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Teaching to the Technological Demands of the 21st-Century Classroom

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Abstract

Learners of the 21st century are met with the need to collaborate, problem solve, critically think, and synthesize various sources of information. Simultaneously, teachers and learners are expected to utilize rapidly evolving digital technologies as tools to make teaching and learning more effective. As digital technologies become increasingly prominent in K-12 classrooms, the question becomes: in what ways are preservice teachers learning to teach to the technological demands of the 21st-century classroom? Dr. Punya Mishra and Dr. Matthew J Koehler of Michigan State University propose the Technological Pedagogical Content Knowledge (TPACK) framework as a means for effective technology integration in the classroom. This framework serves as the lens for this discussion about the ways an undergraduate teacher education program can best prepare its preservice teachers to thoughtfully incorporate technology into the classroom to enhance the learning experience of all students.

Introduction

Imagine a classroom where students follow their own inquiries, collaborate with one another, synthesize multiple sources of information, create meaningful works, and intentionally utilize technology as a tool for learning—all with the goals of strengthening higher-order thinking skills and developing a passion for lifelong learning. This ideal image of a 21st-century classroom concentrates on purposeful technology integration for "transformative learning experiences" (Mishra, Koehler, Henriksen, 2011, 27). In "Learning 21st-Century Skills Requires 21st-Century Teaching," Anna Rosefsky Saavedra and V. Darleen Opfer emphasize the seven "survival skills" learners of the 21st century need to be successful as "critical thinking and problem solving; collaboration and leadership; agility and adaptability; initiative and entrepreneurialism; effective oral and written communication; accessing and analyzing information; and curiosity and imagination" (2012, 8). Similarly, Punya Mishra, Matthew J. Koehler, and Danah Henricksen highlight seven cognitive tools for today's learners, which include

"perceiving, patterning, abstracting, embodied thinking, modeling, playing, and synthesizing" (2011, 24). Note that neither list states "digital technology" as one of its necessary 21st-century survival skills or cognitive tools. Rather, digital technologies serve as means to reach those end-goals, tools available to strengthen teaching and learning.

Throughout my time as an undergraduate student in a preservice teacher education program at a Midwestern university, I experienced a range of how individuals utilize digital technologies both in K-12 classrooms as well as in teacher education courses themselves. My daily work as a resource on the university's academic technology support team provided me with opportunities to assist fellow preservice teachers and university faculty in the navigation of the evolving world of digital technologies. While many of the experiences resulted in positive results, the process of reaching the positive results consisted of countless moments of confusion and frustration, oftentimes attributed to the individual's limited understandings of when, why, and how to utilize digital technologies within their teaching context. These interactions perplexed me as I grew to understand that my fellow preservice teachers and their instructors frequently viewed technology integration as a chore rather than a tool available to strengthen teaching and learning.

As my personal inquiries on this topic developed, I continued to encounter opportunities that provided me with further insight on successful technology integration: presenting on technology integration in a preservice teacher education course, leading a portion of a workshop on using electronic portfolios as a form of assessment, becoming a teaching assistant for a technology in education course, and student teaching in

classrooms with constant access to digital technologies such as iPads and a SmartBoard. During my student teaching placement, I ran into challenges as I realized how hard it is to integrate technology in the classroom in meaningful ways. While my technology skills are well developed due to my work with the academic technology support team, these "sophisticated" technology skills did not always result in "sophisticated" and purposeful technology integration. Such opportunities opened my eyes to large concern for the vision of the 21st-century classroom. Preservice teachers, myself included, may not be receiving the preparation necessary to purposefully utilize digital technologies as tools to enhance teaching and learning. Using this concern as a platform for my research, I investigated what successful technology integration looks like and the ways preservice teachers grow in their understandings and practice of successful technology integration.

