneous. Of the seven items within

the TPACK section of the survey, only two items had positive statistically significant differences, which were the two items that were below the agreement level on the pretest. When averaged, candidates were at the agreement level on the pre and posttest, with an increase in mean score, which was a positive statistically significant difference.

Given the number of Juniors and Seniors enrolled in the five faculty courses, paired samples t-tests were run on both groups to better understand the nature of TPACK characterization for each group.

Table 10

Descriptive and Inferential Statistics for Averaged TPACK Domains for Juniors

	Pretest		Posttest			
TPACK Domain	Mean	SD	Mean	SD	df	P
TK	2.95	0.409	3.02	0.313	35	0.185
CK	3.07	0.390	3.17	0.356	35	0.096
PK	3.30	0.450	3.31	0.370	35	0.870
PCK	3.04	0.377	3.14	0.286	35	0.165
TCK	3.35	0.436	3.33	0.446	35	0.780
TPK	3.19	0.424	3.25	0.431	35	0.417
TPACK	3.16	0.333	3.14	0.397	35	0.730

Notes: N = 36, * = Statistical Significance at $P \leq .05$

For Juniors, it was found that on the pretest survey, candidates at the agreement level with each of the TPACK domains, except for TK, although TK was very close to the agreement level (see Table 10). Dispersion was homogeneous for each domain as well. On the posttest survey, Juniors were at the agreement level on each item with positive increases on all but one domain, TCK. TCK mean scores decreased by .02. Dispersion remained homogeneous on the posttest. Paired samples t-test indicated that there were no items with statistically significant differences.

Table 11

Descriptive and Inferential Statistics for Averaged TPACK Domains for Seniors

	Pretest		Posttest			
TPACK Domain	Mean	SD	Mean	SD	df	P
TK	3.02	0.429	3.03	0.490	61	0.808
CK	3.12	0.346	3.28	0.404	61	0.005*
PK	3.24	0.312	3.31	0.403	61	0.226
PCK	3.03	0.323	3.20	0.398	60	0.004*
TCK	3.25	0.507	3.29	0.441	61	0.433
TPK	2.94	0.463	3.11	0.424	60	0.004*
TPACK	2.97	0.413	3.14	0.414	61	0.004*

Notes: N = 62, * = Statistical Significance at $P \leq .05$

Seniors were at the agreement level on all but two TPACK domains on the pretest survey (see Table 11). These domains were TPK and TPACK, both of which were approaching agreement. Dispersion was homogeneous for each of the items on the pretest survey. On the posttest survey, candidates experienced positive increases in mean scores, with all means above the agreement level. Dispersion remained homogeneous. Seniors did experience positive statistically significant differences on our TPACK domains, which include CK, PCK, TPK, and TPACK. These were the same TPACK domains that were statistically different for all participants. Therefore, given that the majority of candidates were either Juniors (N=36) or Seniors (N=62), it was likely that seniors were the candidates that experienced the statistically significant differences in their knowledge as a result of their enrollment in faculty courses.

Table 12

Descriptive and Inferential Statistics for Averaged TPACK Domain for Candidates with Prior Instructional Technology Course Enrollment

	Pretest		Posttest			
TPACK Domain	Mean	SD	Mean	SD	df	P
TK	2.97	0.411	3.02	0.420	78	0.242
CK	3.07	0.335	3.24	0.387	78	<.001*
PK	3.23	0.394	3.29	0.385	78	0.268
PCK	3.05	0.394	3.17	0.364	77	0.018*
TCK	3.24	0.448	3.28	0.439	78	0.446
TPK	3.02	0.460	3.09	0.401	77	0.144
TPACK	3.05	0.395	3.13	0.407	78	0.072

Notes: N = 79, * = Statistical Significance at P ≤ .05

Candidates were also grouped based on their prior enrollment in an instructional technology course to better understand the nature of their knowledge. As Table 12 shows, on the pretest survey candidates with prior enrollment in an instructional technology course were at the agreement level on each of the TPACK domains except TK, although candidates were approaching agreement. Dispersion was homogeneous as well. On the posttest survey, candidates experienced mean score increases for each of the TPACK domains, all of which were at the agreement level. Dispersion remained homogeneous. There were also positive statistically significant differences on two of the seven TPACK domains, which included CK, and PCK.

Table 13

Descriptive and Inferential Statistics for Averaged TPACK Domain for Candidates without Prior Instructional Technology Course Enrollment

	Pretest		Posttest			
TPACK Domain	Mean	SD	Mean	SD	df	P
TK	3.10	0.467	3.09	0.503	21	0.883
CK	3.26	0.443	3.34	0.442	21	0.452
PK	3.43	0.417	3.43	0.424	21	1.000
PCK	3.07	0.423	3.27	0.400	21	0.029*
TCK	3.52	0.566	3.44	0.429	21	0.511
TPK	3.13	0.560	3.45	0.432	21	0.011*
TPACK	3.08	0.457	3.22	0.429	21	0.220

Notes: N = 22, * = Statistical Significance at $P \leq .05$

Candidates without prior enrollment in an instructional technology course responded at the agreement level on each of TPACK domains on the pretest survey (see Table 13). Dispersion was homogeneous on the pretest survey as well. On the posttest survey, mean scores on TK and TCK went down, while PK remained the same, with the remaining domains increasing. However, only two domains had statistically significant differences, which were PCK and TPK.

Table 14

Descriptive and Inferential Statistics for Averaged TPACK Domain for Candidates Completing Field Experience in Fall 2014 Semester

	Pretest		Posttest			
TPACK Domain	Mean	SD	Mean	SD	df	P
TK	3.02	0.399	3.02	0.456	76	0.938
CK	3.10	0.362	3.26	0.403	76	0.001*
PK	3.25	0.399	3.32	0.397	76	0.144
PCK	3.03	0.332	3.20	0.380	75	0.001*
TCK	3.26	0.488	3.34	0.437	76	0.127
TPK	2.96	0.470	3.16	0.445	75	<.001*
TPACK	3.01	0.402	3.16	0.405	76	0.003*

Notes: N = 77, * = Statistical Significance at P ≤ .05

Candidates were also grouped based on whether or not they completed a field experience during the Fall 2014 semester (see Table 14). Candidates who did complete a field experience had mean scores on the pretest survey at the agreement level for all but one TPACK domain, which was TPK. However, candidates were nearing agreement on the TPK domain. Dispersion was also homogeneous on the pretest survey. On the posttest survey, candidates experienced an increase in mean scores for each of the TPACK domains with dispersion remaining homogeneous. Of the seven domains, four were statistically significantly different. These domains included CK, PCK, TPK, and TPACK, which were the same domains as the full sample of candidate participants.

Table 15

Descriptive and Inferential Statistics for Averaged TPACK Domain for Candidates Not Completing Field Experience in Fall 2014 Semester

	Pretest		Posttest			
TPACK Domain	Mean	SD	Mean	SD	df	P
TK	2.95	0.505	3.10	0.375	23	0.019*
CK	3.16	0.391	3.26	0.394	23	0.246
PK	3.35	0.423	3.31	0.375	23	0.689
PCK	3.13	0.426	3.16	0.356	23	0.761
TCK	3.45	0.466	3.24	0.451	23	0.026*
TPK	3.31	0.425	3.21	0.395	23	0.226
TPACK	3.20	0.399	3.13	0.440	23	0.428

Notes: N = 24, * = Statistical Significance at $P \leq .05$

Candidates who had not completed a field experience during the Fall 2014 semester had, on the pretest survey, agreement on all but one of the TPACK domains, which was TK (see Table 15). Dispersion was also homogeneous for each of the domains. On the posttest survey, candidates were at the agreement level for all domains. However, on four of the seven domains, mean scores decreased, while dispersion remained homogeneous for each domain. Of the four items that had decreased mean scores from pre to post, one of those domains was a statistically significant difference. On the three other domains that experienced an increase, only one was a statistically significant difference, which was TK.

Candidate perceived impact of project on TPACK. On the TPACK survey, candidates were asked to respond to the following statement: Describe how your ability to combine your knowledge of content, teaching approaches, and technologies has changed as a result of the [project] completed in [this] class. In the question, the project was defined for each faculty member, such as video strategy presentation, and this in the question was the faculty participant's name. Of the 101 candidates that participated in the survey, 85 left a response to this question, which were coded for themes. The themes that emerged from analysis included: development of TPK, awareness of technological affordances, and critical critiques.

The first them, and most salient, was the development of TPK. Multiple candidates commented how they had a better understanding of how to use technologies to assess learner knowledge. Comments within this category included:

- "I feel that by using and creating Poll Everywhere questions, I have been able to connect it to prior knowledge and then also use it to see where other students are at with their background knowledge."
- "I liked having a way that can anonymous [sic] show me what some of the students are thinking so students who may not like to participate are able to share their opinions."
- "I learned that as a teacher I can use Poll Everywhere to assess my students' prior knowledge to a topic before starting a unit."
- "I learned that I can see where my students are at with understanding the material being taught."
- "I was able to document what I did with the kindergarteners my group worked with using technology."
- "It was beneficial to show student's progress and development through an eportfolio."

The majority of comments emerged from both Debbie's and Alice's projects, which were both on using technology with assessment, although the approaches they used varied greatly.

The second salient theme was that candidates expressed a greater understanding of technological affordances. These comments were very technical in nature. Comments included:

- "I also did not know that there were multiple types of poll everywhere like making a word cluster, doing a multiple choice question, etc."
- "I learned polleverywhere can be used for many different things."
- "The documentation project in Alice's course made me aware of different possibilities for using technology (PowerPoint, iMovie, Google Sites, Prezi, etc.) in order to communicate student learning that resulted from my instruction in a given unit."

- "The Poll Everywhere activities has improved my understanding of the use of it but not in my confidence of it."
- "I have actually created a poll everywhere, and I now know how easy it is to create."

Again, the majority of these comments emerged from Debbie's and Alice's projects, likely due to the nature of candidate control over their learning while they learned about the technologies used in those courses. In both courses, candidates had a very hands-on experience as they created the final product for each respective project, which allowed them to independently and as part of a group, explore the affordances of the technologies.

The final salient theme that emerged was that of critical critiques. These comments were critical of the project they completed or that the project had no impact on their knowledge and skills. Comments included:

- "Honestly, I used the skills I have already learned and made a presentation very similar to other classes, so I would not say my ability has changed."
- "I honestly don't like poll everywhere. It simply allows students to have their phones out, which is an added distraction. I think there is a better way we could integrate technology."
- "I used a powerpoint to document the final portfolio which I had done multiple times before so I was already comfortable with it."
- "Not much honestly, I think that polls everywhere is fun and exciting, but it doesn't seem like a super special event that enriches the lessons."
- "I think Poll Everywhere is a cool resource, but it is kind of boring. I don't see how it would bring variety into teaching approaches since all students do is anonymously answer a question, vote, etc."

