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Pre-Service Teacher Preparation for Technology Integration in Literacy

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Abstract

This case study of a pre-service teacher education course on integrating technology in literacy curriculum focuses upon the following research questions: (1) What experiences do pre-service teachers have integrating technology into literacy curricula and (2) How does implementing a technological inquiry impact their preparation? The 22 pre-service teachers were partnered with in-service elementary teachers who were implementing an inquiry question as part of their professional development. This study focuses upon pre-service teachers' initial reflection forms regarding their level of experience with technology integration prior to the course in their pre-service education and their final interviews reflecting on their experiences working with in-service teachers. The researchers used emergent coding and discuss seven focused and three theoretical codes.

Keywords: technology integration, literacy, teacher education, professional development

Teachers are using technology more than ever as they experiment with not only teaching their students digital literacy, but exploring new means of teaching, such as online or hybrid forms of instruction. In other words, the pandemic has heightened the need for teachers to use digital tools as exemplified by the 2021 survey of *What's Hot in Literacy* (Cassidy et al., 2021) finding digital literacy a "very hot" topic. This research suggested that although these digital skills are needed more than ever for teachers, schools often do not have the funding or means to prepare teachers in this area. Further, teachers need direction not only on how to use these tools themselves, but how to meaningful integrate digital tools into curriculum (Howell, 2018; Howell et al., 2021). Research shows that even recent teacher education graduates, often assumed to be *digital natives*, needed training on how to integrate digital tools into their curriculum (Lei, 2009). Thus, the authors address this gap in the research in this study pairing both in-service and pre-service teachers in their quest for technology integration specifically in literacy curriculum and discuss their findings related to teacher education in needed areas of research, theory, and practice. Research on these partnerships and their role in teacher education regarding technology is an especially needed area of research (Nelson, 2017).

This case study focuses upon a pre-service teacher education course at a Midwestern university in the United States related to technology integration in literacy curriculum. This course served mainly undergraduate students majoring in elementary education, who would then be licensed K-6 teachers. We will focus here upon pre-service teachers' experiences being paired with in-service elementary teachers who were part of a larger study (see Howell et al., 2021). The in-service teachers (ISTs) developed an inquiry question asking how they could make writing a more digital, participatory process. The pre-service teachers (PSTs), the focus of this study, were partnered in teams with these ISTs to help the ISTs carry out their inquiry during this

semester long course. The research questions guiding this case study during that partnership and the PST course were the following: (1) What experiences do PSTs have integrating technology into literacy curricula and (2) How does implementing a technological inquiry impact their preparation?

Theoretical Perspectives

Theoretical perspectives such as new media literacies (NML; Jenkins, 2006) define the literacy skills needed to fully participate in an environment in which new media are fundamental. This perspective suggests the need to move beyond simply accessing technology, although that is still certainly important, and making sure once students have these tools, they are interacting with them in ways meaningful to today's culture. Technology is defined as any application of knowledge for purpose (Williams, 2015). The terms technology and digital tools are used interchangeably to refer to this focus on computer integration. In their original white paper, Jenkins (2006) defined NML skills as the following: play, performance, simulation, appropriation, multitasking, distributed cognition, collective intelligence, judgment, transmedia navigation, networking, and negotiation. Visualization was later added and discusses the need for students to be able to both understand and create visual interpretations of data and is a complement to simulation included in the original eleven (Reilly, 2013). This addition shows that these skills are dynamic and will fluctuate as new media is created and demands new literacy skills. Many of these skills, such as simulation, appropriation, multitasking, and transmedia navigation among others, involve multimodality, a concept important to other theoretical perspectives of literacy such as multiliteracies developed by the New London Group (1996).

Multimodality is understanding and creating meaning across more than one mode, or way of interpreting meaning (Cope & Kalantzis, 2000; Howell, 2018; Howell et al., 2021).

