AN EXPLORATORY STUDY: HOW EARLY CHILDHOOD PRESERVICE TEACHERS CONSTRUCT THEIR UNDERSTANDING OF TECHNOLOGY INTEGRATION IN A TECHNOLOGY-INFUSED SOCIAL STUDIES METHODS COURSE

by

Payal Shah
A Dissertation
Submitted to the
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of
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in Partial Fulfillment of
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of
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Education

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## Dedication

This dissertation is dedicated to both my sets of parents, my Vibha mom, Popeye (dad), Smriti mom and to my late father-in-law Sukesh dad. Thank You!!! to my Vibha ma for your faith, Smriti mom for being a role model, my Popeye for letting me know it's okay to fail, and Sukesh dad – you were there when I started this journey and I know you will be there with me as I celebrate its completion. It is also dedicated to my children Ayaan and Aneyah, who gave their time and childhood to watch their mom follow her dream.

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| | |
|---|---|
| Council for the Accreditation of Educator Preparation | CAEP |
| Early Childhood Education | ECE |
| International Society for Technology in Education | ISTE |
| National Center for Education Statistics | NCES |
| National Council for Accreditation of Teacher Education | NCATE |
| National Council for the Social Studies | NCSS |
| Office of Educational Technology | OET |
| Pre-Kindergarten | PreK/Pre-K |
| Preparing Tomorrow's Teachers to Use Technology | PT3 |
| Substitution, Augmentation, Modification, and Redefinition | SAMR |
| Technological Pedagogical Content Knowledge | TPACK |
| The National Association for the Education of Young Children | NAEYC |
| United States Department of Education | USDOE |

# Abstract

AN EXPLORATORY STUDY: HOW EARLY CHILDHOOD PRESERVICE TEACHERS CONSTRUCT THEIR UNDERSTANDING OF TECHNOLOGY INTEGRATION IN A TECHNOLOGY-INFUSED SOCIAL STUDIES METHODS COURSE

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Long before the COVID-19 pandemic, the education technology narrative asserted that "New tools hold great promise for teaching and learning, but only when they are used effectively, appropriately and intentionally". In this dissertation, I explored how early childhood educationteachers construct their understanding of technology integration in a technology-infused social studies methods course. The preservice teachers came into the course expressing their attitudes towards technology as positive, negative, or mixed. In addition, they articulated their self-perceptions of technology skill as confident, unconfident, or both confident and unconfident. As they continued in this technology-infused methods course, they experienced technology as a way to understand, engage, explore/examine, reflect, collaborate/share, and extend their knowledge about social studies. As they experienced different technologies throughout the course, preservice teachers recognized technology as a space for building a community of learners to share and generate knowledge and build learner agency. They also identified technology as a multimodal tool to support learning that simulates realistic experiences, provides creative outlets, and expands opportunities for learning. The preservice teachers described engaging with technology passively, actively, and critically by noticing, extending, and evaluating technology. In their lesson plans, they conceptualized using technology with children in many of the same ways they engaged in technology in the course. Specifically, they created experiences that encouraged young children to explore/examine, collaborate/share, and extend their learning. Each of these broad categories are expounded upon in the sections below.

*Keywords:* attitudes towards technology; experienced technology; recognized technology as; engaging with technology; conceptualized using technology.

# Chapter One

Education in the United States (U.S.) emerged in part from the goals of a democratic society: to prepare people to become responsible citizens (Center for Education Policy, 1996). In 1983, in an essential report on education in America entitled *A Nation at Risk: The Imperative for Educational Reform*, the National Commission on Excellence in Education called for a change in shifting what it means to prepare citizens as the U.S. transitions from the industrial (factory) age into an information age. The obligation to prepare students to function successfully in an information age was further underlined in a report issued by the U.S. Department of Labor Secretary's Commission on Achieving Necessary Skills (Secretary's Commission on Achieving Necessary Skills [SCANS], 1991). The SCANS report (1991) identified five competencies that are the hallmark of what it means to teach to prepare students for the information age: (a) resources (knowing how to allocate time, money, materials, space, and people); (b) interpersonal skills (knowing how to work on teams, teach others, collaborate with people from culturally diverse backgrounds); (c) information (knowing how to acquire, evaluate, interpret and communicate data, and use computers to process information); (d) systems (understanding social, organizational and technological systems); (e) technology (knowing how to select equipment and tools, apply technology to specific tasks, and maintain and troubleshoot technologies).

This report envisioned how the learning environments of tomorrow would look different than the traditional learning environment. It acknowledged that learning with technology will be constructive and interactive, yet less tied to a specific location such as a classroom (SCANS, 1991). Teachers, too, will have different goals, different responsibilities within these different learning spaces, shifting towards “creat[ing] and engaging, relevant, and personalized learning experiences for all learners that mirror students’ daily lives and the reality of their futures” (U.S. Department of Education, Office of Educational Technology, National Education Technology Plan [USDOE, OET, NETP], 2010, p. x). This shift is in part due to the recognition that digital technologies could not only *enhance* learning but could also *transform* it (Karasavvidis & Kollias, 2014). Publications such as the K-12 Horizon Report (Johnson et al., 2015), the International Society for Technology in Education (ISTE) standards for teachers (ISTE, 2017), and the United States National Educational Technology Plan (U.S. Department of Education, Office of Educational Technology, National Education Technology Plan [USDOE, OET, NETP], 2017) affirm these beliefs.

Fast-forward to November 2019, COVID-19 emerged in China and was declared a pandemic by the World Health Organization in March 2020. As the world grappled with the challenges from COVID-19, strict social isolation measures were prompted, abruptly closing schools, colleges, and other educational institutions. PreK-12 and higher education institutions worldwide were forced to find alternatives to in-person instruction to ensure the continuation of teaching and learning (Grajek & Brooks, 2020). With an unprecedented push to online learning, the debate on using technologies in education became a forced reality (Lederman, 2020). Ninety-three percent of school-age children reported some form of online learning during COVID-19 (Mcelrath, 2020). Education for children as young as preschoolers was forced to move to some kind of online learning, except for children of critical workers (American Institutes for Research, 2020). While the COVID-19 pandemic is still raging worldwide, educational institutions are making choices about technology integration that will be instrumental to the future of education (Teräs et al., 2020). This critical historical moment is also an opportune time to explore how future teachers are being prepared to integrate technology into their learning and teaching (Franko, 2021).

Long before the COVID-19 pandemic, the education technology narrative asserted that "New tools hold great promise for teaching and learning, but only when they are used effectively, appropriately and intentionally" (Donohue & Schomburg, 2015, p. 50). The underlying argument supporting the above assertion in early childhood education literature is that innovative and developmentally appropriate use of technological tools can optimize young children's potential to engage in "active learning, inquiry, and problem solving" (Yelland, 2005, p. 223). While most research on young children's use of technology has focused on in-service teachers, the purpose of this current study is to contribute to the research on early childhood education preservice teachers in higher education. This unique population are the potential initiators of these experiences. This dissertation will explore how early childhood education teachers construct their understanding of technology integration in a technology-infused social studies methods course and what they recognize as essential to learning about intentional technology integration for their future teaching.

**Defining technology-infused Methods Course**

In conceptualizing technology as an educational tool, it is essential to note that literature uses various terms to define the use of technology in education (i.e., technology integration, technology infusion, and technology enhanced). For the purpose of this study, I define technology integration and technology infusion to clarify how I have contextualized them within the study.

Foulger (2020) defines technology integration as any learning experience that seamlessly integrates technology within the context of a learning process and in a manner that enhances the experience and/or outcome in some way. On the other hand, technology infusion is “a program-deep and program-wide approach” within a teacher preparation program to prepare future teachers to use technology in their teaching (Schmidt-Crawford et al., 2020, p. 82). In this regard, technology integration can be considered a strategy that occurs at any given point in time, whereas technology infusion is a model that stretches over a longer time. In the vision of the technology infusion approach, learning to use technology is infused into a methods course and student learning (Borthwick et al., 2020). In this regard, a technology-infused methods course is one in which technology integration is taught, modeled, and practiced.

However, literature refers to the term technology integration, in itself, in various ways. Like, Cuban et al. (2001) and Hew and Brush (2007) defined technology integration in terms of technology use (i.e., low-level, or high-level), whereas Hennessy et al. (2005) defined technology integration in terms of how technology is utilized to perform and reshape familiar tasks more productively. Giving a more straightforward definition, Kimmons (2020) referred to technology integration in education to the meaningful use of technology to achieve learning goals.

As my conceptualization of technology integration aligns with how Foulger et al. (2015) conceptualized technology in their methods course, I used the same terminology as theirs: the technology-infused methods course. A detailed definition and rationale for the technology-infused methods course selected for this study are explained in Chapter 3.

**Context of the Problem**

Early childhood education's unique pedagogical characteristic has historically triggered controversy on "what can young children learn and when" (Bers, 2008, p. xi), specifically when it comes to the use of technology (Mertala, 2017). While some view technology as a threat to playful learning and young children's development (Cordes & Miller, 2000; Healy, 2004), others promote the positive impact of technology on many aspects of early childhood education practice (Bolstad, 2004). They argue that technology "presents a new space for exploration and discovery to young children" (Hatzigianni & Margetts, 2012, p. 5). Notwithstanding this debate, in March 2012, the National Association for the Education of Young Children (NAEYC) and Fred Rogers Center released a joint position statement on Technology and Digital Media as Tools in Early Childhood Programs Serving Children Birth through Age 8 (NAEYC & Fred Rogers Center, 2012). The statement provided guidance for early childhood educators about the appropriate and intentional use of technology with young children and highlights the need for digital media literacy to inform the selection and use of technology tools in early childhood education environments. Even literature that establishes the use of educational technology and positive outcomes for children indicates that technology needs to (a) be developmentally appropriate for children; (b) include tools to help teachers implement the technology successfully; and (c) be integrated into the classroom and curriculum (Clements & Samara, 2003; Glaubke, 2007; NAEYC & Fred Rogers Center, 2012). While this intentional and meaningful use of technology has been advocated widely in academics, there is limited research examining how preservice teachers come to understand integrating technology into their future teaching.

***Technology and Preservice Teachers***

One-way preservice teachers have been characterized in literature has been based on their *generation* gap. However, relying on the concept of generation is both complex and contradictory as it involves assumptions and characteristics that are more generalized than individuals (Purhonen, 2015, 2016). Bennett and Maton (2010) find it alarming that a number of scholars point to this generational dichotomy as the reason that education institutions are unable to “meet the needs of a new generation of ‘tech-savvy’ learners” (p. 322), stating that a closer look reveals that such understandings are based on “claims rather than evidence” (p. 321). Moving beyond these age-based arguments, Bennett and Maton (2010) suggested a need to develop a more sophisticated understanding of learners’ experiences with technology by studying “how diverse learners of all ages [conceptualize] their technology experiences” (p. 325). In line with Bennett and Maton’s (2010) suggestion, Geng et al. (2017) add that preservice teachers’ technology integration may be influenced by their learning experiences with technology and the fact that the influx of digital technology is transforming the traditional classrooms that they will be teaching in.

Preservice teachers who enter the teacher preparation programs “are not just bundles of skill, competence, and technique: they are creators of meaning, interpreters of the world” (Hargreaves, 1988, p. 216). These individuals, who are continually creating meaning and interpreting the world, are unique individuals with various backgrounds and different personalities. These preservice teachers come to teacher education programs with experiences that influence their beliefs about the role of educational technology. Ertmer (2005) and Neiss (2005) recognized that preservice teachers' experience or lack of experience with technology as PreK-12 students influence how they value the role of technology in addressing critical teaching and learning needs.

Prensky (2001) declared that the generation who had grown up surrounded with technology, popularly known as digital natives, “have sufficient expertise with generic technologies” (Lei, 2009, p. 92). However, scholars have since argued that even though the digital natives could be considered tech-savvy as students (Gaston, 2006; Wood, 2006), their technological sophistication does not extend to include integrating technologies into teaching and learning environments (Cameron, 2005; Guo et al., 2008; Kvavik et al., 2004; Sprague & Katradis, 2015). For preservice teachers, this means that simply being a digital native does not necessarily result in a deep, complex understanding of technology, its affordances, and its application to the curriculum (Lei, 2009). Instead, preservice teachers' experiences with technology in their teacher preparation program are what results in how they conceptualize facilitating technology intentionally and meaningfully in their teaching practice (Lei, 2009; Kumar & Vigil, 2011).

### *21st Century Education*

"Learning about using technology in the early childhood setting is—at the heart of what it means to be a 21st-century educator" (Donohue & Schomburg, 2015, p. 50). To cultivate the development of the 21st-century competencies and expertise, such as "critical thinking, complex problem solving, collaboration, and multimedia communication" (USDOE, OET, NETP, 2010, p. xi), learners need to use technology tools to create opportunities to learn as professionals do in the real world. However, the responsibility for preparing students with 21st-century competencies fall on the educator (Hohlfeld et al., 2008; Jones et al., 2011; Larson & Miller, 2012). In the teacher education context, this raises the question as to how preservice teachers in their teacher preparation programs are being prepared to integrate technology (Hare et al., 2002; Inan & Lowther, 2010; Tondeur et al., 2012).

Since the last two decades, teacher preparation programs have been the subject of debate in technology policies and reports for their efforts to integrate technology in education like in the National Center for Education Statistics (Schmitt, 2002) and National Research Council (2000). Teacher development has also been emphasized as "the single most important step" (Culp et al., 2005, p. 292) toward integrating technology into education (Groth et al., 2007; Schmidt-Crawford et al., 2018; Stokes-Beverley & Simoy, 2016). Numerous professional organizations and governmental agencies such as the International Society for Technology in Education (ISTE; 2017), Council for

Accreditation of Educator Preparation (CAEP; 2021), the National Association for the Education of Young Children (NAEYC & Fred Rogers Center, 2012), and others have joined in the pedagogical crusade to respond to the role of teacher preparation programs in preparing preservice teachers to integrate technology in their future classrooms. These policies and standards set expectations for teacher preparation programs while also providing a framework to guide technology integration (Willis, 2012).

***Technology Education Standards***

When preparing preservice teachers to be competent in integrating technology, the International Society for Technology in Education (ISTE) standards (iste.org/standards) serve as a widely used guide to preparing preservice teachers with strong technological knowledge and skills. The most recent 2017 ISTE Standards for Educators outline the seven values or, as they call it, a 'roadmap' for how educators can use technology to create next-generation learning environments. These seven values include learning, leadership, digital citizenship, collaboration, designing authentic, learner-driven activities, facilitating learning opportunities with technology, and analyzing data to drive their instruction and support students in achieving their learning goals (ISTE, 2017). Further outlined within the standards of collaboration, designing and facilitation are aspects of the learning environments that can help teacher preparation programs in making decisions about curriculum, instruction, professional learning, and the transformation of pedagogy with technology (ISTE, 2017).

Other national organizations like the National Educational Technology Plan (2017) by the Office of Educational Technology (OET) and Partnership for 21st Century

Skills (P21; 2019) layout a vision similar to ISTE that emphasizes that technology integration must be "imbedded in every aspect of educator preparation" (Council for Accreditation of Educator Preparation [CAEP], 2013, p. 3). Even in the early childhood education context, the National Association for the Education of Young Children (NAEYC) and the Fred Rogers Center for Early Learning and Children's Media (2012) issued a joint position statement entitled Technology and Interactive Media as Tools in Early Childhood Programs Serving Children from Birth through Age 8. The statement established the need to prepare "digitally literate educators who . . . have the knowledge, skills, and experience to select and use technology tools and interactive media that suit the ages and developmental levels of the children in their care, and . . . know when and how to integrate technology into the program effectively" (NAEYC & Fred Rogers Center, 2012, p. 4).

### *Teacher Preparation Programs*

Responding to the call for intentional technology integration, teacher preparation programs have designed opportunities based on three main models: (a) stand-alone educational technology course; (b) technology integrated into a method and/or content courses; and (c) hybrid model in which a stand-alone technology course is taught in conjunction with methods and/or content courses (Amador et al., 2015). However, emerging research is suggesting a move towards technology integration throughout the teacher preparation programs rather than stand-alone educational technology courses (Mouza, 2016). More recently, Foulger et al. (2018) called for a fourth model, technology infusion in teacher preparation programs, which suggests technology to be integrated across the entire teacher preparation program and not as a stand-alone technology course.

The stand-alone educational technology course has by far been the most commonly used pathway in teacher preparation programs since the 1990s (Mulder, 2016; Niess, 2012). Literature focusing on stand-alone educational technology courses reveals many positive benefits, including improved preservice teachers' self-efficacy and discreet technology skills (Kay, 2006; Niess, 2012). However, the stand-alone educational technology course has also been criticized for not providing preservice teachers with appropriate groundwork to successfully integrate technology into their classroom instruction (Bielefeldt, 2001). The argument behind this is that the stand-alone class or workshop is successful in teaching technology knowledge and skills (Ertmer, 1999; Zhao & Frank, 2003). However, because technology is not tied to preservice teachers' method courses and/or field experiences, preservice teachers are not able to "retain and transfer the knowledge and skills" to their subsequent instruction (Sutton, 2011, p. 44). In contrast, Vannatta and Beyerbach (2000) found that teacher preparation programs that embedded hands-on technology models in methods courses and student teaching requirements were more likely to produce teachers who use technology in their own practice. Many have since advocated for a deliberate integration of technology into methods and content courses (e.g., Pierson & Thompson, 2005; Pope et al., 2005; Shapely et al., 2003; Tonduer et al., 2012).

Researchers are now advocating for a fourth model, the technology-infused approach, that eliminates the educational technology course to pursue a technology-infused methods courses and technology-infused student teaching (e.g., Buss et al., 2018; Foulger et al., 2018; Wetzel et al., 2014). The technology-infusion approach successfully demonstrated that integrating technology in methods courses improved preservice teachers' technology integration skills (Buss et al., 2015) and the application of technology in their future teaching (Foulger et al., 2015). However, the approach is relatively new, and only a handful of studies have intentionally studied the approach. Buss et al. (2015) recognize that more research is needed to explore factors that influence the development of technology integration in the methods courses.

Most of the empirical literature has examined stand-alone educational technology courses, and only a few have examined courses that use the integrated approach (Mouza, 2016). There is also an overarching consensus in teacher education research to prepare preservice teachers to become "mindful users of technology" (Amador et al., 2015, p. 86), so they are able to view technology in relation to the content they will teach as well as the pedagogies they will employ. In relation to the characteristics of 21st-century learning and considering that contemporary research is advocating for technology integrated approaches in contrast to a more limited preparation focusing on teaching with specific technology tools, more research is needed that looks at how preservice teachers construct their technology, pedagogy, and content knowledge in technology-infused methods courses (Yigit, 2014).

### *Defining Technology*

Conceptually, the definition of technology in education is quite scattered. Technology is oftentimes synonymously used with the term educational technology or the acronym ICT (information and communication technology) as a plural form for technologies (Lloyd, 2005). In early childhood education literature alone, technology concepts such as technology, digital technologies, ICT, and digital media are often used interchangeably to describe a broad set of digital devices and applications (Dong, 2018; Mertala, 2019a; Stephen & Edwards, 2017). Despite the variety in the use of terminology, all these terms denote an understanding that technology used for teaching will foster learning opportunities for students.

Similar ambiguity also exists in the typologies around the concept of technology integration. Schmitt (2002). has defined technology integration as "the incorporation of technology resources and technology-based practices into the daily routines, work, and management of schools" (p.75). Lloyd (2006) suggests that the term integration is often used interchangeably with the more plebeian term, use. Mertala (2019a) asserts that such a direct alignment is problematic as technology integration is a far more complicated phenomenon than the mere use of technology. To integrate, as defined by Merriam Webster's online dictionary, is "to form, coordinate, or blend into a functioning or unified whole" (Merriam-Webster, n.d.). Putting this definition in context, technology integration refers to the process in which technology is used as a tool or medium to support teaching and learning actively (Cloete, 2017). Hess (2002) defines it as a "source to meaning-making materials" (p. 32). In line with that argument, then technology integration refers to a rather complex phenomenon than just the use of technology as a tool. Jonassen et al. (1999) indicate the following:

> The most productive and meaningful uses of technology will not occur if technologies are used in traditional ways—as delivery vehicles for instructional lessons. Technology cannot teach students. Instead, learners should use the technologies to teach themselves and others. Meaningful learning will result when technologies engage learners in:
>
> - Knowledge construction, not a reproduction
> - Conversation, not reception
> - Articulation, not repetition
> - Collaboration, not competition
> - Reflection, not prescription. (p. 16)

In other words, integration is possible only if technology is incorporated in the curriculum meaningfully and intentionally as opposed to integrating the curriculum into the technology (Keengwe & Georguna, 2013). In this way, integration of technology is defined not by the amount or type of use but more by how and why it is used (Earle, 2002).

