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Access Is Not Enough: A Collaborative Autoethnographic Study of Affordances and Challenges of Teacher Educators' iPad Integration in Elementary Education Methods Courses

Sheri Vasinda
Oklahoma State University

Di Ann Ryter
Fort Lewis College

Stephanie Hathcock and Qiuying Wang
Oklahoma State University

Research indicates that preservice teachers' understandings of how to integrate technology into their classrooms are dependent upon experience in their university methods courses and in their field placements. These findings place a new responsibility on teacher educators for modeling effective integration of technology into methods courses. This study focused on teacher educators' integration of technology using iPads to enhance teaching and learning in an elementary education teacher preparation program. Four faculty members documented their own technology integration journey through collaborative autoethnography identifying the affordances and challenges of 1:1 iPad integration into their science, social studies and literacy methods courses. The researchers discovered that access to technology alone is not sufficient for faculty members to integrate iPad use in their courses. High quality use of iPads and their applications require time for exploration, experimentation, and practice, as well as professional support and development adding another dimension to the work of teacher educators.

In the past, technologies remained relatively stable throughout a teacher's career. The basic tools for teaching were standardized for most U.S. classrooms: books, paper, pencils, math manipulatives, and overhead projectors (Mishra & Koehler, 2006). Initially, even when computers were introduced as a new tool, they were clustered in computer labs bound by scheduled time and static place (Foulger et al., 2013).

The current climate of rapid change and the pervasiveness of mobile technology, however, offer a new array of unexplored tools and new opportunities for classrooms to capitalize on the mobile learning that happens outside the classroom. This influx of mobile devices characterizes what Harvard professor of business administration Clayton Christensen (1997) coined as "disruptive technology."

In contrast to "sustainable technology," which is established and changes incrementally, disruptive technologies may not have easily and immediately recognized applications and may lack refinement. Smartphones, tablets, and laptops fall into this category. They are pervasive, but educators are just learning their potential for school-based teaching and learning. Because university teacher preparation programs often partner with K-12 schools, faculties want and need to prepare preservice teachers to understand the opportunities and challenges of purposeful and transformative technology integration. To move past a siloed approach to technology integration, which is often relegated to a specific and separate educational technology (EdTech) course, methods courses in each discipline seemed to be a wise and logical choice in which to demonstrate and experience technology integrations that support discipline-based teaching and learning.

Traditionally, the main responsibility of methods courses is to build pedagogical knowledge for teaching specific disciplines, such as science, mathematics, social studies, and reading/language arts. Teacher educators often find that they are still building stronger disciplinary content knowledge while addressing pedagogy. Shulman (1986) identified this specific type of teacher knowledge as pedagogical content knowledge (PCK). This task is demanding for teacher educators, who must not only strengthen content knowledge (CK) but also model pedagogical knowledge (PK) in the delivery of CK to demonstrate PCK.

With the disruption and pervasiveness of mobile devices, more and more K-12 schools are exploring and implementing mobile devices to increase learning opportunities for students. Mobile technology provides new challenges for teacher educators, who currently prepare teachers for teaching and learning environments that neither they experienced as K-12 teachers or teacher candidates experienced as learners. Teachers are now expected also to have technological knowledge (TK) that intersects with CK, PK, and PCK. This integration forms a new teacher knowledge referred to as technological, pedagogical, and content knowledge, or TPACK (Mishra & Koehler, 2006).

Although young people are often referred to as digital natives (Prensky, 2001), others suggest that simply being born into a world of digital technology does not make one a digital native (Eduardsen, 2011; Thompson, 2013). Recently, Vasinda, Kander, and Sanogo (2015) found that preservice teachers did not naturally transfer and integrate their TK to educational practices. In their study of iPad integration in the context of practicums in the university reading and mathematics center, preservice teacher tutors integrated only what their university instructors modeled in class when working with their tutees, indicating that their development of TPACK was dependent upon experiences with digital technologies modeled for students in their methods courses. Preservice teachers tended to prioritize the PCK that they learned ahead of the TK, which resulted in limited TPACK (Vasinda et al., 2015). This finding was consistent with studies that have challenged and disputed the idea of the digital native (Bennett & Maton, 2010; Dresang, 2005; Johnson, 2006; Koutropoulos, 2011; Thompson, 2013).

In a survey conducted by Project Tomorrow's Speak Up (Blackboard, 2013) preservice teachers reported that their experiences modeled by their university instructors represented one of the two most influential factors of their growing TK. The other factor was the technology integration experienced in their student teaching. Similarly, Schuck, Aubusson, Kearney and Burden (2013) identified the need for teacher educators to

implement and model teaching and learning with mobile devices to prepare future educators.

Teacher educators are faced with a new and urgent challenge. Although university faculty members are considered content area specialists with strong pedagogical knowledge committed to modeling and teaching, they may not have well developed TK or TPACK. The understanding of these findings and challenges, led four elementary education teacher educators to study their own mobile technology integration to support curriculum objectives in science, social studies, and literacy courses.

The research question guiding this study was as follows: In content-specific teacher preparation courses, what are the affordances and challenges for teacher educators of integrating mobile technology in contexts of 1:1 access to iPads? Although Gaver (1991) described affordances as both the "strengths and weaknesses of technologies with respect to the possibilities they offer the people who might use them" (p. 79), in this study we defined affordance as the benefits or possibilities that technology provides or makes available (Merriam-Webster, n.d.), sometimes referred to as positive affordances.