These critical critiques of faculty projects indicate that there was still room for faculty to continue enhancing their projects for the future. Yet, when these comments are combined with the comments from the other two themes, it indicates that even if some candidates did not perceive any development as a result of the projects, they were using their metacognitive ability to consider the role that each technology,

content, and pedagogy had in the educative process. Then for the candidates in the other themes, it demonstrated that they perceived some degree of knowledge development, especially in terms of TPK.

CHAPTER 5

DISCUSSION

Research Question 1

This study sought to answer the question: How can the faculty development experience be characterized? Of special interest, therefore, was the educative process content methods faculty progressed through as they learned to leverage technologies in their instruction. Traditional approaches to faculty development, such as workshops, often fail to provide the necessary supports for faculty members as they explore new or different approaches to teaching with technologies (Mishra & Koehler, 2006). This often occurs due to what faculty in this study described as "one shot" development opportunities that are overly focused on only technologies, which they thought were insufficient to meet the needs they had that were required to reach success in the classroom.

The literature (Mishra & Koehler, 2006) on supporting faculty, and educators in general, indicated that technology-focused learning opportunities are a misguided approach to developing faculty knowledge and skills. Simply knowing how to use a technological tool without any connection to the what and how of teaching creates what Papert (1987) called technocentric learning experiences. Therefore, this study sought to take a different approach that blended both traditional approaches with more nontraditional approaches, which resulted in the emergence of a systematic faculty development process.

Emergence of Systematic Faculty Development

When looking at the faculty development process that was used in this study, both traditional faculty development approaches were used in conjunction with more nontraditional approaches. Specifically, the traditional workshop was leveraged at two points during the study, at the beginning and then again at the end. Yet, neither workshop resembled the traditional approaches used in this type of faculty development experiences. This is because the activities within the workshops were firmly grounded in the principles of social constructivism and adult learning theory, while seeking to also develop faculty TPACK.

Personalized, collaborative, and problem-based design.

While workshops were used in this study, they departed from the typical workshop experience that Mishra and Koehler (2006) described where the

focus was typically on technologies separate from any discussions of content and pedagogy. To avoid a technocentric approach in the kickoff workshop, it was personalized to focus on faculty interests, while also engaging them in collaborative problem solving and design-based activities. Each of these characteristics are central social constructivism and adult learning theory, and as such there was no focus on teaching technology that would have been disconnected from these theories. Rather, by focusing on activities firmly grounded in these two theories, faculty became more comfortable using technologies, while also coming to better understand the complex interactions between content, pedagogy, and technologies. This took place during micro-design project, the TPACK game, as well as during the feedback on faculty project activity. Faculty then applied what they had learned to the development of instruction for their course.

Examining each of the activities, the first activity, the micro-design project, focused on what Koehler et al. (2011) described as making the familiar unfamiliar. Faculty were put into an active learner role where they collaborated with each other to solve problems. In this case, they had to find and take pictures of every day objects to spell a word and then present it all at once. Even though on its face this activity did not appear to be much of a challenge, faculty were given great latitude with how they completed that task. What happened when this occurred was that faculty had to make decisions about how to move forward. They were not given instructions on what to do or any other instructions beyond a well-defined end product they had to create. As faculty began making decisions, they quickly experienced the intricacies of the technologies they selected to use. Each of the faculty groups struggled initially and as they struggled they did so through both collaborative and reflective processes. Individual tasks they thought should be easy to accomplish were difficult and they had to problem solve with their peers to manipulate the technology to do what they wanted. In doing so they likely had to question their own knowledge and assumptions as they created solutions to the problems they faced. Eventually each group had success and was able to accomplish the task, but what seemed like a familiar task (taking pictures), became very unfamiliar (putting them together to make the final product). Faculty reported that they were put in the seat of the learner, which they claimed was a valuable experience because it contextualized for them the experience their students, the teacher education candidates, have as they complete projects in their courses.

Had this initial activity been technocentric, it is likely the faculty developer would have given direct instruction on what technologies faculty should or could use, as well as how the final product should be constructed. This is an experience many educators have had, including this researcher. Yet, when so much direction is provided to participants, faculty are deprived of any socio-constructivist learning experiences since they would not have had to question their own knowledge or collaborate with others to complete the task. Their knowledge, abilities, and skills of the likely would have been ignored, overlooked, or otherwise disregarded. Faculty, albeit any professional educator, likely have the requisite knowledge, abilities, and skills to problem solve. They have had to problem solve in the past, but might not have had to transfer those experiences to a new situation, such as the experience faculty participants had in this first activity. It was highly probable that each of them had taken a picture before, but likely not in the context they had in this activity. Even though they did not have that experience, they were able to do it. They were able to problem solve. They completed the activity, each in their own unique way.

The second activity in the workshop focused on changing the conceptual understanding faculty had about how technologies were integrated into the learning experience. One of the overarching goals of this study was to determine if candidate TPACK had positive changes as a result of their enrollment in one of the faculty courses where faculty had implemented a TPACK-based project. Therefore, it was important that faculty had an understanding of what constituted effective technology integration. To help faculty reach these understandings, two activities took place. The first was a very short, traditional lecture and discussion about the TPACK construct. This was then followed up with the TPACK game, which forced them into situations where they had to make poorly matched technologies, instructional approaches, and curricular topics fit together effectively. As faculty struggled with poor fit, they again had to problem solve and again, make decisions about what they could change and why, thus challenging prior assumptions they may have had. An aha moment occurred for faculty as they began sharing which of the TPACK domains they would change in order to have a good fit. Three faculty each indicated a different domain that they would change, which made very clear that each of the three components were equal ingredients in the development of instruction. This demonstrated the power of collaborative processes where both egocentric and communicative speech were used. Through communicative speech faculty were able to observe their

peers who had different conceptualizations about TPACK, which then required egocentric speech for each individual faculty member to make sense of what they had observed.

The focus on finding fit among the three TPACK domains was important for faculty to experience. If technology was to be considered as an equal in the lesson development process, then faculty needed to understand that when there was not fit among the domains that a change could be made in any of the domains. Recognizing that technologies have specific affordances and constraints that must be accounted for is critical for having success with technology in instruction. This was especially important for the faculty in this project, because it was not just their knowledge that was being targeted for development, but also the knowledge of candidates enrolled in their courses. Having this understanding of how to take advantage of technological affordances and how to address constraints would be necessary as they implemented their projects, because candidates likely struggled to overcome various technical constraints as they completed the project. When these situations arose, faculty needed to have the clarity of understanding in order to help candidates problem solve. In doing so, faculty were able to help candidates experience effective fit among each of the TPACK domains.

As faculty concluded the TPACK game and began sharing about their projects, they applied what they learned about fit. They did this through the feedback they provided to their colleagues as well as through the dialogue they had about their projects with other faculty. This knowledge was reinforced as they created instruction for their own course, again making decisions and problem solving to make their ideas come to fruition in ways that were grounded in TPACK-based design. Again, faculty choice was central in keeping this workshop from becoming technocentric and as a result, grounded the work they were doing in the principles of adult learning theory. Faculty had specific needs they wanted to address based on their experiences and the structure of the kickoff workshop supported them as they began applying what they had just learned through prior workshop activities. Simply put, the overarching goal of the workshop aligned with faculty goals.

Reflecting with colleagues. During the final faculty workshop, faculty had the opportunity to share about their projects. They were very open about their experience implementing their project, especially in terms of what worked well and what did not. As faculty shared, their colleagues provided feedback both in

support of their actions, as well as feedback that sought to help address some of the issues within the project. Erica was especially active in the workshop, both in terms of sharing about her project as well as providing feedback.

What was characteristic about the final workshop was the degree of comfort faculty had with one another. Even though this was only the second meeting of all faculty participants, the faculty were very open about their projects. There appeared to be a certain level of trust within the cohort that they had no qualms about opening up about their instruction. Several of the faculty mentioned this degree of comfort they had during the final interview with the researcher and the interactions they had with other faculty during this final workshop further supported their statements.

Interesting about the level of collegiality among these faculty members was how organic it appeared to be. While four of the five faculty members were from the same department, and all of them had previously interacted on some level with each other, they each appeared to have that high level of comfort with each other. This was not true during the kickoff workshop however. During that workshop, Debbie felt intimidated by her colleagues' projects, and likely to an extent her colleagues themselves. The collaborative nature of the activities required each of the faculty to open up about their practice, which made them vulnerable to criticism. For Debbie, who explained that she was very uncomfortable using technologies at the onset of the project, this resulted in intimidation. However, that sensation eventually subsided by the time she reached the final workshop, primarily because she had stopped comparing herself to her peers and what they were doing. She recognized that this faculty development experience was focused on what she wanted to do and that everyone was going to do something unique.

The change Debbie underwent from the start of the program to the end highlights a critical need that faculty development needs to support. That is that faculty development should be focused on the individual faculty member, not necessarily the collective group of faculty participants. Taking a personalized approach as this study did, developers are able to better support faculty knowledge growth. If the learning experience is within the faculty's zone of proximal development (Vygotsky, 1978), then they will likely perceive the learning goal as being within grasp. In this study, focusing on what Debbie wanted to do rather than trying to dictate what she should do, Debbie's idea was validated and she was able to

experience some success with her project. Further, the personalized faculty development experience in this study supported the underlying notion that faculty have knowledge and experiences that can be of service to them as they assimilate new knowledge. Debbie knew what was best for her course, because she has the wisdom of practice about her course that allowed her to identify what she wanted to accomplish through this development opportunity. Yet, there were gaps in her knowledge and she needed help achieving her very much self-directed goal. It did not matter that she had a different focus from other faculty participants, because the development was focused on her needs, just as it was for each of the faculty participants.

Faculty, presumably, attend development opportunities, because they want to increase their knowledge, abilities, and skills. Yet, when faculty development opportunities support comparisons of faculty abilities with other faculty, regardless if that was the intent, some may begin feeling uncomfortable. This is problematic for faculty development, because if faculty are uncomfortable, such as Debbie was in her level of intimidation, then they will likely disengage. Bernice and Alice spoke to this as they compared the more "one shot" opportunities with the process they experienced in this study and the intimidation they had felt in those situations. Bernice described how when that happened that the faculty development was no longer for her, both in terms of the purpose of the development and her interest in attending. Alice too explained how the priorities of the facilitator outweighed what she needed and that her needs were dismissed. Therefore, if a goal for faculty development is to have faculty open up and share about changes they have made to their instruction, it is necessary that safe environments are created so that faculty feel willing to share about their practice as they strive to achieve their individual, self-directed goals. Beyond that, however, is ensuring participants know upon the onset of the experience that the focus of the opportunity is on them and what they want to accomplish. In doing so, hopefully faculty will recognize as Debbie did, that their peers are there to support them, not to judge them.