Multimodality and the new media literacies are not inherent to students and must be taught, which is why it is imperative teachers understand these NML skills. The New London Group (1996) developed a specific pedagogical framework for this with multimodality, and Jenkins (2006) also argued new media literacies must be taught with specific "resources and processes" (p. 53). Yet, in schools, both frameworks and the concepts they represent remain largely theoretical (Howell et al., 2021), new media literacies for needing to make more specific connections to formal learning spaces and multiliteracies as researchers often forget its pedagogical application in favor of its focus on multimodality (Alvermann, 2017). Further problematic to students gaining these new media literacies is the field of literacy at large, and thereby how teachers are trained to teach literacy, remains fragmented with research calling for literacy teachers in particular to understand more diverse theoretical perspectives (Parsons & Gallagher, 2016). These perspectives often do not include digital tools as even the standards guiding the preparation of literacy professionals, such as those of the International Literacy Association (2018), do not include digital tools in their standards of foundational knowledge as those focus on reading, writing, language, and connections between literacy and disciplinary knowledge. However, programs that are regarded as distinguished for preparing literacy teachers include "technology infused throughout the program" as one of 14 programmatic features that ranked more highly than others at a statistically significant level (Lacina & Block, 2011, p. 337).

Jenkins (2006) calls for this literacy to take place in a participatory culture. This culture is defined as one in which students learn through creation and social collaboration. This creation is set in a digital culture and therefore often includes the use of digital, multimodal tools. Thus, the professional development (PD) for the ISTs focused upon three essential elements: (a) sustained PD, including the gradual release of teacher inquiry; (b) writing as a social practice; and (c) the

use of digital tools to engage students in writing (see Howell et al., 2021). The gradual release of teacher inquiry meant ISTs learned about inquiry topics during a summer PD, developed their inquiry questions with colleagues and thus had both guided instruction and collaborative learning before they were expected to implement their inquiry independently. Due to their roles supporting these ISTs, the PSTs who were enrolled in the aforementioned undergraduate class learned about these essential elements as they worked to support the inquiry these in-service teachers created. In other words, ISTs created questions during their PD to guide their teaching of how writing and digital tools would be integrated, and the PSTs helped them to implement practice related to these questions during the school year. To enact the other two essential elements, ISTs worked during the implementation of teaching around their inquiry to implement digital tools in ways that would encourage their students to use both social collaboration and creation. Thus, these were also elements PSTs learned about during the course and helped the ISTs to enact. This focus of the study aligned with Jenkins (2006) concept of NML needed in a participatory culture and also focused on overcoming obstacles research shows remain for both pre-service and in-service teachers. For example, research shows teachers, especially those in elementary education, lack the training needed to integrate digital tools effectively into their content areas (Parette et al., 2010), and this integration is something they struggle with once in classrooms (Hutchison & Reinking, 2011; Hutchison et al., 2016).

Relevant Research

Expectations of Pre-Service Teachers

Current research shows pre-service elementary teachers expect many challenges in terms of technology integration in their own classrooms, and they have concerns about the problems they will face when they start teaching (Dinc, 2019; Quinn, 1998). Even when encouraged to

experiment with digital tool integration during practicum experiences, many PSTs are still reluctant to actually do so (Bencze, 2010). However, when given the opportunity to evaluate educational technology, such as internet-based resources, PSTs are more likely to use such websites as tools for instruction and communication (Son & Hu, 2014).

In addition, PSTs' self-efficacy toward technology integration in the classroom can increase after having their own inquiry-based learning experiences using technology (Novak & Wisdom, 2018), engaging in practicum student teaching experiences (Al-Awidi & Alghazo, 2012), and being exposed to technology instruction in meaningful contexts (Kaya et al., 2019). On the other hand, some research shows prolonged intense exposure to technology instruction can reduce their confidence over time as PSTs begin to realize how much they still need to learn and keep learning in the future (Lyublinskaya & Zhou, 2008).

In many ways, these findings contradict conventional wisdom about college students and younger teachers. School administrators are increasingly expecting new teachers to be comfortable using technology and, by extension, to effortlessly integrate technology with their instruction based on assumptions all young people have technological proficiencies. However, Lei (2009) surveyed 70 PSTs considered to be *digital natives* about their beliefs, attitudes, confidence, and interest in technology, then evaluated their technological strengths and weaknesses. They found, despite being frequent users and consumers of social/communicative technology, PSTs were unfamiliar with and lacking in experience with content-specific technologies, educational technologies, and technologies to help students with special needs.

