DEVELOPING TPACK IN PRACTICE:
A MULTIPLE CASE STUDY OF HIGHER EDUCATION INSTRUCTORS

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Dedication

We trust our faith to each other. Together we rise forward.
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Chapter 1
Introduction

Background

Within educational contexts, technology represents both an “application of scientific know-how” and “tools or equipment” (Lowyck, 2014, p. 6). Spector, Merril, Elen, Bishop (2014) offer a further definition of technology as a disciplined application of tools (traditional and emerging) and pedagogical strategies to support and facilitate learning. Despite perceptions of instructors being slow to adopt new technologies for teaching (Ertmer 2005; Georgina & Olson, 2008), teaching and learning in higher education continues to move increasingly towards “emerging pedagogical methods” (McKee & Tew, 2013, p. 6) which involve technology rich learning experiences. Seventy-two percent of students in colleges and universities report that most or all of their instructors have adequate technology skills for carrying out course instruction (Dahlstrom, 2015). To ensure that faculty members are “appropriately prepared and supported to deliver” (McKee & Tew, 2013, p. 7) meaningful learning experiences to their students (Dahlstrom, 2015), colleges and universities provide faculty with professional development opportunities that encourage technology integration. The EDUCAUSE Center
for Analysis and Research (EDCR) reports that 54% of instructors found professional development around uses of technology for teaching at their institutions to be good or excellent (Dahlstrom, 2015). Further, institutions that provide faculty with various types of support around integrating technology note that student and instructor impressions about technology in teaching are more positive (Dahlstrom, 2015). Understanding how instructors develop their knowledge of teaching with technology can help support deeper fusing of technology in higher education teaching and learning.

Statement of the problem

Teaching with technology requires a combination of technological, pedagogical, and content knowledge (TPACK) (Mishra & Koehler, 2006; Roblyer & Doering, 2013). Engaging instructors with technology remains a problem in higher education (Westberry, McNaughton, Billot, & Gaeta, 2015). For many instructors, developing competency with new tools and practices remains a barrier to using technologies in their teaching (Buchanan, Sainter, & Saunders, 2013; Georgina & Hosford, 2009; Georgina & Olson, 2008; Kopcha, 2010, 2012; Roblyer & Doering, 2013). In higher education contexts, professional development experiences offer instructors opportunities to develop competencies that may
enhance their practice (Lowenthal, 2008; Desimone, et. al 2002). Scholars describe professional development for higher education instructors as “self-directed learning experiences” (Caffarella & Zinn, 1999, 242), both formal and informal, which help a faculty member with adopting and adjusting to shifting roles as they progress through different stages in their career (Polly, Grant, & Gikas, 2011; Caffarella & Zinn, 1999). Developing competencies in teaching with technology can change or transform instructor’s thinking about themselves and their approach to teaching (Baran, Correia, & Thompson, 2011; Redmond, 2011). Existing research addresses a variety of barriers and reservations faculty hold towards teaching with technology (Cerrone, 2008; Ertmer 2005; Georgina & Olson, 2008; Georgina & Hosford, 2009). In order to help instructors and institutions overcome some of these barriers more research is needed to understand how faculty successfully develop their knowledge and practice of teaching with technology. An aim of this research is to address gaps in the research literature and contribute to scholarship on how university instructors develop their TPACK.
Rationale for the study

A major factor in how instructors use technology in the classroom is the support they receive while learning the technology (Hughes, 2005; Maradiegue, 2012). Many instructors in higher education enter the profession with little or no classroom experience before their first post-doctoral faculty appointment (Austin, 2002). Bailey and Card (2009) claim that the majority of professors at the college level have never taken a course in teaching or education of any kind. Institutions offer professional development opportunities to help instructors engage and develop new ideas and skills useful to the changing environments in higher education (Desimone, Porter, Garet, Yoon, & Birman, 2002; Lowenthal, 2008). Despite this, many professional development experiences around technology either don’t allow learners to be self-driven, or place more emphasis on the technology than on concerns for pedagogy (Barber, 2011). Professional development for instructors can contribute to informed pedagogy, teaching innovations, and “to the effective use of emerging technologies” (Randall, 2008, p. 18). Meaningful professional development for technology integration provides occasions for instructors to reflect and form new knowledge while focusing on the interplay of technology,
pedagogy, and content within their learning contexts (Mishra & Koehler, 2006; Wright, 2010). Professional development that supports technology infusion raises awareness and knowledge of emerging technologies and pedagogical techniques while also offering instructors opportunities to collaborate in developing best practices for teaching with technology (Mishra & Koehler, 2006). Brown, Benson, and Uhde (as cited in Georgina & Hosford, 2009) suggest that to better support and encourage instructors use technologies in their teaching, professional development experiences should:

- be sensitive to the technologically challenged
- facilitate communication, sharing, and coaching between colleagues
- develop individualized action plans and provide opportunities to access necessary resources from the institutions.

Due to the direct link between the learning experiences and the learner’s professional roles, scholars make the argument that faculty are adult learners and their professional development experiences should be perceived through an adult learning lens (King and Lawler, 2003). Kidd (1973) posits that adults’ readiness to learn is stimulated by real life tasks and problems. Knowles (1980)
makes the claim that adults become internally motivated and increasingly self-directed in their learning. These key elements of adult learning inform the professional development model Sparks and Loucks-Horsley (1989) call individually-guided staff development.

Sparks and Loucks-Horsley (1989) detail individually-guided staff development as a model that emphasizes a focus on participant-centered professional development, rather than program centered or outcome-based. Individually-guided staff development describes processes which have participants pursue activities that they believe will promote their own learning (Sparks & Loucks-Horsley, 1989). A key characteristic of individually-guided staff development is that the participant determines their own goals and selects activities that will help them achieve those goals (Sparks & Loucks-Horsley, 1989). Individually-guided development assumes that the individual, as an adult learner, is self-directed and will learn most effectively when they initiate and plan for learning activities which are relevant to their own goals (Sparks & Loucks-Horsley, 1989). As a professional development process, individually-guided staff development “allows teachers to find answers to self-selected professional problems using their preferred modes of learning” (Sparks and Loucks-Horsley,
According to Sparks and Loucks-Horsley (1989), individually-guided staff development for instructors can be an iterative process with multiple phases.

1) Instructors identify a learning need or area of interest such as teaching with technology.

2) Instructors sets learning goals and selects activities that will help them achieve those goals. Those activities may include workshops, readings, visits to another classroom, participation in learning communities, etc.

3) Instructors engage in learning activities. These activities can include single workshops or readings in new content areas, or may be prolonged and occur over time. These learning activities are based and taken in the individual’s preferred mode(s) of learning.

4) Instructors assess whether the learning has met their need or interest. This assessment can be a formal report or can simply be the recognition and acknowledgement that he or she better understands something. In their assessment, instructors may also realize they have much more to learn on the topic or discover new and emerging interests.
In their assessment of instructors learning to teach with technology, Bybee & Loucks-Horsley (2000) note that many teachers do not have “pedagogical content knowledge” (p. 33) to teach expertly with technology. Individually-guided staff development, they argue, is an emerging model taken up by many instructors to address professional knowledge gaps and support the development of their own expertise to teach with technology in their content area (Bybee & Loucks-Horsley, 2000).

When situated in actual classroom practice, “professional development has tremendous potential to promote long-term changes in teachers’ attitudes toward and practices with technology in the classroom” (Kopcha, 2012, p.1110). Kopcha (2010, 2012) notes the importance of equipping instructors with skills needed to negotiate barriers to integrating technology. Providing individualized support situated to their respective teaching context is an important step to improving instructor’s use of technology to support learning (Baran, 2016; Kopcha, 2012). Although scholars have argued for design-based professional development experiences to support integrating technology and pedagogy across various content areas (Koehler & Mishra, 2014; Kriek & Coetzee, 2016), however these arguments focus on design of the
professional development interventions rather than on the individuals, their goals, or professional development needs. Individually-guided staff development, as a framework, focuses on the individual and their professional development rather than any particular intervention. In the context of the present study, a focus on the individual offers a perspective about the individual’s own experiences integrating technology and pedagogy in their content areas.

Instructor desires to better use technology for teaching and their professional development learning experiences to support those efforts provides rationale for this study.

Purpose of the Study

This study examines instructor’s technological pedagogical content knowledge in the College of Education faculty at a large Mid-Western research university. Specifically, this study explores the following research questions:

RQ1 How do instructors describe their technological pedagogical content knowledge?
RQ2 How do professional development activities support instructor’s technological pedagogical content knowledge development?
Chapter 2
Review of Literature

The framework that guides this study is composed of a foundational theory of learning and a construct of instructor knowledge. The follow sections will outline the key constructivist ideas of assimilation and accommodation, and how they connect to knowledge construction. Then I present TPACK which is the focal knowledge construct of this study. Together these form the conceptual framework for this work.

This study is concerned with how instructors describe their technological pedagogical content knowledge (TPACK) and how individually guided professional development activities support development of that knowledge. This study does not assess learning or evaluate the instructor’s practices. In this study, TPACK is a framework centered upon the integration of technology, pedagogy, and content in instructional contexts (Koehler, Mishra, & Cain, 2013). Having knowledge of technology and teaching plays an important role in instructor decision making and is influenced by professional development activities. Professional development can either facilitate or impede instructor knowledge and use of technology in their teaching (Accuosti, 2014). This study describes instructor
perspectives of their own knowledge and use of technology in their teaching.

Overview of Constructivism

There are various theories on constructivism and each theory addresses different aspects of constructivism (Lowyck, 2014). While some of these theories describe constructivism through the perspective of culture and social interaction, others focus on the individual learner, their learning activities, and their processes of knowledge construction (Molenda, 2008). Through this lens, constructivism argues that learning is an active process through which the experiences of the learner and his/her interactions with their environment allows the learner to build knowledge (Cox & Zarillo, 1993). Constructivism further determines that learning is most effective when the tasks and contexts are authentic and hold meaning for learners (Anderson, 2016). From a constructivist perspective, learner’s experiences represents spaces where many ideas and identities can converge and encourage learners to participate in contributing content and shaping their contexts (Moore, 1973). The framework used in this study draws on constructivism theory that examines the interaction between an individual’s experiences and how their ideas form (Ertmer & Newby, 1993; Piaget, 1967).
Piaget (1973) argues that individuals can incorporate new information into their already existing knowledge frameworks without changing those frameworks. This process which he calls assimilation happens when an individual’s experiences or new information they encounter are aligned with knowledge they already hold or ways they currently see the world. For example, it is easier for instructors to take up new teaching methods that extend their existing practices without disrupting them. Assimilating the new with existing can construct new ways of knowing, understanding, and doing. Further, Piaget (1973) details assimilation in three forms.

**Assimilation**

Functional or reproductive assimilation describes the process that happens when action is repeated until the new practice assimilates into the existing (Piaget, 1973). For example, an instructor may try a new tool or strategy in their teaching. If they repeat and continue to use it, it becomes part of their practice. Piaget (1973) describes recognitive assimilation as a process of appropriately assimilating components of a knowledge scheme. For example, as new tools become available an instructor is able to successfully use these new tools without disrupting their teaching. Generalizing assimilation describes how an
individual can “extend the field of the scheme” (Piaget, 1973, p.70). Having assimilated information and ideas from their experiences, a person is more equipped to assess which tools are most appropriate to address different problems. For example, as instructors become more experienced with different technologies, they are better equipped to select tools and strategies most appropriate to their teaching contexts.

Accommodation

Accommodation is another key part of constructivist learning according to Piaget (1973). Through accommodation, failure leads to learning. Using a new tool or attempting a new strategy may not be successful. That failure is a learning experience that contributes to understanding and knowledge construction (Piaget, 1973). An instructor may discover that a new strategy does not work for them but still works well for others in their discipline. Reframing knowledge to accept multiple approaches accommodates a person’s mind to different possibilities (Piaget, 1973).

Accommodation also contributes to knowledge construction by adjusting preexisting ideas to accommodate for new information. Learning that a tool or strategy can preform a function previously thought to be impossible, an
instructor can modify their earlier ideas and understanding to accommodate for this new information (Piaget, 1973).

From a constructivist perspective, knowledge is constructed as learners strive to organize their experiences in terms of preexisting schemes or ideas (Bodner, 1986). Piaget argued that cognitive functions like organization and adaptation remain constant throughout development, but qualitative and quantitative changes can happen in cognitive structures with new experiences (Boder, 1986). These structural changes as new knowledge is constructed. Equilibration, according to Piaget, is a process of internal self-regulation between assimilation and accommodation of new information into existing ideas (Boder, 1986). Knowledge construction, or development, is a product of this process.

Constructivism argues that disequilibration happens when learners are not able to assimilate their experiences with existing ideas. In these cases, learners must modify their preexisting ideas in order to assimilate the new information. This modification is the accommodation that restores equilibration (Boder, 1986).

The interaction between assimilation and accommodation offers a response to the question of how teachers combine new and old knowledge to form a new base of knowledge.
(Shulman, 1986). In his exploration of teacher knowledge, Shulman (1985) argues that there are distinctive bodies of knowledge for teaching.

Pedagogical content knowledge (PCK), blends content and pedagogy into unique understandings of how topics, problems, or issues are organized or represented, and adapted to diverse interests and abilities of learners and presented for instruction (Shulman, 1987, p.8).

Pedagogical content knowledge or PCK is a blending of teachers’ knowledge of subject matters, their content knowledge (CK), with the knowledge of various teaching methods, their pedagogical knowledge (PK). An instructor’s specific knowledge of content, pedagogy, and the combination of their pedagogical content knowledge (PCK), makes them better able to adapt in various teaching and learning contexts and to different learners’ needs (Shulman, 1986). A hallmark of good teaching and good teaching practice includes the continued development of PCK to respond to different learners and different teaching and learning contexts (Shulman, 1986). Emergent technologies in teaching and learning environments have extended the PCK framework to better understand teaching and learning in these new contexts (Hughes, 2005; Mishra & Koehler, 2005).
Technology, within educational contexts, represents both an “application of scientific know-how” and “tools or equipment” (Lowyck, 2014, p. 6). Spector, Merril, Elen, and Bishop (2014) offer a further definition of technology within teaching and learning as a disciplined application of tools (traditional and emerging) and pedagogical strategies to support and facilitate learning. Specialized knowledge is required for handling complex teaching and learning situations that arise as teachers employ technologies in their teaching (Margerum-Leys & Marx, 2004). This technological knowledge (TK), forms a basis for sound decision making (Margerum-Lyes & Marx, 2004) and is how instructors come to understand, think about, and respond to technology in their teaching (Hughes, 2005). When blended and applied together with their pedagogical content knowledge, technological knowledge affords instructors the ability to develop innovative technology-supported teaching and learning opportunities for students (Hughes, 2005).