Breaking faculty development boundaries. Where many faculty development opportunities truly are one-time events, this experience took place over the course of a semester, thus moving towards a systems approach to faculty development that spanned the entire instructional design process. After the kickoff workshop had ended, the faculty development process became very individualized to the needs of the faculty participants. This occurred differently for different faculty and across what became several

stages of the faculty development program. Initially, during the faculty and faculty developer discussions prior to project implementation, the major theme that emerged was that of feedback. Faculty overviewed their progress and their needs and then the faculty developer provided feedback based on faculty needs. There was however, no obligation on the part of the faculty members to seek support prior to implementation from the faculty developer. Rather, the support was there if it was needed.

The feedback role the faculty developer had during the discussions with faculty served as a bridge between the initial work completed during the kickoff workshop around faculty projects and full implementation. Some faculty, they required at least a conversation with the faculty developer. Others, were comfortable moving directly to implementation, even though they knew this support was available should they have the need. What this was indicative of was the need to follow up with support after beginning a faculty development experience. Even in this study where the kickoff workshop was highly design-based, some faculty needed follow up before they proceeded with implementation. While it is unknown whether or not faculty would have been successful without this follow up support, faculty indicated that they liked the access and support they received from the faculty developer that was ongoing, not just immediately after the kickoff workshop, but throughout the entire faculty development experience.

The faculty developer attended class as faculty moved into project implementation. The faculty developer had two roles while in the classroom. The first was primarily passive. As faculty implemented their project, the faculty developer had a relatively minor role during class activities. Faculty and candidates both knew he was there, but very little interaction occurred. The second role was much more active with the faculty developer becoming an active participant in classroom activities. This dualistic role occurred most clearly in Alice's project. There were days when the faculty developer went relatively unnoticed and then there were other days when the faculty developer had a very active role in the classroom, such as talking about how technologies could be used to collect formative assessment data.

There were two themes that emerged from the faculty developer's participation in the classroom. The first was that the faculty developer, for some faculty, provided a boost in confidence or comfort. This did not occur for all faculty, but it did for three: Alice, Debbie, and Erica. In Alice and Debbie's courses, this confidence boost emerged across the several sections. There were instances when the faculty developer

attended several sections of the course in the same day and in both instances, he took on a more active role during this initial section, but then as the day progressed he had a more passive role. This was due to the faculty member integrating more of the developer's actions into their own instruction. Where in the first section the faculty were likely unsure of their knowledge or ability to do a task, by the end of the day their confidence had increased to the point where the developer no longer had a role in the class beyond a passive observer. In Erica's class however, she explained that it was the presence of having someone in the classroom with her that helped her become more confident. When she experienced an issue or had a question, such as the Ken Burns Effect or when the iPad apps would not install, there was someone in the classroom available to support her and the candidates. Someone to explain the technical constraints they faced. This was markedly in contrast to the support she received from her college technical staff that provided support from a distance via email rather than in the classroom.

The confidence boost these faculty members experienced denotes an area of focus that faculty required support, which should be part of faculty development opportunities. Had this been a traditional faculty development experience with minimal if any ongoing support, faculty would have had to proceed alone as they implemented their projects. When they encountered areas where they had less confidence and were more uncomfortable, such as their lack of knowledge about technical affordances or when they encountered technical constraints, they likely would have proceeded alone or reached out to support staff or other faculty outside of class. While most institutions have support systems in place, reaching out and scheduling a meeting takes time faculty typically do not have. This points to a discrepancy between the organization of faculty support systems and the actual needed faculty support.

While it is unknown if the support faculty needed in this study is the typical faculty experience, the support the five faculty participants received in this study required a considerable amount of personnel resources as well as time. The nature of the support provided in this study likely is not the norm at most institutions. Yet, if faculty are frustrated with the faculty development support that is available at their institution, it does beg the question: Does the organization of faculty development support for university faculty adequate to meet their needs? Based on the findings of this study, especially in the context of Bernice's comments about how the development support provided in this study should be what faculty

development is, then the answer is likely no. What becomes problematic then is when faculty do not have the time and they proceed independently. When this happens, they may not have the comfort to move forward independently, because what they need to accomplish is outside their zone of proximal development (Vygotsky, 1978). Having in time support from the faculty developer, in this case, appeared to help these issues move within the zone of proximal development and they were able to have success. Therefore, when the faculty development support is in misalignment with faculty needs, it will likely be incumbent upon faculty developers at institutions to restructure their support to be more in line with faculty goals and needs.

Leveraging community integration. The second theme that emerged from the faculty developer's interactions during class was that of community integration for the developer. In Alice, Debbie, and Erica's courses, the developer became a part of the classroom community. Debbie reflected on this during an interview where she explained that the candidates became comfortable with the developer and would approach him for questions and seek his input. This occurred in Alice's course too. During the final days of the project, candidates were open to asking the developer questions and seeking his feedback. In Erica's course this too occurred. Candidates would ask the developer questions and at points, actively sought out his support, such as Fred who approached the developer about technical issues, as well as talked with him during a class field trip.

Community integration was an exciting finding from this study, because the role of a faculty developer as part of a classroom community is a relatively new concept. There was no mention in the literature, which the research was able to locate, of faculty developers becoming part of classroom communities as they worked with faculty. This may be an indication of the potential advantages of faculty developers that have knowledge of both how to integrate technologies, as well as knowledge of instructional approaches. As such, there is the potential of an expanded role within the classroom once the developer has been integrated. While the focus of developer work is typically on supporting faculty, once accepted into the classroom community that role likely changes, as did the role of the developer in this study. As the developer was accepted into the community, he was able to continue faculty development in different ways than had previously been possible. This change occurred in both Alice's and Debbie's

courses where the faculty developer interacted more with candidates. The faculty learned from the developer as evidence by how in the following section the faculty integrated more of the developer's interactions into their own actions during class. This is an example of leverage, where a small change can result in an enduring result (Senge, 2006). Therefore, it is probable that once accepted into the community, the developer would have a more active role in supporting both faculty and their candidates.

Evaluative reflections. As the faculty development process continued, faculty began having discussions with the developer about their practice. The theme that emerged here was the evaluative nature of faculty reflections on their practice. As each of the faculty discussed with the developer, they indicated areas where they could improve their instruction. For some they focused on deficiencies within their project, such as Bernice who was unhappy with the platform for organizing her candidates' strategy videos. For others, the focus shifted to how they could expand what they did to other projects in the future, such as Cara who reflected on how she could combine two projects to encompass both cartography and the VoiceThread storytelling experience.

The researcher at the onset of the faculty development experience did not expect these reflections to occur in the way they did. What began as an interview to learn more about how faculty implemented their projects turned into a critical reflection by faculty on the implementation of their projects and how they could improve for the future. While evaluation is a critical component in any instructional design model, it is a stage that rarely is reached as part of faculty development because development activities typically do not reach the implementation phase. Therefore, as this study indicated, continuing faculty development so that there was a reflective component for faculty participants can be another layer of development that is outside the traditional norms of what is perceived as faculty development. For these faculty, however, there appeared to be some form of value for them as they looked to the future and how they could improve their instruction, which is the goal of faculty development.

The Ongoing Faculty Development System. Emerging from this phenomenon of ongoing faculty development activities following an instructional design process is the emergence of an ongoing faculty development system (Figure 9). Senge (2006) explained that individuals are taught to break down complex ideas into smaller components. Yet when this occurs what often happens is that the individual forgets what

the whole looks like. Faculty development appears to be one of these systems. Where the goal of faculty development is the enhancement of instruction, what often appears to happen is that the system is broken down to smaller chunks that are targeted for development through independent one-time development experiences. As this happens over time, both the faculty and developers likely lose track of the entire instructional design process and instruction fails to change in systemic ways.

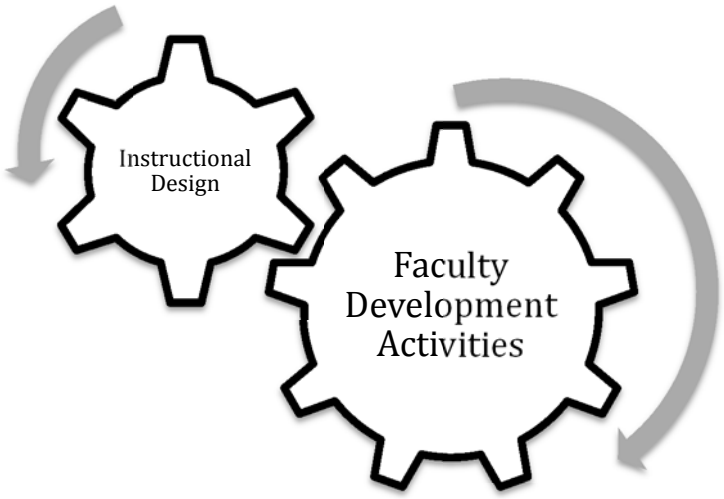

Figure 9. The Ongoing Faculty Development System is represented as a two-part system consisting of faculty development activities that engage faculty in the instructional design process.

Therefore, emerging from this study is the outgrowth of an ongoing faculty development system that moves beyond the independent activities involved in the faculty development experience. As the understanding of the development experience expands, it moves to include the instructional design process, which includes the necessary components that faculty need to progress through in order to create instruction, implement it, and ultimately evaluate that implementation so that further development can be can take place. As faculty and developers approach development opportunities, this should be the conceptual framework that guides the actions that take place.

The Value of Ongoing Faculty Development

As faculty reflected on the faculty development experience, they highlighted two areas. One was that there was value in development that moved beyond "one shot" experiences. The other was related to how the faculty developer support allowed faculty to take more of what they identified as risks with their own instruction.

Transcending "one shot" experiences. Faculty discussed at length how "one shot" opportunities were less effective due to the amount of information covered that became overwhelmed, as well as the lack of follow up by development facilitators. What this study provided was a different experience. Specifically, the experience was focused on faculty interests and needs, which prevented participants from feeling overwhelmed. This experience was also ongoing, where faculty received support from a developer. Debbie characterized the support from the developer as being "more than one" time where she had the "undivided attention" of the developer. The other faculty had similar perceptions and each valued the ongoing support.

Given that faculty valued having extra layers of support during the program, this should be an area developers seek to expand upon in their work. Bernice in fact mentioned this during the final interview. She explained that the experience she had during this experience should in fact be what faculty development is, especially in the context of colleges of education. She specifically highlighted the value of the "collegial, conversational facilitation" that occurred throughout the experience. She went on to explain how these kinds of experiences changes who the expert was and raised the overall professionalism of faculty development. The key factor that Bernice was getting at was that the knowledge, skills, experiences, abilities, and values of the faculty were respected, which was a major component of adult learning theory (Knowles, 1980). Teacher education is a professional field and should be treated as such.