### *Technology and Social Studies Education*

Technology has had an ambiguous relationship with social studies. While social studies education researchers, like Beisser (1999), have been advocating for the infusion of technology to enhance teaching and learning for a long time, many have advised caution in assimilating technology into social studies instruction (Berson, 1996; Heafner, 2004). Friedman et al. (2009) argue that,

> Teaching technology skills holds a unique importance in social studies education. Students must have familiarity with technology because many of the foundations upon which the American democracy rests are increasingly interwoven with technology. Social studies teacher educators, thus, are called upon to prepare teachers who will use technology to foster citizenship skills. (p. 477)

In 2008, Swan and Hofer had noted that educational technologies had not been appreciably used in elementary social studies classrooms. Moreover, even when it was used, the primary purpose was to play educational games (Buckingham, 2007; Taylor & Duran, 2006). Kormos (2019) blamed the lingering dichotomy over technology for the slow technology integration in social studies education. Others like Doolittle (2001) and Hicks et al. (2014) associated the sluggish use of technology in social studies with its theoretical potential. Shaver (1999) and Tally (2007) had expressed doubt that technology will ever incite any pedagogy reform in social studies. However, since the inception of digital technologies and the internet, this doubt started changing as educators started realizing the potential of technology to improve social studies learning.

Çiftçi and Savaş (2018) established the potential of technologies to facilitate intercultural dialogue and collaboration in social studies instruction. Krutka and Carpenter (2016) noted that Web 2.0 sites and social media platforms like Twitter led to more participatory and interactive media experiences in social studies. Mullins et al. (2019) incorporated wearable technologies to record videos and take pictures on her trip to Antarctica and then used them to enhance her $8^{th}$-grade world geography instruction. Wagner (2019) used the Geocaching.com website and mobile app to engage students in learning history and geography. Despite this growing use of technologies in social studies, Freedman et al. (2018) noted that the potential of online and digital technology tools in social studies instruction had not been fully realized. Friedman and Hicks (2006) urged for more research that moves beyond talking about the potential of technology to transform social studies education towards "investigating how teachers and teacher educators are… designing and examining how associated technology-enhanced instructional strategies can scaffold student learning" (p. 248). Hicks et al. (2006) echoed this call when they asked social studies educators, to "examine how, and to what extent, social studies teachers can implement digital technologies as a tool for inquiry in order to scaffold and facilitate active, relevant, and meaningful learning" (p. 4118).

Over two decades ago, the National Council for the Social Studies (NCSS) asserted that technology integration in social studies education "can add important dimensions to students' learning" (National Council for the Social Studies [NCSS], 1994, p. 165). However, there has been relatively little empirical research on how preservice teachers are prepared to use technology for the teaching and learning of social studies (Byke, 2014; Lee & Friedman, 2009). In a longitudinal study of 23 elementary social studies teachers, Franklin and Molebash (2007) posited a positive relationship between preservice teachers' experiences integrating technology in their methods courses and its successful technology integration in their instruction. This is consistent with the literature on technology integration, in general, that advocates that preservice teachers benefit from experiencing an intentional technology integration in their teacher preparation methods course (Finger et al., 2013; Foulger et al., 2017; Sweeney & Drummond, 2013).

Nevertheless, studies that employ a technology-infused approach in social studies methods courses are rare (Brush & Saye, 2009; Good et al., 2005; Hew & Brush, 2006). Byker (2014) asserted that teachers need a better understanding of how to combine pedagogical practices and social studies content with instructional technology to be able to integrate technology in their classrooms fully. Berson (2000) also emphasized that on rethinking teacher education pedagogy reform, one of the considerations should be to seamlessly "employ content-specific uses of technology as a means to evolve more effective social studies teaching and learning" (p. 128).

**Problem Statement**

Teacher preparation programs are now expected to infuse "experiences with educational technology [that] are program-deep and program-wide, rather than one-off courses separate from their methods courses" (USDOE, OET, NETP, 2017, p. 35). National proposals like the Preparing Tomorrow's Teachers to Use Technology (PT3) funded projects, International Society for Technology in Education's (ISTE, 2017) sponsored standards, and organizations like (Council for the Accreditation of Educator Preparation (CAEP), 2021) have promoted technology integration approaches in teacher education programs (Brenner & Brill, 2016). Essential to this vision is an emphasis on providing a *meaningful* technology integration experience in their teacher preparation coursework and field experience, a term emphasized 19 times in the 2017 National Educational Technology Plan (USDOE, OET, NETP, 2017).

Teacher education programs are making a substantial effort to integrate technologies to support teaching and learning (Bebell et al., 2004). This includes the development of “an effective curriculum model for preservice teachers…that not only shows how to use technology effectively in the classroom, but also requires students to explore, create, and plan with technology, both prior to and during their field experiences” (Lewis, 2015, p. 238). Brenner and Brill (2016) identified that providing hands-on, authentic, and meaningful activities incorporating technology in meaningful contexts that mirror future classrooms were a few of the salient factors that lead to meaningful technology integration in teacher education. Research also emphasizes that teacher educators must model and align technology with “discipline-specific pedagogy” (Brush & Saye, 2009, p. 46). In addition, Pearcy (2013) found in his review of studies that finding solutions to applying beliefs, motivations, and self-efficacy in learning experiences positively impacted one’s ability to use technology effectively.

Despite this growing enthusiasm for integrating technology within the higher education environment, research so far says that preservice teachers continue to matriculate through teacher education programs without sufficient attention to how their content and method courses merge in the practice of teaching with technology (Lewis, 2015; McClanahan, 2017). Literature suggests that part of the problem is that technology in teacher education programs continues to be taught in isolation from content and methods courses, widening the disconnect between learning to teach content and learning to teach meaningfully with technology (Angeli & Valanides, 2009; Brush et al., 2003; Hughes, 2013; Kay, 2006). Finger et al. (2013) and Sweeney and Drummond (2013) concluded that preservice teacher education should not only focus on how to use technology but also how technology intersects with pedagogical and content knowledge.

The transition from isolated educational technology courses to technology integration into technology-infused method courses, as described in Tondeur et al.'s (2012) study, aligns with the educational framework known as TPACK (Mishra & Koehler, 2006). The TPACK framework (Technological, Pedagogical, and Content Knowledge) was introduced by Mishra and Koehler in 2006 and has continued to be developed. It provides a rationale for a technology-infused approach in preparing teachers. The problem that still remains is that many of the studies that have been conducted to examine the development of TPACK in preservice teachers have been carried out in educational technology courses rather than in technology-infused methods courses (Chai et al., 2010; Koh & Divaharan, 2011; Pamuk, 2011).

Fullan (1982), a renowned expert in change theory, stated that "educational change depends on what teachers do and think—it is as simple and complex as that" (p. 107). In order to bring a shift in preservice teachers' future technology integration practices, preservice teachers must be scaffolded to use technology effectively (Carpenter et al., 2016; Wright & Wilson, 2005). Ultimately, the educational shift needed to appropriately utilize technology in a meaningful manner begins with the teacher as an agent of change (Ertmer & Ottenbreit-leftwich, 2010). However, this cannot be accomplished through isolated technology experiences or without ongoing discussion, modeling, and evaluation. Talking about social studies education, Adcock and Bolick (2011) posit that "preservice social studies teachers need to see technology effectively modeled and have meaningful opportunities to use technology if they are going to integrate technology into their future social studies teaching" (p. 224). While the literature suggests that preservice teachers need experiences and understanding to make essential connections between course material and technology, there is insufficient course-specific literature that looks at how teacher education programs are making this connection. Agreeing to their recommendation, Brush and Saye (2009) add that seeing technology integration modeled requires preservice teacher education programs to offer preservice teachers the opportunity to examine the use of technology situated in the context of practitioners and as it relates to integration in the social studies classroom. Friedman and Hicks (2006) suggest "tak[ing] an instructional design perspective, where the needs of teachers and students are analyzed, specific learning objectives are designed in which there is then a 'seamless integration of technology into social studies instruction" (p. 253).

**Significance of the Problem**

In his article "The Dilemma of Teacher Training," Bork (2003) posed a critical issue—how to prepare teachers for changes within the educational field. The recent influx of technologies in the educational field has added to this issue by now posing the question of how to prepare teachers not just to learn technology but also learn to teach with technology (Neiss, 2011). While the field is still grappling to answer this issue, the COVID-19 pandemic has accelerated the use of technology in PreK-12 and higher education with unparalleled speed (O'Brien & Eger, 2020). Some even state that the pandemic has changed the role of technology in education forever (Li & Lalani, 2020). However, much is still to be learned about the influence of this pandemic on preservice teachers' experiences with technology.

Mishra and Koehler (2006) illustrated that learning to teach with technology involves more than just learning how to use the specific technology. Instead, it also involves having opportunities to understand, develop, and implement technology-rich instructional activities (Brush et al., 2001). Since then, teacher preparation programs have moved away from stand-alone educational technology courses and have started integrating technology throughout teacher preparation programs, specifically in the methods courses (Sutton, 2011). Until fairly recently, research in the area of technology integration in methods courses has been relatively limited as either the studies have been focused on re-envisioning technology courses (e.g., Pierson & Thompson, 2005) or focused on using a technology tool or two in a particular content area (e.g., Childs et al., 2011). Few studies have looked at infusing technology intentionally in their methods courses (e.g., An et al., 2011; Buss et al., 2018; Foulger et al., 2018; Mouza et al., 2014; Wetzel et al., 2014). However, not many studies have looked holistically at how integrated technology experiences are experienced and conceptualized by preservice teachers (Nelson & Hawk, 2020).

Early childhood education has continued to challenge students, teacher candidates, and teacher educators at being meaningful and intentional in their integration of technology (Orlando, 2009). While there is a dearth of scientific interest on early childhood education in-service teachers use of technology (e.g., Brown et al., 2016; Istenic Starčič et al., 2016; Izumi-Taylor et al., 2010; Lindahl & Folkesson, 2012), more research is needed that look at how early childhood education preservice teachers' understanding of the role of digital technologies (Alelaimat et al., 2020). A nascent and unexplored area of preservice teacher technology integration research is the investigation of how future teachers conceptualize technology integration in their teacher education and critically reflect on pedagogical practices related to technology, specifically in early childhood education (Hernandez et al., 2015; U.S. Department of Education, Office of Educational Technology [USDOE, OET], 2016).

In this regard, this study is significant as it explored (a) preservice teachers' learning experiences with technology in a technology-infused methods course; (b) what they recognized as being noteworthy about integrating technology for themselves as learners and young children as learners; and (c) how they engaged with technology in a technology-infused social studies methods course and envisioned engaging young children with technology in their future teaching. It also explored how preservice teachers conceptualized creating learning experiences with technology for young children. It is also amongst the first few to explore preservice teachers' attitudes towards using technology that emerged within the context of the COVID-19 pandemic.

This study highlights the critical role teacher preparation programs play in the preparation of early childhood education teachers who are critical and intentional in their use of technology. This study aimed to contribute to the limited research in teacher education that examines infusing technology into an early childhood education social studies methods course. In addition, a goal of this study is to contribute to the knowledge about how engaging preservice teachers in a technology-infused course can prepare future teachers for learning and teaching with technology. The findings of this study also contribute specifically to the knowledge base of meaningful educational technology and intentional technology-infused learning spaces in the early childhood education context.

**Purpose of the Study**

The purpose of this explorative qualitative study was to explore how preservice teachers describe their experiences in a technology-infused early childhood education social studies methods class. Specifically, the study examined what they said about how these experiences influenced their knowledge and competencies related to technology integration, including their ability to design technology-integrated lessons. In addition, this study investigated how elements of the class were related to preservice teachers' understanding of meaningful and intentional technology integration as it pertains to early the unique pedagogies implemented in early childhood education. Literature supports that it is crucial to consider the perspectives of preservice teachers and to understand their experiences as they unfold. Exploring how teachers perceive their experiences in an intentional technology-infused methods course through the description of their own experiences may hold great promise for attaining "digitally literate [early childhood] educators" (NAEYC & Fred Rogers Center, 2012, p. 4).

**Research Questions**

Shifting the emphasis of technology integration in teacher preparation programs from teaching to an emphasis on learning, the focus of attention in this study was firmly on the learner, their interests, and perceptions. Recognizing that experiences are influenced through perceptions and meanings derived from those experiences, it was critical to focus on the meanings that individuals constructed in their effort to "make sense of their world and the experiences they have in the world” (Merriam, 2009, p. 13). With that in mind, this study was broadly framed to explore early childhood education preservice teachers' descriptions and perceptions of their learning in a technology-infused methods course.

More specifically, the following research questions informed the study:

1. How did early childhood education preservice teachers describe their attitudes towards and confidence in using technology upon entering a technology-infused social studies methods course during the COVID-19 pandemic?
2. What were preservice teachers’ learning experiences with technology in a technology-infused social studies methods course?
3. What did early childhood education preservice teachers recognize as being noteworthy about integrating technology for themselves as learners and young children as learners?
4. How did early childhood education preservice teachers (a) engage with technology in a technology-infused social studies methods course and (b) envision engaging young children with technology in their future teaching?
5. How do early childhood education preservice teachers engaged in a technology-infused social studies methods course conceptualize creating learning experiences with technology for young children in their future teaching?

**Summary**

This chapter has made specific the need for research that explores the experiences in a technology-infused methods course. It specifies a need to examine how those experiences shape preservice teachers' technology integration knowledge and competencies. Further, it also connects to how they anticipate creating learning experiences with technology for young children in their future teaching. This study also explored the experiences preservice teachers recognize as being necessary while planning for intentional technology integration for their future teaching with young children.

Chapter 2 of this study presents a substantive review of literature that looks at how technology has evolved in education and teacher education and the approaches that have been adopted by teacher preparation programs to prepare preservice teachers to integrate technology—particularly in early childhood education social studies methods course. Chapter 2 examines the literature to find the relationship between technology and (a) education; (b) teacher education; (c) teacher preparation program; (d) early childhood education; and (e) social studies to get an overall picture of where the field is right now. Chapter 3 provides details and rationale for choosing an exploratory qualitative research explanations paradigm and methodology for this study. Chapter 4 summarizes the findings on the data collected and analyzed to answer the research questions. Qualitative data is analyzed for patterns or themes and is presented based on the major themes found in the data. Chapter 5 presents the discussions, interpretations, and implications of the findings in connection to the context of this study.

## Definitions

***Asynchronous Sessions*** refer to scheduled course sessions that are pre-recorded lectures for learners to watch independently at their own pace.

***Breakout Room*** is a feature in the video collaboration platform, Zoom that allows the meeting participants to be split into separate sessions.

***Early Childhood Education*** is a branch of education theory that relates to the teaching of children from birth up to the age of eight or PreK-3rd grade (NAEYC, n.d.).

***Early Childhood Education Preservice Teachers (also Early Childhood Education Preservice candidates)*** is a student in a teacher education program who is preparing to become a teacher in PreK-3rd grade but does not yet teach independently in their own classroom.

***Early Childhood Education Social Studies Methods Course*** is a course in the teacher education program that prepares the next generation of teachers to address the principles and practices of developing knowledge and skills in social studies with PreK-3rd grade children.

***Educational Technology:*** According to Lawless and Pellegrino (2007), "[educational] technology is not one thing, but many things that can be woven into the instructional environment by a teacher to assist the teaching and learning process" (p. 578).

***Face-to-face learning*** refers to a traditional learning environment that occurs in person. This means that assignments, discussions, and activities occur in the classroom under the direction of an instructor.

***Learning environment*** refers to the way a classroom environment is set up. A learning environment can be face-to-face, virtual, or a combination of both also called hybrid.

***A Podcast*** is an episodic series of spoken-word digital audio files that a user can download to a personal device for easy listening.

***Preservice Teachers (also teacher candidates)*** is a student in a teacher education program who is preparing to become a teacher but does not yet teach independently in their own classroom.

***Social Studies Methods Course*** is a course in the teacher education program that prepares the next generation of teachers to address the principles and practices of developing knowledge and skills in social studies.

***Synchronous Sessions*** refer to scheduled course sessions where learning takes place virtually with the learners and instructors in the same place, at the same time.

***Teacher Education*** refers to teacher training that has been designed to prepare teachers to teach.

***A Teacher Educator*** is a professor, associate professor, assistant professor, instructor, or faculty member teaching in a college, department, or school of education, tasked with educating future or practicing teachers.

***The Teacher Preparation Program*** is a formal program designed to prepare both undergraduate and graduate students to become licensed teachers.

***Technology-infused Methods Course*** is a course in the teacher education program where the methods teacher educator (a) models the use of technology in their teaching; (b) teaches about the idea of technology integration; (c) aligns technology integration curriculum to course content; and (d) requires candidates to practice teaching with technology throughout the program (based on Buss et al.'s, 2018 empirical study).

***Technology(ies)*** are digital pedagogical tools used for effective delivery of instruction such as various devices, computer programs (software and hardware), multimedia, internet, and web-based resources.

***Virtual or Online Learning*** refers to a learning environment that occurs via an internet-based platform. Other terms used for this type of learning environment in literature are open learning, web-based learning, computer-mediated learning, blended learning, m-learning.

***Web-Based Google Docs Editors Suite*** is a productivity office suite offered by Google that includes Google Docs, Google Sheets, Google Slides, Google Forms, Google Jamboard, and other programs.

***Zoom*** is a video collaboration platform available via the web app that integrates video meetings, voice, webinars, as well as chat across desktops, phones, mobile devices, and conference room systems.

# Chapter Two

The challenge for early childhood educators is to make informed choices that maximize learning opportunities for children while managing screen time and mediating the potential for misuse and overuse of screen media, even as these devices offer new interfaces that increase their appeal and use to young children (NAEYC & Fred Rogers Center, 2012). The same developmentally appropriate principles and practices that mediate early childhood education teachers' use of print materials or other learning tools and content for young children now mediates their use of technology (Clements & Samara, 2002; Plowman & Stephen, 2007; Van Scoter et al., 2001). In this regard, both traditional and newer educational technologies play an essential role in young children's learning provided the teacher uses them in a developmentally appropriate manner, and it aligns with the curriculum goals (McManis & Gunnewig, 2012). As NAEYC and Fred Rogers Center (2012) and Daugherty et al. (2014) suggest, the question then becomes how early childhood educators are being prepared to integrate technology appropriately, intentionally, and productively into early childhood education settings.

Educational technology, when used appropriately, has been lauded as a potentially powerful enabling tool for teaching and learning (Manichander, 2016). Gooden and Silverman (1996) said that the most effective way to benefit from technology is to integrate it into the curriculum instead of integrating the curriculum into the technology. In this regard, the definition of technology integration has moved from computer literacy or technology literacy to an emphasis on integrating technology into the context of the curriculum as a teaching and learning tool (Blackwell et al., 2016; Keengwe et al., 2008). Roblyer (2000) noted, “Integrating educational technology refers to the process of determining which electronic tools and which methods for implementing them are appropriate for given classroom situations and problems” (p. 8).

For early childhood education, the relationship between early childhood education and technologies has always been controversial. While some regard technology usage in an early childhood education as necessary to prepare children for the 21st century, others report that technology integration threatens traditional and imaginary play and hinders children’s social interactions (House, 2012; Mertala, 2019c; Palaiologou, 2016). Cuban (2001) described technology use in early childhood education as “a benign addition” (p. 67) or a valuable supplement to existing resources. However, Plowman and Stephen (2003) countered Cuban (2001), stating that new technologies are much more than just an addition as they allow for new concepts of play and learning. According to the NAEYC and Fred Rogers Center’s (2012) position statement, technology and interactive media can support and enhance children’s learning and their social relationships when used wisely by adults within the principles of developmentally appropriate practices. Samara and Clements (2002) indicated that it is the design of the curriculum and the learning experiences with technology provided by the teacher that contributes to young children’s development, thereby taking the focus away from technology and putting it on how technology is intentionally integrated into the children’s play-based learning (Edwards, 2013).

Many researchers state that how technology is addressed in teacher education programs is one of the conditions for how preservice teachers apply technology in their teaching instruction after their graduation (Admiraal et al., 2017; Blackwell et al., 2013; Wang et al., 2018). An important consideration in preparing future teachers is to provide them with opportunities in their teacher preparation programs to understand, develop, and implement technology-rich instructional activities (Brush et al., 2001) and expose examples of effective technology integration (Davis & Roblyer, 2005). More recent studies on technology in teacher preparation programs have concluded that teacher education should focus on teaching preservice teachers not just how to use technology but also how technology intersects with pedagogical and content knowledge (Finger et al., 2013; Foulger et al., 2017; Sweeney & Drummond, 2013). Researchers have stressed the value of integrating technology into preservice teachers' methods and content courses (Admiraal et al., 2017).

