Cultivating Future 21st Century Literacy Teachers: An Examination of the Perceptions of Pre-service Teachers and Technology Integration

Chrystine Mitchell
York College of Pennsylvania
Cmitchell4@ycp.edu
Abstract:

Preparing pre-service teachers to teach in the 21st century is the goal of most teaching programs, yet graduating teachers are still entering schools unprepared to use technology in meaningful ways. This research focuses on three cohorts of pre-service teachers who took a three-course literacy block using a modeled approach to teaching literacy with technology. Using a qualitative exploratory design and content analysis (Stelmer, 2001), pre-service teachers’ voices were analyzed to investigate what contributes to their understanding of technology integration and how their perceptions are shaped by coursework and field placements. The findings generated important implications about teaching with technology in regard to technology integration not being a one-size-fits-all model, the pre-service teachers perceived confidence being conditional, and exploration opportunities being integral to successful application. This study serves as a foundation to consider how and in what ways technology can be used to help prepare future teachers to be ready for 21st century classrooms.

Keywords: technology integration, pre-service teachers, teacher preparation, 21st century literacy learning
“Today’s students need and deserve the skills, strategies, and insights to successfully exploit the rapidly changing information and communication technologies that continually emerge in the world” (Larson, 2008, p. 12)

Teaching K12 students the skills and strategies necessary to thrive as active contributors in a participatory culture (Jenkins, Purushotma, Weigel, Clinton, Robison, 2009) requires teachers to be adept at integrating technology in seamless ways that both engage learners and contribute to their growing understanding of 21st century scholarship. Therefore, teacher educators must illustrate for pre-service teachers how to integrate both innovative technology and the way it can enhance learning for students. Pre-service teachers are change agents (Kidd, 2013), yet teacher educators cannot assume that pre-service teachers value and utilize digital technology in meaningful ways on a consistent basis (Hutchison & Wang, 2012). Future educators need to understand that, “students are entering an age when knowledge of technology is a necessity and not a luxury” (Gambrell, Malloy, Marinak, & Mazzoni, 2015). So, it seems that preparing future teachers to face the unique challenges of teaching in the 21st century is not only an area of great prominence for teacher educators, but it is also a professional responsibility.

This increased use of digital tools is transforming the way teacher educators can share information, connect with one another, and what it means to be literate (Beach, 2012). An important consideration for teacher educators is how we are preparing pre-service teachers to teach in the 21st century and how to equip them with the tools and experiences to make a successful transition into the classroom. The responsibility is then thrust on universities and teacher educators to prepare future teachers for this changing landscape where the population of pre-service teachers need experience using and teaching with digital literacies.
The purpose of this study was to investigate pre-service teachers’ perceptions of pedagogy while infusing technology and how their experiences help or hinder their conceptions of teaching elementary school in the 21st century. Kolb (2008) advocates that pre-service teachers need to be supported in their technology integration by seeing everyday pedagogical strategies modeled daily, and this study investigated an approach to elementary literacy instruction that resulted in pre-service teachers using multiple modalities of technology through exposure and application of digital literacies practices in both their college classroom and through their field placements.

The primary research question that informed this study is: How do undergraduate pre-service teachers perceive the inclusion of technology while instructing and assessing elementary literacy practices? The two underlying questions that helped to clarify pre-service teachers’ perceptions are: 1) What experiences help to shape their beliefs about teaching with technology? and 2) How do their perceptions shape pre-service visions for future practice? The coursework and experiences are significant in order to consider how these components work in tandem and also isolation to contribute to pre-service teachers’ perceptions.