What is Currently Being Done in Pre-Service Programs

Kleiner et al. (2007) surveyed 1,439 institutions with teacher education programs for information on the types of educational technology training provided to preservice teachers.

They found 90% or more of the surveyed institutions had teacher preparation programs that taught topics related to technology. To a lesser degree, 80% or more taught the application of technology in assessing student achievement and creating or using digital portfolios. However, just 52% covered topics related to teaching via distance learning. Kleiner et al. (2007) reported such topics were most often covered in preservice teachers' methods courses (93%); although 79% of institutions reported they were taught within field experiences. Seventy-one percent of institutions integrated technology education with existing content courses curricula, while approximately 80% offered some version of stand-alone coursework in educational technology.

In an updated examination of trends in technology related coursework in teacher education programs over a ten-year span, Betrus (2012) surveyed 35 institutions and found an increase of 8% in the percentage of schools reporting they integrated technology with other coursework. The types of strategies used to teach such topics in education programs were examined in a review of existing research that found the following:

> Strategies were used to teach technology to preservice teachers, including integrating technology in all courses . . . using multimedia . . . focusing on education faculty . . . delivering a single technology course . . . modeling how to use technology . . . collaboration among preservice teachers, mentor teachers, and . . . practicing technology in the field . . . offering mini-workshops . . . improving access to software, hardware, and/or support . . . and focusing on mentor teachers. (Kay, 2006, p. 389)

A synthesis of qualitative research on approaches to technology integration by teacher preparation programs yielded multiple key themes (Tondeur et al., 2012). The first theme was the alignment of theory and practice—that is, providing preservice teachers with opportunities to

practice the application of theory in meaningful ways. Secondly, PSTs have access to mentors and faculty members that serve as role models. In addition, they are given opportunities to reflect on the role of technology in education. Learning technology by design through collaborative planning was another key theme across teacher preparation programs. Scaffolding authentic learning experiences and shifting from traditional assessment to continuous feedback embodied prevalent approaches to preparing PSTs to integrate technology with their instruction.

Strengths

Modified curricula for teacher preparation programs focusing on the development of TPACK, technological pedagogical content knowledge (Koehler & Mishra, 2009), have yielded positive results around topics such as information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving (Reisoğlu & Çebi, 2020). Even more so, opportunities to apply learning shortly after being introduced to new theories and tools while having faculty and mentor teachers as models were reported as significant contributors to increased confidence among PSTs (Reisoğlu & Çebi, 2020).

Nelson and Hawk (2020) examined the changes in values and beliefs of 35 preservice teachers after observing technology integration in their field placement. They found being paired with mentor teachers who frequently used educational technology in their classrooms led to stronger beliefs in the utility of educational technology, indirectly increasing PSTs' intentions to integrate technology with their future instruction—especially those participants who observed mentor teachers with high TPACK.

Bullock (2004) discovered through a case study of two PSTs that mentor teachers who actively collaborated with PSTs to develop and implement lessons enhanced by technology were a significant enabling factor to PSTs' integration of technology with their own instruction. In

addition, regular modeling, encouragement, and support from faculty and mentor teachers were reported as significant enabling factors (Adamy & Boulmetis, 2006; Gunter, 2001). Lastly, research has shown authentic learning exercises, such as collaborative planning and reflection, may also positively influence self-efficacy related to technology integration as well as PSTs' intentions to integrate technology with their future instruction (Banas & York, 2014). Thus, teachers are capable of integrating technology, but this capability is not accidental; rather, it is a product of intentional development, collaboration, and planning.

Challenges

Betrus (2012) emphasized technology is often vetted through public use before making its way into the classroom environment. As a result, the technology used in educational settings lags behind that used by broader society and is unlikely to reflect the most recent technological advancements. The advancement of technology creates a moving target for curriculum designers of teacher education programs.