In order to better understand the relationship between instructor’s knowledge of technology and their pedagogical content knowledge, Technological Pedagogical Content Knowledge, or TPACK (Figure 1), has emerged as a useful framework for thinking about the knowledge instructors have
of using technology for teaching and how this knowledge develops (Baran, Chuang, & Thompson, 2011; Mishra & Koehler, 2006).

Figure 1. TPACK Framework. Reproduced by permission of the publisher, © 2012 by tpack.org

TPACK (Mishra & Koehler, 2006) serves as framework for considering the impact of combining layers of technology knowledge (TK) with pedagogical content knowledge (PCK) in different teaching and learning contexts. During instruction, teachers integrate their knowledge of the subject matter with their knowledge of various
instructional strategies appropriate to their learners (Shih & Chuang, 2013). Their use of PCK, “reflects the ways instructors consider the connections between their subject matter and different instructional strategies” (Kushner Benson & Ward, 2013, p.156). Further, by integrating technology knowledge (TK) and PCK instructors can adapt instructional methods and use various technologies to offer varied representations of content in ways meaningful to more learners (Kushner Benson & Ward, 2013). Technological knowledge integrated into this model of teacher knowledge also emphasizes that it is in how technology is used to support teaching and learning that is significant (Shih & Chuang, 2013). Therefore, in addition to TK + PCK relationships, the TPACK framework also identifies knowledge domains which uniquely characterize how instructors use technologies relative to teaching their subject matter (technological content knowledge, TCK) and the ways instructors use technologies in their teaching to influence learning (technological pedagogical knowledge, TPK). Technological content knowledge, TCK, is an understanding of how technology may be meaningfully married with content in learning experiences (Mishra & Koehler, 2006). Developing TCK affords instructors “greater flexibility” to present “varied representations” of content
to students (Mishra & Koehler, 2006, p. 1028). Within instructor’s TCK lie understandings of how texts, images, audio, video, computer applications, and other technologies can all potentially impact the interpretation and translation of subject matter to learners (Mishra & Koehler, 2006). Technological pedagogical knowledge (TPK) not only encompasses how technologies may support pedagogical goals, but also considers how teaching and learning can change when particular technologies are used in particular ways (Koehler & Mishra, 2005). These subdomains of instructor knowledge are integral to developing TPACK and form a foundational lens for looking at instructor’s combination of technology knowledge with the knowledge of teaching and knowledge of their discipline (Koh, Chai, & Tsai, 2010; Kushner Benson & Ward, 2013; Mishra & Koehler, 2006; Shinas, Yilmaz-Ozden, Mouza, Karchmer-Klein, & Glutting, 2013). Through numerous studies, researchers have found TPACK to be a fruitful model for creating and sustaining meaningful conversation about technology integration (Kimmons & Hall, 2016).

**TPACK in Higher Education**

Although extensively used in pre- and in-service teacher education research, there is limited empirical research of TPACK in higher education (Mourlam, 2017;
Kushner Benson & Ward, 2013; Reinties, Brouwer, & Lygo-Baker, 2013). In his review of TPACK in higher education literature, Mourlam (2017) conducted analysis of peer-reviewed journal articles, conference proceedings, doctoral dissertations, and academic book chapters revealing 41 publications related to TPACK in higher education. These publications qualified under the criteria that they include a research question or purpose statement, description of the methodology used, a higher education context, a specific focus on TPACK or a component of TPACK, and reporting of sufficient findings to draw conclusions. A major theme of these studies was the nature of development activities used to target faculty TPACK. Mourlam’s analysis revealed common approaches to developing instructor TPACK in higher education included design-based activities, workshops, mentoring, and online development modes. Design-based activities focused on the design or re-design of instructional activities to address instructional needs. Mourlam (2017) describes the majority of these experiences as “typically collaborative” and “often grounded in constructivist and adult learning theories (p. 2077). Workshops, mentoring, and online development modes were other common approaches to developing instructor TPACK (Mourlam, 2017). Workshops, according to Mourlam,
facilitated development for instructors in different topics like technological knowledge, curriculum development, as well as a means for instructors to revise curriculum plans (Mourlam, 2017). Instructors also found that individualized support, or mentoring by faculty developers, facilitators, or faculty peers was a primary TPACK development method for many instructors (Mourlam, 2017).

Jaikaran-Doe and Doe’s (2015) study of university instructors argued that constructing, understanding, and applying TPACK can help instructor’s overcome tensions to using learning technologies to support teaching and learning. Kushner Benson and Ward (2013) cite findings from Scott’s (2009) case study on professional development to support instructor TPACK development that “Scott (2009) concluded that mastery of technology skills and confidence in using technology were key factors in achieving TPACK integration”. In their own study of education professors, Kushner Benson and Ward (2013) concur that TPACK is an important lens through which to conceptualize excellence in higher education teaching and learning with technology. Mishra, Koehler, and Henriksen (2010) argue that TPACK development evidenced by increased mastery of technology skills and confidence in using technology for teaching, is a required characteristic of instructors who nurture
transformative learning experiences. With increased emphasis on cultivating awareness of the complex interplay between technology, pedagogy, and content within their disciplines, researchers have suggested that professional development activities can support higher education instructor’s TPACK development (Reinties, Brouwer, & Lygo-Baker, 2013).

TPACK and Instructor professional development

In order to better understand the literature published regarding TPACK in instructor professional development, a systematic literature review (Evans & Benefield, 2001) including peer-reviewed journal articles, conference proceedings, doctoral dissertations, and academic book chapters was conducted. Multiple databases were searched (i.e. EBSCO Academic Search Premier, Google scholar) to identify relevant literature. Various combinations of keywords including TPACK, higher education, faculty development, professional development, career development, professional education, teacher development, technological literacy, and educational planning were combined to produce 118 results. These results were reviewed for relevance by first looking at titles and abstracts for information related to TPACK and instructor professional development. A follow-up review of the initial 118 results focused more
specifically on studies relative to higher education, faculty development, professional development, and professional education which reduced the number to 28 studies fitting the general context of this study. These studies were further refined to exclude program evaluations studies and studies about TPACK evaluation instruments. Inclusion criteria focused on reports of instructor outcomes and reflections on professional development experiences.

Increased emphasis on cultivating awareness of the complex interplay between technology, pedagogy, and content within disciplines have led researchers to suggested that professional development activities can support higher education instructor’s TPACK development (Reinties, Brouwer, & Lygo-Baker, 2013). Matherson, Wilson, and Wright (2014) argue that gaps in instructor TPACK can be alleviated by providing instructors with authentic and sustained professional development. Matherson’s et. al (2014) argument asserts that within a sustained professional development effort, opportunities for instructors to build knowledge and skills, establish community among themselves, have practical strategies modeled and for them are important parts of a process of supporting instructor development of TPACK.
Harris and Hofer (2017) described the use of TPACK as a framework for conceptualizing applied knowledge in university-based research. Their own research on TPACK in professional development reveal that context and professional culture are important in individual TPACK development. Based on oral and written reflections on their professional development experiences, participants articulate that their choices became more conscious and strategic in regards to technology use and learning activities, their planning became more student-centered and focused on students’ intellectual engagement, participants also raised their own standards for technology integration which resulted in more deliberate and judicious use of educational technology in their teaching (Harris & Hofer, 2017).

Xie, Kim, Cheng, and Luthy (2017) studied instructor participants in an on-going professional development program focused on instructor TPACK development. Their analysis of interview data, surveys, and self-reflections, found that when participants evaluated how and why they made particular choices in integrating technology and their teaching they perceived an increase in their TPACK over time (Xie et al, 2017).
Scholars have also found the TPACK framework useful for analyzing instructor discussions of their intentions, actions, and outcomes using technology within their learning environments (Manfra & Hammond, 2008). Tokmak’s (2015) exploration of instructor TPACK development found that through course design activities, instructors describe perceived increases in their abilities to use technologies for teaching. Riordain, Johnston, & Walshe’s (2016) found that using TPACK as a framework to examine instructor’s practices can positively contribute to supporting in-services teachers’ integration of content and technology in their pedagogy. Boschman, McKenney, and Voogt’s (2015) analysis of instructor talk about design in their teaching experiences found that TPACK was expressed and linked to instructor’s questions of practicality between using technologies in their teaching and instructors achieving different teaching outcomes.

Aiming to extend the use of TPACK as an analytical framework, Olofson, Swallow, and Neumann (2016) called for newer ways of capturing and analyzing the openness and creativity possible in technology-rich learning environments. Their positon calls for using TPACK as a framework for analyzing an instructor’s knowledge construction and practice. This position stems from their
analysis of instructor descriptions of practices in technology rich settings. Olofson et al (2016) noticed that a static interpretation of TPACK made it difficult to provide rich descriptions of instructor’s actual experiences. “TPACKing” (p. 189), according to Olofson, Swallow, and Neumann (2016), operationalizes TPACK into a dynamic process of instructor knowledge construction for technology rich instruction. A dynamic perspective on TPACK affords for the interactions instructors make between their technological, pedagogical, and content knowledge and their past experiences, their knowledge of students, and contextual influences when teaching with technology. These interactions are continuous and contribute to the building of instructors’ TPACK. In the research, embracing TPACKing as a dynamic process, rather than a static thing allows for rich descriptions of instructor’s actual experiences.

The literature presents several positions and arguments for the viability of TPACK as a framework for analyzing instructor knowledge and knowledge development. For higher education instructors, effective professional development can serve to close gaps in the construction and application of knowledge innovations such as TPACK. Berman & McLaughlin (1978) assert that when development experiences for instructors are flexible, adaptable, and
“to the reality of the institutional setting” (p. viii) they allow instructors to implement innovations authentic to their needs and teaching goals. In other words, allowing for instructors to drive the process of their professional development experiences is a pathway to new knowledge construction and application in practice.

This chapter reviewed a body of literature focused on the theoretical foundations guiding this study of faculty technological pedagogical content knowledge. Further, the chapter demonstrates the viability of TPACK as a framework for analyzing instructor experiences teaching and learning with technology within higher education contexts.
Chapter 3
Method

In order to provide a context for the present study, descriptions of the research methods are organized into several different sections. They include descriptions of the research design, research context, my role as researcher, research participants, data collection, data analysis, and limitations of the study. Together these methods are used to examine how instructors in a College of Education describe their technological pedagogical content knowledge. The research questions guiding this study are:

RQ1 How do instructors describe their technological pedagogical content knowledge?
RQ2 How do professional development activities support instructor’s technological pedagogical content knowledge development?

Given the guiding research questions, the reviewed literature, and the stated purpose of this research, a multiple case study approach was selected to conduct this research.

Multiple case study

This study employs a multiple case study design (Yin, 2009) to investigate how instructors within the real-life context of a college of education describe their
technological pedagogical content knowledge (TPACK). Scholars generally agree that the case study approach can be particularly useful to studying an entity or a phenomenon in its real life context (Merriam, 1998; Stake, 1995; Yin, 2009). Yin offers that, as a methodology, case study can be especially effective “when the boundaries between a phenomenon and context are not clear and the researcher has little control over the phenomenon and context” (Yin, 2009, p. 18). Yin (2009) asserts that case study can be an most appropriate when: (1) the study aims at answering ‘why’ and ‘how’ questions; (2) the researcher has no control over the behavior of those involved in the study; (3) contextual conditions need to be covered due to their relevance to the phenomenon under study; and/or (4) the boundaries are not clear between the phenomenon and context. According to Yin (2009) a multiple case study design can lend certain strengths to a study over a single case study design. First, there can be an analytic benefit from studying multiple cases. Independent conclusions rising from each case can lend greater support to claims than studies focused on a single case (Yin, 2009). Further, critics of single case studies voice fears linked to the uniqueness of the case or conditions surrounding the case (Yin, 2009). In a multiple case study design, each
subsequent case adds a complexity and further develops the conditions that bind the cases together in a study (Yin, 2009).

Within the context of this multiple case study, each participant represents a unique case and description of an instructor’s technological pedagogical content knowledge. Further, in the investigation of each case, an aim of this research is to understand a phenomenon in its context, namely instructor’s technological pedagogical content knowledge and how professional development experiences facilitate the development of instructor’s technological pedagogical content knowledge within a college of education.

**Context Overview**

This study was conducted within the College of Education at a large Midwestern research university. A top priority of the College leadership is meeting the learning needs of 21st century learners by supporting instructors’ development of new ways to teach. In order to support this goal, the college offers professional development opportunities to help instructors use technology in their teaching in meaningful ways. Instructors are invited to select and participate in a number of professional development activities in order to support their
integrating technology in their teaching. Participation in the College provided professional development activities is not mandated. Each participant’s professional development is individually-guided. These professional development activities include embedding instructional designers and graduate teaching assistants as mentors in departments throughout the college, individual and small group consultation on learning activities and course design, online and face-to-face tutorials on university supported technological tools, and an annual intensive summer workshop series directed at integrating technology and pedagogy. The instructional designers and graduate assistants embedded within departments provide support integrating technology and pedagogy appropriate to the disciplines and unique contexts of each academic department. Instructional designers within the College of Education are academic professionals, each with graduate degrees in education or instructional design and years of experience working as instructional designers in support of instructors and subject matter experts. Doctoral students from within the respective departments are placed as graduate teaching assistants to offer a combination of disciplinary knowledge the knowledge of learning with technology within their respective disciplines. This
knowledge combination supports instructors in meaningfully integrating technology with their pedagogy. Consultations allow instructors to receive immediate support to address needs or issues related to using technology in their teaching as they arise. Tutorials ranging from function and application of technology teaching tools to strategies for integrating technology and teaching are available online and face-to-face for individual instructors and small group collaborative teaching teams. Each summer, the College offers intensive four-day workshops as opportunities for instructors to engage in deep exploration of tools and strategies for meaningfully infusing technology into their teaching. Workshop attendees also participate in guided revisions of course assignments or revisions of entire courses to integrate technology and teaching. Each four-day workshops follows a similar format:

Day 1: a facilitated direct instruction introducing instructors to tools and strategies for teaching with technology

Day 2: a facilitated online learning experience which introduces big ideas in technology mediated teaching and learning

Day 3 & 4: are structured as learner-driven guided practice for instructors to work and receive direct support
on design and development projects relative to their own courses.