Theoretical Framework

The study was grounded using two primary principles: (1) Technology and other media sources provide elementary students a form of access to text and appropriate instructional tools, and (2) Pre-service teachers are actively constructing their own vision for future practice during coursework and fieldwork. Mishra and Koehler’s (2006) TPACK Framework (Teacher Pedagogical Application of Content Knowledge) help to substantiate these principles about pre-service teachers’ understandings of technology integration. The TPACK (Mishra & Koehler, 2006) framework delineates the knowledge a pre-service teacher must have in order to effectively deliver instruction where technology enhances learning. The TPACK framework
describes the coinciding areas of knowledge that are integral for teachers to teach content
effectively with digital mediums and applications. The TPACK is illustrated using three
overlapping circles of knowledge: pedagogy, content knowledge, and technology. The
intersection of all three circles is the goal for instruction where teacher knowledge and
instruction promote elementary students’ development of digital literacy practices. Grounding
instruction using the TPACK framework helps teacher educators conceptualize how technology
can be incorporated into teaching and learning. It allows teacher educators to carry out effective
instruction, but also addresses the personal and social influences that are integral to make
teaching with technology meaningful and sustainable.

A separate construct uses the work from pre-service teacher beliefs and vision (Mercado
& Turner, 2010; Vannatta, 2000) and the growing body of literature regarding technology
integration among pre-service teachers (Abbitt, 2011; Koehler & Mishra, 2009). An important
consideration is also how action research has aided pre-service teachers in their inquiry and
evaluation of teaching practices (Hagevik, Aydeniz, & Rowell, 2012; Hulse & Hulme, 2012).
Although the TPACK (Mishra & Koehler, 2006) provides the foundation to consider the
knowledge pre-service teachers must draw upon, it is also important to understand that pre-
service teachers often struggle to integrate technology in their field experiences due to
pedagogical complexities and educational contexts (Dawson & Dana, 2007). Yet, researchers
find that opportunities for pre-service teachers to utilize technological tools in field experiences
courage technology integration and help shape perceptions and attitudes toward technology
integration (Mason, 2000).

Students’ understanding of text and literacy practices continue to involve digital mobile
devices (Cardullo, 2013; Wilson, Briere, & Nahachewsky, 2015), and researchers identify that
eBooks and mobile devices can change the face of education (Neuman & Gambrell, 2014). Part of developing pre-service teachers’ TPACK (Mishra & Koehler, 2006) involves allowing pre-service teachers’ learning about technology through modeling and engagement (Vannatta, 2000) and developing a high level of digital literacy themselves while simultaneously learning how to use a range of technologies within digital pedagogies (Milton & Vozzo, 2013). Most importantly, if pre-service teachers can navigate the technological landscape, they can help their students understand how to draw upon various modes to meet the challenges of the twenty-first century (Borsheim, Merritt & Reed, 2008).

These frameworks are important to pre-service teachers and illustrate the many areas of knowledge a teacher must possess in order to be successful in teaching content with technology. For a pre-service teacher, these areas of expertise are developing. As teacher educators consider the TPACK and the overlapping areas of expertise necessary to thrive in 21st century classrooms, it would seem obvious that any teacher new to the field would struggle to teach without opportunities to apply those simultaneous understandings. Therefore, it is important to support them in their exploration of how to integrate technology and to find ways to problem-solve while using their developing knowledge.

**Methodology**

This study sought to understand undergraduate pre-service teachers’ perceptions about technology integration, and a qualitative research design was employed to collect data to answer the research questions (Patton, 2002). This method allowed for the analysis to reveal the pre-service teachers’ contextual worlds through their experiences. This qualitative research analyzed how the experiences of pre-service teachers helped to shape their visions for future practice.
Partial class time was spent sharing, modeling and then later scaffolding the use of different websites and applications during content area methods instruction.

**Selection of Participants**

This study took place at a small, suburban commonwealth campus with approximately 3200 students. During the junior year, elementary education pre-service teachers are enrolled in a three-course literacy methods block and a corresponding 2-day field placement for two hours each day. The PSTs were from three cohorts with ten to twelve PSTs in each cohort. The participants were recruited from the PSTs during their senior year once they had already completed their junior-year coursework. The first cohort was conducted as a pilot study and consisted of 11 PSTs. The remaining 23 PSTs were participants in the larger study that helped to broaden and fill out the themes originally developed through the pilot study.