Therefore, the purpose of this literature review is to review the literature on what is known about technology integration in education and technology infusion in teacher preparation programs, specifically in the context of early childhood education. Because the setting of the study is an Early/Primary Education PreK-3 social studies methods course, I also examined more extensive literature concerning technology integration in social studies methods courses in teacher preparation specific to the context of early childhood education. In addition, acknowledging the impact of the COVID-19 pandemic on the educational systems and technology use, the literature review also includes a review of recent studies on the use of technology in education during the COVID-19 pandemic. The literature review, as mentioned earlier, provides an overarching conceptual framework, and addresses the increasing attention on how preservice teachers experience and learn about technology that intersects with pedagogical and content knowledge. This review also includes an overview of the models of technology integration in education as they provide insights on different approaches for integrating technology to prepare future teachers.

This literature review draws upon a variety of empirical studies conducted in the United States and abroad. Education Research Complete database, ERIC, EBSCO databases, ProQuest database, and Google Scholar were all searched using several combinations of keywords, such as *technology, technology integration, preservice/preservice, early childhood education, social studies, methods courses, teacher preparation, and teacher education.* Within each article, references were examined, and additional empirical studies were identified for further review.

**Theoretical Framework**

The theoretical framework that bears on this study is constructivism, which provides insights into the essential elements of the learning process. While the word constructivism elicits multiple definitions (Phillips, 1995), the proponent of constructivism that is universally accepted is that the learner constructs their knowledge in "an active process of constructing rather than acquiring knowledge" (Duffy & Cunningham, 1996, p. 171). In other words, new knowledge is constructed by shifting the focus from what the teacher is doing to what the learner is doing as an active conceptualizer of knowledge (de Kock et al., 2004). Constructivism, in this regard, describes ways of knowing through the lens of how a learner collaboratively and reflectively constructs new meanings and makes sense of information grounded in their personal experience (O'Connor, 1998).

### Constructivism

Constructivism has emerged as an education reform movement since the late 1980s (Fosnot & Perry, 1996). Today, constructivism is often adopted by educators as a way of thinking about teaching and learning (Akpan & Beard, 2016; Hatzigianni & Kalaitzidis, 2018; Howell, 2013), with its core tenets tracing back to work done by Dewey, Piaget, Vygotsky, and Bruner. In the present day, constructivism has gained popularity and familiarity in practical applications like experiential learning, discovery learning, inquiry-based learning, active learning, collaborative learning, problem-based learning, project-based learning, and so on. However, von Glasersfeld (1991) asserted that constructivism could only be understood by considering both its ontology and epistemology.

von Glasersfeld (1991) recognized Giambattista Vico as the first philosopher to formulate the constructivist epistemology. Since then, there have been different approaches and interpretations of constructivism (Phillips, 1995): cognitive, social, radical, and transactional. While John Dewey (1916/1938) is often cited as the philosophical founder of the constructivist approach, Piaget (1970) and Bruner (1960) are often recognized for their contribution to cognitive constructivism and Vygotsky (1978) for his contribution to social constructivism.

### *John Dewey*

As Vanderstraeten (2002) explains, Dewey never explicitly used the concept of constructivism, but Dewey's notion of organism-environment interaction has been perceived as a promising approach to the construction processes. Echoing the same, Phillips (1995) noted that Dewey (1938) took issue with the traditional approach to education, providing reasons to believe that Dewey's educational theory was constructivist in nature. He also placed Dewey within the ranks of social constructivists, contending Dewey's beliefs that a learner is an active and social being and the learner's activities are either (individual) cognitive, social, or political processes (Phillips, 1995).

Dewey (1916) illustrated his viewpoint by explaining that children learn best when they interact with their environments and are actively involved with the school curriculum. Further, Dewey's (1938) work entitled *Experience and Education* echoed the importance of social processes in learning. Dewey's (1938) theory of experience was based on two concepts: interaction and continuity. *Interaction* is the aspect of the experience that leads to learning from dialogue and communication, while *continuity* is the aspect of the experience that connects to prior interaction and leads to subsequent ones (Dewey, 1938). According to Dewey (1916), true education is achieved through experience; however, he cautioned that not all experiences are equally educative. An educative experience, Dewey explained, is one that leads to the discovery of what those learners enjoy or suffer in connections to the things in consequence. In addition, "the value of an experience lies in the perception of relationships or continuities to which it leads up" (Dewey, 1916, p. 140). Dewey (1938) rejected the traditional notion of education where the teacher possesses the knowledge and that the child must receive knowledge that is passed on. He also chastised progressive education, a movement that he had influenced in the early 1900s, for confounding traditional education without offering something fundamental to replace it. He later reformulated his view on the classroom as a microcosm of a society where students learn by experience, articulating his theory of experiential education as a critique of traditional education (Dewey, 1938).

Envisioning an education that prepares for critical reflective thinking, Dewey (1916) offered a reconstructive definition of the education in which “reconstruction or reorganization of experience” (p. 45) adds meaning to the current experience and subsequent experience. His views on reflection suggest that “we do not learn from experience; we learn from reflecting on experience” (Dewey, 1933, p. 78). So, it is essential to reconstruct experiences by adding meaning to the knowledge drawn from the experience. With regards to education, this can be translated as an experience where if the necessary knowledge is achieved, one will grow and flourish at the cognitive and cultural level by using intelligence (reflection) to expand the experience. Dewey’s work affirms his fundamental belief in meaningful experiences and the importance of reflection on those experiences that lead to meaningful learning. He also believed that these experiences must be integrated into a social context, such as a classroom, where learners can engage in dialogue and form a community of learners who construct their knowledge together (Narayan et al., 2013; Sikandar, 2016).

### ***Jean Piaget***

Jean Piaget is another foundational figure of constructivism credited as "the prolific constructivist" (von Glasersfeld 1996, p. 6) for providing solid foundations for the constructivist approach to cognition. Piaget (1970) proposed that humans develop through four stages: the sensorimotor stage, the preoperational stage, the concrete operational stage, and the formal operational stage. He viewed human intellectual development through the process of biology. He suggested that learning is a transformative process rather than a cumulative one. New experiences are *assimilated* into an already existing understanding. At the same time, the unfamiliar knowledge and experiences that do not fit with current understanding are *accommodated* into the mind (Piaget, 1953). However, his theories were more associated with the nature of knowledge than with the theory of education (Sjøberg, 2010). Later, researchers explained how Piaget's theories could be applied to the theory of education. For example, von Glasersfeld (1996) proposed his theory on radical constructivism, stemming from Piaget's theory. By explaining the constructivist teaching strategy, von Glasersfeld (1995) stated that knowledge resides inside individuals and must be constructed based on their experience. Specifically, he emphasized that knowledge is not an external commodity that can be transmitted, but it must be constructed by everyone (von Glaserfeld, 1998). Piaget's idea of constructivism was also further developed in the works of Lev Vygotsky and Seymour Papert.

### ***Lev Vygotsky***

For most social constructivists, Lev Vygotsky was one the most seminal theorist (Bentley, 1998). Vygotsky developed and diverged from Piaget's view on constructivism by emphasizing the role of the social and cultural context within which learning is embedded (Oxford, 1997). Vygotsky began his analysis from the context external to the individual and proposed that learning leads to cognitive development, which contrasted with Piaget's individualistic assumptions that development leads to learning. Vygotsky devised the term *More Knowledgeable Other (MKO)* and the notion of the *Zone of Proximal Development (ZPD)*, claiming that cognition began with social context. In *Mind in Society,* he wrote,

> The zone of proximal development is the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem-solving under adult guidance or in collaboration with more capable peers. (Vygotsky, 1978, p. 86)

In his theory, Vygotsky emphasized the role of social and cultural interaction as a mediating action that influences cognitive processes (DeVries, 2000; Shayer, 2003; Wertsch & Tulviste, 1992). Stressing the influence of culture and language, Vygotsky suggested that humans' mental functioning, even when acquired in isolation, is never as distinct from social interferences as it might first appear (Wertsch & Tulviste, 1992). Shayer (2003) added that while literature often represents Piaget for individual learning and Vygotsky for social processes of learning, the two philosophies are quite complementary.

***Jerome Bruner***

Identifying with cognitive constructivism like Piaget, Bruner is often considered the modern constructivist (Tomic & Kingma, 1996) who considered Vygotsky's theories on constructivism essential to his "theory of education" (Moll, 1992, p. 3). Bruner is also known for his pivotal role in bringing his work on the cognitive revolution to the educational discussion in *The Process of Education* (Bruner, 1960). Bruner's idea of a constructivist approach has contributed to many other theories that inform the process of education and the development of the curriculum. Although much of Burner's ideas were linked to Piaget's child development research, he shared Vygotsky's belief that a child's social environment and social interactions are crucial elements of the learning process.

Advancing the cognitive theory, Bruner proposed the idea of a *spiral curriculum* in his work, *The Process of Education* (Bruner, 1960). He suggested that a more complex idea can be thought at a simplified level first and at a more sophisticated level later by "revisit[ing] the basic ideas repeatedly, building upon them until the student has grasped the full formal apparatus that goes with them" (Bruner, 1960, p. 8). This idea of studying previously learned material again after some time but with deepened contents is an example of what Bruner refers to as the spiral curriculum.

Bruner's (1961) work, *Act of Discovery,* led to the construct, *discovery learning*. Bruner described this type of learning as inquiry-based, constructivist learning. He proposed that learners construct their own knowledge by organizing and categorizing existing knowledge and past experiences using a coding system. According to Bruner (1961), the most effective way to develop a coding system is to discover it rather than it being conveyed by a teacher. Building on this, Bruner hypothesized three relatively discreet modes of representation, or as interpreted today, three levels of learning: *enactive* representation or action-based learning, *iconic* representation or image-based learning, and *symbolic* representation or language-based learning. Bruner (1960) contrasted Piaget's stages of development by suggesting that a very young child is capable of learning any new knowledge as long as learning follows a progression from enactive to symbolic.

Bruner (1978) also developed the concept of *scaffolding*, which is closely aligned with Vygotsky's zone of proximal development and is often used interchangeably. Scaffolding, as described by Bruner, stresses the inherently social nature of learning, and emphasizes the social interaction in the theory of social constructivism. He characterized the role of the mother (expert) as someone who

> reduces the degrees of freedom with which the child has to cope, concentrates his attention into a manageable domain, and provides models of the expected dialogue from which he can extract selectively what he needs for fulfilling his role in discourse. (Bruner, 1978, p. 244)

**Constructionism**

A final theoretical approach to constructivism can be found in Seymour Papert's notion of constructionism. Following the influences of the constructivists, constructionism also proposes a change in the nature of knowledge. Papert and Harel's (1991) notion of constructionism shares constructivism's view "of learning as 'building knowledge structures' irrespective of the circumstances of the learning" (p. 2).

Most of Papert's argument in his seminal book, Mindstorms, traced back to his academic work in mathematics, yet it can be extended to any discipline or context. Papert's exploration and development of constructionism began with a quest to find a better way to learn rather than just putting emphasis on teaching. Asking a basic yet complex question, "Why is there no word in English for the art of learning?" (Papert, 1996, p. 9), he illustrated the vital role that learning plays in the construction of knowledge—challenging the predominant "belief that the route to better learning must be improvement of instruction" (Papert, 1993, pp. 138-139).

While Dewey's notion of constructionism was founded on "learning by doing" (Dewey, 1916, p. 180), Papert asked why learning itself is not considered a possible option for doing. Papert's pivotal work on constructionism fundamentally changed the way educators think about learning. Concerned mainly with the question of how humans learn, process, or build knowledge, Papert (1996) emphasized that there was an undeniable relationship between the how and the what of learning. In other words, to understand learning means to be mindful of both how and what learners learn since they mutually inform and reinforce each other.

According to Ackerman (2001), Papert (1991) described learning through "progressive internalization of actions" (p. 1) rather than just the transmission of knowledge. Ackerman (2001) observed that,

> because of its greater focus on learning through making rather than overall cognitive potentials, Papert's approach helps us understand how ideas get formed and transformed when expressed through different media when actualized in

> particular contexts when worked out by individual minds. The emphasis shifts from universals to individual learners' conversation with their own favorite representations, artifacts, or objects-to-think with. (p. 438)

What this essentially means is that Papert's approach to learning stressed externalization or representation of knowledge, something that makes knowledge tangible and shareable. Papert argued that instead of teaching the most appropriate form of knowledge, the emphasis should focus on teaching representations of those ideas that are more easily linked to prior knowledge and can be more easily appropriated to engage interests. This is similar to Vygotsky's idea of cultural artifacts (e.g., tools, language, people), although Papert's approach specifically focused on digital artifacts (Ackerman, 2001). In practice, Papert's approach to learning suggests that learning is about teaching learners to do something instead of teaching them about something, such as teaching them to learn with technology rather than teaching them about technology.

He illustrated this approach to learning in the development of the Logo language, a simple imperative programming language that used a 'turtle' graphic to move on command and produce lines as it moved (Powell, 2017). Papert's aim for developing the LOGO computer language was not so much related to the programming language as much as it was to understand how working on that tool helped children form new ideas about geometry. It was a way to give children an opportunity to take the lead in their own learning through technology while also emphasizing Piaget's notion of active involvement in the construction of knowledge (Powell, 2017). According to Powell (2017), Papert viewed technology tools as a powerful medium for creating contexts that provide opportunities to construct knowledge through collaboration, visualization, simulation, and programming. Papert's creation of 'Logo Turtle' was a way to understand the learner's thought processes in the form of external products. It was also a way to illustrate that technology provides for a context that allows learners to learn different things at different paces.

The work of Papert has now been extended by Mitch Resnick's in The Lifelong Kindergarten group at the Media Lab. Resnick (2017) believed in engaging young children in creative learning experiences with technology and allowing them to express themselves creatively through technology. To allow young children to think computationally rather than solely consume technology, Resnick (2017) created a creative learning spiral that goes through Imagine, Create, Play, Share, Reflect, and back to Imagine (see Figure 1).

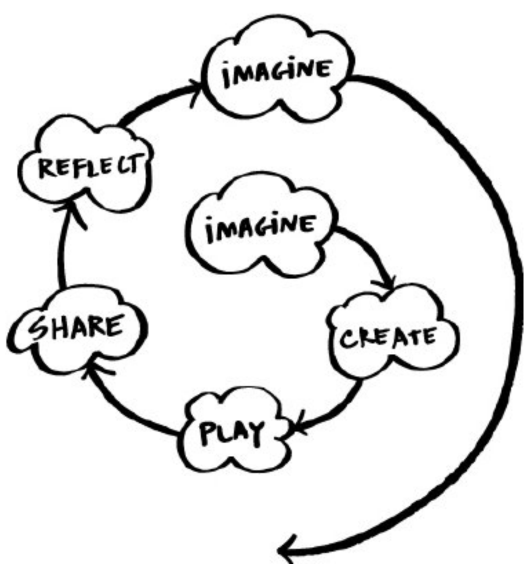

**Figure 1**

*Creative Learning Spiral*

According to Resnick (2017), the process of learning with technology is a spiral and not a circle because growth and learning emerge with each iteration. While the work of Resnick and Papert were often concentrated in *making* concrete activities, they did not undermine the importance of developing learners' abstract thinking as long as the learning was genuine (Bergner & Chen, 2018). However, Bergner and Chen (2018) agree that to develop genuine understanding; learning should go beyond just knowing procedures (e.g., how to use technology) and instead include experiences and understanding of *how* and *why* this learning is carried out in a particular way (e.g., what aspects of the learning was dependent on the technology, and why?). This will help the learner not just acquire new knowledge for the particular context but also allow them to anticipate how that technology could be used in the future, thus filling the transferability gap (Bergner & Chen, 2018).

## Constructivism and Technology

Dwyer et al. (1991) suggested that technology is a powerful tool for the constructivist value of learning by doing. Many researchers have long elucidated that technologies promote constructivist ideas of teaching and learning (e.g., Amarin & Ghishan, 2013; Brush & Saye, 2000; Fosnot & Perry, 1996; Gilakjani et al., 2013; Landis, 2008). While constructivism supports the contextual nature of learning, technology provides a learning environment that engages learners (Gilakjani et al., 2013).

One of the distinct advantages of learning environments informed by constructivism is that they utilize experience, collaborative discourse, and reflection together to assist learners in confronting their own learning needs (Brooks & Brooks, 1999). In this regard, it can be argued that constructivism could provide the foundation that guides the effective use of technology toward a meaningful purpose.

However, not all technologies lend themselves to a constructivist environment. Technologies like online chat and bulletin boards do not support a constructivist approach to learning and instruction unless used with a purpose. McClintock (1992) noted that effective use of technology requires putting technology to meaningful and constructive use rather than making it the object of instruction. However, as early as the 1990s, researchers created tools such as Knowledge Forum (Scardamalia et al., 1994); Web-SMILE (Puntambekar et al., 1997); and Co Vis (Edelson & O'Neil, 1994) to address constructivist principles more comprehensively. The inherent characteristic of these technology tools favors pedagogical beliefs of constructivism, significant tasks, meaningful relationships, authentic contexts, and effective collaboration by structuring the kinds of contributions learners can make and guide students' inquiries. According to Jonassen et al. (2003), five interdependent characteristics make learning with technology educational: active, collaborative, constructive, authentic, and goal-directed (i.e., reflective).

Research on educational technology has also addressed the difference between learning from technology and learning about technology. Clarifying the differences, Jonassen (1995) coined the term mindtools, which epitomizes the role of technology in education as a tool that facilitates knowledge construction and critical thinking. The very first sentence in Jonassen's (1995) book about mindtools states that it "represents a concept, not a real entity" (p. iv), emphasizing the role of the instructor or researcher that uses the specific technology. Work in the area of shifting from instructive to constructivist teaching *with* technology in young children began with Seymour Papert's (1980) work on "Mindstorms" that integrated technology in early childhood education mathematics. Continuing Papert's vision, Resnick (2019) developed Scratch 3.0 that introduces coding to young children as a way to think creatively, reason systematically, and work collaboratively. Papert's work has also been extended in the work of Bers (2018a, b), whose KIBO robotics and ScratchJr. View young children as producers of knowledge. Besides robotics, new learning, and telecommunications technologies like Web 2.0 (blogs, microblogs, wikis, podcasts, and more) have also been used with a constructivist framework in early childhood education. For example, Cicconi (2014) reveals that the use of Voki, Vodcasts, and VoiceThread technology ushered collaboration and empowerment in an early childhood education mathematics classroom. Similarly, Berson (2009) concluded that using podcasting in the early childhood education social studies classroom shifted young children "from being passive consumers of technology to producers of content" (p.11). Ramírez Verdugo and Alonso Belmonte (2007) relied upon the use of multimedia sources, such as images, videos, and sounds, that assist learners in constructing knowledge required for English language composition and comprehension in young Spanish learners. Many other ubiquitous technologies like digital storytelling software (O'Byrne et al., 2018), interactive whiteboards (Linder, 2012), and touch tablets (Shifflet et al., 2012) have been used with young children to increase young children's higher-order thinking skills and to strengthen social connections. Attwell (2007) postulates that these computing and social software are now driving changes in the education system, which are not only just technological but also social.

In summary, constructivists believe that the interactive nature of the technology allows students to collaborate, share perspectives and experiences, and establish relationships that can influence intercultural attitudes (Müller-Hartmann, 2000). However, central to this collaboration is the need for opportunities that enable learners to engage in open and critical discourse that fosters the attainment of learning, understanding, and reflection.

**Summary**

In conclusion, Dewey, Piaget, Vygotsky, and Bruner's theoretical perspectives have been influential in the development of constructivist approaches to teaching and learning. What these approaches diverge on is the role that external influences may play in the construction of knowledge: the learner's experiences, the learner's social and cultural background, the learner's language, the impact the approach will have on society, and the role of reflection. However, all these theorists supported the idea that learners actively construct their own knowledge through experience. The strength of constructivism consists of "interrelating constructions, methods, and practices together with their respective implications in cultural contexts" (Reich, 2009, pg. 46). Further, pedagogy of constructivist learning theories, such as social constructivism, have been altered and empowered through the use of technology as a tool in teaching and learning. With the ever-increasing use of educational technology, more research on meaningful learning experiences will take place (Reich, 2009).

## Use of Technology in Teaching and Learning

Educational technology has been touted as a tool in teaching and learning. According to Stošić et al. (2020), educational technology can be used as a tutor, a teaching tool, and a learning tool. Technology is a tool used for tutoring when programmed to teach (instruct and guide) on its own. Technology as a tool in teaching supports instruction by providing unique avenues to teach in creative ways. At the same time, technology as a learning tool enhances learning by making it easier and effective.