In 2006, successful technology integration in K-12 schools "lagged far behind the vision" because of "a tendency to only look at the technology and not how it is used" (Mishra & Koehler, 2006, 1018). Eight years later, the demand for digital technology use in the classroom still exists, quite possibly at a higher rate. In most K-12 classrooms, the definition of 21st-century learning remains a vision, imagination, rarity, and dream for what education could be. Attributing to this infrequent, purposeful integration of digital technologies is their "protean (usable in many different ways); unstable (rapidly changing); and opaque (the inner workings are hidden from users)" qualities (Mishra & Koehler, 2009, 61). Overcoming these hurdles requires thoughtful planning by teachers to ensure the technology use is serving its purpose as a tool to aid students in reaching higher-order thinking skills. Although the demand has been present for over a decade, teachers "have not had the opportunity to learn to maximize its pedagogical value"

(Saavedra & Opfer, 2012, 12). Research on K-12 teachers exposes recent attempts at technology integration as "pedagogically unsophisticated" and "limited" (Harris, Mishra, & Koehler, 2009, 393) with "disappointing levels of penetration and success" (Mishra, Koehler, Henriksen, 2011, 23). K-12 teachers are focusing their attempts at technology integration on "presentation software, learner-friendly Web sites, and management tools" rather than aligning with the vision of the 21st-century classroom where digital technologies serve as tools for student creation, collaboration, and inquiry (Harris, Mishra, & Koehler, 2009, 393). While K-12 teachers are incorporating digital technologies, the potential of such tools stretches far beyond the current application.

Alongside the surface-level technology use comes an expectation, frequent amongst teacher education instructors and school administrators, which lessens the demand for effective technology integration. The expectation is that today's preservice teachers have the prior knowledge for successful technology integration simply because they are "digital natives" or members of a generation where digital technologies were always present. Yet, this expectation has not come to fruition, as "few preservice teachers bring the skills and experiences that are needed to transform today's classrooms" (Duncan & Barnett, 2009, 360). The "uncertain, inconsistent, and unequal" focus on technology integration in preservice education programs leads to "infrequent use when the teacher candidate progresses to the classroom" (AACTE Committee on Innovation and Technology, 2008, vii-viii). In other words, when preservice teachers do not experience an "opportunity to learn" how to intentionally integrate technology they will fall victim to the "pedagogically unsophisticated" and "limited" attempts at technology integration. Because of this, teacher preparation programs must prepare preservice

teachers to transform today's classrooms through deliberate technology use, a task that is "not straightforward and may require rethinking teacher education" (Mishra & Koehler, 2009, 61). Preservice teacher education programs must prepare future teachers for purposeful technology integration by creating a curriculum with explicit, metacognitive modeling of an instructor's synthesized technological, pedagogical, and content knowledge as well as opportunities for the future educators to practice the synthesis throughout the duration of the program.

As educators look for ways to teach successful technology integration in preservice teacher education programs, Dr. Punya Mishra and Dr. Matthew J. Koehler of Michigan State University lead the research with their 2006 introduction of the "Technology Pedagogical Content Knowledge (TPACK)" framework. The framework suggests effective teaching occurs at the intersection of a teacher's pedagogical knowledge, content knowledge, and technological knowledge, with a strong consideration of the context (Harris, Mishra, & Koehler, 2009, 393). The release of this framework coincided with the statement, "We do not argue that this TPACK approach is completely new" (Mishra & Koehler, 2006, 1025). As based on Dr. Lee Shulman's original research and development of the "Pedagogical Content Knowledge (PCK)" (Shulman, 1987, 4), TPACK expands to address the relationships between different teacher knowledge domains by incorporating the technological demands of the 21st-century classroom (Mishra, Koehler, 2009, 62). Mishra and Koehler's framework will serve as a focus, or lens, by which to discuss technology integration throughout this paper, as additional scholars deem the framework a success and verify the framework as best practice for all teachers.

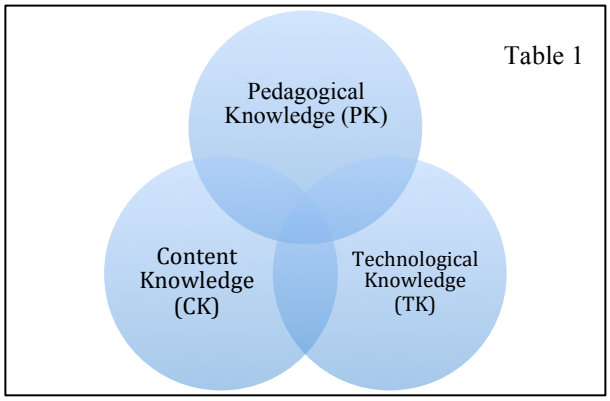
The TPACK Framework

In a classroom setting, all teachers react "on-the-spot" to situations presented at any particular moment—whether it be content, classroom management, technology-related, and more. Those reactions are a synthesis of the teacher's previous knowledge, beliefs about education, and the context of the given moment, which are also known as a teacher's pedagogical and content knowledge (Shulman, 1987, 5). Teachers must learn how to skillfully synthesize within the two knowledge domains of pedagogical and content knowledge to make their teaching more effective. The technological demands of the 21st-century classroom add a new domain to the puzzle—technological knowledge. If the goal of teacher education programs "is not to indoctrinate or train teachers to behave in prescribed ways, but to educate teachers to reason soundly about their teaching as well as to perform skillfully," (Mishra & Koehler, 2006, 1046) then preservice teachers must learn to synthesize the three domains of teacher knowledge. The TPACK framework provides a means for teachers to learn that synthesis.