The summer workshops are led and facilitated by the team of instructional designers and graduate teaching assistants who are embedded across the College of Education.

**Researcher role**

My interests in instructor technological pedagogical knowledge stem from my own experiences as an instructor in higher education. In my first year as an adjunct faculty I became increasingly aware of my need to learn various technology tools and how to use those tools in my teaching. This awareness was paired with various tensions in my own professional development as a higher education instructor. Challenged by the increasing presence of technologies in teaching and learning environments, I was very motivated to seek out and pursue professional development opportunities to learn and become more comfortable with increasingly changing contexts of teaching and learning in colleges and universities.

I related to many faculty in higher education who face new technologies in their teaching environments and have to adapt or develop new practices. In my own experiences I experienced various challenges and tensions in the
processes of adopting technologies in my teaching. I enrolled in the PhD program in learning technologies in order to better understand challenges higher education instructors face integrating technology and their teaching. I worked on various projects and initiatives during my doctoral program in which I was responsible for helping instructors meaningfully incorporate technology in their teaching, and support learner-driven professional development for integrating technology and pedagogy.

During the time of this study I was a graduate teaching assistant in the College of Education, embedded within two departments in the College, and a member of the team responsible for leading and facilitating summer workshops between 2012 and 2016. Being naturally embedded within the context of this study I had access to each of the participants. Further, since I was embedded within two academic departments during the period covered in this research I consulted with and supported each of the participants in this study with integrating technology and their teaching.

Participants

Each of the four participants in this study, Mikel, Mac, Rena, and Sam, is a faculty member in the College of
Education who was purposefully selected to participate in this research.

Because the summer workshop series is an integral component of the professional development offerings available to support instructors integrate technology and their pedagogy, instructors from across the College who had participated in the summer workshops between 2011 and 2016 were invited to participate in this research. Invitations to participate were extended to one hundred and forty-three instructors from the eight departments of the College of Education.

After initially evaluating responses to the call for participation, I decided to narrow the pool of potential participants to instructors who I had engaged with directly in my role as a graduate teaching assistant. I believed that the relationships already established between myself and these instructors would allow for more open sharing and richer data in my collection. From the pool of one hundred and forty-three, twenty-four instructors met these criteria. Since technological pedagogical content knowledge is a construct related to teaching, I focused participants who had received college or university awards and recognition for their teaching. Four participants were
purposefully selected who met all of these criteria and who I believed would be rich data sources for this research. For anonymity, pseudonyms are used throughout this report. Table 1 provides a snapshot of each participant.

Table 1. Participant profiles

<table>
<thead>
<tr>
<th>Instructor</th>
<th>Years teaching in Higher Ed</th>
<th># of workshop attendances (2011-2016)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mikel</td>
<td>17</td>
<td>2</td>
</tr>
<tr>
<td>Rena</td>
<td>17</td>
<td>3</td>
</tr>
<tr>
<td>Sam</td>
<td>25</td>
<td>2</td>
</tr>
<tr>
<td>Mac</td>
<td>20</td>
<td>3</td>
</tr>
</tbody>
</table>

Mikel, a white male between 40-49 years old, is a professor of literature and has taught in higher education for 17 years. He participated in the college’s summer professional development workshops in 2015 and 2016. His goals for integrating technology and teaching are to design “activities that make students develop their critical thinking and critical literacy skills.”

Rena, an Asian/Pacific Islander woman between 40-49 years old, is a professor in the social sciences and has taught in higher education for 17 years. She participated in the college’s summer professional development workshops in 2012, 2013, and 2016. Her goals for integrating technology and teaching are to help learners critically process their worlds so they can challenge isolation and marginalization in college and society.
Sam, a white female between 50-59 years old, is a professor of mathematics and has taught in higher education for 25 years. She participated in the summer professional development workshops in 2015 and 2016. Her goals for integrating technology and teaching are to try different methods to help learners transfer their knowledge of mathematics and see math in different contexts.

Mac, a white male between 40-49 years old, is a professor in the social sciences and has taught in higher education for 20 years. He participated in the college’s summer professional development workshops in 2012, 2015, and 2016. His goals for integrating technology and teaching include learning strategies to enhance some of his teaching experiences by making them hybrid or blended (online and face-to-face).

Data Collection

Data collection for this study occurred during fall 2016 and spring 2017. These data include semi-structured interviews, artifacts (questionnaire responses, archived workshop websites, instructor course sites, course assignments, consultation reports) and extensive field notes.

Semi-structured interviews. During the August 2016 workshop I confirmed appointments to interview each participant.
during the first two weeks of the fall semester. The four weeks between the August workshop and our interview would allow time for reflection on their most recent workshop experience. Semi-structured interviews allow “participants to discuss their lives and experiences in free-flowing, open-ended discussions and enable the researcher to gain access to the thoughts and ideas of participants’ individual situations” (Taylor and Bogdan, 1984). In order to ensure that interviews were consistent and to control for interviewer bias, I developed a simple interview protocol (Appendix A) for the initial data collection. The semi-structured interviews were conducted to gain insight to instructors’ knowledge and experiences teaching with technology.

TPACK Questionnaire. I had the participants complete a TPACK questionnaire (Appendix B) to better establish links between their practices and the TPACK framework. The TPACK questionnaire derived directly from previously developed open-ended survey items about teachers’ knowledge of teaching and technology (Doering, Koseoglu, Scharber, Henrickson, & Lanegran, 2014) and was modified to better suite the context of this research. Assessing the impact of professional development on preservice geography teacher’s TPACK, Doering, et.al (2014) initially designed these
survey items in order to address “teachers’ experiences and perceptions with using technology in educational settings” (p.228). In order to learn about instructor’s experiences and perceptions unique to the context of this study, references to geography were omitted from the original protocol. For example, the original question “What do you like most about using technology for teaching geography?” was modified to “What do you like most about using technology for teaching?” Further, the modified questionnaire focused on the technology related domains of instructor knowledge including technological knowledge, technological pedagogical knowledge, technological content knowledge, and technological pedagogical content knowledge. Follow-up interview. After the initial interviews and the questionnaire, I conducted follow-up interviews with each participant to review my initial analysis and ask follow-up questions based on their responses (Appendix C). These follow-up interviews used the TPACK visual as a focal point and asked participants to describe their practices relative to the TPACK framework. These follow-up interviews provided details about each instructor’s individual practices and strategies, previous experiences with technology, and their ideas about using technologies in their teaching.
Before interviewing any of the participants, I did have my interview questions reviewed by instructional designers who were familiar with the nature of the various professional development experiences available to instructors within the College of Education. The reason for having the interview questions reviewed was to make sure that the questions were appropriate to participants within this context.

In the beginning of fall semester 2016 I interviewed each participant. Each digitally recorded interview took 45-60 minutes and was conducted in the participant’s office at their option. I immediately transcribed each interview and delivered a transcript within 24 hours of the interview to each participant for member check. I also immediately began preliminary analysis of the interview data and transcripts while collecting artifacts and amounting copious notes.

During Spring of 2017 I conducted follow-up interviews with each participant. These interviews, each lasting 45-60 minutes and conducted in the participants office, gave me a chance to member check my initial analysis and also ask participants follow-up questions specific to their TPACK (Appendix C).
Artifacts. Data artifacts analyzed in this research include questionnaire responses, archived course management sites, and course assignments. Each participant in this research completed a questionnaire about their technology related professional development experiences while in the College of Education. This questionnaire included open-ended reflection questions about how professional development experiences in the College has impacted their perspectives about their use of technology in their teaching. Each of the summer professional development workshops conducted by the College are facilitated and archived using an online course management system (CMS). Each of the participants in this research also use a similar course management system to create individual sections of their own courses. Assignments designed by each of the participants during the workshops were also analyzed to understand how the participant’s descriptions of integrating technology and pedagogy looked like in practice.

Data Analysis

In order to analyze this multiple case study I used both deductive and inductive coding. Table 2 includes the a priori TPACK codes I used to conduct in-case analysis of data. I specifically coded data for technological knowledge (TK), technological pedagogical knowledge (TPK),
technological content knowledge (TCK), and technological pedagogical content knowledge (TPACK) to focus on data specific to the integration of technology with content, pedagogy, pedagogical content knowledge rather than data focusing on technology independent factors.

Table 2. A Priori TPACK codes

<table>
<thead>
<tr>
<th>Construct</th>
<th>Definition</th>
</tr>
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<tbody>
<tr>
<td>TK</td>
<td>Knowledge about certain ways of thinking about, and working with technology, tools and resources. Working with technology can apply to all technology tools and resources. This includes understanding information technology broadly enough to apply it productively at work and in everyday life, being able to recognize when information technology can assist or impede the achievement of a goal, and being able continually adapt to changes in information technology</td>
</tr>
<tr>
<td>TPK</td>
<td>An understanding of how teaching and learning can change when particular technologies are used in particular ways. This includes knowing the pedagogical affordances and constraints of a range of technological tools as they relate to disciplinarily and developmentally appropriate pedagogical designs and strategies</td>
</tr>
<tr>
<td>TCK</td>
<td>An understanding of the manner in which technology and content influence and constrain one another. Instructors need to master more than the subject matter they teach; they must also have a deep understanding of the manner in which the subject matter (or the kinds of representations that can be constructed) can be changed by the application of particular technologies. Instructors need to understand which specific technologies are best suited for addressing subject-matter learning in their domains and how the content dictates or perhaps even changes the technology—or vice versa</td>
</tr>
<tr>
<td>TPACK</td>
<td>Underlying truly meaningful and deeply skilled teaching with technology, TPACK is different from knowledge of all concepts individually. Instead, TPACK is the basis of effective teaching with technology, requiring an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students’ prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge to develop new epistemologies or strengthen old ones</td>
</tr>
</tbody>
</table>

I then read and coded across the cases for themes emergent in the data that showcased concepts, actions, and relationships relative to instructor’s descriptions of their TPACK and how professional development activities facilitated their TPACK development. Miles, Huberman, & Saldana (2014) suggest that paring these coding methods allows researchers to use a framework as a guide for reading the data while also allowing the concepts, actions, or meanings tell the story of the unique context.

I followed a specific strategy to code the data. After reading through the first interviews, I coded each instructor’s first interview for descriptions and demonstrations of technological knowledge, technological pedagogical knowledge, and technological content knowledge. I followed the same process for each instructor’s responses.
in the workshop CMS artifacts and researcher field notes. I conducted secondary interviews asking questions specific to TPACK and the instructor’s professional development experiences. I then read all of the data for descriptors how professional development activities supported instructors’ technological pedagogical content knowledge development.

Writing up the data, I arraigned the data themes into clusters that helped me tell the individual stories of how the instructors describe their technological pedagogical content knowledge. Themes within these descriptive TPACK stories clustered into four primary categories: knowledge of technology, technology and teaching, technology, discipline, and context, and TPACK in practice. In addition to speaking to experience of each participant, the data also revealed that there were various similarities across multiple cases.

**Validity and Reliability**

Validity and reliability are important to consider when using qualitative methods in case study research. In order to increase the level of validity in the study results, I carefully followed a strategy aligning research design to research questions (Creswell, 2009; Maxwell, 2013). I collected rich data from multiple sources
including interviews, questionnaires, and artifacts from
the instructor’s professional development experiences.
These multiple data sources, along with field notes and
researcher journals were used for data triangulation, which
lends validity in this type of research. Table 3 shows the
connection between research questions and the data.

Table 3. Connection between research questions and data

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Data Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>How do instructors describe their technological pedagogical content knowledge?</td>
<td>- Individual participant interview</td>
</tr>
<tr>
<td></td>
<td>- TPACK Questionnaire</td>
</tr>
<tr>
<td></td>
<td>- Artifact (Archived workshop CMS site)</td>
</tr>
<tr>
<td></td>
<td>- Field notes</td>
</tr>
<tr>
<td></td>
<td>- Follow-up interview</td>
</tr>
<tr>
<td>How do professional development activities support instructor’s development of technological pedagogical content knowledge?</td>
<td>- Individual participant interview</td>
</tr>
<tr>
<td></td>
<td>- Artifacts (workshop &amp; course sites, assignments)</td>
</tr>
<tr>
<td></td>
<td>- Field notes</td>
</tr>
<tr>
<td></td>
<td>- Follow-up interview</td>
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</tbody>
</table>

Reliability of the results was addressed in this study by
documenting all of the procedures and following a case
study protocol. Once I completed the analysis of all data
and written up each case, I had colleagues more experienced
in this type of research review the write-ups.
Limitations of the Study

There are several limitations of this study. The first limitation of this study is the nature and number of the participants. Four participants were selected from a pool of one hundred and forty-three instructors from a single college. Although four participants may present rich data for the context of this research, such a small number of participants will produce findings that cannot be generalized to a larger population. However, the findings do provide insights that may inform the implementation of faculty professional development in similar higher education contexts. Second, I didn’t not observe or examine the in-class practices of the participants. In-class observations may have allow for corroborating the instructors descriptions of the TPACK and practices, but my presence in their classes would not have been natural in every instance and also would have been outside of the scope of this research.

In this chapter I presented an overview of the methods and the methodology which guided this work. I detailed the research design, gave an overview of the research context, described the researcher role and research participants, and also described data collection, data analysis, as well as accounted for validity and reliability of findings.
Finally I concluded with limitations of this study. The next chapter will present the individual cases analyzed for this multiple case study of higher education instructor’s developing their TPACK in practice.
Chapter 4

Findings

In this section, each of the participant of this multiple case study is presented following a similar format. Each presentation opens with a snapshot of the participant’s background as instructor before joining the College and since. Each case then addresses the first research question through four descriptive themes:

- knowledge of technology
- technology and teaching
- technology, discipline, and context,
- TPACK in practice.