### *Teaching Tool*

According to the U.S. Department of Education, technology as a teaching tool "has the power to transform teaching by ushering in a new model of connected teaching" (Use of Technology in Teaching and Learning, n.d., para. 1). The oldest and the most prevalent teaching model has been the lecture (Laurillard, 2002; Phillips, 2005a; Sheely, 2006). As a teaching model, Lectures originated from medieval times (Friesen, 2011) when books or teachers were few and far between. Back in those days, knowledge was recited by a monk standing in front of the room while the students hurriedly took notes or made changes to a ready-made text of his oral teaching. The purpose was not just notetaking but also to reproduce texts in an era before the invention of the printing press or any subsequent technologies (Friesen, 2011). As universities emerged, this tradition sustained, and hence was born the "sage on the stage," the expert transferring their knowledge to the students (Laurillard, 2002).

Not much has changed since the illustration by Laurentius de Voltolina depicting a 14th-century university lecture (Wikimedia Commons, 2008) in terms of the classroom structure. What has changed over the decades (and centuries) is that experts (faculty) are now using an array of audio, video, and student feedback technologies, and the students in tiered seating are looking at their laptops, tablets, or smartphones while the expert talks (Purdue Online, n.d.). Although the critical element of the expert providing information in real-time to groups of listening students still remain unchanged even in models like a podcast, the TED Talk, and Khan Academy, Romanelli et al. (2014) argue the many ways platforms like TED Talks are an antithesis to a lecture.

***Learning Tool***

Technology, as a learning tool, is not a new idea. Atkinson (1968) and others began attempts to use computers as a technological learning tool back in the 1960s (National Research Council, 2000). According to the USDOE, OET, NETP (2017), technology "can offer more flexibility and learning supports than can traditional formats" (p. 22). Technology has allowed for learning spaces that are more situated, experiential, and contextualized within specific domains, like bringing real-world challenges into the classroom (e.g., Uberadmin, 2017). For a long time, schools struggled to deal with the logistics of providing concrete real-world experiences for students, be it field trips, laboratories, and work-study programs. Digital tools like multimedia apps, social networking platforms, and mobile technologies helped bridge this gap (USDOE, NETP, 2017). For example, Simkins and Cole (2002) used multimedia tools to enable students in a California school to apply their Spanish lessons to a real-world purpose by having them create and produce a video for orienting new Spanish-speaking students to the school. Friedman (2014) described how two preschool teachers used transmedia materials to help a 5-year-old make social connections by exploring a virtual tool of the Titanic. These are both examples of how technology was used to bring real-world challenges into the classroom.

Research indicates many such affordances of technology as a learning tool, yet it also cautions that using technologies does not guarantee effective learning (National Research Council, 2000). It cautions that “inappropriate uses of technology can hinder learning – for example, if students spend most of their time picking fonts and colors for multimedia reports instead of planning, writing, and revising their ideas” (National Research Council, 2000, p. 206). However, when integrated meaningfully and with thoughtful (intentional) adult involvement, technology creates an environment of learning (National Research Council, 2000).

Technology has, in fact, evolved the role of the expert and the art of learning. The learners are no longer passive receivers of information. In their blog, Purdue Online (n.d.), authors asserted that technology has expanded *access* to education. Rather than looking through books and encyclopedias, students can now have information at their fingertips. Taking out the restriction of time and space, technology has *increased opportunities* for more formal learning (Van Roekel, 2008). In medieval times, books were rare, and education institutes were only accessible to the elite (Purdue Online, n.d.).

Today, through Massive Open Online Courses (MOOCs), online courses, blended learning, flipped classrooms, and more, there is more access to unprecedented learning opportunities (Purdue Online, n.d.). Technology has *connected* people and societies within their context and around the world (Powers, 2018). Google docs, blogs, and personal social media sites such as Facebook, Instagram, and Twitter allow students and teachers to collaborate on projects and invite new ways of communication (Powers, 2018).

However, no matter how sophisticated and digitalized the medium of education becomes, it is important to differentiate between "the process of developing a technology of education" and the technological tools used for instruction (Saetller, 2004, p. 4). In this situated view of technology, the technology of education can be referred to as the way of learning about the processes of knowledge related to technology. In the same view, the technology of instruction can be referred to as an integration of educational technologies into a teaching-learning environment to aid the process of achieving any teaching-learning goal.

**Evolution of Educational Technologies and COVID-19**

As the name suggests, the meaning and structural composition of educational technology have to do with two components, education, and technology. The term is oftentimes interchangeably used with instructional technology. The etymology of educational technology refers to three concepts: the Latin "educare," meaning to train or gain knowledge; the Greek "techne," meaning a systematic art or craft of learning; and the Greek "logia," meaning to express or discourse (Spector, 2015). In translation, educational technology means discourse about learning something systematically to gain knowledge. However, researchers have long argued about the role of technology in education (e.g., Saetller, 2004), especially in the education of young children (Luke, 2000).

Education has adopted and adapted technology over a long period of time. The role of technology in education has shifted from wooden paddles to social media; however, there are important lessons to be learned from the past developments of technology use in education. This is because new technology rarely completely replaces old technology. In fact, it always operates as an integrated part of the newer technology (Bates, 2019), for example, the use of video in podcasts. But it is important to look at the evolution of technology in education as technology moves from its use in activities to technology-based activities.

**Evolution of Technology in Education**

The history of technology in education can be traced back to colonial years, where wooden paddles with printed lessons were used to teach verses to students (The Evolution of Technology in the Classroom, n.d.). Then came the primitive version of a slide projector called the Magic Lantern in the 1870s, followed by the Chalkboard in the 1890s and the pencil in the 1900s. Since then, educational tools have become more electronic with the advent of radio in the 1920s, overhead projectors in the 1930s, and videotapes in the 1950s (Purdue Online, n.d.). By the early 1980s, technology had started infiltrating schools. With Toshiba's mass-market computer and Apple's Macintosh, the technology-to-student ratio in U.S. schools was about 1:92 (LSU Online, 2020). It was during this time that researchers started introducing computer languages in schools. Mathematician and professor Seymour Papert introduced microcomputers in the classroom by teaching primary programming language ‘Logo’ to young children, which was followed by programs like BASIC, PLATO, and computer-controlled videodisc systems (Keane & Sterling, 2016). Since Papert’s groundbreaking work, the tools available for learning in schools have become increasingly powerful and widespread, from personal computers and 1:1 handheld devices (e.g., iPads) to interactive whiteboards, digital video cameras, and a constantly expanding suite of Web 2.0 tools.

As technology keeps on evolving, conceptions about the educational component of technology also keep evolving, often leading to an everchanging temporary definition of technology in education. The Association for Educational Communications and Technology (AECT), the oldest professional organization for educational technology, started with a definition of instructional technology as the “theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning” (Richey & Seels, 1994, p. 1). This definition was revised in 2007 to combine the terms instructional technology and educational technology into one definition. A new definition for educational technology was issued in 2018: “Educational technology is the study and ethical application of theory, research, and best practices to advance knowledge as well as mediate and improve learning and performance through the strategic design, management and implementation of learning and instructional processes and resources” (AECT, n.d.). Stating that the definition of educational technology keeps changing, Januszewski and Molenda (2013) provided a temporary definition of educational technology as “the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources” (p. 1). Stošić et al. (2020) defined educational technology as a process of systematically applying modern technology to improve education. The most current definition of educational technology provided by Lathan (2020) focuses on “the technological tools and media [or platforms] that assist in the communication of knowledge, and its development and exchange” (para. 5).

To understand the role of educational technology in the diverse educational field, it is crucial to understand not only its definitions but also the ways in which the term is interpreted. According to Aggarwal (2014), there are five stages of educational technology evolution. At the first stage, until about 1970, the term used for educational technology was *technology in education*, implying the use of a variety of media (audio/visual) aids for teaching purposes. The term referred primarily to the technology used for transmitting lesson content. An excerpt from Derek Rowntree’s (1974) book, *Educational Technology in Curriculum Development*, concedes to this construct as he clarifies the following:

> His book is not about audio-visual aids... Educational technology is not to be confused with electronic gadgetry… educational technology is as wide as education itself: it is concerned with the design and evaluation of curricula and learning experiences and with the problems of implementing and renovating them. Essentially, it is a rational problem-solving approach to education, a way of thinking skeptically and systematically about learning and teaching. (p. 1)

In its second stage, around the mid-1970s, the term technology of education became widespread. Education started recognizing technology, in the broader sense, to include aspects such as learners, goals, content, and evaluation in the instructional process (Aggarwal, 2014). The third stage started with the arrival of digital media, where technology started encouraging interactivity and interconnectivity. The fourth was when technology was used to program individualized learning. And lastly, technology started being integrated into education to systematically design, practice, and assess the entire teaching and learning process in terms of specific objectives (Aggarwal, 2014).

In this regard, Koehler and Mishra (2005) explain, "Merely introducing technology to the educational process is not enough to ensure technology integration since technology alone does not lead to change" (p. 132). This stresses the important role of the pedagogical processes in which teachers use technology that has the potential to change education. The issue no longer remains whether teachers should integrate technology into their existing practices, but instead, how teachers use technology to transform their teaching and create new opportunities for learning (Bers, 2008).

Much of the beliefs about technology use in education started shifting during the COVID-19 pandemic (Winther & Byrne, 2020). With the rapid spread of COVID-19, governors and legislatures announced statewide closure of at least 124,000 public schools in 48 states and every U.S. territory (Olneck-Brown, 2021). About 3 billion people were asked to stay in lockdown, providing educators, parents, and advocates the much-needed push to think of technology as a critical tool for children's access to learning, play, entertainment, and social interaction (Winther & Byrne, 2020). Most institutions of education tried to recreate the school settings online using asynchronous and synchronous platforms (e.g., Canvas, Blackboard, Zoom, WebEx). While technology afforded the replacement of in-person instruction through virtual or remote instruction, many other important limitations came to the surface. Melia et al. (2019) reported that that 17% of U.S. students do not have computers in the home, and 18% of students lack access to high-speed internet. Besides the digital divide, questions were raised about the variable effect of the pandemic on students with disabilities, students with different backgrounds, school meals, accountability, instructional time, college readiness, and also digital risks (NCSL, 2020). In addition, there was an implicit expectation that amidst these differences and disparities, teachers would be able to adjust to the new learning platforms and provide personalized resources, opportunities, and support outside of school. While there were exemplary uses of technology and creative teaching examples from virtual meetings to drive-through graduations, there was also a rising concern that teachers were scrambling to figure out how to use digital tools, online resources, and applications (also called apps) stating they were unprepared for technology integration (Apriyanti, 2020; Rasmitadila et al., 2020)

The prediction is that COVID-19 will change the way of life and may also change humankind as a species (Soga et al., 2021). However, the fact is that the impact of COVID-19 on life and education is still in its infancy, and there is still a lot to learn about how it has and will impact teaching and learning in higher education and the PK-12 context. What has become apparent is that educators around the world are now talking about the need to rethink how to best educate future teachers and future students (Luthra

& Mackenzie, 2020). Keeping in mind the disruption experienced due to this pandemic only strengthens the argument that technology has stepped into the education realm and future teachers must be prepared to integrate technology into their future instruction.

This circles back to the important role that teacher preparation programs play in preparing preservice teachers to integrate technology in meaningful ways for their future instruction. And it is not that schools of education and other colleges were not integrating technology integration in teacher education or online education pre-COVID-19 (Kim, 2020). In fact, it was quite the opposite. But the variation to which technology is integrated varies widely depending on how central it has been to that institution's strategic planning (Kim, 2020). This may perhaps change, and technology integration may become a core aspect in the plan of every higher education and PreK-12 strategic plan as they now plan for their institutional resilience and academic continuity in the future. But again, much is still unknown. However, to better understand the influences of technology on teaching and learning, the next section will discuss how technology has evolved in teacher education.

**Evolution of Technology in Teacher Education**

According to Benjamin (1988), the first documented use of technology in teacher education was the development of teaching machines that was demonstrated in 1920s at the American Psychological Association. This included to the machines invented by B. F. Skinner in the 1950s. The machine combined the system of teaching and testing (i.e., assessment; Benjamin, 1988). Later, Skinner developed a theory of programmed learning that was implemented by teaching machines in an effort to improve teaching methods for spelling, math, and other school subjects by using a mechanical device that would surpass the usual classroom experience (Hill, 1977).

Later in the 1980s, with the development of personal computers, Bull et al. (1989) introduced Teacher-LINK to support preservice teaching internships by linking university faculty, student teachers, and mentor teachers via email. In a noteworthy publication entitled "The Electronic Academical Village," Bull et al. introduced that email can be used in multiple ways to aid communication (e.g., an advisor could share a lesson plan, respond to requests for teaching suggestions, or respond to questions about teaching ideas). However, Bull et al. (1989) also mentioned that the benefits of technology were not coincidental because the technology by itself did not establish academic networks. In fact, technology provided an opportunity to develop an extended academic community that could lead to higher-order discussion and networks (Bull et al., 1989).

In 1991, at the Harvard Graduate School of Education, interactive computer networks which included "the electronic transfer of text messages from one person to another or to a group of individuals where the form of exchange is printed text on a computer screen" (p. 141) were used to support 39 beginning teachers (Merseth, 1991). In this study, The Beginning Teacher Computer Network (BTCN) offered participants the capacity to engage in a personal and public exchange of emails and group discussions on topics related to their teaching experiences. Merseth noted that although the use of interactive computer networks had been well developed in the scientific and business communities, it was relatively unused in teacher education. One reason for this could be that in the late 1980s and early 1990s, the personal computer had just started entering classrooms, and teachers were trying to figure out how this tool that was new at that time could be used to support teaching and learning (Gale, 2012). However, Merseth (1991) concluded that a significant benefit of the interactive computer network support was that it provided both emotional and technical support to novice teachers in geographically diverse areas and such support and the feeling of being supported were essential to teachers' future instructional quality.

In 2001, Hawkes and Romiszowski moved a step further from emails to the use of computer-mediated communications (CMC) to analyze the reflective discourse of 28 teachers during their interdisciplinary problem-based curriculum development. Hawkes and Romiszowski described CMC to include “electronic mail [email], listservs, threaded forums, electronic bulletin boards, network videoconferencing, conferencing software, and multi-user domains” (p. 288). Comparable to email, the CMC afforded speed, time, and place independence for participants to investigate and engage in discourse while “constructing, communicating, and refining ideas” (p. 289). Moreover, CMC allowed for not only self-inquiry but also external dialogue with teachers or peers. The authors concluded that this collaborative shared reflection, facilitated by network technology, was more critically reflective than face-to-face discourse.

In the later part of the 1900s and early 2000s, hypermedia tools were gaining popularity as a new way of relating information and sources (Howard & Mozejko, 2015). Hypermedia tools were defined by Lloyd and Wilson (2001) as a medium to share information that included but were not limited to “hypertext links, quick-time movies from videotaped segments of practice teaching, other video, and audio components, and links to a variety of applications" (p. 497). Many studies reported the use of electronic portfolios in teacher education (e.g., Aschermann, 1999; Barrett, 1998; Glasson & McKenzie, 1999; McKinney, 1998). Morris and Buckland (2000) reported the use of Hyperstudio to develop multimedia portfolios in an elementary teacher preparation program. The authors concluded that while constructing their multimedia portfolios, prospective teachers learned not only from the development process but from the product as well.

In another study, Lloyd and Wilson (2001) introduced portfolio-like hypermedia projects to encourage prospective secondary mathematics teachers to become reflective practitioners by building explicit connections within their own experiences. Lloyd and Wilson noted that specific to hypermedia format was the ability to incorporate multiple media (e.g., video, audio, text, hyperlinks, animation) into a single document to share across different platforms. The authors concluded that participation in creating such projects afforded prospective teachers not only the experience of using such technology tools but also "provid[ed] them with a context to discuss, reflect upon, and improve their own teaching" (p. 513).

Two years later, Nicholson and Bond (2003) examined the use of an electronic discussion board, a type of computer-mediated communication (CMC) for preservice secondary education majors to share experiences and ideas over the course of 10-week field experience. The CMC in this study allowed teacher educators and preservice teachers to circumvent problems associated with time, scheduling, and geography. In addition, it also allowed preservice teachers to get support from their professors and peers and receive cognitive and emotional support while also collaboratively reflecting in conversations about students and the practice of teaching outside of the classroom.

Five years later, discussion boards were still discussed and favored as a possible avenue for teachers to engage in reflection and cognitive development (Romano, 2008). Romano (2008) analyzed the type of conversation and reflection amongst 10 beginning teachers, five of whom were elementary teachers, and found evidence of cognitive development in their discussions. Romano argued that discussion boards give teachers an opportunity to engage in deep discussion about issues related to teaching, which "is essential to a teacher's professional development" (p. 53).

Web technologies, such as blogs, wikis, podcasts, social bookmarking, rich site summary (RSS), and other powerful web tools, started flooding the education community (Richardson, 2006). This influx of technologies also influenced the field of teacher education. Leuf and Cunningham (2001) define a wiki as a "freely expandable collection of interlinked web pages and hypertext system for storing and modifying information" (p. 14). Matthew et al. (2009) examined the benefits and challenges of wiki's contribution to a language arts methods class with 37 elementary preservice teachers. They concluded that the use of wikis encouraged deeper processing of the course content (Matthew et al., 2009). Yang (2009) studied blog usage of 43 English as Foreign Language student teachers and posited that "using blogs as a platform for reflection, participants got more opportunities to make comments and challenge each other's viewpoints" (p. 18).

The early 2010s saw one of the fastest and largest growing segments of technology, the digital technologies, specifically mobile technology. Şad and Göktaş

(2014) defined mobile technology learning as learning that is mediated by mobile devices such as iPhones, tablets, smartphones, digital cameras, netbooks, and tablets. The use of mobile technologies was not new to preservice teacher education; however, the sudden growth of the technology renewed its use (Kearney & Maher, 2013). In one of the studies, Husbye and Elsener (2013) integrated mobile technologies into two literacy education coursework, one with early childhood education teacher candidates and one with elementary teacher candidates. The authors looked at how mobile technologies gave teacher candidates mobility within the classroom. By using Google Forms, Twitter, iPads, and QR codes, the teacher educators co-constructed the definition of 21st-century literacies with the teacher candidates. They concluded that mobile technologies provided the digital space for teacher candidates to have a voice and build their communities of practice (Husbye & Elsener, 2013). Mobile technologies were also found valuable for supporting preservice teachers' technology integration practices for future instruction. For example, Bannon et al. (2012) found that both preservice secondary teachers and in-service elementary teachers saw value in integrating math apps targeting specific mathematics concepts as a potential tool to promote student learning. While Bannon et al. (2012) saw value in using iPads with pedagogical objectives, they also described a range of extrinsic factors like bandwidth, cost, and distribution of iPads as inhibitors of using it.

Parallel to the use of mobile devices, social media was opening possibilities of interaction and collaboration with other learners and their digital content across the globe. Some examples of social media include social network sites like Facebook and LinkedIn, wikis blogs, micro-blogging services like Twitter, and video-sharing services like

YouTube. In a literature review of using social media in academic practice, Guy (2012) found that faculty used social media for personal communication, information sharing, and professional connections but not as much for academic practice.

With various new digital tools and digital spaces providing a variety of options to enhance education, the use of social media and social environments in teacher education also increased considerably. For example, Kumar and Leeman (2013) designed an educational technology course for social studies preservice teachers that explored social media technologies that could be useful for social studies teaching and learning while also using social media platforms to build communities with experienced educators. Their findings indicated that preservice teachers gained confidence in using new technologies and social media tools for their future instructions. In another study, Tur and Marín (2015) introduced Twitter into a debate activity for 153 primary and secondary student teachers and assessed its impact on how they learned and understood the debate topic. In their analysis of the collected tweets and a questionnaire, they found that the student teachers responded positively to the educational possibilities of Twitter and social networks in their future teaching. Similarly, Billen (2015) used Instagram to elicit 14 preservice elementary teachers' reflective practices and reported that using Instagram not just helped preservice teachers exhibit intricate and profound reflections, but they also expressed that they would consider the use of Instagram for their future teaching. Amongst newer studies, Schroeder et al. (2019) used Pinterest to expand elementary-level preservice and in-service teachers' learning networks. In addition, they indicated that both preservice and in-service teachers used Pinterest productively to search for educational resources and were also able to adapt resources to suit their classroom needs.