The goal of the TPACK framework is for a teacher to combine his or her knowledge about methods of teaching and learning (Pedagogical Knowledge, or PK), knowledge of the class subject (Content Knowledge, or CK), and knowledge about the function and uses of technologies (Technological Knowledge, or TK) (Mishra & Koehler, 2006, 1025). Resulting from this complex, skillful merging of knowledge is a teaching that is "more accessible to the learner" (Koehler & Mishra, 2006, 7) because "effective teaching depends on flexible access to rich, well-organized and integrated knowledge from different domains" (Mishra & Koehler, 2009, 61). In other words, strong technology integration is not as simple as using a digital technology in your classroom,

rather the success results from the thoughtful planning across multiple domains of teacher knowledge. "The TPACK framework acknowledges that teaching is a highly complicated practice using flexible and integrated knowledge . . . At the intersection of pedagogy, content, and technology is the specialized brand of teacher knowledge represented by TPACK" (Mishra, Koehler, Henriksen, 2011, 23). What makes the TPACK framework successful for technology integration is the explicit and metacognitive "how" and "why" behind the technology use, not simply the "what." The framework elicits continuous "creating, maintaining, and re-establishing a dynamic equilibrium among all components" (Mishra & Koehler, 2009, 67). It is this equilibrium, as represented in Table 1, that preservice teachers must see modeled within their teacher education programs, alongside other opportunities for development and application, to best address the technological demands of the 21st-century classroom.

Table 1



Pedagogical and Content Knowledge

The equilibrium consists of the synthesis between a teacher's technological, pedagogical, and content knowledge with a strong understanding of the context in which the learning will occur. Within the framework, pedagogical knowledge (PK) encompasses the information and skills that teacher education programs heavily focus

on—how students best learn and what techniques will help them learn. Mishra and Koehler explain, "A teacher with deep pedagogical knowledge understands how students construct knowledge, acquire skills, and develop habits of the mind and positive dispositions toward learning" (2006, 1027). Additionally, topics such as classroom management, assessment, and developmental theories fall within this knowledge domain. To successfully apply one's pedagogical knowledge, a teacher selects methods and strategies depending on the student's current needs. This knowledge domain does not exist in a vacuum; teachers simultaneously call on their content knowledge to make decisions within the process. A teacher's content knowledge, or understandings of the subject he or she teaches, includes "knowledge of central facts, concepts, theories, and procedures within a given field; knowledge of explanatory frameworks that organize and connect ideas; and knowledge of the rules of evidence and proof" (Mishra & Koehler, 2006, 1026). Originally studied by Shulman, the result of a teacher synthesizing these two domains is referred to as pedagogical content knowledge (PCK) and offers a title for the complexity that derives from the relationship between what to teach and how to teach.

Technological Knowledge

As digital technologies increase in both number and capability, the demand to bring them into the classroom increases along with the need for teachers to possess technological knowledge. Technological knowledge (TK) involves having the understanding of how technologies work and the skills to use the technologies. Unlike the early days of digital technologies, "Teachers will have to do more than simply learn to use currently available tools; they will also have to learn new techniques and skills as

current technologies become obsolete" (Mishra & Koehler, 2006, 1024). When a teacher has foundational knowledge and skills in this domain, he or she must understand how the technology works in relation to engaging in the course's content and selecting pedagogical methods and strategies (Mishra, Koehler, Henriksen, 2011, 23). In other words, simply having technological knowledge does not lead to effective technology integration. Rather, the TPACK framework provides teachers with the power to synthesize multiple domains of knowledge to create purposeful lessons that meet the needs of their learners and the technological demands of the 21st-century classroom. Within this framework lies the understandings "there is no 'one best way' to integrate technology into curriculum" (Mishra & Koehler, 2009, 62), and "the TPACK framework does not specify how this should be accomplished, recognizing that there are many possible approaches to knowledge development of this type" (Harris, Mishra, & Koehler, 2009, 403). Constructing a curriculum that ties together these three areas ensures the addition and integration of technology to the classroom is a professional, purposeful, and pedagogically meaningful act.