We used Hughes, Thomas, & Scharber's (2006) Replacement, Amplification, and Transformation (RAT) framework to help us understand and evaluate the realized and potential benefits of thoughtful technology integrations that support and offer transformative learning opportunities.

Theoretical Framework

Two conceptual frameworks informed this study: Mishra & Koehler's (2006) TPACK framework and Hughes et al.'s (2006) RAT framework. TPACK builds from Shulman's (1986, 1987) theory of PCK, in which the intersection of PK and CK form a new type of knowledge. This knowledge describes effective teachers' deep understanding of how to teach their content with special knowledge about intricacies of the process.

Mishra and Koehler (2006) identified TK as a new kind of teacher knowledge that intersects with PCK. By extending Schulman's PCK model to include TK as a third knowledge domain, additional knowledge interactions are created: technological content knowledge (TCK), technological pedagogical knowledge (TPK), and the integration of all three knowledge domains resulting in TPACK (Koehler & Mishra, 2005; Mishra & Koehler, 2006). Table 1 describes each of these knowledge domains and their unique intersections.

TPACK offers a framework for understanding the complexities of teaching and learning with technology and can help educators choose technological tools that enhance student understanding and are aligned with effective pedagogy. This framework also provides a common language with which teacher educators and preservice teachers can more clearly converse about the multifaceted interactions of pedagogy, content, and technological affordances to support learning. Therefore, the TPACK model (Figure 1) was used as a conceptual framework for university faculty as they planned lessons for their respective students.

Table 1
Brief Descriptions of the Knowledge Domain Represented in the TPACK Framework (Abbitt, 2011; Koehler, Mishra, & Yahya, 2007; Mishra & Koehler, 2006)

Knowledge Domain	Description
Pedagogical	Knowledge of nature of teaching and learning, including teaching methods, classroom management, instructional planning, assessment of student learning, etc.
Content	Knowledge of the subject matter to be taught (e.g., earth science, mathematics, language arts, etc.).
Technology	Continually changing and evolving knowledge base that includes knowledge of technology for information processing, communications, and problem solving and focuses on the productive applications of technology in both work and daily life.
Pedagogical Content	Knowledge of the pedagogies, teaching practices, and planning processes that are applicable and appropriate to teaching a given subject matter.
Technological Content	Knowledge of the relationship between subject matter and technology including knowledge of technology that has influenced and is used in exploring a given content discipline.
Technological Pedagogical	Knowledge of the influence of technology on teaching and learning as well as the affordances and constraints of technology with regard to pedagogical designs and strategies.
Technological, Pedagogical, and Content	Knowledge of the complex interaction among the principle knowledge domains (content, pedagogy, technology).

To evaluate our technology integrations in terms of enhancing learning in our courses, we used the RAT framework. According to the RAT framework, technology is used in one of three ways: Technology as a Replacement, Technology as Amplification, or Technology as Transformation. When used as a replacement, the technology offers no functional difference from the traditional task. For example, when interactive whiteboards are used to project a presentation or instructional video, they replace a pull-down screen and offer no difference in the experience for learners.

Many technologies offer at least some amplification, such as using a word processor rather than a typewriter to afford easy revisions and easy access to tools such as spelling and grammar check, word counts, and thesaurus. The task is not necessarily different, but digital tools make the work easier and more efficient.

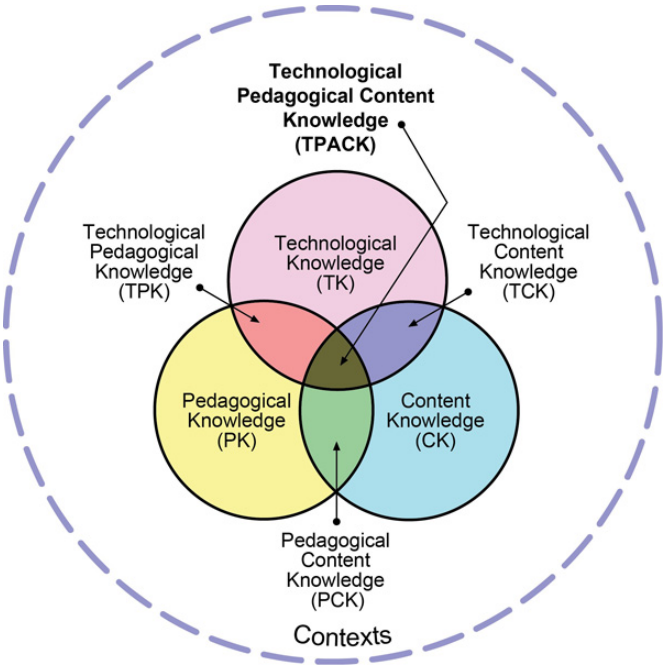

Figure 1. *Technological, pedagogical, and content knowledge (Reproduced by permission of the publisher, © 2012 by tpack.org).*

When technology provides opportunities to do work, create products, communicate, and collaborate in ways that were previously not possible, transformation can occur. The ability to add voice comments, voice type, and work collaboratively and simultaneously within a Google document with colleagues around the globe was previously impossible; thus, the work is transformed by the technology.