Just like digital spaces started becoming a viable complement to the traditional learning approaches, the online environment also started becoming an expansive educational context. The International Association for K–12 Online Learning (iNACOL) defines *online learning* as instruction and content delivered primarily over the internet (Watson, 2005). The term has been used interchangeably with Virtual learning, Cyberlearning, e-learning (iNACOL, 2011). It has also been used, for example, with blended learning, digital learning, web-based education, computer-based learning, and distance learning (Rice & Deschaine, 2020). Claiming political reasons like public costs, Rice and Deschaine (2020) stated that preparing teachers to facilitate learning in an online environment has not been an easy endeavor. Kennedy and Archambault (2012) argued that preparing teachers to facilitate online learning is different from merely putting more teacher education courses offered online because it is about preparing teachers to educate the children in the digital age. In a 2015 annual review of policy and practice, Gemin et al. (2015) reported that there were about 2.2 million students taking 3.8 million online courses. On the other hand, Kennedy and Archambault (2012) reported that teacher preparation that intentionally prepares teachers to teach online is essentially non-existent.

This was all before the world faced the COVID-19 pandemic. With the disruption caused to most lives amidst the COVID-19 crisis, almost all schools and higher education institutes in the US and around the world became virtual. What came to the surface was that PreK-12 schools also had to quickly adapt to an online model, albeit with limited to no experience (Vegas & Winthrop, 2020). A hope is that this will help teacher preparation programs take the leap that Kennedy and Archambault (2012) and Rice and Deschaine (2020) have been advocating for.

## National Technology Standards and Frameworks

Technology integration into teacher preparation programs was highlighted and encouraged through national organizations such as the International Society for Technology in Education (ISTE) and Council for Accreditation of Educator Preparation (CAEP), along with the National Educational Technology Standards (NETS) standards. The U.S. Office of Technology Assessment (1995) stipulated that efforts must be made to not only implement technology tools in preservice teacher preparation, but to provide preservice teachers with "visions of the technologies' potential, opportunities to apply them, training and just-in-time support, and time to experiment" (p. 13). Understanding these standards is important because what they say about technology skills and competencies in teachers influences how teacher preparation programs prepare preservice teachers (Willis, 2012).

### *ISTE Standards*

When preparing preservice teachers to be competent in integrating technology, the ISTE standards (iste.org/standards) serve as a widely used guide to preparing preservice teachers with strong technological knowledge and skills (ISTE, 2017). These standards connect with different roles and responsibilities in an educational environment. The ISTE Standards for Students direct how the students are using technology, whereas the ISTE Standards for Educators guide how teachers must integrate technology. Other sets of standards include the ISTE Standards for Education Leaders and Coaches, plus Computational Thinking Competencies for Educators.

The ISTE last updated its National Educational Technology Standards for Educators (previously called NETS•T) in June 2017. While the 2008 standards focused on supporting learning with technology, the 2017 standards reflected an evolution in education that is amplified by the promise of technology on empowering learning and the teaching profession. In other words, while the previous ISTE standards focused on technology skills (i.e., specific to technology integration), the new standards focus on competencies (i.e., a set of skills with abilities and knowledge) needed to effectively integrate technology for teaching and learning. Notably, the ISTE (2017) Standards for Educators outline the seven values or, as they call it, 'roadmap' for educators to use technology to create next-generation learning environments. These ISTE standards include

- learning continually from and with others and exploring proven and promising practices that leverage technology to improve student learning.
- seeking out opportunities for leadership to support student empowerment and success and improve teaching and learning.
- inspiring students to become citizens that positively contribute to and responsibly participate in the digital world
- collaborating with both colleagues and students to improve practice, discover and share resources and ideas, and solve problems.

- designing authentic, learner-driven activities and environments that recognize and accommodate learner variability.
- facilitating learning opportunities with technology to support student achievement of the ISTE Standards for Students; and
- analyzing data to drive their instruction and support students in achieving their learning goals.

Further outlined within the standards of collaboration, designing and facilitation are aspects of the learning environments that can help teacher preparation programs in making decisions about curriculum, instruction, professional learning, and the transformation of pedagogy with technology (ISTE, 2017).

***National Educational Technology Plan (NETP)***

In addition to the national standards, the Office of Educational Technology (OET) released the National Educational Technology Plan (NETP; U.S. Department of Education [USDOE, OET, NETP], 1996), a flagship educational technology policy that provided a vision and a call to action for all U.S. schools on how they could use technology for learning. This plan has since been updated every 5 years, with the latest being the 2017 plan, which had a new iteration just a year after the 2016 plan to keep pace with the rapidly changing circumstances and technological advancement in education (USDOE, OET, NETP, 2017).

An evolution similar to one in the ISTE standards can be noticed from the 1996 NETP to the 2017 NETP as to how it views technologies and their utilization in the educational sphere. The 1996 plan viewed technology as the panacea for education and outlined specific, national e-learning goals (Roumell & Salajan, 2016). The 2017 plan, however, talks about reimagining the role of technology to transform education and approaches to student learning (USDOE, OET, NETP, 2017). The 2017 NETP is more aligned to support teacher preparation programs because it synthesizes not only current knowledge about the successful integration of technology in learning environments but also identifies important elements from exemplary and aspirant institutions and projects. The NETP calls for a focus on the active use of technology by students as tools for them to explore, create, communicate, and solve rather than more passive uses of technology (USDOE, OET, NETP, 2017). Moreover, it was accompanied with a Higher Education Supplement that builds on the NETP's five sections, learning, teaching, leadership, assessment, and infrastructure, and examines them in the context of higher education (King & South, 2017).

The 2017 NETP was also developed to align with The Early Learning and Educational Technology Policy Brief (EL-ETPB), which was jointly released with the U.S. Department of Health and Human Services (USDHH) in October 2016 (USDOE, OET, 2016). The EL-ETPB is another technology brief that provides guiding principles for early educators to integrate technology, which recognizes the role of unstructured, unplugged, interactive, and creative play in the early childhood education context. The EL-ETPB acknowledges the large age span in the development of early learners from birth to 8 years of age, further providing guidelines for implementing a developmentally appropriate technology curriculum (USDOE, OET, 2016). The EL-ETPB outlines the following four guiding principles to guide early educators on how to introduce and use technology as a tool to support learning in the classroom, community, or home:

- Technology, when used appropriately, can be a tool for learning.
- Technology should be used to increase access to learning opportunities for all children.
- Technology may be used to strengthen relationships among parents, families, early educators, and young children.
- Technology is more effective for learning when adults and peers interact or co-view with young children

Further outlined in this brief are guiding principles that can help early educators and policymakers at state and local levels better understand the importance of developmentally appropriate technology for early learners and the importance of training and supporting early educators to best use technology in early learning settings (USDOE, OET, 2016).

***Partnership for 21st Century Skills (P21)***

Another national organization that advocated for the 21st-century readiness of every student was the Partnership for 21st Century Skills (P21). In 2006, the development of P21was supported by research across the national business community, education leaders, and policymakers (Ledward & Hirata, 2011). This partnership laid out a vision similar to ISTE. It stated that all learners must be able to "exhibit a range of functional and critical thinking skills, such as Information Literacy, Media Literacy, and ICT (Information, Communications, and Technology) Literacy" (Partnership for 21st Century

Skills, 2019, p. 2). While the framework started with defining seven 21st Century skills in 2006, it was updated in 2015 with a goal to provide a set of competencies that emphasize the 21st Century Skills, which include Learning and Innovation Skills (also called the 4Cs: creativity, critical thinking, communication, and collaboration), Information, Media, and Technology Skills; and Life and Career Skills (Remake Learning, 2016). The P21 framework puts more emphasis on integrating core content and interdisciplinary themes with the 4Cs rather than just technological literacy (Johnson, 2009). With P21's broad base adaptable to both in-school and out-of-school activities (Remake Learning, 2016), the P21 framework and the ISTE framework together can provide a solid foundation for preparing 21st-century teacher education.

***Council for Accreditation of Educator Preparation (CAEP)***

Accrediting bodies of teacher preparations across the nation like the Council for Accreditation of Educator Preparation (CAEP) have also reflected a commitment to technology integration by stating that technology "needs to be integrated throughout preparation experiences" (CAEP, 2013, p. 1). Before developing the ISTE standards for educators, CAEP and ISTE standards worked jointly to create the ISTE-CAEP standards, which up until Fall 2018 held all educator preparation programs accrediting through CAEP responsible for providing evidence of meeting the specific technology standards (Stokes-Beverley & Simoy, 2016). Currently, the CAEP K-6 Elementary Teacher Preparation Standards recognize the integration of technology throughout the recommended standards as opposed to providing an isolated section for technology standards (CAEP, 2021).

Globally, frameworks like The United Nations Educational, Scientific and Cultural Organization [UNESCO; 2011] ICT Competency Framework for Teachers have aimed to establish international teacher competency policies and standards. Aimed at educational policymakers, teacher educators, providers of professional learning, and practicing teachers, the framework proposes and progresses through three different stages of teaching –from 'basic tools' in Technology Literacy through 'complex tools' in Knowledge Deepening to 'pervasive tools' in Knowledge Creation.

Another initiative by the U.S. Department of Education that sought to restructure the teacher education programs by integrating technology was the Preparing Tomorrow's Teachers to Use Technology (PT3) initiative (http://www.pt3. org) and the Project PICT (Preservice Infusion of Computer Technology). Project PICT implemented numerous activities, such as mini-grants, extensive faculty training on technology and pedagogy, partnerships with K–12 schools, and increased technology equipment and support, to increase the technology experiences for teacher candidates throughout their teacher education. Studies like Banister and Reinhart (2012) reported that their project PICT (Preservice Infusion of Computer Technology) resulted in significant increases in technology proficiency and integration among participating faculty, K–12 teachers, and teacher candidates.

***PT3 initiative and Other Standards Affecting Technology in Early Childhood Education***

In 1999, the U.S. Congress approved the Preparing Tomorrow's Teachers to Use Technology (PT3) initiative that has since provided grant funding to over 400 studies in an effort to transform teacher preparation programs to become models for technology integration (USDOE, 2006a). The implementation of the PT3 grants focused on enhancing technology integration in preservice courses and field experiences (Mims et al., 2006) to carry out projects on higher education faculty technology competencies (e.g., Jonas, 2003; Snow & Miller, 2003; Sprague & Cooper, 2003), teacher candidates technology skills and competencies (e.g., Swain et al., 2003), and creation of training and learning tools (e.g., Knezek et al., 2000). However, only a handful of these studies focused on early childhood education (e.g., Arikan, 2007; Chen, 2003; Choi, 2004; Duran et al., 2005; Groth et al., 2007; Kelley et al., 2003; Prejean et al., 2007; Wheatley, 2002).

A closer look at the studies in the early childhood education context reveals that most of the researchers participating in the PT3 grants were focused on building faculty technology competence as a strategy to enhance technology integration in early childhood education teacher education programs. For example, in a reflective action research case study, Wheatley (2002) participated in a PT3 granted project that aimed at increasing technology integration in a teacher education program at an urban state university. Giving an account from a non-fluent higher education faculty, the author noted that various project-related factors, own expectations, and efficacy were factors that affected a faculty's computer infusion efforts (Wheatey, 2002). In another PT3 funded study, Chen (2003) studied how preservice teachers were taught about technology in three existing early childhood education courses. The author noted that many things affected the success of technology integration, like having a "HOW-TO MANUAL," emphasis on technology integration in course assignments, and the technical proficiency of teacher educators (Chen, 2003, p. 3439). Similarly, Özgül and Campbell (2002) used an electronic portfolio to enhance the way university faculty use technology in their own teaching practice but also to provide a model for teacher candidates to use in their own instruction.

In addition to The Early Learning and Educational Technology Policy Brief (USDOE, OET, 2016) and Preparing Tomorrow's Teachers to Use Technology (PT3) initiative, standards from the Association for Childhood Education International Elementary Education (ACEI) note that initial teacher candidates should adapt the curriculum and instruction by using technology resources and that candidates should know how to use appropriate technology so their students can use the technology tools. Furthermore, the Council for Exceptional Children (CEC) requires teacher candidates to use technology to design appropriate adaptations for all individuals with special learning needs and exceptionalities (McLeskey et al., 2017). In keeping with the pattern of other accreditation organizations, the NAEYC and Fred Rogers Center (2012) expects teacher preparation programs to teach candidates how to use technology appropriately and effectively when working with young children. In January 2012, a joint position statement was issued by the NAEYC & Fred Rogers Center, *Technology and Interactive Media as Tools in Early Childhood Programs Serving Children from Birth Through Age 8*, advising educators on developmentally appropriate uses for the technology. As part of this alignment, "effective uses of technology and media are active, hands-on, engaging, and empowering; give the child control; provide adaptive scaffolds to ease the accomplishments of tasks; and are used as one of many options to support children's learning" (NAEYC & Fred Rogers Center, 2012, p. 6). This statement was amongst the first attempt to focus research on developmentally appropriate technology use in early childhood education.

As technology and its use continued to advance, consideration of developmentally appropriate practice (DAP) in the use of technology also continued. For example, Rosen and Jaruszewicz (2009) asked teacher educators and their students to think about how to extend DAP to technology use. In early childhood education contexts, DAP is the pedagogical lens used to gauge technology integration. DAP is an educational philosophy that requires educators to evaluate individual children's developmental stages, contexts, and desired developmental goals in order to be intentional in making curricular decisions that will further promote learning and development (Copple & Bredekamp, 2009; Finegan & Austin, 2002; NAEYC & Fred Rogers Center, 2012).

Given the historically triggered controversy on the consequences of technology on young children, it is easy to see why early childhood educators might be hesitant to use technology in their instruction. Like, Selmi and Gallagher (2014) stated that long-term exposure to computers might result in a lack of interaction with people in the physical world that can further lead to poor social skills and physical health because. Similarly, Chaudron (2015) argued that the lack of time to play due to excessive use of technology may increase childhood obesity. Others like DeLoatch (2015); Haughton et al. (2015); and Rowan (2014) have also associated increased risk of obesity amongst minors with the negative impact of technology. On the other hand, many have promoted the positive impact of technology on many aspects of early childhood education practice. Like

Costley (2014) and Fleischer (2012) indicated that the use of a laptop increases young children's' engagement and motivation to learn. Recognizing that most of the content in technology for young children was not designed for the physical, emotional, and social development of children, Chau (2014) underscored the need for choosing apps that are intentional and meaningful. NAEYC and Fred Rogers Center (2012) also asserted that "early childhood educators who are informed, intentional, and reflective" in their use of technology and interactive media "choose technology, technology-supported activities, and media" to align with their teaching and learning goals (p. 10). Further, literature that establishes the use of educational technology and positive outcomes for children indicates that technology needs to (a) be developmentally appropriate for children; (b) include tools to help teachers implement the technology successfully; and (c) be integrated into the classroom and curriculum (see Clements & Samara, 2003; Glaubke, 2007; NAEYC & Fred Rogers Center, 2012).

Frameworks like ISTE, NETP, EL-ETPB, P12, CEC, ACEI, and NAEYC were all developed in some way or the other to provide a frame of reference to integrate technology in teacher education programs. The U.S. Department of Education's PT3 grant awarded over 400 grants to education consortia to addressing the concern that "all elementary and secondary schools are now "wired" to the Internet, but most teachers still feel uncomfortable using technology in their teaching." (U.S. Department of Education, 2006a, para.1). The 2006 PT3 application expert read that "The PT3 Program provides grants to consortia that are helping future teachers become proficient in the use of modern learning technologies." U.S. Department of Education, 2006b, Current Application).

Later the he Higher Education Act of 1965 replaced the Preparing Tomorrow's Teachers to Use Technology program with the Preparing Teachers for Digital Age Learners program (The Law Library of Congress, n.d.).

With the issuance of technology standards, teacher education programs found themselves rethinking their current training approaches (Bucci et al., 2003). For example, Kovalik et al. (2013) studied how an educational technology 100 preservice teacher course, of which 27 were in Early Childhood Education) at Kent State University aligned to the ISTE's National Educational Technology Standards for Teachers (NETS•T). They found that although the preservice teachers made progress in technology knowledge in all five standards in the set, the course did not adequately address some of the performance indicators. Addressing what ideal ISTE standard adoption looks like, Bucci et al. (2003) noted that the contextual factors listed in ISTE (n.d.-a.) helped facilitate strong practices with educational technologies in the four exemplary teacher education programs they examined.

While the technology integration expectations were made abundantly clear in literature and in standards, the way technology was used by faculty and integrated into the higher education programs was dependent on a number of factors (Kyei-Blankson et al., 2009). Bingimlas (2009) identified teacher-level barriers like lack of teacher confidence and competence along with resistance to change and negative attitudes, while school-level barriers were identified as lack of time, accessibility, technical support, and lack of adequate training. While the influx of technology has addressed some of the access issues, teacher preparation programs have been placed with the highest expectation to provide intentional technology experiences for teacher candidates (Stokes-Beverley & Simoy, 2016). As per CAEP standard 1.5, teacher preparation programs must "ensure that candidates model and apply technology standards as they design, implement and assess learning experiences to engage students and improve learning; and enrich professional practice" (CAEP, 2019, Provider Responsibilities section 1.5).

Another important aspect stressed in the technology standards is the critical relationship between technology and pedagogy. Such relationships are often illustrated in models or frameworks that are developed to guide technological integration, like the Technology Acceptance Model 2 (TAM2; Venkatesh et al., 2003), Technology Integration Matrix (TIM; Jonassen, 2000), Technological Pedagogical and Content Knowledge (TPACK; Mishra & Koehler, 2006; Pierson, 2001), the Substitution Amplification Modification Redefinition (SAMR) model, and the trudacot model (McLeod & Graber, 2014), to name a few.

**Models or Frameworks for Technology Integration**

Technology integration is complex and can get complicated for teachers to understand. Thus, researchers have been investigating multiple models or frameworks that can create a compelling and sustainable methodology to help both in-service and preservice teachers understand technology integration for teaching and learning. Some of the models/frameworks for technology integration like the Technology Acceptance Model 2 (TAM2), Technology Integration Matrix (TIM), Technological Pedagogical and Content Knowledge (TPACK), Substitution Amplification Modification Redefinition

(SAMR) provide a theoretical yet practical framework to help guide discussion about technology integration.

### *Technology Acceptance Model 2 (TAM2)*

Technology Acceptance Model (TAM), presented by Davis (1986), is an information systems theory that models how users come to accept and use technology. Li (2010) identified perceived ease of use and perceived usefulness as the two most identifiable and studied components of the TAM model. Venkatesh and Davis proposed an extended model named TAM2 to identify the variables that most influenced perceived usefulness (Marangunić & Granić, 2015). The updated TAM2 included social influences and cognitive processes as two additional determinants of technology use along with experience and voluntariness as factors that influence a user’s perception, intentional use, and actual use of technology.

After analyzing various models of TAM2, Ventakesh et al. (2003) created their own model of teacher technology integration based on those in their analysis, known as the Unified Theory of Acceptance and Use of Technology (UTAUT). This model considered a number of important factors in a teacher’s decision to integrate technology, including the belief that the technology will enhance job performance; the ease of use of the technology, the perception that important people would support the use of the technology, and the belief that the organizational culture would support the use of the new technology. By measuring perceived ease of use and perceived usefulness, this framework guides teachers’ decisions to integrate technology in the classroom and can be utilized by teacher educators or administrators to ensure that conditions allow teachers to comfortably integrate technology.

### *Technology Integration Matrix (TIM)*

Another framework that combines levels of technology integration into the curriculum with characteristics of the learning environment is the Technology Integration Matrix (TIM; Jonassen, 2000), which was developed by the Florida Center for Instructional Technology (FCIT) in 2005 (Harmes et al., 2016). Now in its third edition, TIM incorporates five interdependent characteristics of meaningful learning with five levels of technology integration. According to this model, the characteristics of the learning environment are not specifically about technology but the kinds of meaningful learning that technology enables. The five characteristics of meaningful learning are active, collaborative, constructive, authentic, and goal-directed. These are then aligned to the five levels of technology: integration, entry, adoption, adaptation, infusion, and transformation (Florida Center for Instructional Technology [FCIT], 2019). In terms of technology integration, TIM serves as a practical guide and pedagogically useful vocabulary for technology integration (FCIT, 2019). The TIM model is also supported by TIM tools that include includes a tech user and perception survey, an observation instrument, coaching and action research tools, and a survey maker, all managed by one admin center.

### *Technological Pedagogical and Content Knowledge (TPACK)*

While the TIM framework focuses on planning, describing, and evaluating technology integration, the Technological Pedagogical and Content Knowledge conceptualization (Mishra & Koehler, 2006, 2008) has been a catalyst for teacher education research. Mishra and Koehler (2008) built on Shulman's (1986) Pedagogy, Content, and Knowledge (PCK) model by adding technology to develop the Technology, Pedagogy, Content Knowledge (TPACK) framework. According to Koehler (2015), the "Technological Pedagogical Content Knowledge (TPACK) attempts to identify the nature of knowledge required by teachers for technology integration in their teaching while addressing the complex, multifaceted and situated nature of teacher knowledge" (para. 1). The TPACK framework illustrates an important relationship between content, pedagogy, and technology, which according to Koehler & Mishra (2009), is a key component in effective teaching. Figure 2 shows the TPACK model and the seven constructs within the model.