According to Kleiner et al. (2007), other barriers to embedding technology instruction within teacher preparation programs include faculty members' lack of time (87%), training (83%), and interest (73%). Additionally, and unlike at the institutions themselves, the infrastructure at local schools were reported as a barrier for approximately 30% of teacher education programs. Other challenges reported include "lack of training or skill, time, and willingness of supervising teachers to integrate technology into their [own] classrooms" (p. 12).

Current Need for Research

Research suggests single technology courses, mini-workshops, technology infused courses, modeling, using multimedia, collaboration (among PSTs, mentor teachers, and faculty), and practice lead to increases in digital tools used in the classroom and access to quality

resources and support are necessary in the university setting as well as in field placements (Kay, 2006). However, determining which of these strategies is most effective is difficult, but results indicate a positive correlation between the number of strategies used and the amount of digital tool use in the classroom.

Additionally, searches for relevant research on PST preparation for technology integration currently yields more studies on the university programs and faculty than the micro-interactions between mentor teachers and PSTs in their field placements—that is, "Less emphasis has been placed on understanding the impact of field placement observations on a preservice teacher's technology integration intentions" (Nelson, 2017, p. 449). Existing research suggests mentors who regularly use technology and encourage their mentees to do the same have a positive impact on PSTs' motivation and willingness to use technology in the classroom (Franklin et al., 2001). However, the nature of mentor-mentee daily interactions, tools/strategies taught and used, and degree of collaboration are important influencers that need to be further explored.

Thus, when considering future teachers' concerns (Dinc, 2019; Quinn, 1998), reluctance to integrate technology (Bencze, 2010), and the resulting increase in willingness (Son & Hu, 2014) and self-efficacy (Al-Awidi & Alghazo, 2012; Kaya et al., 2019; Novak & Wisdom, 2018) for integrating technology when given meaningful experiences, this study addresses a need for how to engage PSTs in technology integration in applied experiences, specifically when applying literacy instruction in fourth and fifth-grade classrooms.

Method

This study uses a single, common-case study method, which Yin (2014) described by its embodiment of "the circumstances and conditions of an everyday situation" (p. 52). The case of

this pre-service class is common as seen in our literature review in that PSTs are not trained in student teaching experiences specialized in technology integration. The time the PSTs participated in this course, a fall semester, served as the binding of the case, which Yin (2014) defined as boundaries needed in a case to help researchers focus on the unit of analyses.

Participants

The class had an enrollment of 22 PSTs. These PSTs were taking this course primarily as part of their reading endorsement in addition to their elementary major. At the Midwestern university where these participants were pursuing their undergraduate degrees, they were required to pursue at least one endorsement in addition to their major in teacher education. The participants were asked in an initial survey to describe their technological ability. The researchers grouped their experience into levels from basic, below average, average, and above average. Of the 22 participants, the largest percentage (41%) of students considered their technology use average, with 27% considering themselves below that and 32% above. While these students are required to have student teaching observations to be admitted into elementary education, and they each receive teaching experience in both dedicated student teaching experiences as well as student teaching integrated in their methods courses, the students are not required to do any student teaching or observation related to technology integration. Those students pursuing a learning technologies minor (five of the 22 participants) would observe a person in a technology role in the school district, but even those students would not necessarily have an opportunity to implement in their own teaching what they observed.

Data Collection and Analysis

This study focuses on several assignments collected as part of the undergraduate course for these PSTs. We will focus on students' initial reflection forms regarding their level of

experience with technology integration prior to the course in their pre-service education and their final interviews reflecting on their experiences working with ISTs. The PSTs met with their IST partners at least four times over the course of the semester. This study followed Yin's (2014) recommendation of data triangulation as we include both pre-service teacher written reflections and audio-recorded interview responses. The data was coded using elements of a grounded theory method of coding and constant comparison analysis in which the researchers formed initial, focused, and theoretical codes (Charmaz, 2014; Glaser, 1965). Initial codes were developed independently by both authors focusing on line-by-line coding of PSTs' actions and beliefs. The researchers then met and reviewed initial codes until 100% interrater reliability was attained. Forty initial codes were collapsed into seven focused codes according to emerging themes, and those seven focused codes were further collapsed into three theoretical codes, useful for guiding future teacher education pedagogy. See Table 1 for focused codes leading to theoretical codes, which guide our findings and discussion.