The senior year placements are in stark contrast to the junior-year experience because the placements are in under-resourced schools. This divergence from the PSTs’ junior-level placement made it important to build a sense of how the pre-service teachers perceived their TPACK knowledge when faced with the realities of their current urban school placements with limited abilities of implementing technology. This massive divergence between field experiences offers a space to reflect on what they learned and how it helped cultivate the pre-service teachers’ visions of future practice.

**Modeled Approach to Technology Integration**

During the three-course literacy block numerous opportunities for modeling, exploration, and application were given to the pre-service teachers for both instructional and assessment purposes. Pre-service teachers explored various web sites and applications through classroom activities and assignments. The assignments incorporated the concurrent elementary field
experience placements where the pre-service teachers provided a limited amount of instruction to children and used classroom experiences to implement class assignments in placement classrooms. Table 1 below outlines the courses and the technological applications introduced and applied in the courses. It illustrates examples that were used in class and the assignments that demanded technological literacy knowledge. The list below is not exhaustive but highlights some of the ways PSTs were exposed to different tools expanding on literacy objectives.

Table 1: Digital Applications and Assignments for Junior Block

<table>
<thead>
<tr>
<th>Literacy Course Name</th>
<th>Examples of Digital Applications and Websites</th>
<th>Assignments utilizing Technical Applications</th>
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| Teaching Reading in Elementary Schools | • Shadow Puppet app  
• Sock Puppets app  
• Chatterpix app  
• [www.popplet.com](http://www.popplet.com)  
• Trading cards app  
• Talking hippo app  
• Glow Paint app  
• Nearpod app | • Website development  
• Research technological application |
| Teaching Writing in Elementary Schools | • [www.pixton.com](http://www.pixton.com)  
• [www.emaze.com](http://www.emaze.com)  
• [www.kidblog.com](http://www.kidblog.com)  
• 30 Hands app  
• CapDis app  
• Book Creator app  
• [www.twitter.com](http://www.twitter.com)  
• [www.wonderopolis.com](http://www.wonderopolis.com) | • Digital photo journal  
• Action research with technological application  
• Blogging |
| Teaching Children’s Literature | • [www.arounder.com](http://www.arounder.com)  
• Goosechase app  
• News-o-Matic app  
• Epic app  
• QR scanner/generator app  
• Socrative app  
• [www.pinterest.com](http://www.pinterest.com)  
• [www.padlet.com](http://www.padlet.com)  
• Photo collage app | • iMovie creation  
• Action research/inquiry findings about technological application |
This approach was developed to include technology in the pre-service teaching experience. Currently, no educational technology courses exist in the elementary education program for the pre-service teachers. Integrating technology into pre-service teacher education through the use of modeling, using, implementing, and applying their learning, the pre-service teachers are able to develop their own TPACK (Mishra & Koehler, 2006) knowledge so they can create instruction that is focused on literacy goals rather than the technology they use.

Data Sources

Anecdotal records, artifact analysis, questionnaires and focus group interviews were the methods of data collection used consistently with qualitative research design (Merriam, 2002). The data collection and analyses aimed to clarify how pre-service teachers perceived their experience and to understand whether their experiences helped or hindered their general conceptions of teaching literacy with technology. Anecdotal records were taken during class sessions where the pre-service teachers were using different websites and applications. The researcher recorded observations of the pre-service teachers’ reactions, discussions and overall use of the technological tools to teach literacy concepts. The researcher also collected a baseline reflection regarding the role of technology on literacy instruction at the beginning of each term. A final vision statement was collected at the completion of the course and was later analyzed to identify patterns about their beliefs for future practice.