Technology in Current Teacher Preparation Programs

While teacher preparation programs have curriculum to teach preservice teachers about the use of technology in the classroom, it is primarily focused on introducing specific tools of technology in isolation instead of focusing on how to utilize technology as a tool to strengthen teaching and learning. Examples of such approaches include: "software-focused initiatives, demonstrations of sample resources, . . . structured/standardized professional development workshops or courses, and technology-

focused teacher education courses" (Harris, Mishra, Koehler, 2009, 394). The complexity of integration presented within the TPACK framework often goes over-looked, as the capabilities of the technologies serve as the curricular target even when the phrase "technology integration" is directly mentioned in course titles (Harris, Mishra, Koehler, 2009, 395). The ineffectiveness of the current approaches in technology integration curriculums is explained by the idea that "learning about technology is different than learning what to do with it instructionally" (Harris, Mishra, & Koehler, 2009, 402). Additionally, the ever-changing supply of digital technologies illuminates the need for teachers to go beyond learning a singular technology as they "will have to learn new techniques and skills as current technologies become obsolete. This is a very different context from earlier conceptualizations of teacher knowledge, in which technologies were standardized and relatively stable" (Mishra & Koehler, 2006, 1023-1024). This is where a curriculum with explicit, metacognitive modeling of a teacher's synthesized technological, pedagogical, and content knowledge comes into play.

Methodology and Data Collection

Using the TPACK framework as a lens, I analyzed how Midwestern's—a liberal arts university with professional colleges—teacher education program prepares preservice teachers for successful technology integration. The purpose of the analysis is to unveil the means by which preservice teachers witness strong, purposeful technology integration in conjunction with the development of their pedagogical and content knowledge. Reviewing the ways a specific teacher education program aligns its teaching with the TPACK framework allows for an exploration into the ways preservice teachers

are currently experiencing technology integration and opens the doors for conversations regarding the program's success at preparing its teachers to teach to the technological demands of the 21st century classroom.

At Midwestern, preservice teachers are required to complete one course on technology in education. Additionally, the college possesses a list of technology proficiencies that set the expectation of preservice teachers to be current on emerging technologies, find unique ways to use technology for better instruction, and become efficient in their practice through technology. These proficiencies are explored throughout various courses with the understanding that they should be developed by the time the preservice teacher completes the program. Through the examination of four teacher preparation courses at this university, I explored the ways preservice teachers encounter a curriculum with explicit, metacognitive modeling of a teacher's synthesized technological, pedagogical, and content knowledge throughout the duration of the program. Selected based on the presence of technology in the course, the courses include:

- **Course A:** a face-to-face, entry-level course on technology in education required by the teacher education program
- **Course B:** a face-to-face, block of courses covering developmental theory, special needs, and other concepts of education
- **Course C:** an online course on middle school curriculum and instruction
- **Course D:** a hybrid course focusing on young adult literature.

Data was collected through questionnaires given to the course instructors as well as through access to archival data from class websites and the university's learning management system. The archival data consists of course syllabi, assignments, discussion forums, readings, and additional resources (i.e. videos, images, hyperlinks,

etc.). The data collected from these preservice teacher education courses identifies the ways course instructors utilize technology, model purposeful technology integration, and aid preservice teachers in their ability to synthesize their technological, pedagogical, and content knowledge.

Findings and Analysis

Each course offers a different perspective on the approaches for teaching preservice teachers to purposefully integrate technology in their classrooms, but the ultimate success factor in preparing preservice teachers for purposeful technology integration derived from the instructor's transparent metacognitive modeling of the synthesis between his or her technological, pedagogical, and content knowledge throughout the duration of the course. In other words, the more an instructor described his or her thoughts regarding "how" and "why" he or she taught in a particular way and integrated technology in a particular way, the more the preservice teachers were able to grow in their understandings of purposeful technology integration. The results from each course, provided below, share insight into the means by which technology integration was addressed and an analysis of the success of that approach.