Table 1

Focused Codes Leading to Theoretical Codes

Focused Codes	Theoretical Code
● Prior Experience ● Theoretical Learning	Limitations of Present Teacher Education Preparation
● Pros of This Course for Pre-Service Teachers ● Ways Teachers Helped Teachers	What Worked Well in This Course
● Challenges of This Course for Pre-Service Teachers ● Limitations with Teacher Collaborator ● Future Implications	Implications for Future Change

Findings

The authors will discuss here the seven focused codes formed from the forty initial codes: *prior experience, theoretical learning, challenges of the course for pre-service teachers, pros of the course for pre-service teachers, ways teachers helped teachers, limitations with teacher collaborator,* and *future implications*.

Prior Experience

Thirteen initial codes were grouped as these codes relate to the PSTs' experience prior to the course in this study. The codes included the following: *prior technology experience in classrooms, prior experience working in classrooms, prior experience planning lessons, learning to bridge new and previous learning, prior theoretical learning, prior use of technology as reward or recreation, prior focus on content material, prior experience with multimedia project, prior feeling of intimidation with technology, expectations of prior technology experiences, prior pressure from observation, prior regrets of technology use, and students consuming technology prior*. These codes painted an unpleasant picture for both PSTs and students they had worked with regarding technology use. The PSTs described their previous experiences with teaching during their pre-service education as focused on content, with technology included but in a high-stakes environment. Whereas the PSTs were confident in their amount of time spent in the classroom and the teaching experience gained, they did not convey this same familiarity with technology integration. For example, one PST described their practicum experience: "I taught one practicum. I had to research things... I forgot exactly what topic it was, but just some science related things. Other than that, just not too much technology, I guess."

The pressure they instead associated with digital tools came from limited observations in which the PST was supposed to demonstrate their knowledge of content and pedagogy with what seemed to be a nod to technology. This nod was high stakes as it was not the focus, thus

seemingly not as highly valued and for that small contribution was a potential landmine. In other words, technological integration was not worth the risk to the observation of their content or pedagogical knowledge. One PST in particular illustrates this risk when asked about their prior technology integration in their student teaching experience:

Student: If I would have been more risky I would have done something…

Interviewer: You thought of it…it was kind of a risk?

Student: Yeah

Interviewer: You're only in there three times and you don't want to mess up?

Student: Yeah. When I was there they actually had a lot of issues…

The interviewer followed up later with this PST in the same interview after the PST discussed a problematic student use of technology in their previous student teaching experience:

Student: I didn't want to be anybody who started something worse.

Interviewer: A guinea pig?

Student: Yes. Oh, yeah.

Thus, overall, the PSTs were thankful for the opportunity to play with technology in this course not only during their undergraduate class time, but also observing and implementing with their partner ISTs. This experience seemed to help them overcome regrets regarding how they had used technology in previous student teaching experiences which arose in the initial codes *prior regrets with technology use*, *students consuming technology prior*, and *prior feeling of intimidation of technology*. They seemed to regret not letting their students be more innovative and in control with technology. One PST described it:

> Reflecting back on it, it's not really technology integration cause all I was doing was just using it, but the students weren't using it and I wasn't teaching about it, so obviously not a great example of technology integration in that sense.

Theoretical Learning

There was only one initial code in this focused code, which was *theories learned in class*; however, this was the second most frequently referenced initial code. This code pictured both success and perhaps room for growth in PST education. The success was the PSTs had clearly learned the theory of TPACK (Koehler & Mishra, 2009). A representative comment of students speaking about previous technological learning and theory is the following describing TPACK: "But that was the only one I've previously learned about." However, students were less aware of theories that applied technology more specifically to their content knowledge, in this case literacy, such as multiliteracies and NML. Students described these theories as being both useful and new perspectives to them. The following are representative PSTs' discussion of theories learned in the course:

(a) "I really like the new media literacies, that was something I've never learned about before, so I think I latched onto that one."