A questionnaire adapted from Schmidt, Baran, Thompson, Koehler, Shin, and Mishra (2009), which was correlated with the TPACK framework was distributed to the consenting participants. The questionnaire included both closed-ended Likert scale survey items as well as several open-ended questions. Focus group interviews were conducted following the administration of the questionnaire to gather more information about the pre-service teachers’
experiences and gather contextual evidence about their reflections. The interviews captured a more thorough understanding of the artifact analysis and provided an in-depth discussion of the pre-service teachers’ beliefs about their perceived role of technology in classroom instruction. Focus group interviews give researchers an opportunity to view the world we do not experience ourselves (Krueger & Casey, 2008). The importance of capturing the pre-service teachers’ beliefs was an attempt to more profoundly understand the phenomenon being investigated.

**Data Analysis**

The researcher analyzed the data with specific strategies and across multiple sources in an ongoing and systematic manner using content analysis (Taylor-Powell & Renner, 2003) to identify categories and patterns of how pre-service teachers perceive teaching in the 21st century and what shaped those conceptions. Assertions generated from across all data sources and interpretive commentary connected the assertions. Merriam (2002) describes content analysis as analyzing interviews, field notes, and documents so a researcher can seek to find themes and reoccurring patterns of meaning. The researcher transcribed the interview data after listening to the recordings several times, looking at the information from different lenses. The researcher looked for counterpoint evidence and identified emerging categories. The researcher continued to compare categories and themes from each of the data sources within and between artifacts to look for patterns and outliers. Descriptive statistics were used for the survey items to analyze the pre-service teachers’ responses and look for patterns in their perceptions about teaching with technology. The researcher triangulated the different data sources through the comparison of multiple data sources. The multiple sources confirmed interpretive accuracy and validated the
themes. As a means of maintaining reliability, the researcher also used member checking with participants.

**Role of the Researcher**

Data collection took place with one course instructor. I was both the instructor and the researcher in this study. The role of the qualitative researcher ranges on a continuum from a fully-present researcher and a co-participant, to a researcher who experiences the investigation, without being fully involved in the events (Rossman & Rallis, 2003). I had an active role in the study because I am the course instructor implementing this specific technology-driven approach to literacy instruction. I tried to extricate myself as the center of this work by collecting data following PSTs’ coursework and by also allowing them to speak freely about their experiences. Therefore, I collected data after grades were submitted so there would not be evidence of coercion. Creswell (1998) suggests that the qualitative researcher often takes on the role of the active learner and tells a story from the participants’ point of view, rather than an expert passing judgment. The researcher’s role as an active learner is especially important in today’s literacy classrooms. Often, the researcher’s own knowledge, within the context of observation or study, constrains or broadens what he/she can observe, and, therefore, he/she is in a position to explain and theorize (Steinkuehler, Black, & Clinton, 2005).

**Findings**

This study offered an opportunity to understand the PSTs’ perceptions more profoundly outside of their junior block experience. The themes generated new insights and offered rich descriptions to clarify the pre-service teachers’ perceptions regarding the preparation of future teachers using technology. The themes identified through the data analysis are: 1) Technology integration is not one-size-fits-all, 2) PST technology confidence is conditional, and 3) Literacy
block learning should include opportunities for technology play/exploration. These themes help to generate new insight into how pre-service teachers experience technology integration as students yet reflecting on its use as teachers.

**Technology Integration Is Not One-Size-Fits-All**

Pre-service teachers shared that they noticed a disconnect between what they learned the previous year and what they had anticipated to use for their senior-year placements and beyond. It did not take long for the pre-service teachers to realize that sometimes learning about technology is how *not* to use it. Teaching with technology does not automatically mean that student learning will be better and the artifacts will be meaningful. During their junior-year the PSTs experienced a model for technology integration that followed Puente's (2006) work, which hinged on the SAMR model. The aim of this approach to technology integration is that technology and digital applications should only be used when they can modify and/or transform student learning and outcomes. The PSTs noted that the junior-year placements used technology differently than those in the urban schools during their senior year. They identified that the technology-use in the suburban school was much more meaningful and relevant. For instance, the student artifacts were entrenched in some kind of literacy practice.