Course A

Throughout this entry-level course on technology in education, preservice teachers encountered a snapshot of surface-level technology use, which often focused on the functionality of the technology rather than the vision of successful technology integration. Course objectives focused on preservice teachers accessing web-based sources, developing proficiencies in word processing, email, and presentation software,

using computer-related terms, describing important considerations involved with the selection of technology resources and the potential of technology to impact student learning, and articulating a philosophy of education that demonstrates understandings of technologies. The preservice teachers worked to meet these objectives, oftentimes bypassing the depth and higher order thinking necessary in the last two objectives, through technology-focused classroom activities and independent projects. For example, preservice teachers taught a minilesson that required them to use one digital technology, created a technology toolkit of digital technologies they may like to use in their future classrooms, and selected a technology of their choice to present on in a poster session. Simultaneously, preservice teachers were expected to have knowledge of the National Educational Technology Standards and the TPACK framework.

This course appears to capture the expectation of preparing preservice teachers for successful technology integration, but when one looks beyond how the course appears on paper he or she may discover that this course simply perpetuates the "limited" technology integration as defined by Harris, Mishra, and Koehler (2009, 393). As stated in the course syllabus, the intent was for preservice teachers to leave with an understanding of presentation software, word processing, and computer-related terms, an act that Harris, Mishra, and Koehler deem "pedagogically unsophisticated" (Harris, Mishra, and Koehler, 2009, 393). The attempts at overcoming the focus on surface-level technology use through the creation of a philosophy of education with a focus on technology, introduction of the TPACK framework, and the minilesson project also did not fulfill the potential as preservice teachers continuously focused on the "what" rather than the "how" and "why." In other words, the preservice teachers often skirted around the depth and

higher order thinking necessary to synthesize the three domains of teacher knowledge. A specific example of this can be found through the introduction and application of the TPACK framework, as taught in this technology in education course. The TPACK framework was utilized as a platform for discussing technology integration, but the preservice teachers utilized the framework in a segregated manner. As preservice teachers referred to the framework, they would speak separately of technological, pedagogical, or content knowledge rather than addressing the framework as one, synthesized whole. Evidence of this segregated understanding of TPACK came during the poster presentation project at the end of the course. When asked to explain the TPACK associated with their presentation, the preservice teachers responded with the following format:

- Pedagogy: Teacher/student discussions, student assessment, group collaboration, student's feedback, differentiation
- Technology: QR code, iPad, Smart Phone
- Content: Any type of content

Note that this particular group's explanation is void of a synthesized understanding that represents the equilibrium the TPACK framework captures. Additionally, the response is broad and vague in the descriptions of each domain of knowledge. While the introduction of the TPACK framework appears strong on paper, along with the other objectives for higher order thinking about technology integration, the actual application of the preservice teachers fell short of its potential as preservice teachers were unable to synthesize the three domains of teacher knowledge to purposefully integrate technology.

Course B

Synthesis defines this course on multiple levels with the first synthesis being its block structure, a combination of three different courses necessary for completion of the

teacher education program. The course is centered around a course blog that serves as a home base for all information related to the course: the syllabus, PDF files of course readings, videos, images, info graphics, and hyperlinks. On the syllabus, the instructors share their goal to "open up our individual teaching practices for examination as we attempt to teach in collaboration instead of isolation and to model environments where creative, intellectual risk-taking can happen." Additionally, the syllabus states, "Online material is not skimmable" and "computer-mediated activities will be largely self-directed." Projects and activities included preservice teachers creating a video to capture their personal development and building their electronic portfolios to display their current beliefs about education. For a particular project titled "Practice in Social Imagination," several preservice teachers chose to create an infographic to display their final product after the instructors modeled the use of this instructional technology in prior classes.

At first glance, this course does not have an overwhelming focus on technology; but through analysis, the instructors' synthesis of the three domains of teacher knowledge unveils itself in the form of "a dynamic equilibrium among all components" (Mishra & Koehler, 2009, 67). As demonstrated by the course blog, the instructors are transparent about "how" and "why" they teach the way they do, including "how" and "why" they utilize technology in the course and the expectations they have for preservice teachers in terms of technology use. The combination of the instructors' pedagogical, content, and technological knowledge is so heavily synthesized that it becomes difficult to decipher the exact locations of domain within the course. Through this synthesis, technology is used as a tool, or resource, for learning rather than the ultimate focus or end result. Although the description of the course does not specifically mention "technology" as one

of its objectives, the technology proficiencies are still captured in conjunction with the pedagogy and content of the course. Resulting from this synthesis is an opportunity for preservice teachers to witness a model for successful technology integration as well as an opportunity to hear teacher experts reflect on such practices.