Each case then details how various professional development activities in the College played a role to develop TPACK in each participant. This addresses the second research question.
Findings from Mikel’s Case

Mikel is a literature professor who joined the University and College of Education in 2013. During the 17 years he has taught in higher education, he has taught primarily at research universities both in Europe and in the United States. He participated in the College of Education’s technology integration professional development workshop in 2015 and 2016. Since participating in the college’s professional development programs Mikel has noted a change in his perspective about teaching with technology. Particularly, he says he has realized that technology tools afford him “flexibility” and the ability to “tweak and add to [his] teaching strategies” in ways he had not considered before. Through the professional development programs in the college Mikel has become comfortable and confident with new instructional practices. He was also able to adopt new ways of acting and responding when faced with new technologies in his teaching. Further, he began to think differently about feedback he received from students has they respond to his new practices. All of this has led him to take actions and adopt new ways of teaching. One of the main things he has learned over the course of his engagement with the professional development program in the College is that rather than explaining and outlining
certain types of course content, it works best for him to assign students some preparatory activities with prompts that may spawn rich classroom discussion. Mikel believes that these learnings have been a direct result of the professional development activities he participated in through the College.

RQ 1: How do instructors describe their technological pedagogical content knowledge?

Technology in teaching has impacted how Mikel defines technology, how he engages his students, how he thinks about his content, and overall how he approaches his teaching.

Knowledge of technology. Mikel struggles to define technology in the context of his teaching. When he first used technology in his teaching, photocopy machines helped Mikel make texts and course readings more available to his students. In the context of his role as an instructor, the photocopier represented technology. He said he that he produced copies of certain texts so that each student had an individual copy they could hold and bring to class. For Mikel it was “important that students can physically connect with and have ‘ownership’ over their own texts” to cement the learning experience. This initial definition of
technology Mikel was isolated to a tool for reproducing media. Eventually his definitional of technology evolved.

Course management systems opened up opportunities for Mikel to extend his ability to help students gain access to readings. He said that course management systems helped him begin to think about how he could also extend discussions about course readings beyond the classroom. He now realized that technology gave him the means to easily create his own media relevant to course content and concepts. He would write summary narratives of classroom discussions and key discussion points for students and post the summaries on course management sites. His summaries would often use related images and videos in order to deepen student interaction with course concepts and enrich the overall learning experience.
Speculative Fiction: Taproot Texts and Film Adaptations

We began class by identifying Anderson’s “The Little Mermaid” as a literary fairy tale and a “taproot text” for Disney’s version. A “taproot text” is a term used by scholars of speculative fiction to refer to stories that contain elements of fantasy or science fiction, but were composed or written before the very notion of fantasy or science fiction emerged. Myths, legends, folk and fairy tales all have elements of the supernatural, but were not consciously created as “fantasies”; they are taproot texts for all of their modern reworkings. We then discussed the highlights and puzzles in Anderson’s and Disney’s versions—in fact our entire class was spent on this theme.

First, we made lists of key features of the two versions and then talked about differences. We noted, among others, that Anderson’s original puts a greater premium on pain as part of life and on choices that have consequences. Both of these are largely eliminated in Disney’s version. We noted that Disney’s tale rewrites gender roles. It eliminates Little Mermaid’s grandmother and marginalizes sisters, replacing them with Sebastian and Flounder (males). It takes agency from Little Mermaid and puts it in the hands of King Triton and Prince Eric. Finally, it demonizes Ursula, which in the original was an “honest” witch, but not an evil schemer or power hungry usurper. We did mention the change Disney effected by eliminating the whole theme of religion (soul-seeking), and by adding the battle of the sexes theme. Disney’s Little Mermaid is a sexualized girl (just as Triton and Eric are “paradigmatic” sexualized males) and there’s a lot of sexual tension in this film (even though it’s addressed to a young audience). For example, much has been made of the priest’s erection during the wedding—the priest is supposedly aroused by Ursula’s evil sexual vibes that hypnoitize Eric as well. This tension is never even hinted at in Anderson’s tale, where the Prince interest in her.

Figure 2. Screen shot of Mikel CMS site showing his use of the CMS to supplement and expand on the classroom experience

By using technologies this way, Mikel says that technology became more than a tool, “technology became kind of a teaching partner.” Course management systems expanded Mikel’s definition of technology in his teaching, and his emerging technology knowledge gave him new ways to think about how different technologies could meaningfully support his teaching.
Mikel’s extensive use of course management systems also extended to the different multimedia tools and within the systems. Mikel explored several different tools and incorporated a many of them in various ways to enhance learning experiences. In reflection, he says that as new tools showed up he would kind of give them a try and see what he liked and what he didn’t. “I did not really think about what would work in my teaching or what would not. At first, I mainly looked at what I like and what I could figure out easily.” He says that because he was interested in trying many things he found himself becoming more knowledgeable about technology and more connections between different technologies and his teaching.

Technology and teaching. Mikel’s says that he think teaching with technology is more fun, but that it is not easy. As a student, Mikel never took an online course or had any technology-rich learning experiences. Because of this, all of his knowledge of teaching with technology comes out of his professional experiences and not from his training. He said that not having any examples to model his courses after, “…each semester I kind of have to start from scratch. I try out new things I have learned. I also consider feedback from students and incorporate those things into how I design my courses.”
When Mikel began using course management systems he enjoyed many of the conveniences. Course management systems made it easier for him to have a consistent course design and structure so that he didn’t have to rebuild and redesign a course every single offering. He found this especially helpful because for courses he regularly taught, there was tremendous time savings in the long term because he could be able to reuse media previously created and reuse tools he had used before. Despite the time-savings, he also discovered that with each iteration of the course his assignments needed to be reimagined, modified, and student work had to be graded. This was all additional time investment. He also had to be mindful that students were different with each offering and to respond to these differences he had to invest more time. So where students in one semester were happy to use certain tools, it may become more appropriate to use different tools to complete a similar activity in a new iteration. Mikel learned that exploring alternatives, redesigning activities and assignments, and making decisions on ways to use various technology tools to support teaching and learning takes a considerable amount of time.

Teaching with technology also came with the addition of unforeseen technical difficulties. As an instructor
using technology in his teaching, it is important for Mikel to be able to support students with their technological needs. For him this means not only to know how to use different technologies but also to know how to provide technical support to students. “Part of my teaching responsibility, I think, is to know how to use things I ask students to use, but also to be able to teach them how to use them and then to be their first “go-to” for support.” As he uses more technology in teaching Mikel embraces the challenge of responding and resolving technical issues for students.

Technology, discipline, and context. As a professor of literature, Mikel works to expand student’s knowledge and understanding of literature and literacy skills. Technology in teaching introduces additional layers of literacy for Mikel to expose his students to. When Mikel found that students in his courses were not able to use library websites to find and retrieve resources for class, he thought it was important to help students to learn how to use those tools to do searches. He also thought it was important to help students think about their personal technology devices and the tools they have ready access to as learning instruments. He said that he found it surprising how much students struggled to use different
technologies and devices like their phones and the internet as instruments to support their learning. He realized that some students had not developed technological literacy to help them use familiar devices in different ways.

Maybe it's this psychological barrier of not having done something before and you just don't know where to start. Or maybe it is just that as tech-savvy as students are when it comes to entertainment instructors take it for granted that they automatically transition those skills to their learning. I have found that I need to help students think differently about their technology and how they use it.

Mikel describes students having a different confidence when it comes to using specific tools or technologies with the content itself. In order to help students relate learning technology in a literature courses, Mikel believes there is a lot of conceptual work he needs to do to help students make connections between learning different technologies and learning to read different types of books. He says that he helps students use existing knowledge about technology as building blocks.

It’s like building complex words on the stems of more simple words. If students can think about what they
know as a foundation or entry to new technology, learning new technology can be like learning how to read books that are more complicated or reading books in different subjects.

This strategy helps Mikel make building students’ technology literacy a part of the overall learning experience rather than an add-on to other course content.

**TPACK in practice.** Developing technological literacy for himself and his students has become an important focus of Mikel’s practice in his discipline. Although Mikel says that he does not believe he has high TPACK, he does invest a lot of time in learning technology, in learning how to teach technology, and especially in learning how to teach with technology. Having gone through professional development workshops and worked extensively with academic technologist in the college, Mikel says that the biggest influence technology has made in his teaching is introducing flipped learning as a different way to approach his teaching.

Flipped learning means that an instructor has students spend time outside of the classroom engaging with materials and time in-class is spent collectively interacting. As a teaching strategy, flipped learning has given Mikel opportunities to “space out different course concepts and
Mikel’s TPACK is a high influence as he designs his courses to integrate technology purposefully. His strategies engage students with course content in multiple modes and has students demonstrate deep levels of understanding with the material. For example, one of his courses that uses a course management system sections a unit into “prior-to-class activities,” “in-class activities,” and “homework.”

In the “prior-to-class” activities (Figure 3), Mikel assigns a number of readings from course texts. He posts
some of these on the course management system, and he also asks students to write reflection posts to the course blog.

**Flipped session: 1 class unit on “Spirit Animal Stories”**

**Prior-to-class activities:**
- **Read 3 (assigned) Native American tales about spirit animals. Learning objectives:** identify the role and status of spirit animals in these indigenous tales.
- **Read fragments of 2 critical chapters. Learning objectives:** In Kane’s chapter, distinguish the three types of human civilizations based on different relationship with the earth and how they position animals in relation to humans. In Le Guin’s chapter, list advantages and disadvantages of fantasy and realism for representing animals and the natural world.
- **Content:** 3 tales and 2 critical chapters.
- **Format/delivery method:** pdf scans or printouts distributed a week in advance and available on Moodle.
- **Check-for-understanding activity:** 3 two-sentence blog entries in response to the following prompts: “Create your own definition of spirit animal based on the 3 tales you read,” “What type of myth telling our culture represents in Kane’s typology and why?”, “What, according to Le Guin, are the two top advantages of animal fantasy?”

*Figure 3. Prior-to-class activities*

In these activities, TPACK guides Mikel’s thinking through which tools and strategies will stimulate classroom discussion of key course readings. Having students write blog posts prepares them to come to class and participate in rich discussion over ideas their readings stimulated. Further, student blog posts also become a beginning point for classroom discussion. Mikel and the students are able to continue online conversations offline in the classroom and ideas can be deeper explored.

In addition to discussions, during the in-class sessions (Figure 4) Mikel has students watch short video clips that feature and connect major themes and concepts from the course readings. He uses his knowledge and
understanding of how to use video as a tool and as text to engage students with information in alternative ways. He then invites students to offer their own visual representation of own understanding of different concepts.

**In-class activity (related to pre-class assignments):**
- Learning objectives: understand the commonalities behind spirit animal stories as well as their cultural role in shaping the community’s relationship to the natural world.
- Instructional strategies:
  - Q&A about the readings
  - Small group work (on a single story) to identify unspoken assumptions underlying each tale.
  - Whole class sharing and discussion. Recap of the concepts of totemism and animism introduced a week before; reframing of the discussion to build on these concepts
  - Watching a short YouTube trailer of a modern film with spirit animals
  - Prompt-based discussion (related to issues raised in the critical readings) OR
  - Small group creative work: create/draw a spirit animal that modern people might want to see/hear. Imagine what its message to humanity would be: write 2-3 sentences.

**Figure 4. In-class activities**

Finally as homework (Figure 5), Mikel asks students to record a video response to a specific theme from the unit and make personal connections to that theme. Having students record video of themselves reflecting and relating to course themes captures an authentic account of them constructing knowledge of interactions between themselves and key concepts of the learning experience.

**Homework: post a Flipgrid video about the currency of the concept of spirit animals in today’s culture. Can you recall any stories that include spirit animals? This blog might be graded for participation but less for content.**

**Figure 5. Homework**

Throughout this unit, Mikel used his technological pedagogical content knowledge to structure opportunities
for learners to have meaningful engagement with course materials in a variety of ways. The strategies Mikel used also provided students different ways to demonstrate knowledge and have their understanding assessed. This nurtures a supportive learning environment by welcoming different ways of knowing.

Mikel’s TPACK has also helped him be more willing to “spontaneously change plans” in his teaching. He says that with what he knows about how to use technology in his teaching right now,

...if students are interested in a topic they want to talk about it, rather than move on to another unit just because it's scheduled, we can continue to explore this unit and move other things to online spaces. This is one strategy I've used in terms of in terms of this technological pedagogical content knowledge is the affordance it gives to me and my students to facilitate their learning with a lot of flexibility.

His TPACK has also made him more comfortable with his role as a learning instructor.

I don't have many tested formula that I would be pretty sure would work well with my students. Maybe it’s because most of my courses I've only taught once
or twice so I guess my teaching with technology is an ongoing experiment but I feel like I’m slowly getting more mastery.

Despite having never had any technology-rich learning experiences in this training other than the professional development experiences in the college, he is very positive towards teaching with technology and he says about his TPACK that he is still learning.

RQ2: How do professional development activities support instructors’ technological pedagogical content knowledge development?

Professional development activities in the college that most supported Mikel’s TPACK development included workshop discussion forums, guided practice and individual consultations with academic technologists, and the structure and design of the workshops.

Discussion forums. Participating in the discussion forums during the workshops and hearing the experiences of his colleagues played instrumental roles in developing Mikel’s TPACK. One of his goals during a workshop was to find ways to integrate technologies into assignments so that students could share and interact with each other’s reflections and analysis of course concepts. He had seen colleagues in other disciplines use different tools and
strategies in their own courses and wanted to explore various options that could suit his context. Before the workshop, he had no prior experience using multimedia tools or guiding students in how to use them. Further, he had no ideas on how to design course assignments or units that could integrate technology in meaningful ways that would support student learning. About his learning objectives, Mikel posted in a workshop discussion forum (Figure 6):

*Voicethread would be a great tool here, but since I haven’t used it before, I’m not sure how many students should be assigned to a group, how long the product should be, and how much time I should give students to complete this assignment. Plus, I want other students then to watch it and comment on it as well, both online and in the classroom. All this then grows into a project that might take two or more weeks (with 4 to 6 voicethread projects), and I’m not sure yet how to contain it (gradewise) so that it does not crowd out other assignments students will have to do as well, especially reading and class discussion about books. Any suggestions?*

*Figure 6. Mikel discussion forum post 1*

Within these workshop discussion forums fellow participants offered Mikel many suggestions and strategies they had found successful in their courses. Mikel was also able to ask colleagues questions about who could give him examples that would be specific to his context (Figure 7).