The pre-service teachers’ urban, senior-year placements were much different. They noticed that the focus of technology integration typically associated with district pre-purchased programs and sometimes had no purpose other than to be an “add-on.” In many cases the technology was linked to a district-mandated basal program. Jaime mentioned, “We use programs like Reading Eggs… but it doesn’t get linked to anything else we do.” Donna reiterated, “We put on videos and then just move on to something else.” The PSTs reflected about how technology *should* be used in classrooms, and they were concerned about the
relevance of the technology practices they were experiencing. Felicia remarked, “Throwing elementary students on the computers because the school paid for them doesn’t make it meaningful.” Another PST shared, “We use the Promethean Boards but there are other things we can probably do that would be meaningful and make it more engaging.” They identified that it was a problem when using the Promethean Board typically left the majority of the students at their seats with nothing to do while only one student worked with the board, and they discussed ways this activity could be enhanced using magnetic letters. Furthermore, the mentioned the gap that existed between the two field placement experiences, noting that not having access to the same digital tools does not mean that the technology integration has to be less meaningful. Brooke shared, “Many of the same experiences could be done with one computer, but my teacher just uses the computer for practice games.” Jess echoed that sentiment by adding, “The kids could create something or use the computers to go on virtual field trips or research different things.” The pre-service teachers clearly recognized that the SAMR criteria for technology to modify or transform instructional practices was not being met.

One of the major findings is that technology experience and learning that took place the previous year in one context was not yet applicable in their current context because of some of the constraints they faced. For instance, they found it difficult to make the connections themselves. The PSTs described their mentor teachers as not being comfortable using technology. Practicing teachers often find it difficult to integrate technology into instructional practices (Turbill & Murray, 2006). In this case, both the mentor teachers’ discomfort and the PSTs’ disconnect from what they had previously learned contributed to digital tools not being utilized appropriately. There was an understanding that what they had learned the previous year could not just be replicated in another context. This awareness is incredibly important as they
navigate a space where they understand that a meaningful integration of technology is going to look and feel differently in different learning spaces.

**Tech Confidence is Conditional**

Although the PSTs had a high level of confidence about technology integration, there was a limitation to that heightened sense of self-assurance. The pre-service teachers’ confidence hinged on the belief that they may have relevant technological knowledge worthy of sharing with others. The questionnaire revealed that the PSTs had an increased confidence following the LLED block (mean of 4.25 on a 5-point scale). They felt much less confident in providing leadership to others related to technology integration (a mean score of 3.17). This finding is especially important considering that they had already identified that their mentor teachers were not comfortable using technology. If they were not confident in providing leadership, then they will be less likely to try something different than what their mentor teacher was doing, or even showing their mentor teacher a new way to incorporate a digital tool.

Clearly the introduction to different tools and the technology experience during the PSTs’ junior year is a small part of what could be integrated because the tools and resources that could potentially be incorporated into classrooms is endless. Yet, the PSTs had a diverse digital toolkit to begin to utilize, but they still felt ill-equipped to universally integrate technology with complete confidence. Their confidence using different tools was subject to the tool’s relevance. As an example, Stella shared, “If I am in a school that does not provide me with professional development with the technology they use I don’t know how confident I will be.” Similarly, Felicia recounted, “Last year I felt confident but this year I am a bit doubtful of my own abilities because the only experience we had with technology was in our literacy courses junior year.” Fortunately, Laura had a number of technology-rich experiences in her multiple field
placements and said, “I feel confident because I have seen so many different things being done in different placements. I have a number of experiences to draw from.” Jess recounted, “Although my cooperating teacher did a lot of work with the iPads and Chromebooks, I just don’t remember some of the specifics. I remember a few of the apps, but I don’t feel like I know enough to share the information with my cooperating teacher.” The pre-service teachers’ confidence was site and experience-specific. They had difficulty feeling confident about their technological knowledge in a new context where technology was being used differently.