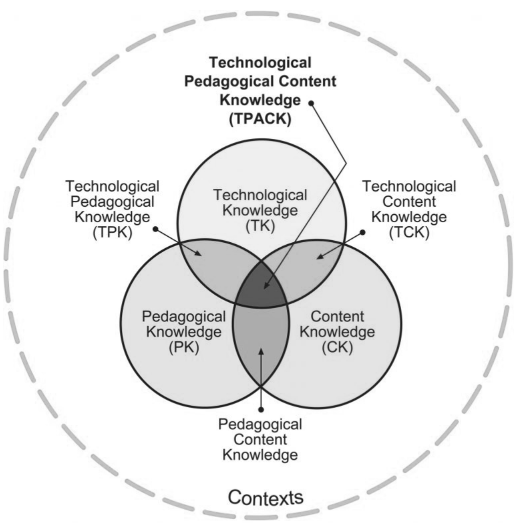


**Figure 2**.

*Technological Pedagogical Content Knowledge (TPACK)*

The TPACK framework has an overlap of the three main constructs—Technology Knowledge (TK), Content Knowledge (CK), and Pedagogical Knowledge (PK)—and seven overall constructs, as illustrated in Figure 2. TPACK has been widely used in literature to understand the application of technology in the field of education and teacher education (Chai et al., 2013). Voogt et al. (2013) provided a review of TPACK literature through the examination of 55 peer-reviewed publications between 2005 and 2011 and determined that there were different understandings of TPACK and that teacher knowledge (TPACK) and teachers' beliefs about pedagogy and technology determined whether or not a teacher might teach with technology. Numerous tools to measure a teacher's TPACK level have been developed, and most of the tools are collected using self-reports like surveys, interviews, or reflective journals; observations like classroom observations; or teaching artifacts like lesson plans and student work (Agyei & Keengwe, 2014).

Pierson (2001) contextualized TPACK and explained that technology integration exemplifies pedagogical expertise when direct connections are made between the technology to specific content and pedagogy needs of the lessons being taught. Thus, content has been identified as one of the critical elements in establishing technology integration skills, as well as supporting the measurement of TPACK constructs. However, content areas are unique. To utilize the TPACK framework in the development of teacher knowledge, a content-specific inquiry must be utilized.

### *Substitution Amplification Modification Redefinition (SAMR)*

The SAMR model (Figure 3), created by Puentedura in 2006, is a model that focuses on the levels of technology used by teachers in their instruction. The four levels are subdivided into two sections: enhancement and transformation. The enhancement sections consist of the substitution and augmentation levels. These two levels are generally the first experience teachers have when teaching with technology. Contained within transformation are modification and redefinition. Typically, moving up the levels of SAMR, like from adaptation level to redefinition level, is the goal when developing learning activities (Puentedura, 2014). Moving up a level can be interpreted as progressing to integrate technology more efficiently in a constructivist manner. A major critique of the SAMR framework is its lack of theoretical foundation in literature because studies refer to a blog from Dr. Ruben Puentedura rather than peer-reviewed academic research. The SAMR framework is relatively new and often compared to either the original 1956 Bloom's Taxonomy or 2001 revised Bloom's Taxonomy.

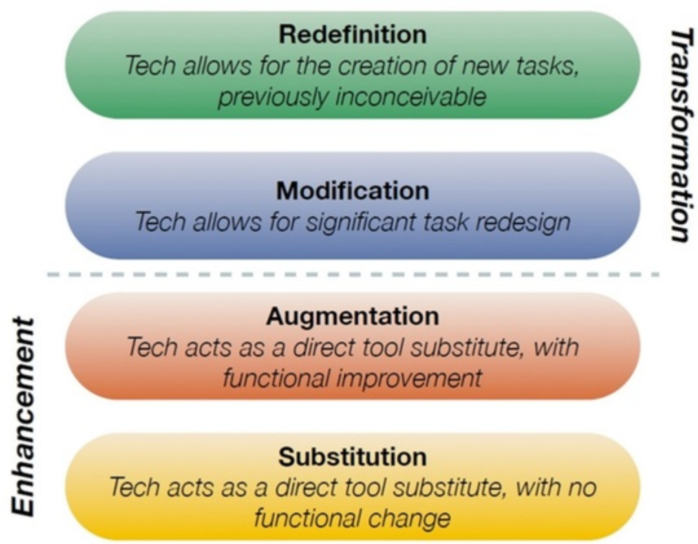


**Figure 3**.

*SAMR model*

*Note.* http://www.hippasus.com/rrpweblog/

Bloom's Taxonomy was first introduced in 1956 by Benjamin Bloom and others (Wilson, 2013). Originally, the taxonomy was used to classify curricular objectives and test to see the breadth, or the lack of breadth, of the objectives (Amer, 2006). The original Bloom's Taxonomy was divided into six categories: knowledge, comprehension, application, analysis, synthesis, and evaluation (Amer, 2006; Krathwohl, 2002). The revised Bloom's Taxonomy still consists of six categories, but they have been modified to reflect developments in the educational and psychological literature (Amer, 2006). The new categories are remembering, understanding, applying, analyzing, evaluating, and creating.

However, Carrington (2012) created a Pedagogy Wheel that combined Bloom's Taxonomy with SAMR. It shows that the intention behind SAMR is not just modification for the sake of modification, but modification (and redefinition) for the sake of higher-order thinking. SAMR model is a way to start intentionally focusing on learning affordances of technology, but teachers (at any level) need help to understand how to foster these learning environments that support powerful learning. Puentedura (2014) posited that combining SAMR and Bloom's Taxonomy (Figure 4 is a method teachers can utilize to help identify which level of the SAMR model a specific lesson is functioning.


**Figure 4.**

*Pedagogy Wheel*

*Note.* http://tinyurl.com/bloomsblog

***Trudacot model***

One final model, the trudacot model, proposed by McLeod and Graber (2014), starts with asking what the purpose of the technology is. Founded on thinking about the purpose of a learning activity, this model asks a series of questions that help the teacher think about how the technology is being used to achieve the desired purpose (McLeod & Graber, 2014). The trudacot model does not provide answers, but the questions asked in this model can be used as a catalyst to think about how to use technology appropriately and move through the levels of other models. The levels move from substitution to redefinition, from lower-order thinking skills to higher-order thinking skills, from entry to transformation, and from isolated knowledge to technological-pedagogical-content knowledge, or as Fullan (1991) says, from symbolic change to real change.

**Summary**

In summary, technology integration is a difficult and complex process (Norton & Sprague, 2001). This is because adding technology in education is not just about bringing a technology tool in the classroom but how to redesign the learning environment with technology such that it supports developmentally appropriate learning (November, 2010). A common understanding between all the above-stated policies, standards, and frameworks of educational practices is that prospective teachers need to be prepared to integrate technology effectively in their future instruction. In this regard, teacher preparation programs must help them build knowledge of content, good pedagogical practices, and technical skills, as well as an understanding of how these constructs interact with one another (Ottenbreit-Leftwich et al., 2010). While most teacher education programs have sought to provide technology integration experiences in their program to some degree, there is a wide variation as to the methods they have employed for instructing preservice teachers (Amador et al., 2015). Further, Sprague and Katradis (2015) note that more research is needed that explains what teacher candidates take away from the technology integration experiences that correlate to its actual use in the teacher candidates' future classroom practices.

**Role of Dispositions in Teachers' Technology Integration**

Identifying challenges to technology integration, studies have considered implementation problems and resource availability (e.g., lack of appropriate training and access to hardware and software) as some of the first-order barriers and teacher dispositions and teaching philosophies as some of the second-order barriers (Ertmer et al., 2012). Heo (2011) recognized dispositions toward technologies such as "teachers' attitudes, beliefs, practices, and resistance toward educational technology" as one of the "internal barriers" to technology integration (p. 62).

According to The National Council for Accreditation of Teacher Education (now Council for Accreditation of Educator Preparation [CAEP]; 2013), dispositions are guided by beliefs and attitudes related to professional attitudes and values. Taylor and Wasicsko (2000) describe them as innate qualities or ways of behaving (Katz & Raths, 1985; Ritchhart, 2002). Hill-Jackson and Lewis (2010) labels these attitudes as precursors to habits and behavior. In this regard, preservice teachers' dispositions towards technology can influence their technology integration practices (Tondeur et al., 2017).

Ertmer (2005) asserted that "the decision of whether and how to use technology for instruction ultimately depends on the teachers themselves and the beliefs they hold about technology" (p. 5). At one teacher-training institute in Singapore, Teo (2008) found that preservice teachers who were fearful toward technology reported low intentions to use technology in their future classrooms while those who had positive dispositions towards technology expressed behavioral intention to incorporate technology into their own teaching. Likewise, Jo (2016) examined preservice teachers' dispositions regarding the use of geospatial technologies for teaching in a senior-level methods course offered in geography and reported that a positive impact on preservice teachers' dispositions impacted their implementation of technology and teaching of spatial thinking in their future classrooms. In another study conducted by Meagher et al. (2011), preservice teachers' perceptions about using advanced digital technologies use of digital technologies was related to their enactment of technology-infused instruction. Other researchers have also studied in-service teachers and identified a positive relationship between teachers' dispositions and technology integration (Conderman & Walker, 2015; Goktas et al., 2009; Inan & Lowther, 2010; Mouza et al., 2017).

However, Shoffner's (2009) study concluded that proficiency with different technologies in various situations could result in developing negative attitudes toward the use of those technologies, whereas "a positive attitude toward technology does not automatically ensure the use of a specific technology" (p. 158). Yet, he also asserts that it is important to understand these perceptions and attitudes toward technologies so that teacher educators can seek ways to interrogate and challenge them.

**Teacher Preparation Programs**

Teacher preparation programs make many important decisions surrounding the integration of technology. One such decision that has been studied mainly in literature has been the focus on examining the *what* or the technological knowledge that preservice teachers need in order to effectively integrate technology in their future classrooms (Karakaya, 2017). Focusing on the *what*, much of the literature has been concerned with looking at technology skills acquired in instructional technology courses in teacher education programs (Hargrave & Hsu, 2000). However, more recently, teacher education research is starting "to share, discuss, learn, and advocate for the 'why' factor associated with integrating technology in teacher preparation" (Schmidt-Crawford et al., 2018, p.

132). More researchers are advocating for studies that understand how the technological, pedagogical, and content constructs interactively relate to one another (Koehler & Mishra, 2009). The following section discusses research that helps identify the approaches and practices in teacher education that have been studied in an effort to effectively prepare preservice teachers to integrate technology for learning and teaching.

### *Program Design*

Responding to the call for intentional technology integrations, teacher preparation programs have mainly designed opportunities based on three main models: (a) stand-alone educational technology course; (b) technology integrated into the method and/or content courses; and (c) hybrid model in which a stand-alone technology course is taught in conjunction with methods and/or content courses (Amador et al., 2015). More recently, Foulger et al. (2019) are calling for a fourth model, technology infusion in teacher preparation programs.

Kay (2006), in his influential review of 68 refereed studies looking at teacher preparation programs that incorporated technology into preservice education, found that the design of the education programs was one of the 10 key strategies that affected preservice teachers' preparedness to integrate technology. He noted that "many faculties of education use the single-course strategy to teach technology" (Kay, 2006, p. 390). And even though he concluded that such a strategy was effective in improving self-efficacy and foundational technical skills, he reported that such courses did not help preservice teachers extend the technology use into their future classrooms (Kay, 2006). Echoing the same findings, Kleiner et al. (2007) and Lambert and Gong (2010) concluded that the teacher education programs that started with providing a stand-alone educational technology course, taught by experts in educational technology, have not been successful in providing adequate opportunities for preservice teachers to develop the competence needed to teach with technology. Such an isolated technological approach did not provide teacher candidates with a clear understanding of pedagogically meaningful technology integration (Tondeur et al., 2012).

Tondeur et al.’s (2012) literature review synthesized the qualitative evidence in 19 empirical studies focusing on technology integration in preservice teacher preparation and posited that many teacher education programs were shifting from stand-alone technology courses to integrating technology throughout the teacher education curriculum (e.g., Doering et al., 2003; Goktas et al., 2009; Niess, 2005; Polly et al., 2010; Wetzel et al., 2014). Emerging research on technology integration in preparation programs seems to concur that preservice teachers need to experience technology integration throughout their teacher preparation programs (Donohue & Schomburg, 2015; Foulger et al., 2019; Tondeur et al., 2012; Wetzel et al., 2014). This emerging integrated approach can be further classified into a two-stage approach. The first approach juxtaposes an educational technology course in conjunction with the methods courses and field experience (e.g., An et al., 2011; Mouza et al., 2014). At the same time, the second approach eliminates the stand-alone course to pursue technology-infused methods courses (e.g., Asim, 2018; Foulger et al., 2019; Wetzel et al., 2014) and a technology-infused student teaching (e.g., Buss et al., 2018).

In an undergraduate teacher preparation program, An et al. (2011) developed an online, two-credit educational technology course with elementary teacher candidates and sequenced it at the beginning of the program. The rationale was to help preservice teachers gain the knowledge, skills, and dispositions for using technology that they could then apply in their subsequent methods courses. All major assignments in the course were planned to show how technologies could be adapted for diverse learners and meet the state technology literacy and core content standards (An et al., 2011). The results in the study showed a positive impact of this two-stage approach on students' development of TPACK. However, in an interesting concluding statement, An et al. (2011) stated that they do not believe in a separate educational technology.

In a similar study, taking a two-stage approach consisting of an educational technology course with a specific set of technology topics in conjunction with methods courses and field experience, Mouza et al. (2014) juxtaposed an educational technology course with an elementary methods course and field experience to help elementary preservice teachers make theory to practice connections and vice versa. By allowing for recursive communication between the methods faculty and educational technology instructor, Mouza et al. (2014) unified the tools, strategies, and ideas emphasized in the courses. They collected data using Schmidt et al.'s (2009) survey developed around the TPACK framework, a technology-integrated lesson plan and lesson critique that required the preservice teachers to think deeply about content, pedagogy, and technology. Mouza et al. (2014) reported positive feedback from participants in accepting the value of technology in teaching and learning. Even though this study meant to highlight the importance of constructing the technology, pedagogy, and content knowledge in harmony, the finding implicitly also reinforced the value of educational technology courses in developing preservice teachers comfort level with technology (Mouza et al., 2014).

In an effort to develop middle-grade preservice teachers' subject matter knowledge using technology and to help them understand what it means to teach with technology, Niess (2005) examined preservice teachers' development of TPACK in technology-integrated mathematics and science methods courses. The findings indicated that technology-integrated programs were effective in developing participants' subject matter content and the impact of technology on the development of that subject. Further questioning how and when do preservice teachers develop TPACK strategic thinking ability if they have not learned the content with these technologies, Niess (2011) implied that content must not only be learned with technology but also learned to teach with technology.

In a more recent study, Asim (2018) infused technology into two sections of an elementary science methods course. In a quest to turn around negative beliefs about science in preservice teachers, she intentionally designed an innovative science methods course infused with educational technology to provide multiple learning environments. Some of the educational technology experiences included a visit to virtual museums, educational apps for assessments, and educational games to supplement science content learning. The results of the study reported that educational technology tools not only enhance science teaching and the learning cycle but also positively influence elementary teacher candidates' beliefs about science.

In a longitudinal and college-wide vision for technology infusion, Mary Lou Fulton Teachers College adopted a technology-infused approach throughout their teacher preparation program. In a long-term effort, Foulger et al. (2012) noted that the college eliminated the stand-alone technology course to create space for the more content-knowledge course using a series of planned research. They first conducted a benchmarking study of the standalone course to determine the successful lessons and practices that should be incorporated into the new program design (Foulger et al., 2012). Then they began phasing in a purposeful infusion of technology into two methods courses and compared the stand-alone technology course with a technology-infused approach (Buss et al., 2015). During their initial infusion efforts, Wetzel et al. (2014) found that in their technology-infused methods courses, teacher candidates described prospective use of TPACK elements but were less confident about their ability to develop and implement content-based lessons in which PK–12 setting.

In a 2-year longitudinal study, Buss et al. (2015) examined teacher candidates' TPACK development in a technology-infused program methods course. They concluded that technology infusion in methods courses fostered TPACK development and technology integration skills among teacher candidates. The technology-infusion project has successfully demonstrated that technology infusion in methods courses improved preservice teachers' technology integration skills (Buss et al., 2015). It also improved the application of technology in preservice teachers' future teaching (Foulger et al., 2015).

However, most of their research has been focused on looking at technology integration across the teacher education program. In examining the long-term effects of the technology-infused technology integration skills, Buss et al. (2015) concluded that technology infusion in methods courses is helpful in developing teacher candidates' TPACK as well as the transfer of learning to classroom educational experiences. However, Buss et al. (2015) also recognized that more research is needed to explore factors that influence this development of technology integration in the methods courses.

Although the integration of technology in the curriculum is not a newer shift, examining more closely the unique advantages and drawbacks of both the emerging technology integration approaches illustrates that technology-infused with and around methods courses fosters both technological knowledge as well as knowledge related to the intersections of content, pedagogy, and technology (Buss et al., 2015; Mouza et al., 2014). Tondeur et al. (2013) suggested that technology "should be infused into the entire curriculum so that pre-service teachers have the opportunity to (a) understand the educational reasons for using [technology] and (b) experience how [technology] can support teaching and learning across different subject domains" (p. 242). However, because these approaches are relatively new and only a handful of studies have intentionally studied the approach, very little is known about the experiences of early childhood education preservice teachers in a technology-infused methods course (Buss et al., 2015; Tondeur et al., 2012). It is also unknown how those experiences influence future teachers' conceptualization of technology integration in their future classrooms (Nelson & Hawk, 2020). Reviewing empirical progress in the investigation of TPACK, Neiss (2011) concluded that more "research is needed to describe teachers' learning trajectories in developing the knowledge, skills, and dispositions for incorporating new and emerging technologies as learning and teaching tools in various subject areas" (p. 314).

Identifying types of the programmatic approaches adopted by teacher preparation programs while integrating technology throughout the curriculum, Ottenbreit-Leftwich et al. (2010) and Polly et al. (2010) reported that preservice teachers received technology integration content (e.g., lectures, podcasts), hands-on technology skill-building activities (e.g., workshops), hands-on technology integration experiences (e.g., field experiences), and technology integration reflections (e.g., electronic portfolios). Doering et al. (2003) emphasized four components within a preservice teacher education program that allow technology-infusion efforts throughout the curriculum: "(a) technology tools [that] can facilitate learning, (b) technology [that is] in the hands of the students, (c) students [learning] with technology, and (d) preservice teachers [learning] to generate future applications for technology integration within their content area" (p. 343).

### *Teacher Educator*

Another important aspect of teacher preparation programs that affect how technology is integrated into the curriculum is the role of teacher educators (Bingimlas, 2009; Foulger et al., 2015; Goktas et al., 2009; Hsu, 2012). Tondeur et al. (2012) identified seven key themes that impacted technology integration in preservice teachers: (a) scaffolding; (b) aligning theoretical and practical knowledge through the use of technology; (c) encouraging preservice teachers to reflect on their attitudes on the role of technology in education; (d) having preservice teachers learn technology by design; (e) having preservice teachers collaborate with peers; (f) providing feedback; and (g) having teacher educators as role models. All of the above themes suggest the important role of teacher educators. Carpenter et al. (2019) note that, amongst other factors that affect the development of preservice teachers' technology knowledge and skills, "teacher educators' technology competencies undeniably impact teacher candidate learning" (p. 797). Acknowledging this aspect, Foulger et al. (2017) developed the Teacher Educator Technology Competencies (TETCs) as a guideline specifically for teacher educators related to technology-related knowledge, skills, and dispositions.

Foulger et al. (2017) suggested that "teacher educators must model appropriate technology integration strategies for teacher candidates in courses, so the candidates, in turn, can effectively teach with technology" (p. 419). Roulston et al. (2019) categorized teacher educator models into three groups: models that (a) prepare preservice teachers to survive in a technologically equipped classroom; (b) build on preservice teachers existing technological knowledge; and (c) perceive preservice teachers' role as "transformative" where attitudes to technology are instilled such that they will grow and develop with the changing technology changes (p. 3786). In particular, Koch et al. (2012) and Nelson (2017) established that technology modeling and program design within a teacher education program significantly impacts preservice teachers' intentions to integrate technology.