Yet professionalism did not come to mind as faculty described the intimidation they felt during past faculty development experiences. In fact it was discouraging to know that faculty were intimidated during other faculty development experiences. While not all faculty had this experience, three of them did and it is likely a safe assumption other faculty have experienced similar feelings as well. This points to a major deficiency within faculty development programs. Participants should not feel intimidated when they

attend events designed to improve their knowledge and skills. Rather, intimidation should be indicative of the failure of a faculty development program.

Encouraging faculty risk taking. The other area faculty valued was that the support provided by the faculty developer allowed them to take more risks in their instruction. While encouraging risk was never an intended outcome of this faculty development program, the faculty explained a variety of ways the developer supported risk taking. Alice explained how she was afraid of letting candidates have more creativity in their portfolios because she was unsure if she would be able to solve technical problems should they arise. However, through the support of the faculty developer this fear subsided and she did allow for increased creativity. Erica explained how the faculty developer provided emotional support that encouraged her to take more risks in how she implemented her project. Rather than being bound by the constraints imposed by the status quo of her college, Erica took steps to implement her project in ways that supported what she needed to accomplish. Debbie took risks as well. She explained that whenever she uses technologies that it was a risk, however, in this project she explained how the faculty developer validated her ideas, which then encouraged her to move forward. Without that validation, it is entirely possible that Debbie would not have taken the risk in implementing her project. Simply put, she needed the support of the developer.

Risk taking was a part of this study even though it was unplanned. Yet, when looking at the purpose of faculty development as being the promotion of changes to the instructional approaches used by faculty, then it makes sense that risk was a component. Rogers (2003), discussing Diffusion of Innovation theory, explained that members of the innovator adopter category are more accepting of setbacks. Yet, for members of the other adopter categories, setbacks can be too large of a risk for them, which therefore prevent them from changing. When looking at the faculty in this study, it is likely safe to say that none of them were innovators and therefore needed some support as they approached changing their instruction. The faculty developer emerged as a change agent in this study by helping faculty take more calculated risks. This support, however, took place outside the traditional workshop in the ongoing activities throughout the semester. Therefore, as faculty development programs and institutions look at how they can

help promote change within faculty instruction, an approach that supports calculated risks in a safe environment should be encouraged.

Research Question 2

This research study also sought to answer the question: How did faculty, while engaging in a cohort- and design-based faculty development program, implement TPACK-based instruction in their course? What emerged was a four-component process that for some faculty included some repetition. These four components included scaffolding candidate knowledge, a practice activity, the main project, and ultimately ending in project dissemination.

Expression of Instructional Strategies

While there were four components in this process, each faculty member had a unique expression of these components in their instruction. For example, Alice's project was implemented where each of the four components emerged in the same linear process as was just described. Cara on the other hand, implemented her project where the main project was split into two parts where a practice activity took place in the median. Bernice too had a different order of the same four components where her project began with the practice activity before candidate knowledge about the project was scaffold. These differences in implementation should be expected given that each project was unique and each faculty member had her own strengths with which they leveraged during instruction.

While the order of the major components of the projects varied across faculty, there was commonality in their instruction. They each had these very basic ingredients of instruction, which are common instructional strategies. Typically, before learners engage in a project, it is usually a good idea to introduce them to what they are trying to achieve and then have some opportunities to practice. Then after completing the project, it is disseminated to someone, even if only the instructor. In other words, while there were unique qualities to each project, they were each very similar in terms of the underlying instructional strategies that were used.

Non-technocentric instruction. What was noticeably absent form these projects was a sole focus on technology. It is plausible to argue that Debbie at times was close to falling into only focusing on technology. However, the way she implemented her instruction still promoted the complex interplay

between the content, instructional approaches, and technologies. The main difference was that she was much more structured in how she wanted candidates to use the technology. She explained to candidates that they could use Poll Everywhere in their presentations to satisfy the technology component. Yet, there were no instances during her course where she directly taught candidates how to use the various features of the technology in isolation from a larger activity that utilized course content. This was the case in each of the projects. When technology was used, it was used in ways where it fit with the subject matter and the instructional approaches that faculty used.

There were additional similarities that went beyond those of the overall process by which faculty implemented their projects. Specifically, there were three themes that emerged from the data about how faculty implemented their projects. These themes included faculty scaffolding, faculty feedback, and the candidate driven nature of projects.

Guiding candidate learning through scaffolding. The first theme that emerged was that of faculty scaffolding. Faculty scaffolding in the projects can best be described as helping candidates gain the requisite knowledge needed to have success as they began completing their projects. This was very clear in both Alice's and Erica's courses. In Alice's course, she spent a large amount of time at the onset of the project discussing with candidates the role of assessment during instruction. While all candidates had a basic understanding of assessment, Alice sought to drive home the purpose and value of formative assessments. She also used scaffolding when she introduced the documentation portfolios to candidates. She showed several exemplars at varying degrees of quality to candidates to show them what was possible, which likely made it easier for candidates to create their own portfolios because they had a schema in mind that they could use.

In Erica's class, she used scaffolding in similar ways. She used scaffolding to both help candidates gain the skills they would need to complete the project, such as how to use the Keynote app, but she also used it to explain the value of her project. With such a heavy emphasis on one-to-one learning with iPads at the field experience site, as well as one-to-one learning throughout the state, Erica spent time discussing one-to-one learning with her candidates. This helped contextualize for candidates the purpose of the project as a way to prepare them for the potential of working in that type of environment.

Bernice also used scaffolding during the presentation part of her project. A struggle her candidates had during the discussion phases of the project was that candidates did not provide much feedback to their peers. Rather, they were mostly quiet. Bernice explained how she recognized that and therefore began asking questions during the presentations. At one point Bernice indicated that she said to her candidates that they could ask many of the same questions that she had been doing. She explained that candidates think that by not asking questions that they are approving of performance the presenters did during the presentation, when in fact a lack of discussion and questioning indicated that they did a poor job. So to help her candidates validate the successes of the presenters, she showed them what effective questioning looked like.

Accessibility to candidates for feedback. Faculty feedback was the second theme that emerged during this study related to faculty implementation of their projects. Most faculty provided a lot of feedback to candidates. Erica had an interesting approach to providing feedback in that the type of feedback she provided varied based on the needs of the candidates at any given moment. In Chapter 4, this dualistic approach to feedback was described as being both "Mother Hen" and also diffusive. Erica described that "Mother Hen" moments emerged when her candidates were getting "lazy" where more diffusive feedback came when candidates became more stressed and needed feedback to help alleviate some of that stress. In addition, Erica provided feedback throughout the entire project to her candidates, often in a supportive but critical role. Given the very authentic nature of their projects, she wanted to make sure that candidates were on the right track and when she saw aspects to candidate lessons that would not be successful, she let them know while also helping them push their idea forward.

Bernice also provided a lot of feedback to candidates during the project. Her feedback was both structured and unstructured. The structured feedback occurred each day at the start of class when she opened up with a short question and answer activity. While the questions were not always on the project associated with this study, she did explain that this was an opportunity for questions they had to come up. The unstructured feedback she provided typically happened during workshop time each Thursday. While again, any question could be asked, Bernice was available to candidates and often checked in with them to

see if they had questions. She made herself available to candidates, often making eye contact, which encouraged candidates to ask questions.

Alice too used feedback with her candidates. Her feedback that was observed took place once candidates were actively creating their portfolios. She explained that her feedback was primarily "technical" in that it was about course content and procedures. She explained that candidates did not ask her very many technology questions, which was something that Bernice experienced as well.

What was interesting about the feedback that faculty provided was that there were only minimal technology demands on the part of the faculty to be able to answer the questions candidates had. For example, Bernice explained an instance when a candidate asked a technology question and she did not know the answer, which surprised the candidate due to the nature of technology in her project. Bernice explained that she did not receive many technology questions in general. Alice too had this phenomenon happen where candidates just did not ask her technology questions. She explained that she figured they knew she did not know how to solve the problem so they did not ask. When they did ask she explained that she was able to problem solve with the candidates even though she did not know what to do.

The nature of faculty feedback where there was minimal focus on the technology begged the question, what do faculty need to know in terms of technology to be able to create learning opportunities that utilize technological affordances. Faculty in this study responded that it depended upon the nature of candidate choice. They explained that the more choice candidates have in the selection of technologies then the less faculty needed to know. However, in instances where the faculty made the choice for candidates on what technology they were to use, then the faculty needed to know much more about the technology.

When examining the implementation and specifically the feedback that faculty provided, this idea of what faculty need to be able to know and do appeared to be true. For example, in Alice's project where candidates had a large degree of latitude in making the selection of the technologies for their portfolios, Alice did not receive many questions from candidates on how to use technologies. However, in Erica's course where she specified exactly the technologies they were going to use, she had a much higher demand from her candidates in terms of her knowledge. This was clearly seen with the stress that was created when she did not know how to resolve the issue with the Ken Burns Effect.

Considering the emergence of this phenomenon, it is suggested here that faculty developers should encourage more open-ended selections of technologies within faculty projects. This is because content methods faculty do not have deep of knowledge of a wide breadth of technologies and since technologies are continually evolving and changing at ever more rapid rates, an open-ended approach to technology based projects reduces the demands on their knowledge. At a perhaps deeper level, having candidates select their own technologies and then problem solve the use of that technology engages them in additional experiences that develop their abilities to use technology. In essence, they learn to use the technology by doing it for the first time, which was the basic tenet of the LT/D process (Koehler et al., 2011). The probable outcome of this type of approach to leveraging technologies in content methods courses is that candidates will have additional opportunities to have development across the various TPACK domains.

Candidate driven projects. Common across each of the projects was that they were candidate driven. Candidate driven implies that the candidates completed the majority of the project. While there were components of each of the projects that were faculty led, the vast majority of the projects were driven by the candidates' actions and decisions. This was very clear in Erica's project. While at the beginning of the project Erica did a considerable amount of scaffolding, once the project reached the point where decisions needed to be made about what and how each iPad project would unfold, Erica turned the reins over to candidates to complete. This was true in Cara's project as well. Candidates, after scaffolding from Cara, began exploring both the content of the various Indian nations, as well as the cartography technologies. Debbie too had a very candidate driven project. Her candidates after becoming aware of Poll Everywhere, integrated the technology into their presentations in a variety of ways. In Bernice's project, candidates had a large amount of flexibility with how they created their video strategy presentations, which was also the case in Alice's project in terms of the portfolio.