(b) "I just feel like the new media literacies is more up to date. They are more content specific. I don't know. TPACK was just kind of confusing to me."

(c) "We've talked about TPACK, but I don't think I really had a good understanding of TPACK before. This class, kind of what we talked with about our collaborating teachers, but just the idea that the content still has to come first."

Thus, students either gained perspectives more closely aligned to content they were learning or mentioned how they grew in their knowledge of TPACK because of the course and their relationship with their ISTs.

Challenges of the Course for Pre-Service Teachers

We found the following seven initial codes that were later collapsed into the challenges focused code: *challenge scheduling and communicating with teacher, need to work with elementary students more, challenge not seeing teacher implement lesson planned, challenge of wanting to meet teacher more, challenge of providing more choice, challenge of wanting more teacher feedback, and teaching teachers priority of content*. These codes presented the challenge of having PSTs join an inquiry that had already been designed by an IST rather than being part of that design process. The ISTs had received four days of PD to design an inquiry regarding integrating technology into their writing curriculum. The PSTs did not join the ISTs until they were attempting to implement this inquiry question in their following fall semester pedagogy. Thus, there were several challenges in getting the in-service and pre-service teachers' schedules and communication aligned and in realizing what their respective priorities were once this scheduling and communication had been resolved. For example, one of the initial codes in this focused code *challenge scheduling and communicating with teacher* was the fifth most frequently coded initial code. Furthermore, while the PSTs enjoyed helping teachers plan lessons and learn digital tools to implement in those lessons, they also expressed a desire to see those lessons implemented with elementary students as expressed in the initial codes *need to work with elementary students more* and *challenge not seeing teacher implement lesson planned*. While some PSTs in their partnerships with the ISTs did get to teach the elementary students, some PSTs only helped the teachers. Eight PSTs discussed wanting to work with the elementary

students more as the following PST discussion represents: “It would've been nice to actually be in the classroom and see how the students reacted because she had nothing but positive things, but it's always nice to kind of see it happen.”

Pros of This Course for Pre-Service Teachers

The PSTs under the focused code *pros of this course for pre-service teachers* talked about the value of learning by planning and implementing the inquiry with the ISTs. The initial codes composing this focused code included the following: *learning from seeing technology implemented in classroom, learning to integrate technology, hopes for learning in class, learning new digital tools in course, learning about student ability level, learning about classroom management, learning about educational policy, learning from working with elementary students, learning from seeing how teachers plan with technology, and liking textbook*. While the PSTs did want to see lessons designed with the ISTs implemented with the elementary students more as discussed previously, they did benefit from their partnerships with the ISTs. Two of the most frequently coded initial codes forming this focused code were *learning from seeing technology implemented in classroom* and *learning to integrate technology*, both of which entailed PSTs learning by seeing ISTs doing and, in particular, learning the coordination of technology and literacy. PSTs appreciated seeing ISTs integrate digital tools even if, and perhaps especially when, that integration did not go perfectly. In other words, as the following PST’s discussion highlights, they enjoyed knowing even practicing teachers had to experiment with digital tools, and that experimentation didn’t have to be high stakes nor perfectly successful:

> I think it was a really awesome experience just to see it in an actual classroom. I think that was really beneficial to be able to be in the classroom and see how it was playing out and whether it was successful, or some things weren't successful, and kind of adapting

> because that's a real-life classroom, and that's a real-life instance that may happen. That not everything is going to work and not everything's going to work out the way that you plan, but I think that at the end of the day it's finding those tools that are meaningful, and finding kind of what works, and what doesn't is kind of the task for us as teachers to find out, is what works best for our students and what might not work for other students.