Goktas et al. (2009) agree with this view and add that teacher educators' competency and willingness to use technologies in their own teaching enriches not just the courses in the technology integration process but also provides modeling of best practices for preservice teachers. However, this aspect may seem easier said than done (Goktas et al., 2009; Tondeur et al., 2016). Gronseth et al. (2010) suggest that one reason that methods faculty do not model enough technology integration is because they themselves are trying to keep up with best practices in current technologies. Gao et al. (2009) stated that modeling technology use and program design allowing technology experience are just two of the many ways' teacher educators could nurture a sophisticated, constructivist view of technology integration. Some other ways to support preservice teachers' technology integration knowledge is by providing scaffolding and authentic learning experiences with technology (Gao et al., 2009).

***Authentic Experience and Pedagogy***

Donovan et al. (1999) defines authentic experiences as realistic experiences that allow for opportunities to gain knowledge, collaborate, provide safe spaces to ask questions, and demonstrate understanding. Ottenbreit-Leftwich et al. (2010) and Tondeur et al. (2012) note that the best practices provided to preservice teachers with regards to technology training include authentic experiences. This sentiment was first posed by Moursund and Bielefeldt in 1999. They conducted a national survey to determine how teacher education programs are preparing new teachers to use information technology (IT). Their findings suggested that teacher preparation programs need to be providing authentic experiences with technology during teacher preparation and field experiences in order for teacher candidates to improve technological skills. Agyei and Voogt (2011) and Sang et al. (2010) add that teacher preparation programs should introduce preservice teachers' authentic experiences with technology to align with pedagogical beliefs and curriculum (Lai et al., 2007; Marcovitz, 2000). This makes intuitive sense as teachers who do not have positive attitudes and beliefs about technology are less likely to use technology in their instruction (Hew & Brush, 2006).

Authentic and meaningful learning experiences with technology develop preservice teacher pedagogy that is consistent with designing and conducting meaningful learning with technology for their students (Bauer & Kenton, 2005; Koehler & Mishra, 2005). However, a search of the literature indicates that there is insufficient research that looks at how authentic experiences contribute to preservice teachers' understanding of aligning technology effectively with pedagogy. Higgins and Moseley (2001) observed both retrospective pedagogies and prospective pedagogies to understand preservice teachers' experiences with technology in their teacher preparation program. The retrospective pedagogies suggest that technology has the potential to support current pedagogy and improve attainment within the frameworks in which the context operates. The prospective pedagogies suggest that unless teaching practices change, technology will not be widely integrated into classrooms because of a mismatch between teachers' beliefs about teaching and learning and their perceptions of the value of educational technology.

***Technology and Pedagogy***

Røkenes and Krumsvik (2014) looked at the pedagogical aspects of the teacher education program that led to preservice teachers' digital competencies and identified eight approaches: collaboration, metacognition, blending, modeling, authentic learning, student-active learning, assessment, and bridging theory/practice gap. Educators and researchers interested in effective technology integration have begun to examine the relationship more closely between technology and pedagogy. Okojie et al. (2006) note that "technology integration not only involves the inclusion of technical artifacts per se but also includes theories about technology integration and the application of research findings to promote teaching/learning" (p. 66).

## Technology in Early Childhood Education (ECE)

As mentioned earlier, whether the technology should be used or not in early childhood education is not currently the center of the debate. The debate now focuses on how preservice teachers can be best prepared to integrate technology for the education of young children. However, Smith et al. (2016) state that in an early childhood education research context, technology and technology integration takes on different meanings because of the pedagogical lens of developmentally appropriate practices (DAP). It is important to look at the discourse of this debate to better understand its implications for technology use in early childhood education, factors that affect preservice teachers' integration decisions, and how teacher preparation programs can better facilitate these decisions.

### *Background*

In 2001, President George W. Bush signed the No Child Left Behind Act (NCLB) into law. It challenged states to improve student academic achievement, including technology literacy. Addressing the digital divide, it ensured "that every student is technologically literate by the time the student finishes the eighth grade, regardless of the student's race, ethnicity, gender, family income, geographic location, or disability" (U.S. Department of Education [USDOE], 2004, Section 2402, b.2.A). It further called for "effective integration of technology resources and systems with teacher training and curriculum development" (USDOE, 2004, Section 2402, b.2.B).

However, The American Academy of Pediatrics (Anderson & Subrahmanyam, 2017; Mulligan et al., 2011) cautioned against any amount or type of screen media and screen time for children under 2 years of age and recommended no more than 1 to 2 hours of total screen time per day for children older than two. The Early Childhood Obesity Prevention Policies recommend that childcare settings limit screen time (including television, videos, digital media, video games, mobile media, cell phones, and the Internet) for preschoolers (age 2 through 5) to fewer than 30 minutes per day for children in half-day programs (McGuire, 2012). The report further encouraged professionals to work with parents to limit screen time to fewer than 2 hours per day for children ages 2 through 5 (NAEYC & Fred Rogers Center, 2012).

Earlier research understood and measured time spent in front of a television screen as a measure of how screen time is used (NAEYC & Fred Rogers Center, 2012). However, children now have access to an ever-expanding selection of screens on computers, tablets, smartphones, handheld gaming devices, portable video players, digital cameras, video recorders, and more. The influx of digital technology has deemed this definition of screen time to become elusive (NAEYC & Fred Rogers Center, 2012). Thus, the definition of screen time is expanded to any and all of these screens (Common Sense Media, 2013; Guernsey, 2011). Acknowledging this change, researchers have warned about considering any amount of time children spend with any kind of technology and media as significant (Christakis & Garrison, 2009; Tandon et al., 2011; Vandewater & Lee, 2009). Further, research also suggests that *how* children spend time with technology must also be considered when determining what is effective and appropriate (Chistakis & Garrison, 2009; Tandon et al., 2011).

The effects of technology in educational settings on the development of young children have been widely documented and strongly positive. For example, children who use educational technology have shown more significant gains in intelligence, structural knowledge, problem-solving, and language skills compared with those who do not use technology in their learning (Clements & Samara, 2003; Swaminathan & Wright, 2003; Vernadakis et al., 2005). Research shows that utilizing educational technology has positive outcomes for children (Glaubke, 2007; McCarrick & Li, 2007; Penuel et al., 2009). However, it also indicates that the technology needs to be developmentally appropriate for children, including tools to help teachers implement the technology successfully and be integrated into the classroom and curriculum (Clements & Samara, 2003; Glaubke, 2007; NAEYC & Fred Rogers Center, 2012). The challenge this has postulated in early childhood education is how to create new experiences that integrate technology into the curriculum to encourage the active engagement and thinking of young children (Couse & Chen, 2010; NAEYC & Fred Rogers Center, 2012).

However, there are also researchers who argue against the use of technology for young children's learning, even for educational purposes (Cordes & Miller, 2000; DeLoatch, 2015). DeLoatch (2015) examined technology use for children aged 2 to 8 years as well as teenagers and reported that incorrect utilization or overuse/abuse of technology is associated with adverse aspects with severe and long-standing consequences for students. Rowan (2014) attributed childhood obesity to increased use of technology amongst children aged 5 years and below due to a lack of physical activities and engagement. Similarly, Haughton et al. (2015) indicated that the use of technological applications (apps) by children at an early age leads to lesser exercise and a higher risk of obesity. All these have implications for understanding the use of technology in early childhood education, especially with preservice teachers (Laffey, 2004)

Over the past decade, a growing number of interactive games and educational software packages (also called apps) have been implemented in early childhood education and address a variety of subjects, including mathematics, science, reading, language, and social studies. For example, two early childhood educational software packages, *Learning with Nemo* (Disney/Pixar, 2005) and *Reader Rabbit* (Games4Kids Sverige AB, 2001), embedded a series of mathematics and language arts activities (e.g., shape and pattern recognition, counting, letter recognition, and vocabulary) in the context of story-based adventures guided by animated characters. The use of the software reportedly engaged young students in solving newly encountered problems and challenges (Casey et al., 2004). Similarly, *Arthur's Math Games* (The Learning Company, 2001) allowed students to learn mathematics concepts (e.g., counting and sorting) by helping computer characters purchase popcorn, lemonade, or brownies from a snack shop. In comparison, *Math Missions* (Scholastic, 2003) situated mathematical problems within the context of concrete and real-world problems such as measuring and estimating for real-life home improvement projects.

However, Clements and Samara (2004) noted that most existing technologies are often designed for drill-and-practice, entertainment, or superficial exploration activities, lacking coherent pedagogy and focused goals on scaffolding children's development of concepts and skills. Similarly, from the content analysis of the mobile application for preschool children, Chau (2014) reported that only a non-significant majority of apps (58%) were created concerning instructional support, visual and audio design, and user interface. He further noted that most of the content in those apps never engaged the children in tasks past academic drill-and-practice, ignoring the essential physical, emotional, and social aspects of the children's development.

Notwithstanding this debate, in March 2012, the National Association for the Education of Young Children (NAEYC) and Fred Rogers Center released a joint position statement on Technology and Digital Media as Tools in Early Childhood Programs Serving Children Birth through Age 8 (NAEYC & Fred Rogers Center, 2012). The statement provided guidance for early childhood educators about the appropriate and intentional use of technology with young children and highlights the need for digital media literacy to inform the selection and use of technology tools in early childhood education environments. Researchers like Clements and Samara (2003) no longer ask whether or to what extent technology should be used with young children in the classroom, but rather, in what ways it should be used. Although teachers have been using different types of technology over the years, the new development and presence of digital technology have created new challenges.

The challenge for early childhood educators is to make informed choices that maximize learning opportunities for children while managing screen time and mediating that potential for misuse and overuse of screen media, even as these devices offer new interfaces that increase their appeal and use to young children (NAEYC & Fred Rogers Center, 2012). The same developmentally appropriate principles and practices that mediate early childhood education teachers' use of print materials or any other learning tools and content for young children now mediate their use of technology (Clements & Samara, 2003; Plowman & Stephen, 2005, 2007; Van Scoter et al., 2001). In this regard, both traditional and newer educational technologies play an important role in young children's learning provided the teacher uses it in a developmentally appropriate manner, and it aligns with the curriculum goals (McManis & Gunnewig, 2012). As asked by NAEYC and Fred Rogers Center (2012) and Daugherty et al. (2014), the question becomes how early childhood education teachers are being prepared to integrate technology appropriately, intentionally, and productively into early childhood education settings.

***Early Childhood Education Teacher Preparation for Technology Integration***

In an earlier statement, NAEYC (1996) noted that it is expected that early childhood education teachers "critically examine the impact of technology on children and be prepared to use technology to benefit children'' (p. 1). If this has been an expectation for over 2 decades, it can be assumed that colleges and schools of education are modeling, using, integrating, and evaluating technology integration in their coursework and field experiences with preservice teachers (Donohue & Schomburg, 2015; Tondeur et al., 2012). Sprague (2004) argues that unless someone in the teacher preparation program is championing technology, the differing philosophies and views of the teacher education faculty and the educational technology faculty make this expectation hard to achieve. More so, the literature on technology integration in teacher education is situated in the elementary, secondary, or higher-level context with very little research relevant specifically to an early childhood education context (Campbell & Scotellaro, 2009). More recent literature also noted a dearth of studies that look at technology integration in early childhood education teacher education programs (Couse & Recchia, 2015; McMannis et al., 2013).

A PT3 grant recipient, Kelley et al. (2003), described how an early childhood education program featured curricula based on ISTE standards led to 100% of their faculty integrating technology into their teaching and better preparing preservice teachers to use it technology in their future classrooms. The approach was based on changes in curriculum and support provided to faculty. The curricula incorporated the ISTE Standards (also called the National Education Technology Standards for Teachers [NETS]) and the Arizona Teaching Standards. The support for change was provided through (a) faculty development; (b) curriculum revision; and (c) technology-friendly field placements. The study reported that this approach modeled a developmentally appropriate approach to the infusion of technology in early childhood education classrooms resulting from systematic training provided for faculty and an increased expectation for preservice teachers to incorporate and demonstrate the NET-T standards within their coursework.

In another PT3 granted study, Prejean et al. (2007) developed a technology-enhanced model pedagogical laboratory to provide an environment for preservice teachers to observe and practice technology-enhanced instructional approaches based on theory and research. Developed on the recommendation by Brandsford et al. (1999), a pedagogical laboratory allows teacher candidates to experiment with new learning and instructional theories by trying them out with students recruited from local schools but focused on technology integration. Prejean et al. (2007) developed such a field experience for 32 teacher candidates taking a technology integration course for elementary education majors. The study concluded that such an approach facilitated teacher candidates learning about student-centered activities and helped them become more successful in this field experience.

Taking what they called a "fearless approach," Pittman and Seitz (2003) restructured a traditional instructional technology course and piloted a constructivist model without changing the content. Twenty six elementary preservice teachers in their 4$^{th}$ and 5$^{th}$ year of teaching preparation completed projects and presented their authentic learning in using technology to enhance the instructional process and student understanding over 10 weeks. Their results indicated that such an approach increased preservice teachers' use of various instructional technologies in their internship; however, the preservice teachers expressed frustration with the non-traditional constructivist learning approach. Most did not include new instructional strategies in their technology integration lesson plans. The authors concluded that it is important to infuse consistent and effective mythologies of technology integration into all methods and subject area instruction to bring comprehensive change in teaching practices.

In a unique study, Hoffman (2005) participated in a PT3 mini-grant through a collaborative university-school partnership of early childhood education teacher education methods course and school district's summer school program. A senior-level methods course on designing developmentally appropriate learning activities for primary grade children collaborated with a summer school program for their field-based experience to apply the methods they were learning about in class. The methods course was infused with technology to help preservice teachers learn how to effectively integrate information and other technologies with content learning activities. The authors noted that this university-school partnership proved to be positive and valuable for preservice teachers, and they were able to integrate technology to the best of the available resources. However, the authors also noted how important it was to match philosophies of where they are learning (i.e., teacher educator) to where they are applying it (i.e., cooperating teacher) to increase the likelihood of matching technology integration theory with practice.

In another PT3 funded study, three literacy faculty in different preservice teacher programs, early childhood education, elementary, and secondary education, integrated technology into a curriculum (literacy) course. Groth et al. (2007) found that faculty modeling of technology use and preservice teachers' ability to choose technologies that support specific pedagogy is essential for pedagogically meaningful use of technology.

However, the authors surprisingly noted that early childhood education preservice teachers' positive attitude towards technology during the language and literacy course did not translate to the use of technology during their internship.

Finding similar results in a collaborative effort by Teachers Learning in Networked Communities (TLINC) and one early childhood education program, Ainsa (2013) reported 70 preservice teachers' level of interest in mobile technology for teaching and learning. The findings reported four levels of engagement for mobile technologies, with about 27% of student teachers interested in teaching with mobile devices, 27% participating in discussions about new teaching methodologies and possible applications (apps) for teaching, 7% planning a lesson that they would use in a classroom using mobile devices, and only a few 4% trying out the lesson that they had planned to use the apps and the devices. Ainsa (2013) also reported that even though the preservice teachers had positive attitudes about mobile technologies, the preservice teachers commented that they would only use it if "districts mandated" use of such technologies (p. 165).

In a more recent study, Nelson and Hawk (2020) examined how an undergraduate exploratory course changed elementary preservice teachers' attitudes about technology. Of their participants, 44% intended to work in primary education. They concluded that preservice teachers' understanding of the utility value and importance of technology in the classroom are significant factors in developing their intentions to integrate technology. These findings mirror previous findings that value beliefs predict technology integration or intentions to integrate (Chen, 2010; Teo, 2009). In a study in Singapore, of which 21.3% of participants were studying a postgraduate diploma in education, Teo

(2009) found that preservice teachers' technology acceptance was directly affected by their perceived use of technology, attitude towards technology and their technological self-efficacy. They further reported that preservice technology acceptance was indirectly influenced by its ease of use, technological complexity, and facilitating conditions that enabled its use.

In an innovative pilot project, Campbell and Scotellaro (2009) provided 60 early childhood education preservice teachers, a 2-week intensive program of 2 hours per day to build their skills, confidence, and ideology on technology-enhanced learning as part of the early childhood education curriculum. The authors concluded that teaching preservice teachers technology content relevant to young children's education helped them build awareness about the possibilities of enhancing the learning experiences of young children by using technology in the classroom. They further emphasized that the students mainly attributed this success to scaffolding provided by teacher educators.

Collier et al. (2004) used the PT3 grant to study how their teacher education program prepared early childhood/elementary education programs to meet the ISTE (2000) technology standards. The teacher education program in this study discontinued their stand-alone technology course to introduce a dual integration model throughout their initial certification program. Technology was integrated into the content area methods course, and the content area integrated into the technology course infused technology. Using information from faculty, course syllabi, and preservice teacher self-assessment, the study examined 43 early childhood/elementary education preservice teachers. The authors concluded that if teacher educators infuse technology education into existing curricular subjects, they can make a difference in preservice teacher technology skill acquisition and development.

Another study (Dexter et al., 2006) within the same PT3 grant at the same university looked at the technology integrated into the content area methods course model of the technology preparation program to understand important factors for successful implementation of such a model. Dexter et al. (2006) concluded that successfully implementing a technology-infused model across the teacher preparation program requires college-wide support and motivated teacher educators who willingly facilitate technology integration into methods courses.

In a 2004 longitudinal study examining early childhood education teacher preparation practices, Laffey (2004) found that preservice teachers appropriated and mastered technology as students and planned on using technology in their classrooms in the future. However, they often remain unconvinced about the use of technology for children's learning. These findings mirror the findings from Chen and Chang (2006), who noted that most teachers are not prepared to use technology in the classroom in ways that are appropriate for young children's learning. Chen and Chang (2006) emphasized that teacher educators must strive towards comprehensive and exemplary technology integration in preservice classes to prepare educators to integrate technology into the teaching and learning of young children effectively.

Pioneering her work in technology and early childhood education, Bers et al. (2013) agree that early childhood educators need more knowledge and understanding about technology and engineering, along with developmentally appropriate pedagogical approaches, to integrate technology into the teaching and learning of young children. Most of their work is situated in the early childhood education classrooms with young children using robotics and computer programming to enhance cognitive, fine motor, and social development (e.g., Bers, 2008; Lee et al., 2013; Sullivan & Bers, 2015). In one study, 32 early childhood educators participated in an intensive 3-day professional development workshop to increase teachers' knowledge about robotics, engineering, and programming, and pedagogies for teaching those content areas in the early childhood education classroom (Bers et al., 2013). The study reported that in-service teachers related their gains in knowledge to the many opportunities to play with technology, ask questions, and collaborate with peers. Bers et al. (2013) concluded by stating that early childhood education teachers need more developmentally appropriate technological experiences to prepare them to implement best practices for technology integration in their future classrooms.

Smeets (2005) suggested the following characteristics of developmentally appropriate learning environments to be best used to support early years learning: (a) embed authenticity; (b) emphasize knowledge construction; (c) use open-ended learning; (d) include student cooperation and collaboration; and (e) integrate mixed ability levels and differentiated instruction where appropriate and possible. Lux and Lux (2015) recommended these two strategies to provide a meaningful developmentally appropriate technology experience in an early childhood education setting: (a) provide preservice teachers opportunities to learn and practice developmentally appropriate technology skills in meaningful and authentic contexts and (b) provide high-quality technology integration instruction in teacher preparation programs.

What is clear from the literature is that early childhood education teacher preparation programs recognize how critical it is to prepare early childhood education preservice teachers to effectively integrate technology into classrooms. However, literature in the context of early childhood education regarding technology integration is still limited (Couse & Recchia, 2015; McMannis et al., 2013). Studies looking into technology integration in the early childhood education context have recommended research-based developmentally appropriate best practices, modeling of technology by teacher educators, the need for more reflective assignments, and infusion of technology into the methods course, amongst other suggestions. With the changes in technology standards by national organizations, there is a migration toward eliminating the standalone educational technology course in favor of technology integration into methods and content courses. However, more research is needed to understand how early childhood education preservice teachers develop their knowledge and attitudes about technology integration (Shaunna et al., 2016).

**Social Studies in PreK-3 Teacher Preparation Programs**

Young children show a natural interest in the world around them as they engage with their context (National Scientific Council on the Developing Child, 2004). As these young children are developing a relationship with the world around them, social studies learning offers many valuable components that can extend these young children's capacity to explore, ask questions, discuss, and identify problems, debate, and think critically about the consequences of their decisions and behaviors on others (NCSS, 2019). Mardell and Carpenter (2012) stated that the children participating in their project saw themselves as responsible "citizens—not as hypothetical or future citizens, but as contemporary members of their community" (p. 76). In this regard, social studies become a microcosm of the early childhood education curriculum, which facilitates children's' unique and valuable perspectives.