Deeper within each of the projects was a collaborative subtheme as well. Each of the projects required candidates to work with others. As they did so, candidates negotiated the different aspects of their final products with their peers. These negotiations were unique to each project. For example, in Alice's project, candidates negotiated the platform for their portfolio. One candidate advocated for using something other than PowerPoint since he had done a number of PowerPoints recently. In Cara's project, candidates

had to negotiate both the content to include in their project narrative, as well as the cartography tool they would ultimately use.

The implementation of each project highlighted the dual nature of the instruction that was used. There was a mix of faculty-driven activities as well as a large portion of each project that was candidate-driven. Within the faculty-driven aspects of the projects, faculty took steps to setup for their candidates the knowledge and skills that would be needed for success. However, they did not provide complete direction and a lot of the project was left up to candidate interpretation with how they should proceed. Faculty provided just enough scaffolding and feedback to candidates to allow them to have a deep enough understanding of what needed to be accomplished and some ways that it could be accomplished. However, candidates had a great deal of latitude with how they completed their projects. While some candidates took on a more risk based approach as did some candidates in Alice's project that took time to pick a portfolio platform, there were others who took more safe routes, such as the groups in Bernice's project who used handwritten credits during their practice activities.

Perhaps the most salient conclusion that can be drawn from how faculty implemented their projects was that they were open, to varying degrees, to candidate choice. The typical perception of college instruction the common person likely has is lecture and discussion. While those instructional approaches were used in this project by each of the faculty at different points during their projects, it was not the only approach. The large degree of candidate autonomy in projects once they were underway afforded a number of different instructional approaches. Given the variety of technologies used by candidates in various projects, Mishra and Koehler's (2006) assertion that there is no single technological solution for every method of instruction holds true.

Research Question 3

The third research question that this study sought to answer was related to faculty TPACK: Was there a change in faculty TPACK as a result of their engagement in a cohort- and design-based faculty development experience? The data showed that there was a positive change on each of the four criteria on the technology integration rubric. The largest change was with faculty selections of technologies. This had a mean difference increase of 1.4 with a posttest assessment mean score of 3.8, which neared the maximum

on the scale. In addition, on the pretest assessment, faculty scores were much more varied with a standard deviation of 1.14. However, on the posttest assessment faculty scores were a lot closer together at .447.

In terms of technology selections, the data indicates that faculty had an increase in their ability to select technologies that were more compatible with the content and their instructional approach, where at the time of the posttest faculty were very adept at picking technologies. While this was a large increase of over a standard deviation, given the large variance on the pretest assessment, it would appear that only some faculty experienced this increase. With a mean score of 2.4 on the pretest and a standard deviation of 1.14, there were some faculty well above and well below the mean score. Therefore, the faculty with pretest scores well below the pretest mean likely had the greatest gains, mainly because they had more room for an increase to occur. This was in contrast to their colleagues who already had higher scores with relatively little room for an increase to occur.

Two of the criteria on the rubric had larger increases as well. These included the curriculum goals and technologies criteria, and the fit criteria. Both had a mean difference of 1.0 with a decrease in standard deviation from pretest to posttest assessments. Therefore, similar to the technology selections criteria, faculty had an increase in their performance on both of these scales. Curriculum goals and technologies, however, had the largest standard deviation change from pretest to posttest assessments. This indicated that scores were very spread out initially but then by the end of the study they were much more close together, indicating that faculty at the end performed at similar levels where initially this was not the case. The fit criteria had a similar trajectory, yet not to the degree of the curriculum goals and technologies criteria.

Taking these three criteria together, it would appear that the faculty development might have played some role in the increase of faculty ability. While the sample size was too small to test for any significance, the large mean score differences of over a standard deviation on one and nearing a full standard deviation on the other two are hard to ignore. Yet, it can said be with no certainty that the faculty development program had anything to do with these changes or that these changes are of any significance. Therefore, further study is needed to see if these increases persist with other faculty and if so to what degree are they significant or not.

The final item measured was related to instructional strategies and technologies. On this item faculty performed at a proficient level on the pretest assessment. There was a .2 increase in mean score, yet the standard deviation also had a slight increase, which would indicate that faculty scores were slightly more spread out on the posttest than on the pretest. These results really are inconclusive and make it hard to make any concrete conclusion other than it would appear that little changes in faculty TPK occurred. As with the other criterion, further study needs to be conducted with larger samples of faculty to determine if these scores persist and if there are any significant differences from pretest to posttest assessments.

As the results indicate, it appears that the faculty development process that was used in this study had some impact. However, caution should be used in any generalization of these findings. Due to the small sample of faculty participants, the extent to which more advanced statistics could be used was necessarily limited. Had the sample size been larger, analysis of significance and effect size could have been conducted. Yet, while there is this limitation in the current study, the large increases found in three of the four TPACK criteria measured indicates a potentially promising approach to developing faculty TPACK that is grounded in both social constructivism and adult learning theory.

Research Question 4

The final research question was interested in the following: How did faculty and teacher candidates perceive candidate TPACK growth after the implementation of TPACK-based instruction? The theme that emerged from faculty interviews about candidate knowledge was that there was a change, but to what degree was unknown. Faculty identified actions candidates took that would be indicative of candidate knowledge growth, but faculty were honest in that they could not be sure the extent to which the changes they saw were generalizable to all candidates. Yet, the positive changes they did witness should not be discredited. Rather, they should be celebrated, because some candidates, such as the ones Bernice described who began using video in their literacy instruction without prompting, did experience some level of transfer. They had the confidence to take what they had learned in terms of video production and applied that to a different situation. At a very basic level, this is evidence of learning. Yet, the extent to which this occurred throughout the entire population of candidates in this study was unknown from faculty perspective.

What was known was that based on candidate responses on the TPACK survey, there were positive statistically significant changes on four of the TPACK domains for candidates overall. These included the CK, PCK, TPK, and TPACK domains. Statistically significant changes on CK and PCK scales were of little surprise given the focus of these courses. Simply put, that is what should be expected to occur in a content methods course. At the beginning of the study, it was unclear how or even if the technology-based domains would change, especially in terms of whether there would be any significant differences. The positive statistically significant differences on the TPK and TPACK domains were interesting findings to emerge from this study, because it showed that there was potential for increasing candidate TPACK through content methods courses. While TPACK development is certainly a focus of many educational technology courses, the literature was not as thoroughly saturated with studies conducted in content methods courses. This study then joins those already in the literature in supporting that there is potential to targeting candidate TPACK for development through non-technology based courses. However, the nature of that change needs further study to determine where best development activities can have the most impact.

The data from this study also showed that based on various candidate demographics, the extent to which TPACK domains developed varied greatly. For example, juniors had no statistically significant differences on any domains, while seniors had significant increases on the CK, PCK, TPK, and TPACK domains. There were also differences in the domains with increases based on prior enrollment in an educational technology course. For those candidates with prior enrollment, they only experienced significant increases in the CK and PCK domains, while their peers without prior educational technology course enrollment had increases on the PCK and TPK domains. Enrollment in a field experience during the semester of the study also showed differences in domain increases. Those candidates with a field experience during the semester had increases in CK, PCK, TPK, and TPACK, where their peers without field experiences in the semester only had an increase in TK and actually had a statistically significant decrease in TCK, which showed that their understanding appeared to regress some, although on the posttest survey these candidates were still well within the agree range.

What all these differences show in terms of the demographics is that TPACK development is a complex endeavor and should be approached as such in teacher education programs. Candidates in this study had markedly different changes in their knowledge of TPACK domains based on where they were in the program. More studies need to be explored that follow candidates throughout their time in a teacher education program so that their development can be better observed and understood as this type of study would likely have a great impact on the development and implementation of TPACK-based curriculum throughout teacher education programs.

The final data point on candidate TPACK was an open-ended question candidates responded to as part of the TPACK survey. Candidates were asked about their ability to combine content, teaching approaches, and technologies as a result of the project they completed in their faculty member's course. The resounding response from candidates was that they had a better understanding of the TPK domain. This was likely due to the majority of candidates coming from either Alice's or Debbie's course, both of which focused on using technologies with assessment practices. Therefore, it comes as no surprise that candidates responded as such to this question on the survey. In addition, candidates also explained that they had a greater understanding of technical affordances. This was interesting since TK was only statistically significant for those candidates without a field experience during the 2014 semester. This would indicate that although the self report data was not statistically significant for all candidates, candidates still though that their understanding of technologies and what they enabled them to do had increased.

Proposition Pattern Matching

Prior to data collection, the researcher made a number of propositions as is consistent with case study analyses (Yin, 2009). Now that the study has concluded, it is necessary to determine the extent to which there were any patterns between what was proposed to have happened and what in fact did happen as evidenced through the data.

Proposition 1

The first proposition was that faculty would target a project within their course that they were already doing and as such they would enhance their instruction and the overall project experience through the use of new or different technologies or that they would change something about the instructional

approach. Data from this study suggests that this proposition in fact did occur. Each of the faculty did target a project they were already doing. Debbie is the clearest example of this happening. She had been doing the chapter presentations for the past several semesters and during this study she used a new technology, Poll Everywhere. Alice, Bernice, and Erica each had implemented their projects for several semesters and in this project continued to perfect their projects by making changes to their instructional approaches, such as Alice who took a much more open-ended approach to candidate choice.

Cara was likely the only faculty of the five who had not implemented this particular project in the past. She did however have plans to do so the year prior to her teaching this course, but due to the shutdown of the US Federal government, she was unable to implement her project as it had been designed. Therefore, for Cara, this was in fact the first time she had implemented this project with any candidates, although the plans for how she could implement it had been mostly in place for over a year. This begs the alternative proposition that if faculty participants had not implemented their project in the past, the genesis of the idea likely already existed. This is a proposition that should be studied further through replication studies.

Proposition 2

The second proposition was that faculty would collaborate with both other faculty and the faculty developer as they implemented their projects. It was also predicted that this would happen in a very informal way as faculty needed due to questions or issues they had. This proposition both did and did not occur, which suggests there are both rival and alternative propositions that need to be addressed.

The stated proposition did occur to some degree in this study. Some faculty did collaborate with the faculty developer during project implementation. This was especially true to Alice, Debbie, and Erica. Each of these faculty members worked with and had discussions with the faculty developer during project implementation. These interactions primarily took place during the classroom and were informal.

Cara's experience, however, highlights an alternative proposition that was less clearly defined at the beginning of this study. Attached to the second proposition was a qualifier about the nature of faculty interaction. It stated that faculty would collaborate as needed due to questions or issues they encountered. In hindsight, this should have been stated as an alternative proposition in a slightly different form. As an

alternative proposition, it might read: Faculty will collaborate with other faculty or the faculty developer as needed during project implementation. This proposition is similar to the first part of the second proposition that was made in that it is still indicating that faculty will collaborate, but differs in that it is not as absolute. This alternative proposition would have occurred in this project through both Cara's and Bernice's experiences.