With regard to integrating digital tools and writing, the PSTs especially appreciated the balance of technology and content: "Use the technology to teach the strategy, not the technology, which is something that you talk about in class." Two initial codes, *learning to integrate technology* and *liking textbook* within this focused code included discussion of PSTs learning how to integrate digital tools into writing. The PSTs liked the planning cycle included in Hutchison and Colwell (2015), called the technology integration planning cycle for literacy and language arts, as it helped them focus on the goal of teaching content over technology and helped them to think through not only what tool to use with that content, but why they are using that tool, and how they might have to adapt that tool as technology changes:

> I loved the book, so it was fun to read. And it gave so many resources, and just different types of technology. 'Cause I think that it mostly talked about how, yes, this is like a specific technology. But as time progresses, there'll be a new one, a different version of it. It may not be the same name, but using it more like a resource, that books was really beneficial.

Ways Teachers Helped Teachers

Two initial codes, *helping teacher find resources* and *making tutorial videos for teacher,* made up the focused code, *ways teachers helped teachers.* This focused code showed that the relationship between the ISTs and the PSTs was symbiotic, with the PSTs learning from their

hands-on, practical experience from the ISTs as discussed in the previous section, but the ISTs also benefiting from their relationship with the PSTs. The PSTs helped the ISTs often by helping them find digital tools to integrate into their writing units for content-specific purposes and made tutorials regarding these tools. The PSTs seemed to recognize their role in not only learning but being empowered to help ISTs: "So it was almost kind of like we were more of PD with them in a way." The PSTs mentioned finding this utility of their learning not only for themselves but for the ISTs to be a source of motivation:

> I do think it helped aid my learning, just because it gave me more motivation to actually do the readings, especially when it was including technology, because I knew that this was actually helping somebody. So, normally when I would be reading, I was like, oh yeah, that's a cool technology. I'll write it down and explore it later, but now I had more of a reason to explore it right away.

Limitations with Teacher Collaborator

Three initial codes, *challenge of teacher not understanding their role*, *challenge of teacher reluctance*, and *challenge working with long-term substitute* composed the focused code of limitations with teacher collaborator. These limitations mainly revolved around both pre-service and in-service teachers not being clear of their role within their partnership. During the summer PD, the researchers told the ISTs that the PSTs would be there to help them and left that role broad for the ISTs to both discuss with the PSTs what their role would be and to allow flexibility for this role. For example, here is an example of how one of the PSTs discussed this limitation:

> I remember I was kind of overwhelmed, because like she didn't really know what was expected of us, and I didn't really know what was expected of her at the same time. But I

think that was like the hardest thing to overcome, but then once we got to that, it was like really good.

To overcome this barrier, some of the PSTs wanted to be part of the summer PD that occurred with the ISTs prior to the start of the PSTs' fall class in which they then helped those ISTs implement their inquiry. However, this was not possible at the time due to scheduling and enrollment of the pre-service course. Another challenge was even during the fall semester, changes occurred such as teachers being absent for various reasons, as illustrated by the initial code *challenge working with long-term substitute*.

Future Implications

Three initial codes, *application to future classrooms*, *becoming more open to use at elementary level*, and *learning a new role of teacher* showed key learnings from the PSTs that were then given the focused code of *future implications.* These implications suggested that overall, the partnership between in-service and pre-service teachers was beneficial as it led to the PSTs being more open to using technology with elementary-aged students as well as them learning a more multifaceted role of the elementary-school teacher.

In their final interviews, PSTs were asked the following question: "If I walked into your classroom in five years, and you had your ideal setup what would students be doing with technology and why?" Out of the 27 references in the code *application to future classrooms* that included the answers to this question, the teachers seemed very open to using technology with elementary students. These responses showed PSTs envisioned technology in the hands of students, to have students creating for the purpose of learning content while using digital tools. For example, one PST answered with the following:

> I think I would want to spend a lot of time in the classroom working on using technology for writing as the process. So the pre-writing and the rough drafting and the revising and not only you get computers for one time to type a final paper. I think that that could connect outside of just literacy time.

This response shows that this PST, though she mentions several digital tools prior to this in the interview, is focused on the content goal of students learning "writing as the process." Furthermore, she wants to integrate digital tools not just at the publication stage of this process, as is often the case when digital tools are just thought of as a presentation tool, but, instead, throughout that process. Furthermore, the initial code *learning a new role of teacher* showed that PSTs learned from this experience that they didn't always have to be an expert with digital tools to bring them into the classroom: "I think the main point I took out of there was that we as teachers need to be the facilitator, and I think it said, 'Not the sage on the stage'."