Teacher educators have a responsibility to model and demonstrate what is possible using new digital tools and to move from replacement to amplification and, ultimately, transformation. Transformed learning experiences offer more opportunities for the type of engaged learning and innovation skills for both teachers and students recommended by the International Society for Technology in Education (2000).

Models of teaching and learning, such as these, help educators conceptualize the theoretical foundations of their practice and develop an understanding of the best ways to foster student understanding. As university faculty members who taught in K-12 schools for years prior to obtaining doctorate degrees, we consider ourselves to have strong PCK. Our goals for preservice teachers include the development of TCK, TPK, and ultimately, TPACK to utilize the new and rapidly changing technologies that have the potential to enhance learning of both CK and PK to develop PCK and then to model TPACK in our methods courses.

Literature Review

Currently, few studies have investigated the affordances and challenges of mobile learning in teacher education in which teacher educators are the subjects of the study. Baran (2014) conducted a review of research on mobile learning and found that of 42 empirical studies only four examined teacher educators, or faculty, in teacher preparation with mobile

devices. Additionally she found that although there is a trend toward integrating mobile devices in teacher education, challenges were scarcely reported.

Foulger et al. (2013) attempted to provide a snapshot of the current intentional inclusion of mobile technologies in teacher preparation programs. Faculty members identified their efforts in one of the following ways:

- Considered, but rejected: We have considered the idea but have rejected or put off planning for now.
- Beginning to explore: We are beginning to explore the idea.
- Planning phase: We are in the process of developing a plan for adding curriculum about how to teach with mobile learning technologies.
- Isolated instances: One/several instructors/program areas are incorporating how to teach with mobile learning technologies.
- Several instances: Some instructors/program areas are incorporating how to teach with mobile technologies.
- Full implementation: We are fully incorporating how to teach with mobile learning technologies with vertical course alignment in our preservice teacher education curriculum. (p. 23)

The majority of the respondents identified their efforts as "Several instances" followed by "Isolated instances." Only six identified as "Full implementation" and only one as "Considered, but rejected." Foulger et al. (2013) concluded that because mobile learning technologies have yet to become commonplace, more high-quality research is needed in terms of effectiveness of use, best practices in terms of teaching and learning in PK-12, and the expansion of teaching and learning opportunities. Additionally, they recommended that higher education innovators share their experiences and that all teacher educators need to be involved in conversations around mobile learning technologies.

For better understanding of teaching and teachers in the mobile learning environment, Hargis, Cavanaugh, Kamali, and Soto (2013) developed a set of tools that included an observation instrument (to capture teaching with mobile learning devices in higher education), an interview protocol (to explore faculty levels of mobile learning knowledge), and a survey (to document faculty understanding and implementations of the adopted specific mobile learning). The triangulated data showed that (a) integrating functional, relevant emerging technology, such as iPads, into the higher education learning environment increased student and faculty engagement; (b) faculty level peer teaching, support, collaboration as sustained professional development (PD) may lead to magnified changes in classrooms as faculty refine their practices; and (c) faculty training should focus on how to translate mobile learning to student learning outcomes.

This study adds to the understanding of both the affordances and the challenges specific to teacher educators in literacy, science, and social studies methods courses. Our work represents what Foulger and colleagues (2013) called "uncharted territory" that innovative teacher educators are exploring with recognized risk (p. 22). This work also follows up on their recommendations for innovators and early adopters to share their work and engage in conversations around mobile learning technologies. As we read the research on technology integration in higher education, we noticed that most research teams are primarily educational technology faculty; in contrast, we are all content area specialists with an interest in technology integration.

Who We Are

At the time of this study, the four of us were content area faculty members interested in technology integration at a land grant university in the U.S. Midwest. Sheri and Lydia were the instructors of the reading clinical course typically taken during students' second semester of their junior year. Stephanie taught the science methods course, and Di taught the social studies methods course, typically taken during the first semester of students' senior year. Additionally, we all base our approach to teaching and learning on a constructivist theory and student inquiry. (See appendix for author biographies.)

Context: 1:1 Teaching and Learning Environments

Sheri was the principal investigator for two grants that funded iPads used by both faculty members and preservice teachers in our literacy and mathematics center to explore their use in both teacher preparation and tutoring K-8 students (Vasinda, Kander, & Sanogo, 2015). These grants resulted in the creation of two specific 1:1 learning environments in the Literacy Assessment and Instruction course during the second semester of junior year and in the Teaching Primary Math course during the first semester of senior year. Because of these grants and the 1:1 learning environments created, we would be considered what Foulger et al. (2013) identified as a program integrating iPads with "Several instances: Some instructors/program areas are incorporating how to teach with mobile technologies" (p. 23).

When students were enrolled in their senior year mathematics course, they were also enrolled in social studies and science methods courses; thus, Di and Stephanie were able to include the use of the iPad in their courses. We all worked toward continuing to build TK, TPK, and TCK leading to TPACK. This creation of additional disciplinary 1:1 environments offered by iPad access in the clinical mathematics practicum courses led to a multidiscipline faculty self-study of technology integration. A recent introduction to the methodology of collaborative autoethnography by another colleague led to the creation of a study team of literacy, science, and social studies teacher educators interested in technology integration. Our mathematics colleague was not able to participate during this initial collaboration.