They found that the experiences during their senior year focused on programmatic connections that did not help them increase their understanding of how to meaningfully deliver literacy instruction using technology thus limiting their knowledge and confidence. A teacher educator goal of providing multiple tools, experiences and connections is to allow pre-service teachers to build their TPACK knowledge (Mishra & Koehler, 2006) while another important goal is to build their confidence using technology. Unfortunately, PSTs’ confidence hinges on unmanageable variables from different contexts. The rich experiential learning afforded to the PSTs did not sustain them through the technology terrain of another school context.

**Technology Exploration is Essential**

Being immersed in opportunities to explore digital tools and reflect about how they work in different contexts helped shape the PSTs’ understandings about how technology can be integrated into elementary content-area instruction. For example, Talia remarked, “I used to think that technology hinders education more than it enhances it, but now I think that meaningful uses with technology can help make instruction more focused.” The pre-service teachers spoke specifically about the course assignments that helped illustrate the ways in which technology could meaningfully support instruction and assessment. Two of the projects that were mentioned
were the iMovie and the technology-integration action research project. Figure 1 is a screen shot of the iMovie Talia produced for her second-grade field placement classroom. She was able to effectively integrate technology into a literacy lesson related to a unit on the life cycle of a butterfly.

Figure 1: iMovie Example for Pre-Service Teacher

Similarly, Felicia remarked, “Our technology-integration action research project offered me an opportunity to explore forms of online collaboration in classrooms with full support from our instructor, which I would not have time to do in another situation.” She commented about being afforded that opportunity and how it offered her a valuable learning opportunity to reflect on what she could do differently with elementary students in her own classroom. Felicia designed her technology inquiry project around the use of Google Expedition with third grade students. She learned about the preparation, the teaching, the modeling needed, and the pitfalls one can face. This opportunity allowed her to experience a redefining task (Puentedura, 2006) that would not have not been possible without the technology.

The pre-service teachers discussed specific applications used during the junior methods
coursework and the ways the apps and sites were used in class and also how they could be used with elementary students. The application of certain digital tools such as Goosechase (an online scavenger hunt) and Shadow Puppet (a video-creation tool) offered the pre-service teachers different opportunities that were aligned to authentic tasks for specific teaching purposes. Not only were they modeled, but the PSTs were given a specific task relevant to course content they needed to complete using these (and other) tools. They were also given time to reflect about these experiences and how they might be used in elementary classrooms. The PSTs were also given space to explore other self-identified digital tools and share those with one another. Figure 2 is a screen shot from a class activity that demonstrates how the PSTs’ were able to multimodally define literacy. They combined using an applicable app with a meaningful task, thus having them collaborate about what it means to be literate in today’s classrooms.

Figure 2: “What is Literacy?” Activity

The PSTs also identified that, “Collaboration is essential,” identifying the importance of working together and building from one another’s ideas. Stella shared, “I think about the inquiry project I did last year with blogging… I would never be able to do that in my current placement because
we only have 6 laptops available.” Laura also iterated, “We had the space to do the action research projects… we had opportunity, guidance, feedback and time.” Brooke reported, “We were able to work a partner on most of our projects so we could use each other to build our ideas.” Stella again shared, “The time we had to share our ideas with the whole group, ask questions and give suggestions gave me direction when I was stuck.” The pre-service teachers valued these types of opportunities, and felt the time and integration of content, pedagogy and technology allowed them to use different elements of technology. Muharis & Ziemke (2015) advocate that teachers should use some element of a digital playground when allowing students “try” different digital tools. The “play” time and means for applying digital tools in different ways is essential to allowing PSTs a chance to understand the uses for different technological while experiencing some of the pitfalls that may exist.

**Discussion**

The findings from this study help connect important points for discussion related to the research questions. Martin (2008) describes digital literacy as

the awareness, attitude and ability of individuals to appropriately use digital tools and facilities to identify, access, manage, integrate, evaluate, analyze and synthesize digital resources, construct new knowledge, create media expressions, and communicate with others, in the context of specific life situations (p. 167).