In Cara's project, she did meet with the faculty developer as she completed project development, but she never appeared to have the need during project implementation. She did explain that she could if she had a need or question. She knew whom to approach to receive that help. Simply put though, she did not need any help. Bernice's project was similar. She had very few interactions with the faculty developer and other faculty during project implementation. She did have discussions with the developer and other faculty post implementation, and she did explain that she knew that support structure existed, but like Cara, she did not have the need.

A rival proposition does exist for this study, which is as follows: Faculty will not collaborate with either faculty or the faculty developer during project implementation due to a lack of interest or desire to do so. As was previously said, there were two faculty that did not collaborate with their colleagues during implementation, which on its face would indicate that this rival proposition was accurate. However, given the alternative proposition that was proposed and the phrasing of the second proposition itself, this rival can be rejected. While Bernice and Cara did not collaborate with the developer or other faculty members to the extent that Alice, Debbie, and Erica did, it does not appear that it was because of a lack of interest or desire to do so. In fact, multiple faculty indicated they would have liked to see more interaction with their peers. Therefore, there was an interest with collaborating with others, it just did not occur given how this development experience unfolded. In looking to the future, identifying was faculty can collaborate on a more ongoing basis should be explored. Bernice, however, highlighted the inherent difficulties with making this happen due to busy faculty schedules.

Proposition 3

The third proposition was that faculty would experience success in their projects to varying degrees. This proposition also occurred, and a rival proposition where faculty would not experience success

in their projects can be rejected. Even though there was no commonly accepted definition of success for faculty projects, faculty all did express some form of success. Debbie explained that it was a success for her anytime she could use technology in her instruction and it works. Her definition of success can be contrasted with Cara's, which was slightly different. For Cara, her indication of success was that her candidates completed the project where for Bernice success was candidate completion of the project, but success also extended to the logistics of sharing the videos and resources created by candidates. For Bernice, she thought that the project had some success. She thought that there were some good video presentations and some that could be better. She also expressed some dissatisfaction with the platform for archiving the videos. For Erica, Alice, and Debbie, they each too had different perceptions of what success was, but they explained that they did experience some success.

The rival proposition can also be rejected, because faculty that are good teachers tend to be highly critical of their instruction regardless of the actual outcome. The researcher is of the opinion that good teachers, regardless of the institution, are always looking for ways to improve. In his nine years of experience helping educators, preschool through higher education, this has held true. Good teachers have an inherent desire to keep getting better, which is why they are quality instructors. If they did not have this desire, then they likely would not be effective in the classroom. The researcher held this opinion of the faculty participants in this study as well. While there were and are areas where each faculty member could improve, they all can be considered effective educators and are considered as such by the researcher.

Proposition 4

The fourth proposition was that after the faculty development process ended, faculty would continue to find ways to continue their development as an instructor. For four of the five faculty participants, this did occur. As the fall semester and the study came to a close, four faculty members signed up for another faculty development program that was facilitated by the faculty developer. Further, the faculty continued to maintain their cohort in the new program, which indicated that there was a strong enough of a relationship among these faculty members that they wanted to continue that relationship in the new semester. Given that these faculty continued their relationship by engaging in further development activities as a cohort, it is recommended that longitudinal studies that occur over much longer periods of

time be conducted to both understand the nature of these relationships in more depth, as well as to examine how faculty knowledge does or does not change over the same period of time.

A rival proposition would be that faculty would cease to engage in faculty development of any kind once the study had ended. For one faculty member, this appeared to occur, but there was no data to necessarily support this assertion. While Cara did not continue to engage with the rest of the cohort and faculty developer in the experience that occurred after this experience ended for faculty, that does not mean that she ceased to engage in faculty development. It just means that she did not engage with the same cohort. It was entirely possible that Cara engaged in continued faculty development, but there were no empirical data to either confirm or reject this assertion. Therefore, it is currently unknown whether this rival proposition did or did not occur in this study.

Proposition 5

The fifth proposition of this study was that the faculty developer would be an important support for faculty as they finalized their projects. This proposition did not occur for the vast majority of faculty. While the faculty developer was a support for some faculty as they finished the design phase of their projects, it would not be fair to state that the developer was an important support for all faculty. A rival proposition for the fifth proposition would have been that the faculty developer would not have been an important support for faculty as they finalized their projects. To an extent, this rival proposition was true, except for Alice and Debbie, who did leverage the faculty developer's knowledge prior to project implementation. Bernice, Erica, and to an extent Cara, each proceeded with minimal if any guidance from the faculty developer, thus confirming this rival proposition.

An alternative proposition that was not stated, but should be investigated further is the following: the faculty developer will be an important support for faculty as they implement their projects. This alternative proposition very clearly emerged in the data. As has been discussed, the faculty developer provided a boost to faculty comfort and confidence, while also enabling faculty to take more risks with their instruction. Some faculty also explained that the developer became integrated into the classroom community. Therefore, it is reasonable to state that this alternative proposition occurred, yet since it was

not stated at the onset of the study it warrants further examination to determine if this was an isolated occurrence or if this phenomenon occurs in other situations.

Proposition 6

The sixth proposition was that faculty TPACK would increase to some degree by the end of the study. This proposition did occur in this study, although the TPK criteria on the technology integration rubric had very minimal increases. Faculty experienced larger increases on the TCK criteria as well as the two criteria aligned to the TPACK domain, which indicates that faculty knowledge did change during this study. The extent to which it did and any effect the faculty development program may have had is unknown however.

A rival proposition would have been that faculty would not experience any increases in their knowledge, which would have remained the same. Yet another rival proposition would have been that faculty knowledge would have decreased by the end of the study. For the latter rival proposition, there was no evidence that faculty knowledge decreased and therefore this proposition can be rejected. However, the former rival proposition cannot be rejected as of yet, because it is currently unknown the extent to which the positive changes to faculty knowledge were statistically significant or not. This was especially true of the TPK related item, which had a very minor change of .2. Yet for the other domains, there was the potential statistical significance, but due to a small sample size, this proposition cannot be confirmed or rejected without further examination with more participants.

Proposition 7

The seventh proposition was that the faculty development experience would be ongoing after the kickoff workshop had ended. This proposition occurred and the faculty development experience did continue beyond the kickoff workshop. The ongoing nature of the experience modeled itself on common instructional design approaches where support persisted through project development, implementation, and evaluation. As such, this phenomenon indicated that the instructional design process shifted from being an isolated event for faculty that they traditionally completed independently to being a more open process where faculty engaged in the instructional design process with their colleagues and in doing so knowledge development activities persisted beyond the kickoff workshop.

Had the process not reached an ongoing state, the rival proposition of the faculty development experience being only a one-time event could have been accepted. This could have occurred if a faculty participant dropped out of the study or if faculty simply stopped participating or attending the various ongoing development activities that emerged. These experiences did not happen and therefore, the rival proposition can be rejected.

Proposition 8

The eighth and final proposition was that there would be positive changes in candidate TPACK and TPACK related domains, especially the TCK domain. This proposition did occur in terms based on the analysis of descriptive statistics for each of the seven averaged TPACK domains. For each of these domains, there were positive increases in candidate knowledge. Therefore, when only considering the descriptive data, a rival proposition where candidate knowledge decreased can safely be rejected. However, in examination of inferential analysis indicates that an alternative proposition exists for this set of data.

An alternative proposition for this study could have been that candidate knowledge remained unchanged. This alternative proposition did occur to varying degrees for certain TPACK constructs. There were statistically significant increases in four TPACK domains for all candidates, which included CK, PCK, TPK, and TPACK. However, knowledge remained unchanged at a statistically significant level for three other domains, which included TK, PK, and TCK. Further analysis by candidate demographics indicated different degrees of changes in candidate knowledge as well. Perhaps the most interesting significant change that occurred was the decrease in TCK for candidates that did not participate in a field experience during this study. So while the eighth proposition did occur when only looking at the descriptive data, the alternative proposition did in fact occur when inferential analyses are examined. In addition, given the statistically significant decrease in TCK for some candidates, it would be hard to fully reject the rival proposition without further exploration in new settings.

Limitations

As with any study, there are several limitations that must be addressed to fully contextualize this study and its results. One of the primary limitations of this study is the relatively small sample size for both faculty and candidates that limits generalization to larger populations. In terms of faculty, it was a

purposive sample, which resulted in only five faculty participants, and therefore is limiting in terms of generalizations that can be made. Further however, was that all faculty had worked with the researcher in the past in various capacities and were very willing to collaborate in this study as well. Given that there was a previous relationship with these faculty members, the ability of the developer to have a perceived impact on faculty confidence and comfort may not persist for faculty the developer has not worked with before. In addition, the faculty in this study had a high degree of willingness to learn new approaches that leveraged the interactions between content, pedagogy, and technologies. This is likely not true for all faculty, therefore limiting the generalizations that can be made to faculty overall. As such, the data from this study could not support any generalizations beyond these five faculty members, as this was not the purpose of this study. Rather, the purpose was to explore the nature of a more systematic faculty development experience that was grounded in TPACK, social constructivism, and adult learning theory. Further research should be conducted that controls for these limitations where more content methods faculty are involved.

In terms of participating candidates, the number of candidates in the sample was small due to the limited number of faculty that participated in the development program. In addition, the overall response rate from this sample was fairly low and is subject to non-response bias. While some small generalizations can be made from the response rate, higher participation by candidates is needed to have a better understanding of changes to their knowledge. Therefore, steps should be taken in future studies that allow for both larger sample sizes as well as increased participation from the sample. In doing so, more advanced statistical analyses can be conducted that will broaden the understanding of candidate TPACK and what a potential development model might look like.

Another limitation of this study was the relationship that faculty had with the researcher. While this relationship was valuable when the researcher had the role of faculty developer, it likely was a limitation when asking faculty about that role. Given the collegial and friendship the researcher has with multiple faculty participants, it was likely that faculty were not as critical of the role the researcher had as faculty developer. Therefore, future studies should be conducted so that the primary investigator of the study is not directly involved in faculty development activities with the participants. This way, faculty can

express more critical comments about the faculty developer's actions and role while still maintaining a positive relationship with the developer.

A final limitation of this study exists in the self-report survey that was used. While the survey was a valid and reliable instrument, the data was still self-report data from candidates who may have responded in ways that they thought the researcher would want to see. Therefore, performance-based data should be collected and assessed using a validated rubric, much like the process that was used with faculty interviews. Should this approach be taken in future studies, it would be worth completing multiple performance assessments that are completed in conjunction with the various stages of project implementation that candidates progressed through in each of the projects. This would allow researchers to identify specific moments where candidate knowledge increased during a project, which could be compared to hypotheses made by faculty and researchers.