Methodology

Collaborative autoethnography is a qualitative research method that builds upon concurrent autobiographical ethnographies in the context of a collaborative group (Chang, Ngunjiri, & Hernandez, 2012). Data for this study included our autoethnographical writings focused on our technology integration in the methods courses, audio recorded discussion notes during our bimonthly meetings, and subsequent expanded autoethnographical writings. These personal stories and reflections became data through the unique lenses of self. Additionally, we pooled our stories together to find commonalities and differences and then wrestled with these stories to discover their meaning in relation to our sociocultural context and the impact on our teaching practices.

Data were generated independently through reflective autobiographical writing. We met to read, reflect, and discuss our writings, which often resulted in assigning ourselves expanded writings on a particular discovery. Ethical considerations were part of our collaborative discussions, which emphasized that the research and writing focused on ourselves, not our students.

Initially, we used open-coding (Corbin & Strauss, 2015) reading and coding our own and each other's journal entries to establish validity and trustworthiness. A second round of axial-coding (Corbin & Strauss, 2015) was conducted to develop categories. After this manual process, we moved our data into Dedoose, a web-based qualitative data analysis software program, which allowed us to work collaboratively in analyzing our code and categories and to identify the frequency or totals of the code co-occurrence, which resulted in 60 analytic codes (a process described by Charmaz, 2000).

We then used three recursive, nonlinear processes to help interpret our codes and categories and establish themes: data organization, analysis, and interpretation (as in Chang et al., 2012). We opted to use both manual coding and Dedoose to compare the identified codes and to ensure qualitative validity.

After initially establishing our codes and themes, we used the analytical-interpretive (AI) writing method to communicate our findings (Chang et al., 2012), which allowed us to continue to collapse and refine our themes as we wrote. The AI style of writing "most closely resembles the traditional format of presenting social science research, beginning with an introduction to the research topic/problem, reviewing the literature, presenting guiding questions and methods employed in the study, results and conclusions" (p. 127).

In implementing AI writing we used a mixed mode, or two forms of writing (Chang et al., 2012): stratified-division writing and reactive writing. Stratified-division writing divides the writings tasks based on the strengths of each researcher, such as editing, researching, composing, and reviewing. Reactive writing is a simultaneous process in which all writers are working together in real-time. This process offers opportunities to react to each other's writing, negotiate deeper understanding, and elaborate. The collaborative autoethnography approach to research enabled us to build a community of researchers and a community of practice while developing our TPACK as we integrated mobile technology in our methods courses.

Findings

Mobile technologies are pervasive, forcing educators to reconsider past teaching practice. By studying our own integration of what some consider "disruptive" technology into our methods courses, we created a space to reflect upon and analyze the affordances and challenges of creating a technology-rich learning environment in our content areas (literacy, social studies, and science). The iPad grant provided an opportunity for us to consider ways in which the instructors and teacher candidates could use iPads to enhance teaching and learning as we developed TPACK and dispositions essential for our 21st-century global society. Our findings address the two foci of our research question: identifying the (a) affordances and (b) challenges of integrating mobile technology in our methods courses.

Affordances

Using the RAT framework to evaluate our technology integration helped us determine if our integrations were simply replacements of traditional methods or if they provided opportunities for our goal of amplification or transformation. We found many instances of amplifications and transformations of technology for building both content and pedagogical knowledge.

Amplification. Amplifications refer to the technology integrations that increase efficiency and productivity without fundamental change (Hughes et al., 2006). We found

many varied instances to amplify learning. All the instructors found that efficiency of instant access to resources was a positive affordance. Mobile technology offered instant access to resources and tools, such as websites or shared collaborative documents, that could be used anytime and anywhere there was Internet access. This instant access to resources amplified the learning opportunity. For example, Stephanie was able to deepen her students' understanding of misconceptions in science with a quick Internet inquiry on the iPads.

> I am finding the iPads very useful for quickly looking things up in class. For example, last week, we learned about misconceptions in science. After watching a video and having a discussion, I challenged the students to spend about 10 minutes trying to find misconceptions that they could share. They came up with great images, such as depictions of the solar system that are not to scale and maps that showcase the United States in the center. Allowing them to look these up on their own in class was useful for promoting conversation and allowing them to see how prevalent misconceptions are in the media. (Hathcock, 2/10/15)

Being able to instantly search to follow up on an unanticipated opportunity to reiterate and expand a point made in class amplified the opportunities for PCK. Stephanie modeled inquiry, a pedagogy we encourage, in an attempt to strengthen students' CK on science misconceptions. The impromptu inquiries Stephanie was able to facilitate *could have* been done with traditional resources, but she *could not have* done them immediately with such an extended reach. Mobile devices amplified that process.

In literacy, Lydia's students used iMovie to create videos to help articulate understandings of literacy concepts they were incorporating in their lessons. Prior to the inclusion of student-created videos, she found that her students were challenged by trying to articulate their understanding of literacy concepts. Doing additional research and representing their thinking with a multimedia product strengthened their understanding, but could have been accomplished by writing a paper.

Sheri's students created collaborative spreadsheets in Google Sheets to respond to texts in real time so that every student in the class could read all of their classmates' responses as they were created, rather than posting sticky notes to a classroom chart. In Stephanie's science class, lab dissection using a virtual frog simulation was discussed and debated. In the social studies course, the inclusion of online PD modules hosted by the Library of Congress, allowed Di's students to complete the PD to develop their ability to analyze and access online primary sources. These simulated experiences offer opportunities that would not be so easily available; however, the authentic and visceral experience cannot be duplicated with a simulation.