Our job in educating future teachers is to reflect on how teachers can do this while teaching our particular pedagogy. One of the important findings from this study identified not only issues related to technology but also the inequities between the different schools where the pre-service
teachers were placed. One experience was more meaningful because of a number of factors that included: 1) it had more technology available, 2) there was more support for teachers to learn new technologies and take risks, and 3) it allowed PSTs to work together to engage in innovative practices. The combination of the two divergent field placements was valuable for the PSTs because they had experience with a technology-rich school context and one with limited means. It also illustrates the need for teachers to be responsive in providing meaningful and varied opportunities with technology. Varied opportunities need multiple approaches to teaching using technology. In particular, the PSTs of tomorrow’s schools need to learn how to integrate technology in all school contexts, whether there is limited or an overabundance of access to technology and digital tools. Specifically, as teacher educators we need to provide experiences where pre-service teachers learn how to promote digital equity and enrich opportunities for elementary students having access to only one iPad or a finite number of devices (Author & Turner, 2018).

The findings reveal that the pre-service teachers found great value in being exposed to different digital tools and opportunities to problem-solve, explore and generate a technology-based inquiry finding their own answers, which is an important 21st century skill. Toyoma (2015) proposes that technology in education should, “amplify whatever pedagogical capacity is already there.” Teacher educators need to move into redefining technology integration by providing opportunities to demonstrate how teachers can create new tasks that only digital tools can help to support, transforming teaching and learning with technology. Using the TPACK model (Mishra & Koehler, 2006) helps to provide general understandings where teachers, faculty members and schools can show specific uses to augment, modify and redefine instruction using technology. Specifically, in this context, by using the TPACK as a model for course design and instruction,
technology modeling and application was a built-in part of the literacy methods coursework. It was not an add-on, but rather the goal was to use the overlapping circles of knowledge as the foundation for course design, activities and assignments.

It is important to provide both general and more focused tools and opportunities. Similarly, there should be opportunities for discussion and exploration to determine different ways of using different tools. By providing time to reflect, pre-service can begin to unpack and discuss how the experiences in a digital-rich school could be applied and adapted for students in a school with limited technology and resources so they could also experience the same important 21st century learning. PSTs need to take risks and try strategies that incorporate content knowledge, pedagogical knowledge and technological knowledge regardless of the teacher whose classroom the PST is placed in and the field placement.

These findings indicate that pre-service teachers each valued their experiences exploring, practicing and integrating technology into instruction and assessment. Even pre-service teachers who did not embrace technology and noted that they were “technologically challenged,” later commented that technology has the potential to enhance literacy instruction. They valued the opportunity to try different tools in different contexts while applying relevant literacy skills. They similarly appreciated using different apps and digital tools with students, thus illustrating how teacher educators can help to form PSTs’ growing TPACK incorporating pedagogy, content knowledge, and knowledge of technology. The PSTs recognized that technology needs to be used in meaningful ways for authentic purposes. For instance, allowing elementary students to create multi-media book teasers to illustrate their understanding of a book applies a number of both traditional and 21st century literacy skills. The findings reveal that the PSTs have varying
degrees of what the technology integration will look like based on their own personal and professional experiences, yet they look forward to future professional development to continue their growth.

**Implications for Teacher Educators**

In consideration of the research questions and what it means for future and practicing teachers, it is important to consider a few implications for teacher educators and 21st century teacher preparation. First, because technology is not a one-size-fits-all blanket that can be applied to any school context, it is important to demonstrate for PSTs ways in which they can use technology to teach their content as well as offer them a means to reflect and problem-solve when they are in school contexts with limited means. One way to offer PSTs some additional support is through introducing them to resources available on the web such as those on social media, through podcasts and blogs, and through YouTube channels (Author & Turner, 2018).