*Hi Dee, I love your first assignment with the use of Voicethread. From what you say, I understand that each student creates their own statement (like in Flipgrid), but then at least two others comment on it. My question is do you then ask the author to revise their statement based on comments? If so, do you ask them to record it again and do you grade it then (again?).*

*Figure 7. Mikel discussion forum post 2*
As his colleagues shared their thoughts with him through forums, Mikel contributes his own insights as an effort to support his colleagues in their own learning and professional development. This not only models the good practice of sharing knowledge, but reinforces his TPACK as he is able to confidently share methods he has used with different tools which have been successful for him (Figure 8).

One strategy I’ve found especially useful is giving students prompts or two, three questions about the reading in advance. This sometimes helps them direct attention to certain themes you then want to discuss in class. The other strategy (also mentioned by Ross) is to ask students to always find a supporting quote or fragment for any claims they want to make based on the reading. This is a standard in close reading; it does not ensure that students will understand the text, but at least it makes them pay attention to how their understanding of the meaning is supported by the text. Thus, you could create a forum in which you ask them to post the most significant quote from the text and then explain why they think it’s so crucial. I think Socrative has a feature in which students post replies, but can’t see what others are saying until the whole activity is completed. This would be a synchronous type of activity they can do in class or at a specified time at home.

*Figure 8. Mikel discussion forum post 3*

Guided practice and consultation. In other workshop experiences, Mikel explored various applications and how they could fit into his courses. He especially appreciated the ability to have guided practice with different tools and worked one-on-one with instructional designers to redesign old course activities and design new assignments in order to more productively make use of tools and
resources available to him. He commented in a personal reflection that (Figure 9):

One of the challenges I feel constantly returning to is being able to compare similar apps: I’ve used Google forms a lot but today I played around with Chime in and found it clunky. So that’s one thing I’m not going to use. Also, I’m still working on getting a better sense of how VideoAnt compares to VoiceThread. VideoAnt seems easier and more intuitive, so I guess I’d like to learn more about VoiceThread.

I’d also like to have time tomorrow to explore new features of Flipgrid (hands-on), ideally with some guidance too.

It was a great day and my biggest take away is VideoAnt which I’m definitely going to use in my courses this year, thanks!

Figure 9. Mikel discussion forum post 4

He continues in another personal reflection that (Figure 10):

I have a much better appreciation of VideoAnt, although I’d still like to see comments flash up just before the moment they’re posted (rather being displayed from the outset). I’m definitely going to play around with Video Ant. I’ve also learned better strategies for setting up and using progress bar.

Figure 10. Mikel discussion forum post 5

Outside of the workshop experiences, Mikel worked extensively through individual consultation with the instructional designers and graduate teaching assistant in his department to build his TPACK and extend his use of it beyond the classroom. In particular, he says he realized that he could integrate the technologies used in his teaching to support his scholarship.

Working with [the professional development team] last year for the first time I created student surveys
based on assignments that are related to my own research. I created an online questionnaire about a novel that I ask my students to take, but I also shared it openly with anyone interested and with other scholars when I went to conferences. I realized that I could use this tool, Google Forms, not only for discussions for my classroom, but that the results could point to themes across different audiences. This data, as I collect it, is helpful to me as I'm working on different book chapters about novels. I have yet to hone these ways of using these types of strategies to collect data from students and non-students, but I think that there are many possibilities in this for my scholarship.

Mikel recognizing linkages between his teaching, scholarship, and use of technology demonstrates a application of TPACK across different contexts. Mikel extends his technological knowledge beyond the context of his classrooms, his department, and his college, into his role as a researcher and scholar. Mikel shows significant confidence in his knowledge of technology, pedagogy, content, and the interaction of those domains as he explores them in his non-instructional roles. Mikel builds his technological pedagogical content knowledge in ways
very meaningful to him as he explores TPACK in different roles and across different contexts.

Workshop structure and design. In addition to participating in deep discussion and exchanging ideas with colleagues within his learning community and working closely with members of the college’s professional development team, Mikel believes the structure of the workshops played a role in supporting the growth and development of his TPACK. He said that prior to the College workshop he had never taken a “four-day hybrid format workshop.” He describes how it was different from experiences he had previously had.

Think that the advantage of the [workshop] format or formula over other professional conferences I have been to would be that this program gives you some extra mental space each day to process some of the things. I could go home and experiment if I wanted, and come back with questions or dig deeper. Each day can build on the previous day.

In-between sessions during the workshop, participants take reflection breaks when they make note of key takeaways from the session, write down follow-up questions for the academic technologists, and exchange ideas with other session participants. Following each day of the workshops
participant’s blog a reflection entry as an assignment in the workshop course management site.

Part of the design of this “four-day hybrid format workshop” is that the four days are Thursday, Friday, Monday, Tuesday, with a weekend in-between. Mikel commented specifically about this structure.

I appreciated the weekend in the middle. I made so many notes over the weekend. I think more over the weekend than during the regular days because I had the space and I could just sit and I could review things and go back and look at training videos. I could sort of get organized with stuff for my course. The weekend is not technically part of [the workshop] but I think that's it is useful to help me find the aspects or tools or strategies that I think could work in a specific class.

Ultimately, Mikel thinks the professional development activities contributed to the growth and development of his TPACK because “[professional development], especially with technology is about developing certain attitudes. It is also about the spirit of experimentation being willing to try these new things.” To make him a better instructor, Mikel is very willing to try.
Findings from Rena’s Case
Rena is a professor of social sciences and the humanities who joined the university in 1993 and the College of Education in 2005. She participated in the College of Education’s technology integration professional development workshop in 2012, 2013, and 2016. Since participating in the College’s professional development programs Rita has noted a change in her perspective about teaching with technology. In particular Rita has developed “an ability to translate ideas into classroom assignments and pedagogy by understanding how and when technology could be usefully employed.” Through the professional development programs in the College Rena has questioned her ideas and realized that she no longer agrees with previously held beliefs about her role as an instructor. She has tried new instructional practices so she could become more comfortable and more confident in them as well and also adopted new teaching practices and taken action to adopt new ways of acting as an instructor. In her professional development, being able to see colleagues try, fail, and succeed with using technology in their teaching has been an “impetus in [her] willingness to try and experiment more intentionally with technology” in her own teaching. Rena believes that the changes in her perspective to teaching
with technology have directly been a result of the professional development activities she has participated in through the College.

**RQ 1: How do instructors describe their technological pedagogical content knowledge?**

Rena isn’t sure for herself how to define technology, but she does believe that technology has made a difference in how she thinks about her teaching and how she approaches it.

Knowledge of technology. “I guess my first thought is what constitutes technology?” Rena says.

I've created some kind of organizational schema in my head where I think of technology as particular tools that I employ around classroom instruction and those often involve something that I didn't have previously. That's kind of how I think of it. When I think of media I think of visual and/or auditory resources that I've always used in my teaching or visual resources that I've used like photography or radio and or some kind of audio music, and film. So in my mind I distinguish those a little bits from how people talk about technology now because many people seem like well we've always done this you know teachers have always use these things [media] or they've used them as content and I've done that throughout...so
this is how I differentiate between what I see is media use versus like media and technology and or technology as a tool.

As she reflects on her first experiences using technology in her teaching, as a teaching assistant using slide projectors in her teaching, Rena equates the different media she incorporated in her teaching as “technology.” She says she first used technology in her teaching to “embed visual cues within the learning experience” so that students “with different learning styles could attend to what I was saying...” Rena used photocopies of images and overhead projectors to display images during her lectures and classroom discussions. She would also arrange galleries of images around the classroom. These images served as “visual ques” to help ground classroom discussions. She saw these visual ques as useful additions that also allowed her to “talk about some things in different ways.” As she gained access to audio and film libraries, she began using those in her classes as well. She describes this as a “very basic level of technology. I would incorporate film clips or images or something like that into whatever I’m doing because it augments something that’s happening in the class.” As more classrooms became equipped with computers and the internet, she expanded her practices to include
tools like using YouTube to incorporate video clips into her teaching, but believes that was “still doing the same thing” she was doing before with still images. She also describes early in-class activities where she had students create “picture collages and moving murals.” These activities have now evolved into her students producing multimedia presentations and mini-documentary films.

Technology and teaching. Digital technology tools have afforded Rena the ability to refine learning activities and give students opportunities to engage in learning in creative and authentic ways.

Rena describes a core learning objective in her courses is for “students to explore, analyze, construct and de-construct content/ context in the various narratives we are working with.” She wants to help students try to “understand the lived experience of others, particularly people of different racial backgrounds.” She thinks that classrooms can be “places of engagement and agency” were images can communicate a thought or an idea in ways that can be difficult to articulate with words.

Just as she has augmented her own in-class use of images with video, she invites her students to use a variety of digital tools such as cameras and video editing applications their smart phones and tablet computers to
“uniquely capture and communicate the changing stories of the world around them through their own eyes.” She now regularly assigns students to create a mini-documentary movie of an immigrant story where students use multiple media including interviews, still images, and video clips to tell an immigrant story from their local community. She believes that students using media and technologies in this assignment can help them have their own individual learning experiences that can make the learning more “personal and meaningful.”

Rena says that she has always been interested in how media communicates ideas and how media can be used to create authentic narratives. She wants to help students “explore, analyze, construct, and de-construct content and context so they are able to create their own narratives.” This interest has been a driving motivation for her to integrate technology and her pedagogy. She describes this motivation as a “struggle to engage students in deeper thinking and collaboration” while also “complementing students’ ability to communicate.” Professionally, this interest started for her while she collected data for her dissertation.

I've always liked visual stories since back when I was collecting stuff on my dissertation. I used Photovoice as
a methodology to explore how students expressed their points of view and how they represented different things from their communities. Much of my work was around using words and pictures, murals and performances that students were making. Students were making profound statements, they were just not making them with the machine, they were making them out of other stuff, other tools.

She thinks that using digital tools like phones and tablets has created for her a “different type of intentionality around how certain things are structured” in the classroom and with students. Because students “pretty much have control over their resources with technology,” the technologies students use make Rena think more intentionally about how she prepares students to create meaningful visual presentations in their assignments.

Digital tools make teaching interesting for her as she has to assess what students already know about creating with the tools and invite more knowledgeable students to share with their peers. She says that

For so many students these tools are such an active currency. Some students come in with such high levels of proficiency that they could become, in many ways, co-teachers. I think students are always co-teachers, and so I think that using technology in my classes requires
intentionality and careful structuring. I have learned that if I planned carefully, students would create better products would engage in deeper thinking.

For Rena it is important that she remains transparent with students about the tensions she experiences while teaching with technology. She says being transparent with students is important for her own growth as an instructor. She also believes that students seeing how instructors address tensions in their work can help students navigate through any tensions they may feel in their own learning experiences.

One thing that struck me is that much of the learning with technology is imbedded in the entire process and I want to work to make that process more transparent to my students so that they understand how it is as central to their experience as it is the final product itself.

Technology, discipline, and context. Rena uses different media, images, and film to explore difficult topics and sensitive social issues in her courses. Incorporating different media in her classes also helps her students relate to ideas and topics in the course material.

I always saw [media] as useful additions but not the heart and core of what was happening in the learning experience, to me that was all is still in the dynamic
between the material and the relationships students formed with the materials.

Exploring the impact of social issues on communities, and how students related to those issues, has been a focus in Rena’s courses. Stories related to people’s experiences in new worlds and new realities are key components of what Rena tries to help student appreciate in her courses. She says that technology helps make “the sociology around immigrant experiences in this country” real for student in a different way.

I began to think of the fact that technology lets my students have access to some things, some knowledge and understanding, that they wouldn't otherwise have had access to. I think about how stories help students understand context and understand cultures and how telling other people’s stories forces students to ask different questions. Also, because of their different experiences with technology tools in their learning, students get to feel and appreciate the discomfort of something being foreign to them and they having to learn to get used to it.

She continues to say that she believes the way she uses technology to teach her subject areas makes her teaching experiences
...more compelling for students because students are engaging in the construction of their learning in a way where they have to use all these tools. The magic is and how students put it all together so that the story they tell has meaning and is told in a way that nobody has told before, and that's important. They [students] have to learn how to put things together and to make meaning in a totally different medium than they would by just writing.

These uses of technology to teach content and to help students relate to important contextual components of her classes makes teaching with technology an integral part of Rena’s identity as an instructor in her field.

TPACK in practice. Rena has become an exemplar of teaching with technology in her department. Many of her peers regularly look to her for suggestions and demonstrations of strategies for integrating technology and their own pedagogy. She believes that her TPACK is driven by her pedagogy. She thinks more about “what I want in the classroom experience for students and then what things could help? Whether that be paper, pencil, or whether that would be [other] technology.” She describes her thinking about technology as
...a very basic level of technology. I am using the term technology very broadly and I think of it in layers. I think about the way I incorporate film or clips or another multimedia formats into whatever it is I’m doing because it augments something that's happening in the classroom. That isn't technology, per se, it's just media which people have been using way before this “technology” started. I'm still not doing that the next level where I'm actually designing something around a technological tool, feature, or app.

Despite not feeling so secure in her TPACK, Rena shows deep levels of TPACK understanding in workshop reflections as she posts (Figure 11):

1. One learning objective in my course is to help student explore, analyze and construct and de-construct content/ context in various narratives we are working with. Ideally students will learn to examine the stories (and film narratives) that we are using to consider diverse perspectives and be able to communicate these positions in class assignments.

2. In examining and consider the arc and critical moments in the narratives of others, students will also begin to create their own narratives -- using ipad, class simulations and written assignments.