Discussion

Three theoretical codes emerged from the collapsed focused codes as depicted in Table 1: Limitations of present teacher education preparation, implications for future change, and what worked well in this course.

Limitations of Present Teacher Education Preparation

Practice and theory were intimately related in this finding. The PSTs felt that they had limited application or practice of technology in literacy experiences in their teacher preparation, and what little they did have was high stakes, typically only in limited observations where technology usage was a box to check on a rubric. This finding emerged from the focused code *prior experience*. The other focused code making up this theoretical code was *theoretical*

learning. The teachers generally felt comfortable with TPACK but discussed the relevance of learning theories more specific to their content area of literacy, such as multiliteracies and new media literacies. The picture that emerged from these two focused codes is perhaps best illustrated through a metaphor. The PSTs felt that each use of technology in their pre-service experience was similar to a high beam at an Olympic event. The stakes were high; the reward for trial-and-error low when compared to the cost. These focused PSTs were not going to risk their grade, even though they recognized the value of trying technology out in classrooms. However, what they wanted was reward for their bravery, rather than their perfection. In other words, they needed a practice mat, perhaps even a crash mat, where they could use digital tools in trial and error with ISTs and their students and be allowed to fail, yet learn from that failure. The mat in this case could be theory, which, just as in gymnastics where the beam gets placed higher off the ground and mats get more specific as the gymnasts advance, so should theory be more specific in its application as teachers need to use it for specific content areas. As the teachers got braver in their application, they appreciated different theories and could not only use those theories to guide their practice but push back and revise those theories as they were tested in classrooms.

What Worked Well in This Course

Just as PSTs wanted more opportunities for trial and error in classrooms with ISTs and students, they also acknowledge the benefit of working with ISTs, even if their practice with technology integration was not always successful. The PSTs appreciated both the successes of our course, such as learning technology planning tools, but also the failures, such as when their ISTs plans did not always work out perfectly when implemented. This partnership allowed teachers, both pre- and in-service, to focus specifically on technology integration, an area where they had limited previous opportunity. Even PSTs such as Samantha, a senior, with teaching

experience every year of her program, acknowledged she had never actually had an opportunity to plan a lesson focusing on integrating technology. Thus, teaching experience does not equate to technology experience.

Implications for Future Change

The theoretical code of implications for future change was composed of the following focused codes: *challenges of this course for pre-service teachers*, *limitations with teacher collaborator*, and *future implications*. Although both PSTs and ISTs expressed gains from their relationship during this course, it could have benefitted from collaboration from the start. The PSTs would have benefitted from designing the inquiry questions with the ISTs in the summer PD. In addition, the PSTs wanted more interaction with the elementary students, which was at times not possible due to conflicts in schedules. Thus, one implication for both research and practice is perhaps integrating the design of PD and pre-service teacher education more closely. Some of these practices are already happening such as holding undergraduate classes in local schools, but more could be done on the PD side. For instance, in this grant, the first author would revise in another iteration to offer a course for undergraduates in the summer that coincided with the ISTs' summer PD and then possibly link that summer offering with the fall course.

Conclusion

In sum, there are implications for research, theory, and practice from this study. Regarding research, there is a need to further explore how to better integrate PST preparation and IST training. Theory was important in this study as PSTs learned theories that were new to them and because these theories were specific to their content area, the PSTs found them useful. Yet, the PSTs were not learning, nor implementing these theories until late in their education. In general, not enough theory was taught, implemented, and consistently put into practice. Too

much time elapsed between their learning of theory and their application; for example, one PST learned TPACK her sophomore year, yet didn't revisit theory related to technology integration until her senior year. Finally, and perhaps most importantly, we saw the need for practice and pedagogy, and more embracing of trial and failure therein. PSTs learned to appreciate failure in this course and learn from it because they were trying out technology consistently and were rewarded for their bravery rather than their perfection. In other words, PSTs need more low-risk opportunities to implement and plan for technology integration in elementary classrooms.

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