Areas for Further Research

Given the findings from this study, there are a number of areas for further research beyond those just described in the limitations. The first is that further studies should be conducted that seeks to confirm the findings of this study with similar populations. Content methods courses provide a unique venue for targeting candidate TPACK development, because of the heavy emphasis in PCK in these courses. Do other content methods faculty implement TPACK-based instruction in similar ways as the faculty in this project did? Does their TPACK increase in similar ways and to what extent is that increase significant? Does the faculty development process emerge as an ongoing process in the same way that it did in this study? Therefore, more studies need to be conducted to determine the level of impact that this approach to faculty development has on both faculty knowledge as well as on candidate knowledge.

A second area for further research surrounds length of the faculty development program. It was discovered that faculty participation in the faculty development cohort persisted to a new opportunity that was available as this study began to end. This would indicate that a relationship had formed with the faculty where faculty found value in working with the same individuals on another semester long project. This needs to be studied further both in terms of the faculty relationships that are formed, but also in terms of faculty knowledge development. How does their knowledge, as well as their practice as an instructor,

change over very long periods of time? This has the potential to change the way faculty development is approached at institutions of higher education and is certainly worthy of continued inquiry.

A third area where additional study should be conducted is with the encouragement of faculty interactions during project development and implementation. Faculty in this study expressed a desire for increased interaction with their faculty peers. Yet, as Bernice accurately pointed out, this could be a difficult task to accomplish since most faculty have extremely busy schedules that do not allow for much collaboration. While this may be the case, it would behoove researchers and developers to find possible solutions to these time constraints, since in the researcher's experience, when faculty have an interest in collaborating with one another, there typically are productive outcomes that emerge.

A fourth area for continued inquiry would be in terms of conducting a replication study where there is a control and an experimental group of faculty. In the control group, faculty would participate in the traditional educational technology based workshops that would otherwise be available to them at their institution. Then in the experimental group, they could participate in a similar process as was implemented in this study. Using a quasi-experimental methodology would help determine any effect that may exist as a result of this approach to faculty development.

Another area for continued research is to identify ways to encourage faculty to take more risks in their instruction. What emerged in this study was that some faculty, such as Alice, opened up to taking risks with her instruction. Given the demand for change emanating from society and learners, the rate at which change likely needs to occur is quite rapid. Therefore, as faculty developers and researchers continue to explore ongoing approaches to faculty development, finding ways to help faculty move outside their comfort zone to take those risks that create new learning opportunities for candidates will be important. A component of this risk taking should also be helping faculty make overt to candidates the risks they are taking so that candidates have a model of what ongoing knowledge development looks like. Doing so would support a classroom culture where failure is part of the norm rather than something that discredits faculty.

One consideration developers and scholars should keep in mind as they investigate encouraging faculty risk taking is that the TPACK framework is not a model of effective pedagogy. Rather, the

framework is pedagogic neutral in that as long as there is fit between the three domains. Therefore, as this issue is explored, it will likely be beneficial to have a construct of effective teaching that is used in conjunction with the TPACK framework in the planning and implementation of development opportunities.

In addition to helping faculty take more risks, it is recommended that developers help faculty take more risks in terms of the dissemination of candidate work. Candidates in Bernice and Erica's course had a very authentic audience for their work, which likely added value for the candidates. While this was not the focus of this study, studies should be conducted where faculty are encouraged to create instruction where candidate work is shared with an authentic audience.

A final recommendation in terms of risk taking is that faculty should encourage more candidate risk taking. There were points in multiple faculty projects where candidates either took risks and in doing so demonstrated some leadership, or they did not have the courage to do so. Just as risk taking can be beneficial for faculty, it can be beneficial for candidates as well. Yet this study only scratched the surface of candidate risk taking and therefore, more inquiry is needed on this topic.

Another recommendation is for developers and researchers to explore the nature of faculty intimidation further. Intimidation should not be a component of faculty development. When faculty enter an unsafe environment the expectations for change and engagement quickly dissipates. Yet, faculty in this project expressed feelings of intimidation in prior development opportunities. Therefore, it is incumbent upon developers and researchers to seek out ways to remove stimuli of intimidation from development opportunities.

A final recommendation is for further inquiry into how faculty development can be conducted in ways that are sustainable. The faculty development experience in this study traversed the entire instructional design process, which resulted in the discovery of the ongoing faculty development system. What became clear in this study related to the ongoing process was that while faculty had varying degrees of success, areas of improvement were identified, which parallels the instructional design process. Continual improvement is a key quality of faculty development, because the goal is enhanced instruction. One time experiences cannot be expected to meet the rapidly changing demands of course curriculum and instruction. Therefore a faculty development process needs to be in place that can support the need for

ongoing change, which is what a systems approach to ongoing faculty development would likely support. The process that emerged in this study provides a first step, but more research is needed to fully understand what this process means and how developers and faculty can take advantage of these opportunities.

Conclusion

The genesis of this project emerged from a need for more new teachers that can effectively leverage technologies during instruction that targets the development of both knowledge of content, as well as skills that are more emphasized in today's society. As Wagner (2012) indicated, the skills needed for the workforce have changed and what was once of value in the past, may not be suitable for the future. Therefore, it is incumbent upon educators at all levels to change instructional practices to meet this demand of society.

Part of the change that is required is a change in how candidates are prepared to use technologies. While there is value in educational technology focused courses, it is unrealistic to expect these teacher education courses to be sufficient enough to meet the demands of the both society, but also learners. Therefore, teacher education programs need to look to other venues for targeting candidate knowledge for development. Content methods courses would seem to be a logical place for this development to occur given the heavy emphasis on PCK related to specific subject areas. Yet, for many of these faculty, they may not feel comfortable using technologies in their instruction, because they have not had the experiences using technologies that their educational technology colleagues have had that they believe are critical for success. This means that faculty development will be a key component in the change process.

Faculty development approaches of the past however, are insufficient for the future. Traditional workshops that, as faculty in this study described, are one shot, need to be redesigned to meet the instructional needs of faculty that moves beyond instructional design. All instructional design models follow instruction into implementation and evaluation, which means that as faculty explore and wrestle with how they can use technologies effectively in ways that are grounded in TPACK, developers need to be an active contributor to those experiences. This was the approach that was taken in this study and what emerged was a faculty development process that was ongoing beginning with instructional design and development, but then it persisted through implementation and evaluation. In addition, the role the faculty

developer had enabled faculty to perceive that they could take more calculated risks. The developer provided encouragement and advocated for faculty, both of which could not occur if the faculty development process ended at the workshop stage.

What was found as at the end of the faculty development process was that faculty and candidate knowledge had changed. In terms of faculty, they experienced increases in their ability to perform in terms of TCK, TPK, and TPACK. While the significance of these changes cannot be known for sure in the given study, it is promising to see that there were positive changes. There were also positive changes for candidates in this study as well. Candidates had statistically significant positive differences in their CK, PCK, TPK, and TPACK. While there was still some uncertainty in terms of how their knowledge increased based on various demographics candidates possessed, increases in knowledge of TPACK related domains is an exciting prospect, because that is a step towards changing instructional practices so that new knowledge and skills can be developed by teachers.

The education system in the United States, albeit everywhere, is at a critical junction. There are a number of forces that are drastically changing the way our society interacts and conducts itself. What is important to remember is that the education system does not operate in isolation. Rather, the changes that are reshaping society are also reshaping how and what we teach whether we recognize it or not. Our willingness to embrace these changes and play an active part in shaping their impact on our education system has yet to be seen. While there are a number of educators who do embrace the paradigmatic shifts that are occurring, there are a number who have not and who refuse to do so. This is problematic, because if we, as a system, do not do our best to prepare and implement curriculum that mirrors the needs and demands of society, then it will be impossible to have a positive impact on the preparation of learners for careers that place greater emphasis on different skills than what has been needed in the past. This study represents one step in trying to make a difference by examining the faculty development process associated with developing content methods educator TPACK. This is not the only step, but it is an important step and perhaps a first step in reinventing our educational system so that the learner of today can be prepared for success of tomorrow.

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APPENDIX A

INTERVIEW 1: PRE-WORKSHOP INTERVIEW PROTOCOL

1. Think of an instance when you used technology in your instruction.
    A. Describe the content and/or topic for the project.
    B. What are the learning goals/objective of this project?
    C. Describe your students (year in college, current place in teacher ed program, learning needs/preferences, etc.).
    D. Walk me through the project as you currently think it will unfold.
    E. What educational technologies, both digital and non-digital will you use in this project?
    F. What educational technologies, both digital and non-digital, will your students use in this project?
    G. Describe any contextual information, like access to computers, materials, and/or resources as well as any initiatives taking place, that might influence the project.
    H. How and why do the particular technologies used in this project "fit" the content goals?
    I. How and why do the particular technologies used in this project "fit" the instructional strategies you plan to use?
    J. How and why do the learning goals, instructional strategies, and technologies you will use all fit together in this project?
2. Talk about what a student would typically experience in your course prior to this semester.
3. Describe your comfort with using technology in general.
4. In terms of your educational technology expertise, do you consider yourself as novice, intermediate, or advanced? Why?
5. Do you currently or have you ever reflected on improving your instruction with other faculty members? If so, please describe the nature of the collaboration you had with the other faculty.
6. How do you typically learn about how to teach your content using new technologies?
    A. Describe the effectiveness of these experiences.
7. What do you hope to gain from this experience?
8. Demographics:

A. How long have you been an educator?

B. How long have you worked at UNI?

C. What is the name of the course you teach?

D. How long have you been teaching your UNI course?

E. Where did you work before teaching at UNI?

F. Do you consider yourself part of the millennial generation, born after 1980?

G. Is there anything else about you that I should know?

APPENDIX B

POST WORKSHOP SURVEY

1. Describe your experiences in the two-day workshop.
2. Describe your interactions with other faculty during the two-day workshop.
3. You were engaged in a few different types of activities during the workshop. To what extent, if any, did those activities assist you in the development of your knowledge about how to use technologies with how you might teach the content of your course?
4. Have you kept in contact with faculty as you've continued to develop your project?
5. At this point in the faculty development program, what stands out the most?
6. Are there questions you have that you would like to discuss?

APPENDIX C

INTERVIEW 2: POST TPACK PROJECT INTERVIEW PROTOCOL

1. How did your students react to this project? Was their reaction similar or different than other assignments in your course? Why do you think that is?
2. Describe the implementation of your TPACK project.
    A. Describe the content and/or topic for the project.
    B. What were the learning goals/objective of this project?
    C. Have you learned anything more about your students that you feel is important to share.
    D. Walk me through the project as it unfolded.
    E. What educational technologies, both digital and non-digital did you use in this project?
    F. What educational technologies, both digital and non-digital, did your students use in this project?
    G. Describe any contextual information, like access to computers, materials, and/or resources as well as any initiatives taking place, that influenced this project.
    H. How and why do the particular technologies used in this project "fit" the content goals?
    I. How and why do the particular technologies used in this project "fit" the instructional strategies you used?
    J. How and why do the learning goals, instructional strategies, and technologies you used all fit together in this project?