Tools that I would consider using are:

a. Google forms-- for peer evaluation of group work
b. epub/ibooks as a tool for students creating their own narrative assignments
c. imovie/ story robe for shorter narratives
d. Google drive-- to facilitate collaborate group work
e. Chime in -- to get in class responses that reflect a broad range of student participation

Figure 11. Rena discussion forum post 1
Here she not only shows knowledge of different tools and their functions, but also how she might have students use these tools in her classes. This suggests a deep thoughtfulness in how TPACK guides her thinking and decision making as an instructor.

She says that although she uses tools to help her update the learning activities she has been using for several years, there are still “lots of times where I feel like I'm not doing it as well as I could.” Rena remains motivated to integrate technology into her teaching because “figuring out which tools will work best for me, even if it takes a while, is the most important thing to who am I as a teacher and who am I as a person.”

Rena’s TPACK has not become something that she thinks much about in her scholarship. Although she uses technology many different ways in her teaching, she doesn’t see herself doing any research about that area of her work. She says that she has been asked by other colleagues and has been listed as co-author on some published works, but she doesn’t think it would be authentic for her make what she does in the classroom a focus of her research. She says

My research interests are really on students, how they learn, and the impacts of various contexts of teaching
and learning on learners. I am uncomfortable with focusing on me and what I’m doing because it doesn’t focus on what is happening with students. I want to learn from students to inform how I improve what I do in the classroom. I think that if I focused on me and what I am doing, or what I know and what I am learning, I might focus on my performance rather than whether students are learning.

As an instructor and as a researcher Rena focuses on the impact the learning experiences have of the students. It doesn’t strike her as natural or authentic to place focus on herself and her own learning within teaching and learning experiences. Although technology plays key roles in much of her teaching and what she does in the classroom, she doesn’t focus on the impacts of technology on her practice. TPACK does play a role in the attention Rena dedicates to investigating the impact technology has on student learning experiences. She says that focusing on the students and their learning outcomes helps her refine and develop more meaningful and engaging learning experiences with technology for her students, and that is what she cares most about.
RQ2: How do professional development activities support instructors’ technological pedagogical content knowledge development?

Sharing her knowledge and strategies for using various technological tools in her teaching and exchanging ideas with colleagues helped Rena build confidence in her practice and develop her TPACK. Professional development activities in the college that most supported Rena’s TPACK development included the workshop structure and design and the individual consultation and in-class support she received in the College.

Workshop structure and design. Rena’s aim to be intentional about uses of technology in her classes drive her participation in College’s professional development opportunities. In an online forum during a workshop experience, Rena mentions (Figure 12)

I appreciated the flexible and in person structure of today for many reasons. The opening check in and group check in this morning allowed me to reflect on and articulate where I wanted to go with my course and which specific apps, tech tools I could see reasonably apply to my class.

Figure 12. Rena discussion forum post 2

Rena continues to describe (Figure 13) how hands-on work period during the workshops were “especially helpful and empowering,” both in helping her know how to do certain
things and in accepting that some things didn’t fit her teaching style or preferences.

I was actually able to make a short movie using a combination of photos, video clips and text and added in voice recording and music... The product in and off itself is nothing to write home about...but learning how to navigate the tools was especially helpful and empowering. I also gave myself permission to say that particular apps are just not for me... Information is good... And so is the power to delete. Finally, I really appreciated having opportunity to talk with varied experts and teachers about ideas, apps, etc... This was big for me.

Figure 13. Rena discussion forum post 3

The workshops helped Rena “work on focused tasks that will have [her] better prepared for class” and be “better informed about the types of questions to consider” so that she can “have enough know how to guide students.”

This experience has been exciting and invigorating to me. I really appreciated the last day with many opportunities to work on focused tasks that will have be better prepared for class in the Fall. I worked on advanced Moodle as well as Hangouts and imovie. As I am co-teaching a class in the Fall, i am now better informed about the types of questions my co-teacher and I need to consider as we create a site ( or sites) that is flexible for both of us.

Figure 14. Rena discussion forum post 4

Rena describes the workshop activities as “carefully scaffolded to accommodate for different learning styles” and this gives her ideas for how she can model different practices in her own classes. For example, she builds in low stakes assignments with technology tools connected to course concepts so that when students need to use technology to engage in deeper or more complex activities,
they are more familiar and comfortable with using various tools to support their learning.

I picked up from the workshops that when I was asked to do something kind of familiar, I could push myself to do more difficult tasks. I thought, then, that if I ask students to use the internet to do basic research, do some writing, and share pictures and video clips to a shared google doc, I’ve give them a foundation to scale up from for more complex work.

Her experiences also make her think about how students can differently use technology to do work out of class which they can bring in and enrich classroom discussions and arguments.

I can ask students to work in groups outside of class, watch a video to identify ideas or themes, use a video annotation tool to make notes, and have them lead in-class discussion or do some mini-teaching. I like how some of these ideas are modeled during the college workshops.

Individual consultation and in-class support. Besides the workshops, Rena has been able to meaningfully integrate technology and her pedagogy by partnering closely with the academic technologists in the college.
During courses where multimedia production and presentation represent major assignment for students, Rena works with college instructional designers to develop in-class tutorial sessions for her students. The purpose of these in-class sessions is to scaffold for students the mechanics of different technology tools with contextual guidelines for course assignments. During the session an instructional designer or a graduate teaching assistant models simple multimedia production and answers student questions specific to working with different tools.

Trusting the support of the professionals in the college has helped Rena focus on developing her teaching, what she feels she does best, and to be able to count on her “support team” to move her teaching ideas forward. As she describes:

The in-class and consultative support offered by [the College’s] team have become a regular part of what I do both in my planning and when I do different things in the classroom. It isn’t always that I feel I need help, but I appreciate that [the] team deals with some of these tools more regularly and might be able to answer some questions for students more quickly and completely than I could. I like that I can model for students how important
it is to continue to learn and get help to make your work better even if you have done some of the things before.

Being able to rely on members of the college team to support integrate technology with her pedagogy has also helped Rena deal her own “ineptitude” when she feels like she does “not know as much as a student about the technological tool.” She says that she wants

...to try new things and [teaching with technology] is an experiment that raises a tension, but it's an exciting tension. It's a vulnerable tension too cause I’ve got to be able to say ‘I don't know stuff, but I'm okay with that’ and I have help from people who won’t judge and who want to see me succeed.

Rena continues to feel anxiety about her ability to make sure she and her teaching methods don’t begin to feel archaic to her students. She feels that technology updates itself so quickly and she worries about being able to quickly learn meaningful ways to use new tools make use of them in her teaching. Working with academic technology professionals in the college has contribute to Rena’s TPACK in ways she would not have expected.

I was working with [an academic technologist] once and I was trying to revise an existing assignment that I had which had students watch a film and annotate it. I
usually had students write field notes, kind of like an ethnographic field note, of what they're watching so they're distinguishing from their observation and their interpretation. In my revision I intended to use VideoAnt or another video annotation tool but as I was going through talking with [the technologist] about the revised assignment we both came to the conclusion that the technology really wasn't necessary and that the field notes, as the assignment was prior, existed just fine. Adding technology wasn't necessarily augmenting the learning outcome or changing in some way and informing the content or pedagogy differently. The act was the same it was just a different medium.

Rena says that teaching with technology has gotten easier and the professional development programs through the College have helped her TPACK “mature”. The support she receives has helped her find a few things that she is good at and focus on using those things very well. Further, she says that it has gotten more difficult for her to think about teaching without using some form of technology.

I cannot imagine being in a classroom and not being able to play a video, pull up a website, play a sound clip or play music, or obviously use PowerPoint or some kind of other device. I guess I'm incorporating forms of
technology. I honestly don't know if I would talk to people and say these are learning technologies. I would say these are tools that I use to help me bring in multiple mediums to engage students and for them (students) to feel like they have some ownership of the space because they're bringing in stuff too.”

Surprisingly for Rena, working with the academic technologists has helped her embrace the idea the technology may not always fix teaching and learning issues in the classroom. Understanding that technology isn’t a “fix” in teaching and learning makes it easier for her to build her confidence and keep developing her technological pedagogical content knowledge.
Findings from Sam’s Case

Sam is a math professor who joined the university in 2003 and the College of Education in 2009. In her 25 years teaching in higher education she has taught in 4-year and research universities in the United States. For Sam, technology represents tools she can use to extend and connect learning from the classroom to the real life things students can see and touch. She participated in the College of Education’s technology integration professional development workshop in 2015 and 2016. Since participating in the college’s professional development programs Sam has noted a change in her perspective about teaching with technology. Particularly, she says she has realized that she has grown more confident in using educational technology in her teaching. The professional development programs have made her feel like she “can actually fit technology learning into her professional life.” Through the college offered professional development programs Sam has become more grounded in her ideas about her role as an instructor, but has also been able to try out new instructional practices so that she could become more comfortable and confident in them. She has also had the opportunity in her professional development to learn how to adopt new instructional practices, making them her own
while also thinking about student’s reactions and feedback to those new practices. One of the main things she has learned over the course of her engagement with the professional development program in the College is that she had developed the ability to try new tools on her own without the aid of someone providing “technical support.” Sam believes that this confidence to experiment with new teaching methods and tools has been a direct result of the professional development activities she participated in through the College.

**RQ 1: How do instructors describe their technological pedagogical content knowledge?**

TPACK is very emerging idea for Sam both as a concept and as something that she practices.

Knowledge of technology. Sam describes photographs, maps, and navigation coordinates as the first technologies she used in her teaching. She said that she had a laptop for over a year before she plugged it in to teach. “I've always been more interested in developing the interactive component and the live-action component between me and the students.” Sam had taught in higher education for several years before realizing she had “a teaching need” to integrate any technology into her courses. Self-described as “humanistic,” Sam’s interests in “interactive and non-
lecture” learning activities made her “pretty resistant to learning to teach with technology”. What she saw from many of her colleagues were uses of technology tools to supplement lectures and not “actively engage’ students in their learning. Further, she thought that much of the technology use she saw was simply delivering information to students rather than challenging them to make “real world, real-life connections”.

Technology and teaching. In her first experiences teaching with technology, Sam would send groups of students on what she describes as “Math Walks.”

Students had to go out in groups and find locations with a map. At the location they would talk about what kind of math it would take to build the sculpture, artifact, or building at the location and take a photograph. Later in the classroom they would give presentations of what they found on their math walk, they problem they had, and how the team would go about solving it.

When she joined the College of Education she collaborated with a colleague to teach an interdisciplinary First-Year Experience (FYE) course that combined learning earth science and learning math. This colleague shared with her the idea of how students could calculate the carbon
footprint of their different lifestyle activities and input those calculations on class webpages. These webpages would be in-class discussion guides to help students consider factors that affect their carbon footprint calculations, what the calculated carbon footprints looked like in their local communities and different communities around the world, and help students make deeper connections between human activities and the environment. Using technology this way helped her think differently about how to frame math problems in ways that have students use both their knowledge and various tools which could “actually increase the interaction” between students, math knowledge, and society. According to her, she could not have taught this way if her colleague was not knowledgeable about different technology tools and “active-learning strategies” using those tools. This co-teaching experience motivated her to think about her own knowledge of technologies and how to better develop that knowledge.

When the tablet computers came to the college, Sam saw it as an opportunity for students to create movies about their “Math Walks” where they could record and document their entire journey from the classroom, to the field, and to resolution of a unique math problem into a multi-media presentation shareable to the class over email. The one-
to-one tablets in the classroom made it possible for Sam to create active and engaging experiences where students could “live math in their own environments.”

Sam teaches math as a “cultural experience.” She says, “like an anthropologist, a math teacher can translate math into terms that engage students.” She believes that...students bring a lot of knowledge about math from their worlds into the classroom. It may not be organized in the way the math teacher or the text book expects, so the craft and the beauty is in thinking about what math problems to give students so they can build their knowledge from what they know.

Using tablet applications such as Explain Everything, Sam created electronic lecture notes and sample problems. These problems helped students make connections between the mathematical theorems and methods discussed in class, and how these principles apply in the real world. She designs her Math Walks experiences so that students, in their own neighborhoods and campus environments, can build their own narratives connecting math principles and their natural world. She says that students using references common to their environments can help them form deeper understanding of core math concepts. Sam is able to devise increasingly complex math problems that require students to think
critically and make deep connections between different ideas in order to solve the problems. Sam’s use of different technologies make her course “a different experience to help students appreciate math.”

Technology, discipline, and context. As Sam has found different ways to use technology and make learning mathematics more authentic, she has been able to let go of several tensions she used to harbor towards integrating technology and pedagogy. Sam believes her remaining tensions have less to do with technology and more to do with balancing her roles as a professor.

Sam feels tension between the institutional expectations that professors develop innovative pedagogy with technology in their courses and the uncertainty of how regularly those classes are offered. She says that

…the uncertainty of teaching future is always a big part of whether you should invest in creating a bunch of cool stuff for classes that might not exist? This still makes me resistant to learning too much technology for my own teaching.

Also, according to Sam, the university values research over teaching and the time it takes for her to integrate technologies into her teaching competes with her research time. This is a stressor for her.
I get very stressed about [integrating technology and teaching]. I'm supposed to be publishing papers [that’s] what I came here to do at the U, publishing papers. It's the new big thing that I had to do. I had done a lot of teaching but the research was the new big thing and so that was very big in my mind and I really saw the time it takes learning to teach with technology as creeping into that time that I was learning to how to be a researcher and a publisher. I saw teaching with technology and my work as a researcher in opposition to each other in terms of time.

This juxtaposition of teaching and research creates a disincentive for Sam to develop her TPACK.

TPACK in practice. Sam says she “definitely used to be” in the PCK “orb, and my (TPACK) orb is becoming a little bit bigger.” She is self-described as “project driven” and her explorations into teaching with technology happen when she enters new “projects” such as new courses or new teaching teams. Sam believes that as she builds her knowledge of different tools and ways to use those tools in her teaching, she will be able to “increase her enthusiasm” about the role of technology in her work as an instructor.
The professional development activities in the college have also unexpectedly extended Sam’s TPACK beyond her classroom teaching into her other professional activities. Sam mentors secondary schools math teachers across the state through a program called College in the Schools. Through his program secondary school teachers collaborate and are mentored by university instructors to teach college level courses in their high schools. This offers students the opportunity to earn college credits while still in high school which they can transfer when they enter university. In her role, Sam uses online tools to help teachers align their classroom experiences with how the courses are taught at the university. The professional development activities in the college have helped Sam create videos (Figure 15) making it possible for her to partner with more teachers and extend the College in the Schools learning opportunities to more students across the state.