Transformation. Transformations (Hughes et al., 2006) refers to creating learning opportunities and products that were not possible prior to these mobile digital technologies. One of the transformation opportunities Sheri found involved the discovery of the difference between vowels and consonants. In the past, she had students use small hand-held mirrors to watch the difference in mouth positions and airflow between vowel sounds and consonant sounds. When she did not have enough mirrors for the class, she had them use the camera feature on their iPads to serve as a mirror.

Using the Chatterpix animation app, which combines photos and voice recordings, the students took photos of their mouth positions. Students created animations with their photos, in which they drew a line across their mouth positions with their fingers and audio recorded their discovery of the differences between vowel and consonant sounds. This action created an animated photo that talked on the replay.

As students giggled while participating in the process, Sheri overheard a student say, "Well, we'll never forget this!" and she thought, "Exactly!" This creation of a multimedia animation in a manner of minutes was not possible without the affordance of this particular app. The student-created, multimedia product transformed the learning from something static that could not previously be captured into a memorable learning artifact for CK development that also modeled TPACK.

This creation of a multimedia animation in a manner of minutes was not possible without the affordance of this particular app. The student-created, multimedia product transformed the learning from something static that could not previously be captured, into a memorable learning artifact for CK development that also modeled TPACK.

Di created other transformative learning opportunities with virtual field trips and associated lesson plans in social studies. In the past, she just talked about virtual field trips and showed a few still photographs. Using the iPads, the whole class explored places such as Ellis Island and the Smithsonian Museum on virtual trips. They took this a step further by creating an elementary-age-appropriate lesson plan based on the virtual field trip.

We have each found the potential to transform the learning by creating opportunities that were not possible prior to these mobile digital technologies. We designed and experienced both planned and spontaneous transformation events, which made us aware of its potential for increased PCK and TPACK for our preservice teachers.

Challenges

We identified four major challenges when implementing and modeling TCK, TPK, and TPACK: limited knowledge of technology applications, technology glitches, concern about students' inappropriate use of technology, and tensions with time. As we began writing, analyzing, and continuing our discussion of these challenges, we noticed an overarching theme of tensions with time that intersected with each of these challenges.

Limited Knowledge of Technology Applications. One of the most consistent challenges we faced was limited knowledge of the technology applications available. Lydia summarized this issue, saying, "There are so many things I think technology can do and support, but I don't always know how to do it (Wang, 10/9/2014)" The lack of TK was evident in our inability to implement TPACK.

Sheri illustrated this lack of TK when discussing a new technology integration possibility, noting, "I really wanted to use Evernote in place of the composition notebook, and I even wanted to use one class for a control group and the other as an innovation group. Then I couldn't wrap my brain around it" (Vasinda, 10/15/14). Even though she is an avid user of Evernote, she could not figure out how her use of Foldables (Zike, 2008), engaging folded paper organizers of content in their academic reading notebooks, could be accomplished with the online platform.

We found that being on the forefront of this integration left us with few resources guiding us, resulting in more need to develop TK, which, again, required more time. Stephanie wrote about needing time to explore.

> I would still love to find apps that would complement our science and pedagogy learning. I have a list of science apps that a colleague at another institution compiled, but sadly, I have not yet taken the time to go through them. It just seemed like the semester slipped away from me. (Hathcock, 12/15/14)

This acknowledgement of seeing the potential of particular technologies, having lists of resources, or even firsthand experience with an app, indicates our TCK and TPK. Without time for exploration and practice, however, we still felt a sense of limited knowledge of technology applications in terms of appropriate implementation in our methods courses, or simply TK.

We initially identified our need to develop more TK, but we also knew that we were not technologically illiterate or inexperienced. We already had PCK and were technology users and appreciators, but our lack of TK, knowing how to implement the use of an app as a teacher rather than as a single user, often prevented us from implementing new technologies with our classes. Our knowledge of the tool's whole-class use was incomplete. There are more aspects to learning to use the apps than at a surface level or product creation level, and it takes time and practice to figure this out.

When we put particular tools to use in ways that supported our content and matched our pedagogy, we sometimes experienced technology glitches in terms of sharing, posting, and connecting, such as when posting student-created work or sharing a set of digital word sort cards to all iPads. Our TK, specifically our understanding of how to use the applications all the way to sharing and connecting, posed a challenge.

Technology Glitches. Our theme of technology glitches referred to those times when something did not work as anticipated. These situations were sometimes out of our control, as when all students tried to connect to the Internet taxing the system in terms of bandwidth (since resolved), but often they were part of our limited knowledge. We could explore and practice an app and set up its use for our class, but we could not practice the sharing and whole class use without the class.

Sometimes glitches were related to limited knowledge of how to use the app in a class setting as opposed to our single user practice. In order to develop or to try new ideas in class, we had to experiment. We found we had to be more comfortable with potential failure and technology glitches. Sheri wrote about one such technology glitch after developing a virtual word sorting activity in an app called iCard Sort. The affordance of creating a set of virtual sorting cards on one device can be shared, or "blasted," to all devices at the tap of a button.