Course C

This multi-layered online course consisted of preservice teachers participating in their own learning online as well as preservice teachers facilitating the online learning of middle school students through the development of a 2-week online course. As participants in the college-level course, preservice teachers used the university's learning management system to complete a pre-course that provided instruction for best online pedagogical practices as well as the actual course itself. Utilizing the learning management system as the central location for instruction, the course instructor provided preservice teachers with diverse resources to expand their understandings of the pedagogical aspects of technology use. Throughout the duration of the course, the instructor posted weekly videos to check in with the preservice teachers on their progress as well as to provide the preservice teachers with transparent remarks about using technology as a learning tool and to model best teaching practices for purposeful technology integration. The responsibilities of the preservice teaching consisted of developing a curriculum and lesson plans to teach an online course to middle school students, writing a classroom management plan, participating in the course's online discussion boards, and writing pre-course and end-of-course reflections. Additionally, preservice teachers completed an annotated web 2.0-tool assignment to make connections between their pedagogical, content, and technological knowledge.

Throughout this course, preservice teachers were provided with metacognitive, transparent technology integration practices as well as opportunities to apply those new understandings through the construction of their own online course. This course is a model for effective teaching as preservice teachers had to rely on their "flexible access to rich, well-organized and integrated knowledge from different domains" (Mishra & Koehler, 2009, 61). The example that best captures the synthesis of preservice teacher's was merging their prior knowledge about their course content (i.e. English, mathematics, etc.), their findings from researching for their classroom management plan, and their understandings of best technology integration practices from the pre-course to create and teach an online course of their own. To aid the preservice teachers in this process was the explicit, metacognitive modeling of the instructor in her own online course as well as the support she provided throughout the duration of the middle school courses.

Course D

As a hybrid form of e-learning, this course on young adult literature utilized both a learning management system and face-to-face meetings to hold class throughout the semester. On the learning management system, preservice teachers were responsible for interacting with one another through discussion forums, posting videos of themselves modeling specific teaching strategies, checking in with the instructor during designated online office hours, and accessing electronic resources such as PDF readings, videos, and hyperlinks. The structure of the course centers on framing questions to guide both the online and in-person components of the course. For instance, preservice teachers explored answers to the question: "How can instructional technology be utilized to improve student learning?" The answers to this question were developed through

discussions prompted by the preservice teachers and instructor, the creation and sharing of "Book Talk" videos to introduce novels in their future classrooms, and reflection on their participation in an online learning environment. Additionally, preservice teachers completed a philosophical syllabus to capture their growing understandings of using technology to improve student learning.

The presence of strong framing questions, as mentioned above, and a model environment rich in metacognitive explanations define the means by which preservice teachers grew in their understandings of purposeful technology integration. As preservice teachers weighed the pros and cons of the hybrid aspect of the course through conversations and forum discussions they expanded their understandings of what it means to purposefully and successfully integrate technology. This course demonstrates Mishra and Koehler's belief that the goal of preservice teacher education "is not to indoctrinate or train teachers to behave in prescribed ways, but to educate teachers to reason soundly about their teaching as well as to perform skillfully" (2006, 1046). Questioning and processing the pros and cons of the hybrid course gave a place for the preservice teachers to "reason soundly about their teaching" through the examination of a model environment. The instructor aided the preservice teachers in this process by sharing her metacognitive processing behind the benefits and areas of growth for the course. In the end, the structure of the course served as a starting point for meaningful conversations about technology integration in K-12 schools.

Analysis

The TPACK framework, a tool for the development of purposeful technology integration strategies, meets success when the user is able to manage a synthesized

equilibrium of his or her pedagogical, content, and technological understandings. In the four preservice teacher education courses, opportunities for future educators to witness an instructor modeling the TPACK synthesis through shared metacognitive processing and to participate in the process of synthesizing the three domains resulted in environments that greatly align with the vision for 21st-century classrooms. While all of the courses possessed the potential for such opportunities, courses B, C, and D truly captured the direction preservice teacher education programs need to progress toward in order to best prepare preservice teachers for purposeful technology integration in their classrooms. The American Association of Colleges for Teacher Education Committee on Innovation and Technology states, "Preservice teachers rely so heavily on the examples or models that are demonstrated during their preservice education . . . Integration cannot be accomplished through isolated technology experiences or without ongoing discussion, modeling, and evaluation" (2008, 94). Courses B, C, and D demonstrate a clear understanding that technological, pedagogical, and content knowledge "co-exist, co-constrain, and co-create each other" within the act of teaching (Harris, Mishra, & Koehler, 2009, 401). The methods by which the instructors of courses B, C, and D personally synthesized the knowledge domains and then took it a step further to share the reasoning behind that synthesis made space for the "ongoing discussion, modeling, and evaluation" that is necessary for preservice teachers to understand the complexities of technology integration.