I really like the workshops because I did solve problems that were actually weighting on me. That first year in the workshop I worked on learning some uses of video and video editing that ended up informing the videos I made for my College in the Schools program. I think I made four videos so something upwards of thirty high schools around the
state had their students watch these videos through flipped classroom style. This was great because the students could watch the videos and the teachers could stop the videos and talk through the math problems I had up. And the way I teach I have students work on problems that are about health and economic disparities internationally through the lens of data collected by different agencies. So it was basically like 30 high schools were using these things and the students practiced math and reasoning that would been kind of hard for them otherwise.
Sam has recently written conference papers about her uses of technology in her teaching and is interested in producing more scholarship around her experiences. She thinks that she can have many things to write about if she focuses on her own experiences and her own learning while teaching with technology. TPACK, for her, describes a “continuum on knowing and understanding.” She likes that, with technology, “we don’t all have to know the same thing or know about the same thing.” She thinks that the tensions she has faced integrating technology with her pedagogy are probably not unique to her and that writing about them would be a service to her field and to instructors in various fields who struggle to authentically adapt in a changing environment of teaching and learning in higher education.

RQ2: How do professional development activities support instructors’ technological pedagogical content knowledge development?

Motivated by her previous experiences collaborating with “more tech-savvy colleagues,” professional development activities in the college including teaching and learning communities and individual consultations, gave Sam opportunities to work and learn from the knowledge and experiences of other instructors in the College.
Faculty teaching and learning communities. In the Fall of 2010 the College announced a one-to-one tablet initiative where all in-coming students were issued tablet computers to support their learning. Instructors teaching First-Year Experience courses were invited to participate in the initiative and received tablets with the encouragement to integrate the tablets into their teaching. The college established learning communities for instructors who were part of the initiative. Instructors in these communities exchanged teaching strategies, assignment ideas, and supported each other in their efforts to use the tablets to support teaching and learning in meaningfully ways. Sam joined the tablet initiative to be part of the learning communities and learn from her colleagues. By her own description,

...there were some people who had already been doing a little bit of digital story stuff in one form or another with phone apps and with the checkout cameras and stuff from the University library, and so they (learning community colleagues) said ‘we could all do digital stories or something like that,’ and things like that were part of the big conversation among FYE instructors. Also within the learning community people started playing around with PDF annotation and other
stuff because we had these new machines that could do things we hadn’t done before.

Working with different colleagues in the tablet initiative Sam says she “didn't feel so resistant.” Sam says about her experiences in learning communities that she “really appreciated and really felt that I learned a lot. I think that my whole confidence really, I mean I became more open to learning technology.” The learning communities also helped Sam become very intentional about exploring technologies and how she might incorporate them in her teaching. This openness and focus towards learning technology influenced Sam’s decision to participate in College offered professional development workshops around integrating technology and pedagogy. She says “the thing that I really liked about (the workshops) is that it's four days and I could be really focused and clear with myself about what I want to accomplish during these four days.”

The approach that worked for her was to go into each workshop with a project to work on.

When I did the [the workshops] I blocked out those four days and just immersed myself in it in. [I would] state my goal and achieve my goal and it just worked really well to really be focused on something and get it done and have a product and have learned something.
Also I like that there are people who would help me get to the next stage (of my project) so I really like [the workshop] for that and that fit within my whole working style and because I did finish stuff and solve problems that were actually weighting on me.

Individual consultations. Outside of learning communities and workshops, Sam describes individual attention from college academic technologists’ as other part of her professional development experience has been “very important” in helping her integrate technology and pedagogy in her classes.

I have increased in my enthusiasm and the there's been several different components. I think having [graduate assistants] and having the [instructional designers] that provided support to me directly, I can call to my class, and I could actually have real-time assistance it wasn't all on me to figure everything out. Those two supports that the college has put into place have been very important. Having people that I could contact, that are able to work with me quickly, that's really good. It's really it's a contrast to the broader University.
Further, Sam finds the individual support she receives from the College academic technologists’ reinforce her TPACK development.

The one-on-one time I get in summer workshops and throughout the year give me confidence to try things, even if it’s just for myself. I also like that members of the team are focused on teaching and learning more than technology, so I feel like I’m asking my stupid technology questions to people who ‘get’ teaching.”
Findings from Mac’s Case

Mac is a professor of teaching and learning who joined the university in 1990 and joined the College of Education in 2008. For more than 20 years he has taught in various higher education environments including 2-year, 4-year, and research colleges and universities in the United States. He participated in the College of Education’s technology integration professional development workshop in 2012, 2014, and 2016. Since participating in the college’s professional development programs Mac has noted a change in his perspective about teaching with technology. In particular, Mac has learned “how technology can be used to supplement [his] teaching in the classroom and outside as well.” Through the professional development programs in the College Mac has had experiences that caused him to question the way he usually acts and question his ideas about his role as an instructor. His professional development experiences made him think about acting in ways different from his usual beliefs as an instructor. He has tried out new instructional practices to become more comfortable and confident with technology in his teaching. He has also tried to figure out ways to adopt new ways of acting in his teaching and thought about the reactions and feedback of
student to his new practices. Mac initially thought that technology would get in the way of his teaching or that learning technology would somehow detract from his pedagogy. Through his professional development experiences in the College of Education Mac has learned that technology can be useful in many ways. Mac believes that the changes in his perspective to teaching with technology have been a direct result of the professional development activities he has participated in through the college.

RQ 1: how do instructors describe their technological pedagogical content knowledge?

His developing TPACK has made Mac much more reflective about himself as an instructor and contemplative about the role technology plays in his teaching.

Knowledge of technology. Mac describes using slides and carousel slide projectors as his first experiences teaching with technology. At that time he didn’t “really give a lot of thought to technology tools impacting pedagogy. It was a way to put your main points on a screen.” As Microsoft Office tools such as PowerPoint became more available, Mac became influenced by colleagues to use PowerPoint to add “different designs” to his presentations and lectures, but he wasn’t sure if he “would consider PowerPoint
‘technology’.” He still uses PowerPoint in his teaching but does not think there is anything particularly innovative about what he does with it.

Shortly after he joined the College of Education in 2008 his teaching collaborations with new colleagues made him more thoughtful about how he could use technology in his teaching. Mac joined a college-wide one-to-one tablet initiative that incentivized him to develop new methods in his teaching, and apply different approaches to help students use technology tools in their learning experiences. Mac shares,

When the iPads first came out and the Dean announced that we were starting this iPad initiative, there was a lot of buzz around it because there weren't a lot of schools that we're doing these types of initiatives and it represented the way students were going to be learning going forward. Students had had these teched-out smartphones and were kind of excited about the college giving each of them a tablet computer and instructors using them in their classes. As instructors we started doing trainings and learning more how to use the tool in the classroom. That was one of the first times where I started thinking that I
could embed technology into the curriculum more intentionally.

Mac says that although he and other instructors “didn’t really know what we were doing” and the “students didn’t really know what they were doing,” they were able to “get through it” and get better with the tools over time. Now in his teaching he continues to look for a “happy medium of using technology to facilitate my teaching rather than the other way around.”

Technology and teaching. Mac says “I didn’t really start thinking about technology and pedagogy until I joined the College I’ve been teaching for over 20 years.” Mac’s courses involve a lot of in-class face-to-face discussion. He finds that technology is most useful for getting students to communicate with him or each other outside of class. Because of this, he has students use technology for homework assignments or other out of class work, but has not found ways to meaningfully make use many technologies in his classroom practice. According to him, although students get excited about learning with some of the technology tools, he feels conflicted about the amount of time students spend learning technology tools rather than learning course content. Further, he has not been convinced
that teaching with technology in his classes really “improves students course learning outcomes.”

Mac believes that technology does afford him different approaches in his teaching. For example, Mac says “the flipped learning concept intrigues me because this process forces us to re-visit what we really want students to learn and take away from our classes.” Mac regularly presents a lot of content in his courses and likes students to “dig in, talk about, and work with the material in small groups” before they apply course concepts to bigger assignments. He believes that flipping his courses, where students access his presentations outside of class before they come to class, allows “more time in class for active synthesis and evaluation of the material.” Engaging students with the material and challenging them to be “critical consumers of information” is a central concern in Mac’s teaching. He works to “find that happy medium of using technology to facilitate [his] teaching.”

Technology, discipline, and context. Mac’s TCK has focused more on himself as a practitioner using technology in his disciplinary area. Mac is continuously frustrated by a “lack of congruence” between the encouragement for more technology in higher ed teaching, and the low value his field places on scholarship around teaching with
technology. He says that journals in his field of adult education have not been receptive to his scholarship on teaching with technology. This has made him have to write for other venues.

What I have done is I've written and contributed to some publications that have been designed more for programs of first-year programming initiatives. In those we've talked about the iPad initiative embedded through sections of First Year Experience courses.

He has also expanded his scholarship to write about his own professional development experiences as a learner.

I recently wrote a piece again for the Journal of Learning Communities where we've talked about our learning community model here at the University and then we embedded in several large sections that incorporate data on some of the iPad use that we've collected over the last few years.

Within his disciplinary area, comments from adult education journal reviewers have not encouraged any enthusiasm in Mac to research technology integration into his teaching.

...some reviewers have said 'you provided too much information about the iPad' or similar comments. So I've had to dial back or retool my manuscripts to talk about other things, or sometimes I've just said to
myself that adult education journals may not be the home for this piece.

Looking forward, Mac does see his scholarship continuing to integrate his thoughts about teaching with technology. He says it has “kind of been frustrating” not getting published by journals in his field. To expand his work as a scholar in adult education he wants to make stronger connections between technology and pedagogy in his own practice. He believes that continuing to write about his experiences learning to teach with technology can be helpful and informative to other university instructors.

TPACK in practice. Mac believes his TPACK is “average”. He says, “I think there are a lot of faculty members (in the College of Education) that don't do much at all with the technology and there are a group of faculty members that do a lot, I would say I'm somewhere in the middle.” I would say I'm not especially tech-savvy but I've learned over time.” Mac’s general motivation for integrating technology and his pedagogy is “to stay up-to-date.” He wants to keep current on updates to the tools he does use and finds it interesting to learn about new tools and strategies his colleagues use in their courses.

As Mac has developed his TPACK, teaching with technology has become both easier and more difficult for
him. His confidence in practicing with new tools has grown and he remains open to incorporating technologies in his teaching. However, he remains conflicted about the amount of in-class time committed to teaching and learning technology tools rather than invested in interacting with courses content. He says,

Those [technology integration] projects, they've been well-intended and I think students have gotten a lot out of them. But I'm sometimes concerned that, at times, too much effort goes into learning the technology and sometimes the students lose priority in terms of the content they should be learning about the subject in the course. Sometimes we devote too much time to learning how to use an app that the course materials kind of just gets dropped in. I've had several moments where I've felt like we're spending a lot of time on developing technical skills and we're losing track of what's most important and really a priority in this course.

Further, the more confident Mac gets in his TPACK, the more “conflicted” he has felt about the role of technology and teaching in his institution and in his field. He says that, typically, the College announces initiatives to integrate technology into teaching and invests money in various
resources to support faculty integrate technology into their teaching. Faculty, however, don’t typically have the “release time” (time off from other responsibilities) to develop and innovate their courses with technology. He also says that for his career as a faculty member, because the university places a higher value on his research than his teaching he feels his time is better invested developing stronger research in his field rather than getting better at teaching with technology. These are things he never thought about before he became more actively engaged in teaching with technology.

**RQ2: How do professional development activities support instructors’ technological pedagogical content knowledge development?**

Professional development activities in the college gave Mac a sense of community where “being one of the instructors who uses technology,” such as teaching and learning communities and workshop discussion forums has been a motivation for Mac to engage deeper help him “think critically about how technology is used in college classrooms."

Faculty teaching and learning communities. Mac co-teaches with many colleagues who use technology in their courses. This encourages him to explore different
strategies to incorporate technology tools in his own teaching. He says that his desire to collaborate with colleagues and stay up-to-date with teaching tools and methods effective with how students are currently learning feeds his motivation to engage in professional development activities.

Being a member of learning communities helps him learn different ways his colleagues use technology tools in their classes and helps him develop his own practice. He describes how colleagues help him think about using technologies to modify his approach and better meet his teaching goals:

“I am beginning to think more intentionally about learning objectives and outcomes. One of my colleagues, Beth, helped me plan how I might move some of my PPT presentations to the transmission, pre-class phase of a flipped course. One concrete idea she shared would be for me to post any PPT 1-2 days in advance of the class meeting and ask students to complete and do a knowledge check in the form of a Moodle quiz. Students will likely come to class more engaged and fully prepared to discuss. Before hearing her examples, I was not clear how to integrate the flipped [model] into my course format. Upon
reflection, I can use knowledge checks via Moodle to help encourage greater student participation”.

Collaborating with his colleagues has also given Mac courage to push past his dissidence with technology and extend beyond teaching strategies he is most comfortable with.

I feel like at times I've struggled, especially working with [some colleagues], [they are] really into digital storytelling and [they] wanted to make digital storytelling as central to the class as possible. I was pushing for the readings that go along with the course concepts. I wanted students to work with the materials and I wanted them to feel uncomfortable with it and then apply it later. [My colleagues] wanted to start applying these concepts right away in the form of a digital storytelling. There were sometimes creative disagreements between the two of us. I think it is personal style and pedagogy preferences.

Discussion forums. Mac received validation of his TPACK through sharing his knowledge and experiences in online discussion forums during workshops(Figure 16).
Forums have also been a valuable way for Mac to receive input, support, and teaching ideas from colleagues that have helped reinforce and develop his TPACK (Figure 16).