> Finally ready to share and make the 1:1 environment a reality with iCardSort blasting, but it wouldn't work. This is not something you can practice prior, because it is a sharing issue. I had to demo it under the doc camera instead (need to learn how to connect my iPad in [classroom] 201). (Vasinda, 2/2/15)

These glitches were frustrating in terms of time, too. After preparing an exam review with an interactive app so that students could use the iPads to respond to review questions, Sheri could not get the slides to advance. She reflected, "The clock kept ticking. They were nervous about this test, as it contains lots of technical vocabulary and concepts. I could feel mutiny in the air as precious review time slipped away." (Vasinda, 11/13/14)

While some of these failures and glitches led us to shy away from trying additional new technologies, Sheri, in particular, seemed to view these experiences as a challenge that she intended to overcome. After what she called "an epic fail," she wrote about persistence in the face of these glitches. "I think I'll try it again as a check in for reading responses with just two or three slides so I'll have less invested and it will be easier to try out with smaller consequences" (Vasinda, 11/13/14).

Concern About Students' Off-Task Use of Technology. Another challenge we identified was inappropriate student use of technology, which intersected with a fear of lost instructional time, even if for just a handful of students. The affordance of efficiency through instant access to programs and information that technology brings also provides students access to personal social networks, or that Faustian bargain in which for something gained, there is something lost.

In this instance, the affordance of instant access to web-based educational resources has a flipside of instant access to anything of a student's choosing, such as unrelated websites. We each noticed a few instances of off-task use of the iPads in our courses. For example, a student in Di's social studies course used class time to search for shoes. Stephanie saw the use of mobile devices during labs as both a positive and negative, again highlighting that Faustian bargain. She wrote,

> I'm noticing that my students are quick to whip out their phones and iPads during labs to take pictures of what they're doing. Those few minutes they spend Snapchatting and Instagramming their photos are minutes that could otherwise be spent on the lab itself. I haven't asked them to stop because I see it as a positive indication of their interest in the lab, but I'm not sure if that's the case. (Hathcock, 10/13/14)

On the day of Sheri's "epic fail," she noticed the following:

> So, they answered the first question, and I watched one student make a screenshot of it on her laptop and another snap a pic with her phone. They were not the same questions as the exam and I had hoped to make the Pear Deck available for review after, but I'm noting how students are ready to take photos on their phone of my composition book or something like the Pear Deck screens when a test in involved. (Vasinda, 11/13/14)

These students were not off task, but if the review app had worked, they would not have been able to make a screenshot of practice exam questions.

Tension With Time. When discussing our various challenges, we found that they often intersected with the theme of tension with time. So many of our entries included the mention of time. There was not enough time to develop our knowledge of new technology applications in addition to our other faculty responsibilities, which left us with limited knowledge in some technology applications. When implementing new technology, glitches resulted in lost class time.

Not only did we need time to explore resources, we also found the need to practice using programs and apps to explore the potential inclusion of technology to support PCK, which involved time. This tension with time resulted in a challenge in reaching our goals, improving our practice, and the amount of time available during a day, as illustrated in the following excerpt:

We got an email from the TECH Playground, which included Pear Dec and another similar looking platform called Kahoot. I'd heard about Kahoot at the [Rockriver] EdCamp and looked at it as well. I looked at some online videos, and thought I might try it rather than Pear Deck, but the practice video didn't let me experience what happened when I clicked on an answer, so I went back to Pear Deck and prepared an extensive review. That morning before going to class, I accessed it from my phone as a student and was excited about how the interface worked on the phone and left confidently for class. (Vasinda, 11/13/14)

This exploration Sheri described took place late at night, as other job-related obligations took up the working days. It takes time to play with new applications and get comfortable with a climate of ever changing technology. Additionally, exploring and applying the application alone does not guarantee the implementation in class will go as envisioned and planned.

Tensions with time became a factor when we experienced technology glitches during class. When an iCard Sort concept development activity did not blast to all the iPads in the room, or when everyone could not access the collaborative response sheet in Google Docs, the troubleshooting took precious class time. Whether caused by our lack of experience or Internet challenges, we sometimes had to take extra the time to troubleshoot and try again. There were no experts to help us, but we, the students and instructors, persevered and figured things out. Once we worked through these problems, or glitches, we had opportunities to discuss the value of using the technology versus traditional responses with our preservice teachers and most often the affordances to amplify or transform were evident.

Finally, we sometimes found some students using technology for their own personal purposes during class, such as when Di observed a student shopping for shoes and Sheri had a student "cheering up" another student by showing her something on Facebook. These off-task behaviors resulted in lost classroom learning time – even if just for a single student. On the other hand, Snapchatting and photos in Stephanie's class could have been part of a note-taking strategy for the lab and not off-task social networking.

The affordance of amplification we found was juxtaposed with on-task and off-task instant access, highlighting Faustian bargains and creating more tensions with time. As our classrooms are opened up to the virtual world, students have access to all resources: educational and recreational. We currently do not have resources to control the access and, as Stephanie often muses, should we? These are, again, some of the uncharted territories we navigated during this study.