Similarly, as teacher educators are cultivating spaces where technology integration is meaningful and relevant, they can model how teaching with digital tools is about transforming instructional and assessment practices to prepare *all* students to think critically and fully participate in 21st century classrooms. So instead of university faculty asking PSTs to put their technology away in classrooms, they can instead teach them *how* to use it appropriately during lectures and classroom activities. For instance, the use of Twitter, back channels, and text organization applications can be illustrated and applied. Creating a space for social networking or collaboration among PSTs will enable them to problem-solve and also support their continued growth.

The goal of technology integration is to illustrate enriching experiences for K12 students. It should take them outside the classroom, into spaces that expand their thinking and deepen their
Puentedura’s (2006) work with the SAMR model (Substitution, Augmentation, Modification, and Redefinition) offers teacher educators a vehicle for using integrative practices. The goal is to redefine instruction, allowing PSTs a space to create learning tasks and assessments where technology is used in ways otherwise inconceivable. An example of this is having elementary students creating multimedia content as a means of assessing understanding. The learning that occurs when a student creates an iMovie is far more consequential than writing a paper about instruction and assessment. Opportunities such as these can help to boost confidence, and similarly provide an application-based learning environment where PSTs can add to their growing TPACK. Similarly, by offering PSTs time to put the pieces together, to process and to share how technology is being used (and not used) in classrooms we as teacher educators can provide a space to problem-solve and share possible solutions to the challenges in today’s classrooms. By offering PSTs opportunities to discuss and reflect we are offering them a chance to learn from one another. Hicks and Turner (2013) said it best: “Digital literacy is no longer a luxury, and we simply cannot wait to build the capacity in our students and colleagues, as well as ourselves” (p. 64).

Since the researcher was also the course instructor and therefore able to use the results of this study to inform instruction, there have been multiple adaptations to the courses. A few of the enhancements for the literacy methods coursework involves the means and dissemination of the assignments and activities that utilize technology. For example, in lieu of submitting papers to the course instructor as a means of reflection, the PSTs instead post to an online portfolio site that is often used in elementary classrooms. The course uses the online app/platform Seesaw to post and reply to one another’s reflections about their literacy field experiences. Similarly, the course now requires the PSTs to blog and connect in professional learning community (PLC) groups similar to an elementary classroom. This exercise helps them write for a different audience and learn how to connect and collaborate with peers. The collaboration has extended beyond the typical university classroom walls, and the PSTs now connect
with other PSTs at a university across the country while they explore technology integration through collaborative blogging. As a result, the across-university blogging resulted in an expansion of the PSTs’ professional learning and also served as a conduit for meaningful technology use (Author, Friedrich & Appleget, 2018). Another course enhancement is the way in which the PSTs evaluate and integrate digital tools. The PSTs are now required to curate a selection of apps and websites to consider the multiple groups of students they may encounter and the apps’ important considerations including: strengths, weaknesses, (teaching) opportunities, and threats (SWOT). As this course continues to be adapted, PSTs will need to align their lessons to state standards and also specifically address how the International Society for Technology in Education (ISTE) standards will be aligned through their lessons in order to make the technological integration intentional and be aligned to the instruction and assessment outcomes for the curriculum.

**Conclusion**

This study is important because it identifies a growing professional need for teacher educators to include technology into education methods courses. Given modeling, a chance for exploration, opportunities for application and a means to demonstrate growing knowledge of content and pedagogy through technological approaches, pre-service teachers can identify their role in delivering appropriate instruction utilizing technological mediums. Through communication and dialogue occurring between groups of pre-service teachers they can glean important insight, share relevant challenges for technology integration and create experiences to make meaningful experiences for their students. This work illustrates how pre-service teachers perceive technology integration and how it begins to unpack what considerations, experiences and opportunities help to prepare future teachers for the changing climate of schools. In addition, it illustrates the ways in which teacher educators can enhance their content methods coursework to include technology. Twenty-first century learning is an important goal, yet the onus relies on teacher educators to adequately prepare those facing the future classrooms.
References