APPENDIX D

INTERVIEW 3: END OF STUDY INTERVIEW PROTOCOL

1. After completing this faculty development experience, what stands out?
2. Has your knowledge about your content, pedagogy, and technologies changed over the course of this program? If so, how?
3. Do you think your students' knowledge of content, pedagogy, and technology has changed as a result of the project you implemented through this program?
4. What role has having a cohort of faculty to interact and reflect with had in your development as an educator?
5. What are you most proud of looking back on this experience?
6. What will you do next to further your growth as an educator?
7. Is there anything else you'd like to share?

APPENDIX E

TPACK SURVEY

Thank you for agreeing to take this survey. This is the second of two surveys you will take in this study. The goal of this survey is to determine if your knowledge increased as a result of the learning activities you engaged in during the course. This survey will take approximately 20 minutes to complete. If you have any questions, please email daniel.mourlam@uni.edu for assistance.

General Explanation: The main purpose of this survey is to identify preservice teachers' TPACK levels and investigate relationships among different components of TPACK (content, pedagogy, and technology). This survey intends to explore your level of technology use in your teaching as prospective teachers. Please respond to each item as if you were an inservice teacher.

Definitions: *Technology*: This term in this survey indicates general information technologies that include computer software, hardware technologies, and Internet use. *Content Knowledge*: This term refers to all knowledge related to your area of teaching.

Section 1

Demographic Information: This section is organized to get information about participants.

1. Your first and last name (Note: Your name is required to compare your responses on both surveys you will complete. Your name will remain confidential and available to only the primary investigator.)
2. Gender
3. Age Range:
    a. 18-22
    b. 23-26
    c. 27-32
    d. 32+
4. Major (Choose all that apply
    a. Early Childhood Education
    b. Elementary Education

   c. Middle Level Education
   d. Secondary Education

5. Subject area you'll be licensed to teach (Choose all that apply)
   a. Art
   b. Early Childhood Education
   c. English/Language Arts/Reading/Literacy
   d. History/Social Studies
   e. Instrumental/Vocal Music
   f. Mathematics
   g. P.E./Health
   h. Science
   i. Special Education
   j. Speech/Theater
   k. World Languages
   l. Other (Open-Ended)
6. Year in college
   a. Freshman
   b. Sophomore
   c. Junior
   d. Senior
7. Are you currently enrolled in an instructional technology course? Yes/No
8. Were you enrolled in an instructional technology course prior to the Fall 2014 semester? Yes/No
9. Are you completing an instructional technology minor? Yes/No
10. Did you complete a field experience this semester? Yes/No

Section 2

The aim of this section is for you to reflect on your TPACK and its components.

For each item, please select your level of agreement or disagreement using the following scale:

1. Strongly Disagree
2. Disagree
3. Agree
4. Strongly Agree

Technology Knowledge (TK)

1. I can learn technology easily.
2. I can easily solve some of the technical problems I encounter.
3. I now how to seek technology help.
4. I have sufficient knowledge and experiences with the most recent technologies.

Content Knowledge (CK)

"My field" indicates your teaching area (Mathematics, Science, Social Studies, etc.).

1. I have sufficient knowledge in my field (Mathematics, Science, Social Studies, etc.)
2. I know basic concepts such as formulas and definitions in my field.
3. I understand the structure (organizations) of topics of content I teach.
4. I can present the same subject matter at different levels.
5. I can explain background details of concepts, formulas, and definitions in my field.
6. I have adequate knowledge in explaining relations among different concepts on the subject matter.
7. I can explain why a specific topic is important.
8. I can make connections with content I teach and daily life.

Pedagogical Knowledge (PK)

In this section, you are asked for your thoughts on teaching and learning in general.

1. I can use different approaches to teach.
2. I can select appropriate teaching styles for students from different backgrounds.
3. I can use a variety of tools (approaches) to assess students' learning.
4. I can motivate students to engage with the content.

Pedagogical Content Knowledge (PCK)

In this section, you are asked to share how you can implement your general pedagogical knowledge and experiences in teaching and learning into your area of teaching.

1. I can effectively develop a plan of teaching a specific subject matter in my field (Mathematics, Science, Social Studies, etc.).
2. I can select teachable content of the subject matter appropriate to students' level.
3. I can teach the same subject matter to students at different levels.
4. I can identify students' preconceptions and misconceptions on the subject matter.
5. I can adjust my teaching according to level of ease and difficulties with learning of specific subject matter.
6. I can identify difficult sides of the subject matter and find ways to explain them.

Technological Pedagogical Knowledge (TPK)

In this section, you are asked to share your thoughts about how you can use technology to support your pedagogical approach.

1. I can use technology to assess students' learning.
2. I can use technology to identify individual differences among students.
3. I can use technology to advance my teaching and students' learning.
4. I can use technology to bring students' individual differences (learning preferences, content background, academic level) into the classroom.

Technological Content Knowledge (TCK)

In this section, you are asked to share your thoughts about how you can use technology with the content you teach.

1. I can use technology to present the content in different ways.
2. I can use technology to enrich the content.
3. I can use technology to demonstrate unobservable facts, concepts, and principles of the content.
4. I can use technology to access additional resources about content that may otherwise not be available.

Technological Pedagogical Content Knowledge (TPACK)

In this section, you are asked to share your thoughts about how you can use technology in your teaching.

1. I can use technology in teaching the specific content within the defined pedagogical approach in a given context.
2. I can use technology to ease students' learning of a specific content.
3. I can use technology in such a way that students feel its positive impact in their learning of specific subject matter.
4. I can use technology to organize my teaching and students' learning of specific content.
5. I can select specific technology for teaching specific content.
6. I can use technology to bring real-life experiences, examples, and analogies about specific content.
7. I can use technology to identify learners' individual differences on understanding of the content.

Section 3

Please complete this section by writing your response.

1. Describe how your ability to combine your knowledge of content, teaching approaches, and technologies has changed as a result of the project you completed in your professor's course (Posttest survey only; customized to each individual faculty member's project topic and name).

APPENDIX F

ASSESSMENT RUBRIC FOR EXPERIENCED TEACHER INTERVIEWS

Criteria	4	3	2	1
Curriculum Goals & Technologies (Curriculum-based technology use)	Technologies selected for use in the instructional plan are strongly aligned with one or more curriculum goals.	Technologies selected for use in the instructional plan are aligned with one or more curriculum goals.	Technologies selected for use in the instructional plan are partially aligned with one or more curriculum goals.	Technologies selected for use in the instructional plan are not aligned with any curriculum goals.
Instructional Strategies & Technologies (Using technology in teaching/learning)	Technology use optimally supports instructional strategies.	Technology use supports instructional strategies.	Technology use minimally supports instructional strategies.	Technology use does not support instructional strategies.
(Technology Selection(s) (Compatibility with curriculum goals & instructional strategies)	Technology selection(s) are exemplary, given curriculum goals(s) and instructional strategies.	Technology selection(s) are appropriate, but not exemplary, given curriculum goals(s) and instructional strategies.	Technology selection(s) are marginally appropriate, given curriculum goals(s) and instructional strategies.	Technology selection(s) are inappropriate, given curriculum goals(s) and instructional strategies.
"Fit" (Content, pedagogy and technology together	Content, instructional strategies, and technology fit together strongly within the instructional plan.	Content, instructional strategies, and technology fit together within the instructional plan.	Content, instructional strategies, and technology fit together somewhat within the instructional plan.	Content, instructional strategies, and technology do not fit together within the instructional plan.

(Harris et al., 2012)

APPENDIX G

POWERPOINT FROM KICKOFF WORKSHOP

5/31/15

TPACK Faculty Development

Daniel Mourlam
8/19/2014

Agenda

- Make the familiar unfamiliar
- TPACK and the TPACK Game
- Project Development

Make the familiar unfamiliar

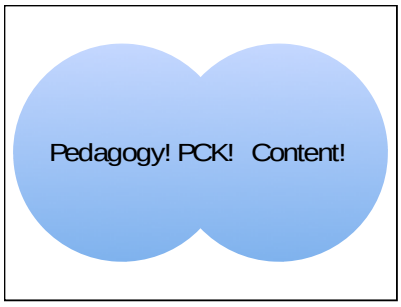
- Spell "Panther" using pictures
- Pictures must be of ordinary objects that look like letters
- Create something that shares all pictures at once
- 30 Minutes

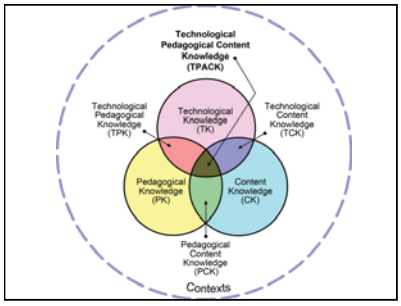
5/31/15%

What is TPACK?!

2%

5/31/15%





TPACK Game!

- Write down content (Senate and the Filibuster) !
- Pick a pedagogy and technology card at random !
- 4 Questions: !
  - What do I gain or lose combining CK with TK? !
  - What do I gain or lose combining PK with TK? !
  - What do I gain or lose combining CK, PK, & TK? !
  - Do they fit? If not, make it fit by changing PK or TK. !

3%

5/31/15

Debrief

- Was responding to these questions easy or difficult? Why?

Activity Types

- http://bit.ly/unilat
- Content Taxonomies of instructional approaches and technologies
- Assist with combining TK with PCK

Project Development

- Identify the following on whiteboard:
  - What is the content to be learned? (Not the tech)
  - What instructional approach will be used?
  - What technologies will be used?
- 1 Minute Summary of Project Idea

5/31/15

Feedback

- How well does the content, instructional approach, and technology fit together?
- What stands out to you about the proposed project that is a real strength?
- Suggestions for further consideration.

Debrief

- Pick one comment that could impact design of project and explain why.

Ticket Out

- Next steps needed to finish project
- Timeline for implementation

APPENDIX H

TPACK GAME CARDS

Each of the following three card types were included on a single card. For example, one card said Lecture, while another card said Presentation.

- Content Card (Can be any content topic)
- Pedagogy Cards
  - Lecture
  - Discussion/Debate
  - Presentation
  - Peer Editing
  - Collaborative
  - Discovery-Based Learning
  - Demonstration
  - Reflection
  - Team-Based
  - Individualized Instruction
- Technology Cards
  - Digital Camera/Camcorder
  - Poster Board and Markers
  - BlackBoard Learn
  - Concept Mapping Software
  - iPad
  - Prezi
  - Skype/Zoom
  - Google Drive
  - VoiceThread