Discussion

In this collaborative autoethnographic study, we explored uncharted territory and we did, indeed, feel like explorers, as we identified ourselves as content and teaching specialists rather than technology experts. When we experienced the joy and satisfaction of technology integrations that supported our students in ways that surprised and delighted them, we felt the thrill of new discoveries. In terms of affordances of technology integration, we found themes of amplification and transformation based on the RAT framework (Hughes et al., 2006). These affordances appeared to support our students' learning and kept us intrigued and motivated to continue our work toward integrating mobile technologies.

We found more challenges than affordances, which were collapsed into the four themes: limited knowledge of technology applications, technology glitches, concern about students' off-task use of technology, and tensions with time. As reflective practitioners, we acknowledge the good but focus on the challenges and working through them. We also wanted to contribute to the body of knowledge on challenges as, according to Baran (2014), they have been scarcely reported.

Most of the challenges were not related to the affordances of the technology, in terms of tradeoffs but, rather, the barriers to our integration. Because of the rapid development of iPad apps, often we simply did not know what apps might support our work. Like some of

our K-12 partner school colleagues, our limited knowledge of technology applications stemmed from navigating this uncharted territory.

It also stemmed from disruptive technologies. When we consider the change in technology integration during our careers, we felt the difference between rapid disruptive technology and incremental sustainable technology (Christensen, 1997). The advent of mobile technology and harnessing its use for education changes rapidly rather than incrementally. We experienced successes in our K-12 careers with sustainable technologies and found the transfer to more disruptive technologies bumpier.

This finding is corroborated by a study of four innovative private universities' iPad integration process conducted by Burke and Foulger (2014). They reported that each of these innovative universities identified critical challenges in increasing faculty knowledge and staying abreast of change. As we garnered more experience, we started to understand more of what is included in the use of mobile technology in our classes, such as how to transfer student created work from the device to digital places to post work or share resources between devices.

Our successful integrations provide such notable transformations in student learning and understanding that the challenges did not outweigh the benefits that were within our grasp. We continue to be excited about possibilities we see with various apps and online resources to support us in developing preservice teachers' content knowledge and helping them communicate and share new understandings while we model constructivist practices of technology integration.

Our biggest discovery is that access to devices is not enough. Simply having the devices did not make the integration easy or seamless, and our personal use was not enough preparation for classroom use (as also noted in Jones, 2001). When we reflected at the end of the year, some of us had made specific changes to our course planning that purposefully included specific technology integrations to support some specific aspects of our content. Others discovered that they still saw technology integration as an in the moment, or spontaneous, event that was more student initiated, which reinforced our understanding that access is not enough.

Purposeful and thoughtful planning is necessary for transformative learning, or even amplified learning, which takes additional time. In terms of the TPACK model, lack of TK often prevented us from implementing new technologies with our classes – not surprising given the rapid nature of app development for mobile devices such as iPad. Additionally, limited knowledge has been identified as a barrier to technology integration by other researchers, as well (Baran, 2014; Foulger et al., 2013).

This lack of understanding seems to work much the same way that a lack of either CK or PK leads to a lack of PCK with beginning teachers (Shulman, 1986, 1987). We were challenged pedagogically by analyzing our integration choices and juxtaposing them with our theoretical perspectives. This juxtaposition created a tension for us as teacher educators, because we are considered experts in our particular disciplines and have strong CK. Also, because we are teacher educators and experienced teachers, we have strong PCK. One of the main findings of this study suggests that we need more time and more support to learn about and implement mobile technology and applications in our methods courses.

Among the few studies exploring faculty mobile technology integration in teacher preparation programs, lack of time is a consistent factor (Baran, 2014; Foulger et al., 2013). Earlier studies of computer integration also included time as a critical factor in technology

integration (Jones, 2001; Samarawickrema & Stacy, 2007). Searching for apps that supported our PCK was time consuming, as was learning how to implement them in our courses. Putting apps into practice required playing with them on our own first and often involved determining how to share among devices, as well as how to share and post student-created products.

This tension with time is in ironic opposition with our finding of efficiency as a factor of amplification, in terms of the ability to search quickly for information or to collaborate easily on Google Docs or Google Slides. As we continue to reflect on our practices and findings, we also continue to discover more complexities such as these.

Implications and Recommendations

The primary responsibilities of higher education faculty members are to instruct courses, conduct research, and provide service. Each of these components of our job is time consuming and requires high levels of expertise. Knowledge of and experience with mobile technology and associated applications and programs are additional areas of expertise (Mishra & Koehler, 2006) in which we need to develop competencies as appropriate to our content areas.

Developing TPACK adds a new responsibility for teacher educators and a fourth component to an already crowded plate. The sweet spot is when we are able to combine the three traditional components by integrating our teaching, research, and service, so we can make time for this new responsibility. For example, part of Di's teaching load was to supervise student teachers in Costa Rica, her service was organizing the International Internship Program and placement of student teachers, and her research investigated students' growth of cultural and global competencies.

Adding this fourth component, or dimension, to our jobs intersects with both developing knowledge and tensions of time. Schuck et al. (2013) recommended creating a professional learning community (PLC; DuFour & Eaker, 1998) to support technology integration in teacher education. Their findings suggest that creating a PLC can help teacher educators establish a safe and committed environment to learn, take risks, and share their experiences of implementing mobile technology in teaching and learning in their disciplines.