While Course A contains the potential for the "ongoing discussion, modeling, and evaluation" needed for preservice teachers to grow in their understandings, the course has several areas of growth in terms of preparing future teachers for purposeful technology

integration. Components of the course, such as the stated objectives and introduction of TPACK, presented the potential for the future educators to "question, reflect, and refract on the best times and ways to integrate technology" (Doering, Veletsianos, Scharber, & Miller, 2009, 335). Those understandings were unfulfilled as demonstrated by the preservice educator's segregated explanations of the three domains of knowledge. One determining factor in this result derives from the course's separate objectives and introduction of technologies, where technology served as the focus rather than the equilibrium between the three domains of knowledge. In other words, the preservice teachers attention was directed to question "what" digital technologies exist instead of the "why" and "how" we should use digital technologies as a tool to enhance teaching and learning. The "why" and "how" are essential as preservice teachers need "the explicitness of the TPACK concept at this point in time" (AACTE Committee on Innovation and Technology, 2008, 89) to successfully and purposefully integrate technology into their future classrooms.

Conclusion

As demonstrated by the findings in four preservice teacher education courses, the courses that best supported preservice teachers in the development of the equilibrium known as technology integration were the ones with explicit, metacognitive modeling of an instructor's synthesized technological, pedagogical, and content knowledge in conjunction with opportunities for the preservice teacher to practice establishing the equilibrium through discussions, projects, and class activities. Because successful integration requires such a strong synthesis of knowledge encountered throughout teacher

education programs, “It is generally agreed that stand-alone technology courses are insufficient and inferior to an integrated programmatic approach” (AACTE Committee on Innovation and Technology, 2008, 95). To connect this statement to the four courses studied, Course A most closely resembled a “stand-alone technology course” and became the outlier among Courses B, C, and D, which heavily emphasized the synthesis of the three domains of knowledge.

A possible explanation for the deviation of results in Course A arrives through the early placement of the course in a four-year teacher education program, when preservice teachers possess a limited understanding of content and pedagogical knowledge. Without the prior knowledge and development in understandings of content and pedagogical knowledge, it becomes difficult for preservice teachers to make meaningful connections and truly synthesize the three domains of knowledge. The existence of a technology in education course at the beginning of the programs hinders purposeful technology integration as preservice are often left to “self-direct” their learning of technology integration for their remaining time in the program, thus making technology integration feel like a chore. An increased emphasis must be placed on the constant synthesis of technological, pedagogical, and content knowledge throughout the entire duration of a preservice teacher education program.

How might preservice teacher education programs work to increase the emphasis placed on the synthesis between the three domains of knowledge? In order to progress toward the vision of K-12 classrooms where students and teachers inquire, collaborate, create meaningful works, and utilize technology as a tool for learning, preservice teacher education programs must review their preservice teacher preparation process to ensure

preservice teachers have the means to develop the equilibrium known at the TPACK framework. As Mishra and Koehler reinforce, "Preparing students for 21st-century learning presents a challenge to educators, and requires us to rethink the goals of education" (Mishra, Koehler, Henriksen, 2011, 24). Through this call, preservice teacher education programs are also presented with a challenge to better prepare future teachers of the 21st century for the potential of what K-12 education should be. One solution that works toward preparing preservice teachers for sound technology integration is to consider the curriculum of the preservice teacher education programs. As demonstrated by the findings of the four university courses, a need exists for preservice teachers to receive the continuous support of metacognitive modeling, discussions to question and explore what it means to successfully integrate technology, and space to practice synthesizing their technological, pedagogical, and content knowledge. If the role of teacher preparation programs is to guide "preservice teachers toward the abilities, strategies, and ways of thinking for teaching today and tomorrow," (AACTE Committee on Innovation and Technology, 2008, 226) then teacher education programs must strongly consider the creation of a curriculum with explicit, metacognitive modeling of an instructor's synthesized technological, pedagogical, and content knowledge as well as provide space for preservice teachers to practice the synthesis of all three domains throughout the duration of the program.

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