I was really impressed by the creativity and quality of the technologies used and highlighted in the video. I have several ideas that I intend to consider:

1) E-books: I am working with this fall on a FYI class that addresses issues related to the "American Dream." We are looking at digital stories or perhaps e-books such as the iBook Author option.

2) Survey and Doodle: I like Tabitha's use of the Survey to help students explore social scientist approaches. I teach a similar course for undergrads, and I may opt to use these tools to help students learn more about ways of knowing in the social sciences.

3) iMovie: I just downloaded this app recently, so I am eager to learn more about it. We've used video approaches in another FYI section in the past, and students have appreciated. Mainly, we used as a group collaboration project. With iMovie, I want to learn more about the creativity and design aspects of putting together images, etc.

Through the online discussion forums, Mac also shares with colleagues ways he has used different tools to bring expert voices into his classrooms and share the knowledge being constructed in his classes with the world (Figure 18).

I also like the idea of using the newly re-visioned and just released Flipgrid app. It now allows students to communicate with each other and comment on individual posts. Another benefit of Flipgrid is that it can be used as "an expert" panel where resources (and opinions) can be shared with a wider audience.
As he has participated in various professional development activities, Mac continues to apply a critical lens to how and why technology might add value to his teaching experiences, and is very conscientious about the roles TPACK plays in his teaching.
Chapter 5
Discussion and Implications

The purpose of this study is to offer an account of higher education instructors describing their technological pedagogical content knowledge and the roles professional development activities played to support their TPACK development. The interplay of assimilation and accommodation helped each instructor easily modify existing practices to take up new tools and strategies in their teaching or negotiate ways of making sense of out of new information they were presented with. Through each individual’s experiences they constructed knowledge that was suitable to their respective contexts and appropriate to the different teaching needs and situations they encounter. As the data were examined common factors in instructors description of their TPACK included:

- Uncertainty over individual technological knowledge due to shifting definitions of what technology is
- Emotional and practical drivers for integrating technological knowledge and pedagogy content knowledge
- Community support and TPACK development
- And reconciling their emerging identities through TPACK.
**Technological Knowledge**

A common theme across the instructors’ descriptions of their technological pedagogical content knowledge is a revolving definition of what is technology. Intrinsically, each of the instructors make definitions for what technology is and what it was useful for in their teaching. Extrinsically, various factors in their environment make the instructors question if they truly know or understand what technology is.

The general ambiguity around defining technology from both the academic technology professionals and within the College environment offer insight to explaining the varying definitions of technology amongst participants. Between the various professional development activities in the College, technology represented everything from digital media, hardware tools, software applications, multi-media production devices, and even new teaching strategies. Characterizing all of these different apparatus as technology created confusion for the instructors in arriving at any singular definition of technology.

A true failure in defining technology stems from inconsistencies across learning technology disciplines in determining what “technology” is. As a result, one theme that was common among participants was their inability to
determine, for themselves, what technology is. When I asked about their first experiences teaching with technology, each participant immediately gave accounts from early in their teaching careers. Interestingly, although each used very different tools and methods in their teaching approaches, all of the participant’s first experiences teaching with technology viewed media as technology. Media became a tool instructors used to help student’s construct their own knowledge and make meaning of key concepts being discussed in the course. In their field defining works, both Saettler (1968) and Reiser (1987) offer that prior to World War 2, technology in education primarily meant media. Training videos produced during the war introduced the notion of audio-visual educational media, and the tools used to project those media began to be what was known as educational technology. By the time any of these instructors would have begun teaching with technology, many other things such as film projectors, television and VHS, even calculators and computers would have been present in their teaching experience, yet when asked about their early experiences teaching with technology they all recall a form of media, not some software or hardware, as the first technology vehicle they used in their teaching. This suggests that despite advances and availability of various
tools, media still meet a primary need as a form of learning technology.

A theme that emerged from the data analysis was that digital tools and technologies represent a higher level of technological knowledge for instructors. The instructors describe a separation of knowledge and understanding over different digital tools for teaching into a higher category of knowledge. They call their early work with media as “simple” or “stuff we’ve all been doing.” Knowledge about tablet computers, software applications, and the internet presented opportunities for instructors to push their teaching and their students beyond what was typical. Because of the easy access and appeal of digital tools and technologies, the instructors have also abandoned non-digital tools and media which may in some cases be more effective than digital tools. For these instructors, the prevalence of digital tools made non-digital tools less relevant as technologies for teaching.

Emotion and TPACK development

In addition to professional and personal growth, other factors such as fear and opportunities to collaborate with colleagues were driving forces for instructors to integrate their teaching and technology.
Fear is a very complicated theme for instructors as they integrate technology and their teaching. Previous research well documents fear as a prohibitive barrier to instructors integrating technology into their teaching. In their research on professional development with higher education instructors, Schrum (1999) and Georgina & Hosford (2009) both cite fear as a factor in preventing instructors from integrating technology and their pedagogy. The National Center for Education Statistics (1998) cites an important consideration in preparing instructors to integrate technology in their teaching is fear of appearing incompetent with technology. In this study however, fear did not prohibit participants from experimenting or incorporating different technologies into their teaching. Once the instructors explored or incorporated various technology tools into their teaching, fear became associated with maintaining their newly adopted practices. Participants described fears of their practices quickly becoming “archaic” in comparison to student’s experiences with technologies in other learning experiences. Participants also voiced a fear of staying “up-to-date” or easily falling “out of touch” with technology tools or practices associated with different technology tools. These fears had not prevented participants from expanding their
teaching with technology. Instead, fear kept them engaged and invested in their professional development so they might stay current with the tools and practices they have found meaningful in their teaching. Fear of falling behind also kept participants curious about emerging technologies and interested in continuing to explore tools that could support their pedagogy. Some of these curiosities and exploring of tools and strategies lead the instructors to many collaborations with colleagues. The opportunities for these collaborations was a factor that motivated participants to work on developing their technological pedagogical content knowledge.

Community and TPACK development

Participants cited collaboration with colleagues as a vital part of professional development that supported their TPACK. After collaborating with peers and colleagues participants not only used technology to deeper engage students with course content, technology helped participants guide students to make connections between course concepts and the students real lives outside of the classroom and off campus. Further, using technologies in their teaching allowed participants to extend her own practice well beyond their classrooms. These things were not possible for before integrating technology and her
pedagogical practices. Participants also describe their learning from faculty communities and team teaching experiences as key factors contributing to them integrating technology and pedagogy. Adopting alternative teaching strategies from colleagues or even exploring different perspectives with peers contributed to participants being more intentional in their integration of technology and pedagogy. Navigating a variety of fears and having co-travelers on the journey were very integral to instructors learning technology and pedagogy integration through professional development experiences.

Emerging identities and TPACK

None of the participants in this study felt themselves experts with learning technologies. Participants acknowledged that they have been able to think about their assignments differently because of technology tools, but none of them have developed mastery of any tools or strategies. Participants feel that although they may do some things well, the perception of them as experts with the tool is a misplaced focus on the technology rather than the teaching and learning taking place. Instructors felt disconnected from institutional foci on technology rather than the "teaching" in their successes. Participants became recognized for expertise in using the technologies in their
teaching, each of the participants also had growing concerns about the focus on technology rather than the teaching or student learning. Each of these participants were uncomfortable with perceptions of them as good with technology rather than good at teaching. These ongoing tensions feed into difficulties for participants to reconcile the perception of them as “good with technology” with their identity as an instructor working to improve their practice.

Throughout this study these instructors described their TPACK and ways professional development experiences in the College supported each of them in developing their TPACK. Findings in this study are consistent with the literature around both TPACK in higher education and TPACK and instructor professional development.

Mourlam’s (2017) analysis of TPACK in higher education revealed commonly effective approaches to developing instructor TPACK in higher education included workshops and mentoring experiences that were “typically collaborative” and “grounded in constructivist” learning theory. Each of the participants in this study were self-directed in their professional development pursuits and each sought out activities and experiences that would have them collaborate with other in their learning. Similar to findings in
Mourlam’s analysis, instructors in this study also found that individualized support from peers where were knowledgeable in both technology and pedagogy was instrumental in developing their own TPACK.

Reinties, Brouwer, & Lygo-Baker (2013) contend that, in higher education, professional development activities can support instructor’s TPACK development. Jaikaran-Doe and Doe (2015) further argued that applying their TPACK can help higher education instructors overcome tensions in teaching with technology. Findings from this study support both of these assertions. Each of the higher education instructors in this study found that professional development activities supported their TPACK development and over time each of them experienced fewer resistances to teaching with technology as they applied their TPACK within their respective teaching contexts.

This study also expands on the work of Boschman, McKenney, and Voogt (2015) by using TPACK as an analytical framework to explore instructors talk about design and technology in their teaching practices. Similar to Boschman et al. (2015), TPACK in this study uncoveres linkages between instructor’s questions of practicality between using technologies in their teaching and instructors achieving different teaching outcomes. Further, this study
responds to Olofson, Swallow, and Neumann’s (2016) call to use TPACK to analyse instructor’s knowledge construction and practice. In this study, TPACK is operationalized as a dynamic process and allowed for rich descriptions of instruction’s actual experiences. “TPACK-ing,” as described and advocated for by Olofson et. al (2016) is also useful to this study as it allows for looking a how the instructors describe their TPACK, how it develops, and the dynamic processes they experience over time. This perspective allows the instructor’s TPACK to be described more as something they live rather than something they simply have at any single point in time.
Implications

Emerging technologies and pedagogical methods are rapidly changing the landscape of teaching and learning for higher education instructors. Development of instructional practice with technology requires deep, ongoing, collaborative, opportunities for instructor learning. This takes significant work, constant reflection and revision, and persistence. Within academic units, opportunities to collaborate, learn from peers, receive one-to-one and in-class support, and attend workshops can all play a significant role in supporting the development of instructor TPACK. Structural flexibility that allows instructors to determine how, when, and where professional development activities take place lets instructors guide their own professional development in ways that are appropriate to their professional and pedagogical goals. Finding in his study of instructor's developing TPACK in practice have implications for researchers, instructors, and institutions interested in higher education technology integration.

Research. TPACK was used as a framework to analyze how instructors described their knowledge of teaching with technology and also how professional development activities within their context support their knowledge development.
Although TPACK is a viable framework for understanding types of knowledge instructors need to develop in order to integrate technology with pedagogy and content, the framework could also be used to examine how instructor’s pedagogical content interests influence how they develop their technological knowledge. Research that explores how instructors’ interests of different content areas in their disciplines and how their preferred teaching methods and strategies influence technology integration can inform knowledge and scholarship about instructor motivation in teaching and learning. Further, studying instructor TPACK within and across disciplines can speak to strengths and weaknesses of the framework in different contexts.

Instructors. As technologies are more present in the higher education landscape, instructors are increasingly faced with finding ways to meaningfully use technologies in their teaching. By relating their own interests to course content, instructors in this study integrated technologies into their teaching by built on practices they developed early in their teaching careers. Working with colleagues and learning from the examples of their peers, instructors were also able to imagine and implement ways to move their teaching practice forward with emerging technologies. This study is a showcase for instructors in higher education of
how they can guide their own professional development by building on earlier developed practices and following their own interests when integrating technology and their teaching.

Institutions. The implications from this study colleges and universities interested in supporting their instructors to integrate technology and teaching range widely from basic definition of terms to the design and administration of professional development programs and activities. Defining technology, particularly in educational contexts, remains an area wrought by ambiguity. Recognizing that instructors have very diverse ideas about what technology is and how technology might fit into their teaching can help institutions clarify how technology is defined and characterized across the institution and in units within the institution. For institutions trying to encourage instructors to introduce technology into their teaching, identifying different factors that drive instructors towards various technologies, or reasons that instructors might avoid technology, can help lead the design and implementation of meaningful professional development experiences that will support technology and teaching integration. Also, professional development for technology integration that is tied to instructor’s
authentic contexts, addresses instructor’s actual teaching needs, and allows instructors the space to have ownership over the process can be catalysts for real change that is sustainable over time.
References


Appendices
Appendix A Semi-structured Interview Questions

_____ Instructors’ experiences teaching with technology

What were your first experiences teaching with technology?
- Tell me about how you’ve used technology in your classes?
- Tell me about assignments you’ve designed that require technology

How has your teaching with technology changed?
- Tell me about things you’ve worked on during college workshops

What has changed about teaching with technology in higher education?
- Have you ever taken a class online?
Has teaching with technology gotten easier or more difficult?
- What are some challenges you have experiences teaching with technology?
- What are some challenges you anticipate to experience in the future using technology for teaching?

What have you learned about your ability to teach with technology?
- How would you describe your experiences learning to use technology for teaching?

Appendix B (Member Check, follow-up)

TPACK Questionnaire of Instructor’s Knowledge of Teaching and Technology Items

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<td>1. I know how to solve my own technical problems.</td>
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<td>2. I can learn technology easily.</td>
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<td>3. I keep up with important new technologies.</td>
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<td>4. I frequently play around the technology.</td>
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5. I know about a lot of different technologies.
6. I have the technical skills I need to use technology.
7. I know about technologies that I can use for understanding subject matter in my courses.
8. I can choose technologies that enhance the teaching approaches for a lesson.
9. I can choose technologies that enhance students' learning for a lesson.
10. I think deeply about how technology could influence the teaching approaches I use in my classroom.
11. I am thinking critically about how to use technology in my classroom.
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<td>12. I can adapt the use of the technologies to different teaching activities.</td>
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<td>13. I can select technologies to use in my classroom that enhance what I teach, how I teach and what students learn.</td>
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<td>14. I can use strategies that combine content, technologies and teaching approaches in my classroom.</td>
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<td>15. I can provide leadership in helping others to coordinate the use of content, technologies and teaching approaches.</td>
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<td>16. I can choose technologies that enhance the content for a lesson.</td>
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<td>17. I can teach lessons that appropriately combine my subject matter, technologies</td>
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and teaching approaches.
1. Based on the TPACK image above, where would you position your TPACK?
2. How would you describe your own TPACK?
3. Do you have lingering tensions about teaching with technology?
4. Have you had experiences teaching with technology that you would not repeat?
5. How has teaching with technology factored in your work outside of the classroom?