Hargis et al. (2013) also recommended faculty peer teaching and collaboration to support and sustain PD that has the potential for change. Interestingly, our collaborative autoethnographic method and design formed a natural PLC. Sharing our successes and challenges has propelled our practices forward in terms of thinking about how we integrated technology and sometimes why we did not or could not. We envision PLCs as a place to try out the challenges of sharing resources between devices in a safe testing ground to avoid some of the technology glitches we experienced.

Additionally, we noticed in the literature that many teacher preparation programs, including our own, provide stand-alone technology courses for preservice teachers. Recently Mouza & Karchmer-Klein (2013) posited that one standalone course, even when integrating content knowledge, may not provide the depth of experiences needed for preservice teachers to have clear ideas about technology use in their future classrooms.

Earlier, Polly, Mims, Shepherd, and Inan (2010) found that preservice teachers who experienced technology integration in their methods courses in addition to their educational technology course reported having a better understanding of how to use

technology in their own teaching and came up with more ideas on how they could use technology with students. As Vasinda et al. (2015) found, preservice teachers with access to iPads in reading and mathematics practicum courses did not naturally transfer and integrate their TK to educational practices unless they experienced and practiced with digital technologies in their methods courses. If methods courses are silos of content without the integration of mobile technology, and preservice teachers do not experience integration of mobile technologies in their preservice classrooms,, these concepts and pedagogies may not transfer to their practices.

Finally, during our continued use of collaborative autoethnographic techniques of writing, reading, reflecting, and discussing, we noticed that the literature and research on technology integration in teacher education is primarily done by educational technology faculty members rather than content area faculty members, which made us consider the campus resources available to us in our own college. We identified the need for more technology PD to support content specialists' TPACK.

Next steps for us include collaborating with our educational technology colleagues. This strategy will provide a partnership of reciprocity, in which content specialists learn how to best integrate technology in pedagogically sound ways, thus developing TPACK. Educational technology faculty members can develop understandings of content area intricacies and challenges developing more CK that leads to broader TPACK for them. Schuckrney et al. (2013), who were teacher educators, interviewed experts in mobile learning to help guide their understanding of mobile technology and applications in education as part of their PLCs. We suggest that continual collaboration with similar experts can facilitate teacher educators' learning and inclusion of mobile technology in content area methods courses, which is in alignment with Hargis et al.'s (2013) recommendation that frequent sharing of teaching practices among faculty can accelerate adoption of new and effective approaches.

By inviting participation, partnering with our educational technology campus colleagues. and providing varied resources (face-to-face support and online, self-paced), space, and time, we hope to support our own continued development of TPACK and support the rest of our faculty, as well. We are motivated to continue this work by modeling what is possible, so our future teachers will, in turn, make their classrooms a place of possibilities.

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Appendix
Author Biographies

Sheri Vasinda
Oklahoma State University
sheri.vasinda@okstate.edu

I have over 20 years of K-12 experience as a classroom teacher and literacy specialist in U.S. public schools and am finishing my fifth year in higher education. I was considered an innovator in both school reform and technology integration in my K-12 school district. My technology integrations were the result of the lead of and collaboration with a then master's student in educational technology, Julie McLeod. Following her as the real innovator, we implemented LOGO programming, digital portfolio (McLeod & Vasinda, 2008), and other web-based contributions (McLeod & Vasinda, 2008, 2009a, 2009b). This collaboration sparked my confidence for new and sometimes independent innovations, such as podcasting Readers Theater (Vasinda & McLeod, 2011, 2013, 2015a, 2015b) and using Nintendo DS for developing math fact fluency. I again find myself considered an innovator at the university but not always feeling like one.

Di Ann Ryter
Fort Lewis College
daryter@fortlewis.edu

I started my 20-year teaching career as a Peace Corps Volunteer in Jamaica. I continued to teach social studies in American and International Baccalaureate accredited high schools abroad in the United Arab Emirates, Japan, and Tanzania. I began working in higher education as a teacher educator in 2008. In this role I consciously considered how to incorporate appropriate technology in my social studies methods courses, which included both content and pedagogy. Despite the fact that technology is part of the courses I instruct, I continue to feel that there is more I can do to keep up with and implement current technology to support and enhance the teaching and learning of social studies.

Stephanie Hathcock
Oklahoma State University
stephanie.hathcock@okstate.edu

I spent 8 years as a classroom teacher in the Midwest and eastern United States. In my teaching career, I have always welcomed the use of technology. During my K-12 teaching career, I was often the first adopter of a new technology within my building and experienced successful results doing things like blogging with students and using probeware. I see the need and desire for my preservice teachers to integrate technology into their teaching and view myself as a catalyst to their increased knowledge, awareness, and appropriate use. I am relatively new to higher education, and as such, am grappling with embracing technology within courses that I am developing.

Qiuying (Lydia) Wang
Oklahoma State University
qiuying.wang@okstate.edu

Born in China and educated in China, Great Britain and the United States, my view of education was shaped through my interaction with people from different perspectives, and through experience by navigating between the clash of Eastern and Western values in education. I am open-minded, cutting edge and a chance-taker with the innovation in

education. As a higher-education faculty member for over 20 years (and as a Literacy faculty for a decade) with teaching experience in multiple settings in my home country and in the U.S., I am comfortable in my own skin most of time. With recent and ever-growing numbers of mobile devices in K-12 classrooms, I feel that it is imperative that future teachers learn and teach with the same tools.