***Social Studies***

Social Studies is regarded as the study of humans in society. The 2016 report by National Education Association's (NEA) Committee on Social Studies "endorsed the term social studies as a shorthand description for the teaching of history and social sciences in the schools, created and recommended interdisciplinary classes, and named citizenship education as an explicit goal of the curriculum" (Fallace, 2017, p. 42). Since then, social studies education came to be defined as a subject that promotes democratic citizenship (Evans, 2004; Thornton & Barton, 2010).

Echoing the same, Bariham (2015) cited Martorella's (1985) opinion that the purpose of social studies is "to develop reflective, competent, and concerned citizens" (p. 13). The National Council for the Social Studies (NCSS; 2017) position statement asserts that building this knowledge in the early years involves teachers who are well-grounded in social studies educational practice. It further suggests that "social studies at the elementary level should provide students with purposeful and meaningful learning experiences that are challenging, of high quality, developmentally appropriate, and reflective of contemporary social and diverse global realities" (NCSS, 2017, Rationale section).

### *Pedagogy on Technology in Social Studies Education*

In his book, Oversold and Underused: Computers in the Classroom, Larry Cuban (2001) described that schools were advocating the use of technology, but teachers were not using it to do much more than enhance teacher-centered lessons. He asked a question that places social studies at the core of the discussion: "In what ways can teachers use technology to create better communities and build strong citizens?" (p. 197).

Understanding the integration of technology in social studies is much more complicated. Powell (2017) reasons a lack of consensus on the aims and purpose of social studies education, which leads to a misfit between social studies content knowledge and its pedagogy. Powell (2017) further asserts that this disconnect is widened by the fact that "social studies is by its very nature an interdisciplinary subject" (p. 4). Journell and Tolbert (2016) argue that this delineation, when viewed within the teacher training program, creates an instructional gap and a subsequent problem for instructors of social studies instructions. In this regard, Mason et al. (2000) claimed that technology might extend learning social studies skills and content that may otherwise be restricted in the traditional classroom. However, he also asserted that technology must be integrated actively and meaningfully to advance the core values of social studies education.

Devising theoretical principles of social constructivism in a social studies teacher education, Doolittle and Hicks (2003) adds that a reflective pedagogy must be contextualized within the use of technology to identify and utilize strategies that effectively address student misconceptions about social studies. Their point is that technology integrated meaningfully within the social studies content can facilitate inquiry, provide real-world relevance, foster local and global interaction, build on students' prior knowledge and interests, and promote independence and creative thinking. Thus, they assert that "the proposition that technology has a role to play in the fulfillment of social studies pedagogy is undeniable" (p. 87).

***Technology Integration in Social Studies Education***

Adler (2008) noted that the increase in the number of studies of technology and teacher preparation was the most significant change in research on social studies teacher education. Over 2 decades ago, Peter Martorella (1997) called the technology a sleeping giant in the social studies curriculum as a metaphor to explain the unutilized potential of leveraging technology in social studies education. Five years after Martorella's analogy, Doolittle and Hicks (2003) wrote, "The sleeping giant has been having quite a long nap" (p. 74). Studies on the use of technology in social studies confirm this assertion, noting that technology typically plays a marginal role in most social studies instruction (e.g., Cuban, 2001; Hicks et al., 2004; Swan & Hofer, 2008; VanFossen & Waterson, 2008).

The National Standards for the Preparation of Social Studies Teachers (2018) asserts that teachers should "design technology-enhanced learning opportunities for all students through the integration of social studies content, digital sources, digital learning tools, and other contemporary technologies" (p. 16). Adler (2008) concluded from his extrapolation of research conducted on social studies teacher education that an effective social studies teacher must engage diverse learners and use technology appropriately. His conclusion also mirrors the National Board for Professional Teaching Standards (NBPTS), where the Social Studies-History Standards address the integration of technology in history teacher and education curricula. However, research suggests that the use of technology in social studies education is minimal.

Berson (2000) emphasized that on rethinking teacher education pedagogy reform, one of the considerations should be to seamlessly "employ content-specific uses of technology as a means to evolve more effective social studies teaching and learning" (p. 128). Lee (2008) identified a series of guidelines to leverage the affordances of technology to transform social studies instruction. He recommended:

- making use of historical source materials available through online sources,
- promoting understandings of spatial, human, and physical systems aided by technology,
- expanding social experiences using technology, and
- encouraging economic literacy through the use of technology. (p. 131)

However, Doolittle and Hicks (2003) suggested that the decision to integrate technology into teachers' instruction begins with their understanding of why and how emerging and current technological tools can be effectively used in the teaching and learning of social studies. They further claim a critical need to explore how to leverage educational technology to empower all students and positively transform the teaching and learning process in all content areas, particularly social studies.

### ***Preparing Preservice Teachers to Integrate Technology in Social Studies Teacher Education***

The early 2000s seemed to have been a period when many researchers started investigating the role of technology in social studies teacher education. Many seminal reviews of technology in social studies have been published in the last three decades (e.g., Berson, 1996; Friedman & Hicks, 2006; Swan & Hofer, 2008; Whitworth & Berson, 2002). However, in the past decade since Diem and Berson's (2010) book, there has not been much systematic research on technology integration in social studies teacher education.

Whitworth and Berson (2002) were amongst the first to summarize the literature about using the internet in social studies classrooms. The authors reviewed over 300 pieces of literature in the NCSS and selected technology-related articles from 1996-2001. They determined that social studies teachers most commonly used the internet for accessing the information on the Web. They also noted that social studies teacher educators do not fully appreciate the role of technology in education and thereby have not been teaching it to its total capacity. Moreover, they asserted that colleges of education should consider teaching technology as a method and a learning tool infused across their programs rather than a mere topic. Finally, they concluded that it is essential to "infus[e] technology into social studies methods courses while affording opportunities to consider the daily demands of a teacher that may present barriers using technology in the classroom" (Whitworth & Berson, 2002, p. 484). Their analysis of the literature revealed that while the incorporation of technology in social studies classrooms is evident, social studies educators need to integrate more new technologies to prepare future teachers for technology integration (Whitworth & Berson, 2002). More recently, Herold (2015) also indicated a need for teacher educators to adopt new technologies to transform their teaching methods and prepare teachers to teach. Wang and Torrisi-Steele (2015) added that educators in higher education need to engage teacher candidates to develop important competencies in the information age.

Advocating for the use of information technology in social studies teacher education, Friedman and Hicks (2006) discussed the state of technology, social studies, and teacher education by looking at relevant literature on social studies and technology. One of their discussions noted that within the 24 social studies content paper from 2005 SITE, two articles described the efforts in teacher preparation that seamlessly integrate technology within and through methods courses. Three explain the impact of technology-infused methods courses on preservice teachers' perceptions and uses of technology. However, they noted that within those papers, the articles examined numerous topics of various complexity that moved beyond looking at the potential of technology and towards important aspects of schooling, gender, digital divide and also "the limited use of technology by social studies teacher educators in general" (Friedman & Hicks, 2006, p. 248). Lastly, Saye and Brush (2002, 2004) advocated for more studies that use technology-enhanced instructional strategies in social studies methods class to support preservice teacher needs and scaffold their learning.

In a similar but non-exhaustive evaluation of the state of the research into technology and social studies education, Swan and Hofer (2008) focused on using the internet in history education. Their recommendation for future research was that the "field would benefit from further exploration of… how teachers navigate the different types of [technology] tools and resources in their own practice" (p. 322). In other words, they suggested that more research is needed that uses qualitative design and focuses on content-specific uses of technology in the classrooms.

The literature reviews, or as Hicks et al. (2014) calls it, historical documents, have a common theme within the literature on approaches to technology integration in teacher preparation. They advocate for technology-infused social studies methods classes to support preservice teacher technology integration learning. Republishing the original guidelines created by Mason et al. (2000) to ingrate technology in teacher preparation, Hicks et al. (2014) encouraged teacher educators to look beyond the technology itself and consider how teachers can use technology to support student learning in discipline-specific inquiries. They further echoed that teacher educators should incorporate technology within the social studies methods courses so that preservice teachers feel supported yet challenged to explore "how digital technologies shape and are shaped by education" (Hicks et al., 2014, p. 444).

***Technology Integration in Social Studies Methods Class***

College and University Faculty Assembly (CUFA) of the NCSS, who created guidelines for using technology to prepare social studies teachers, have also emphasized the role of methods classes in effective technology integration (Hicks et al., 2014; Mason et al., 2000). Despite the overdue calls for methods classes to infuse technology (Beisser, 1999; Handler & Marshall, 1992; Wetzel et al., 2014), there is little evidence to suggest this approach has been adopted (Swan & Hofer, 2008). The focus of the literature on technology integration in social studies has been wide-ranging, with articles describing the use of video cases, telecollaboration, civics education, historical inquiry, perceptions of preservice teachers, portfolio, and journal use, as well as various other technology integration strategies and tools. However, most of the literature has been situated in a secondary or high school age context.

Within the secondary social studies method's courses, Shin et al. (2019) integrated technology-enhanced cases and found that it increased preservice teachers' understanding of social studies teaching. They further added that technology itself did "not teach pedagogical elements or contexts" and required sufficient scaffolding and critical reflection of the learning (Shin et al., 2019, p. 163). Similarly, in a different study, Brush and Saye (2009) adopted three technology integration approaches to provide secondary preservice teachers with an understanding for effectively integrating technology into their future social studies methods class. They used video cases to discuss how social studies teachers utilized various technology, providing meaningful experiences with technology in coursework and providing meaningful experiences with technology in real classrooms. However, Brush and Saye (2009) concluded that their strategies increased preservice teachers' technological pedagogical content knowledge. However, they also noted a need to refine the technology integration models and strategy. They further suggested providing authentic classroom experiences where preservice teachers can explore new technologies and connect them to pedagogical goals (Brush & Saye, 2009). Researchers have also studied technology integration in social studies methods courses through activities that support collaboration (e.g., Hilburn & Maguth, 2012; Wagner, 2019). Others have also reported using technology to promote value-based social studies content like Rodriguez et al. (2020) used online resources like Pinterest to teach critical media literacies on racial capitalism. Nganga (2019) used online discussions to teach global mindedness and social justice. Technology has also been integrated into secondary social studies methods class by using Augmented Reality (AR) to complete a Project-Based Learning (PBL) experience to explore if the experience helped social studies methods students understanding of the use of PBL and AR technology in their own classrooms (Bruewer et al., 2018). It has also been integrated by creating digital documentaries in history teaching (Manfra & Hammond, 2010). The internet has been used to integrate technology by (a) deconstructing Wikipedia articles to promote historical thinking (Hammond, 2012); (b) using Web-based modules in a secondary social studies teacher education methods course (Ehman, 2001); and (c) using Web 2.0 digital history sources to introduce historical thinking and historiography in secondary methods courses (Manfra et al., 2009). Some have used geospatial technologies from GPS to GIS for social studies content learning (Alibrandi et al., 2011). Others have used electronic journaling to empower student reflection with technology (Seo et al., 2009). Another reason technology has been integrated into social studies methods course is to understand how preservice social studies students think when using digital historical resources (Lee, 2002). Technology integration has provided technology-mediated clinical field experience (Heafner, 2012).

***Technology Integration in an Early Childhood Education (PreK-3) Social Studies Methods.***

According to the National Association for the Education of Young Children (n.d), early childhood education means the period of childhood up to age 8, which encompasses pre-kindergarten through third grade. Because there is an overlap between early childhood education (PK-3) and elementary education (K-6), the literature review includes studies in early childhood and elementary education.

Bafumo and Noel (2014) completed an action research project with their preservice teachers in Social Studies Methods course for Elementary Teachers to teach geography, civics, and current events. Using apps like Google Maps, Google Earth; and credible media sources like www.nationalgeographic.com, www.sporcle.com, www.factcheck.org, and others, the researchers suggested three strategies to integrate technology effectively: integrating technology into student lesson plans, using technology to link current and historical events, and consistent use of technology throughout the class. Researchers identified that preservice teachers in this study used technologies to explore, engage, share, and "vowed to use them in their own classes" (p. 47).

Similarly, in Hammond's (2012) study, preservice history teachers' exploration of deconstructing Wikipedia articles helped them “plan to use Wikipedia in their own classroom instruction” (p. 1638). The researcher in this study used Wikipedia to introduce them to historical thinking in their social studies methods class. Through qualitative analysis of student's written responses to an open-ended prompt, the author observed that preservice teachers used Wikipedia to engage in historical thinking.

Interestingly, in Reich et al.'s (2011) study, preservice teachers described the positive in-class experience of their class dialog in the open social networking platform, Ning, yet stated that they were unsure whether or how they might utilize social media after the end of the courses.

While the above studies specified the learning experiences in a technology-infused social studies methods course, Molebash et al. (2009) studied the conceptual change in 124 preservice teachers enrolled in a one-semester social studies methods courses as they either adopted or rejected the innovative pedagogical strategies while integrating technology in their coursework. The majority of the participants in this study were enrolled in elementary methods, although they did not specify the ages or grades the preservice teachers were planning to teach in the future. Facilitating conceptual change, as Molebash et al. (2009) noted, is influenced by a host of factors, including curricular adjustments such as types of assignments (observations, reflections, and lesson plans) and use of technology; teacher educator beliefs and presentation; time, practice, and feedback. They were proposing a four-stage model (orientation, understanding, feasibility, and progression); the researchers noted that "teachers, particularly elementary preservice teachers, lacked content knowledge, or at least a context understanding of important historical events… [and the] complex notion of technological pedagogical content knowledge" (p. 86). They suggested that it is vital to process any new knowledge (i.e., the use of new technology). Putting that knowledge into practice requires learning experiences that develop the expertise of the new content, or at least grow an understanding of the new content. Researchers have also integrated technology in an early childhood education social studies methods course to achieve different learning objectives. Wagner (2019) incorporated the Geocaching.com website and mobile app to engage elementary preservice teachers in learning about history and geography. Using the website as a digital version of the Flat Stanley Project, the author noted that the experience provided an active, constructivist-based strategy that otherwise would not have been possible without technology. Utilizing other resources like National Geographic along with the Geocaching.com website and mobile apps allowed for learning that "move[d] beyond lecture" and engaged preservice teachers in interdisciplinary collaborative learning (p. 1064).

While Wagner (2019) expressed that technology supports interdisciplinary collaborative learning, some researchers have used technology to collaborate beyond the classroom walls. Like, about two decades ago, Mason and Berson (2000) explored the use of computer-mediated communication (CMC) across universities in a PreK-3 social studies methods course. In a novel way to use Internet2, teacher educators from two different universities, one in the Southeast and another in the mid-Atlantic region of the USA, jointly taught a synchronous class via videoconferencing systems and electronic whiteboards for one semester. The students in their class collaborated on a Web-based multimedia teaching case that connected the two classrooms. In conclusion, the authors reported that technology allowed for reflective learning and collaboration.

Similarly, Good et al. (2005) described a telecollaborative experience between two social studies methods courses, one in mid-Atlantic and the other on the Gulf, through the integration of videoconferencing and e-mail. Data from reflective tasks, surveys, and field notes concluded that the study provided preservice teachers an opportunity to experience powerful learning about content and pedagogy. Further, preservice teachers also stated that they benefited from seeing technology use modeled in their methods courses, and it helped them recognize the possibilities of technology in their future classrooms.

In another study, the University of Houston used hypergroups, a Web-based discussion tool, to facilitate online discussion outside of a social studies methods class that "included Elementary Social Studies Methods, Secondary Social Studies Methods, Current Literature in Social Studies, and Integrating Technology in Social Studies" (White, 2000, p. 2023). White (2000) concluded that participating in these discussions helped preservice teachers become a community of learners in their social studies methods course.

Additionally, studies have also investigated preservice teachers' conception of technology and technology integration. Conducting research using CUFA guidelines, Molebash (2002, 2004) provided a personal account of participants' qualitative case study to examine the complexities of an elementary social studies teacher educator's beliefs and practices concerning the use of technology in their teaching methods course. Later, in 2004, the researcher elaborated the same study to understand the impact of technology-enriched teaching methods course on preservice students' perceptions of social studies, teaching social studies, and integrating technology in their future social studies teaching. More specifically, the teacher educator modeled the use of online digital archives to promote inquiry in the classroom, scaffolded classroom discussions, engaged students in interactive reading and explored handheld technologies in social studies. Using observations, multiple interviews, and a content analysis of student artifacts, the author concluded that teacher educator's constructivist philosophical beliefs allowed preservice teachers to see various uses of technology in social studies and positively influenced their desire to integrate technology in a manner consistent with the CUFA Technology Guidelines (Molebash, 2004).

Kieper et al. (2000) also studied perceptions of 58 preservice teachers in elementary and secondary social studies methods courses at two teacher education programs. Using qualitative content analysis, the authors reported that students attributed many of the benefits to technology like the variety of instruction (29%), improvement in technology skills (31%), and using technology as a communication tool (21%). The students also reported obstacles, including access (66%) and reliability (21%) of the technology, difficulty in supervision (22%), and the ability to learn and use technology (35%).

Asking about what technology goals are essential to preparing prospective elementary school teachers, Bennett and Scholes (2001) conducted a pre-/post-survey of 42 elementary social studies methods courses. They reported that technology was used for communicating, collaborating, conducting research, and solving problems. Using technology usage through time spent on technology as the criteria to investigate changes in attitudes toward technology and social studies, the authors reported students' positive attitudes towards technology.

Price et al. (2014) described teacher educators' instructional decisions that integrated technology in social studies method courses in their study. The teacher educator in their study applied the researcher-constructed Integrated Triadic Model (ITM) to elementary social studies teaching methods course that measured the extent to which technological pedagogical content knowledge (TPACK) changed in 42 preservice teachers throughout the semester. The researcher concluded that the application of the ITM created and enhanced course activities and contributed to the development of preservice teachers' TPACK. Similarly, Tschida and Sevier (2013) provided an autoethnographic account of their instructional choices teaching an online social studies course using various tools like Blackboard, Camtasia, VoiceThread, Prezi, etc. Besides reporting a positive change in attitude towards technology use in social studies, the authors also noted that the preservice teacher's assessments reflected "promising applications of technology in teacher education" (p. 509).

The above literature suggests that the proliferation of technology in social studies education has grown exponentially since the Shaver (1992) article was published. Teachers play a significant role in determining whether to use technology, how that technology is used and designing technology-enriched learning experiences for learners. The research on technology integration in social studies methods course exemplifies the various tools (e.g., hypergroups, web-based media, Prezi, digital stories, etc.) ideal for joining together social studies and technology and provide pedagogical implications for integrating technology into social studies. Yet, there is very little fundamental research investigating *how* preservice teachers come to understand learning with technologies.

Instead, there seems to be a pervasive assumption that they *will* learn with technologies (Otero et al., 2005). There is a need for future teachers to understand the *why, when,* and *how* of using technology, developing critical dispositions that help generate meaningful uses of technology (Otero et al., 2005).

However, literature has come to view social studies methods courses as spaces to teach meaningful technology integration in social studies (e.g., Brooks, 2011; Glimps & Ford, 2008; Merryfield, 2000). Almost 2 decades ago, Nickell et al. (2000) stated that there is much of the "How-to do-it" (p. 82) literature on technology integration at the elementary level in social studies ranges, yet we lack "solid, classroom-based, data-informed research that tells us whether, and under what conditions, technology usage in elementary social studies expedites, deepen or broadens learning" (p. 88). This study tries to add to the literature by examining how preservice teachers understand learning with and about technologies in a technology-infused social studies methods course.

**Summary**

In this chapter, I presented a foundation for this study as I identified with constructivism, which provides insights into the essential elements of the learning process and provides theoretical support to the importance of technology in education. I looked at technology integration in teacher preparation programs; I reviewed the literature on the evolution of educational/instructional technology and the impact of COVID-19 on the education landscape.

I discussed the evolution of technology in education and teacher education and illustrated how technology integration is addressed in position statements, standards, and national organizations. Even though many often tout this concept as necessary, the definition of such a term is somewhat unclear. I then defined the term and concluded that there is an ever-changing temporary definition because of the ever-changing nature of technology. From here, I presented how teacher education programs have sought to prepare teachers to integrate technology for their future instruction. As this research was conducted in an Early/Primary Education PreK-3 social studies methods course, the last portion of this chapter highlighted how technology had been integrated into the early childhood education context, social studies context, and the early childhood education and social studies context of the teacher education programs. This literature review provides the foundation for the current study that examined preservice teachers' experiences learning and teaching with technology in a technology-infused social studies methods class required for teacher licensure.

In Chapter 3, I explain the methodology of this study. In Chapter 4, I provide a verbal and visual depiction of the findings from the analysis, and In Chapter 5, I discuss the findings in light of existing literature.

# Chapter Three

Converging literature on technology integration approaches in preservice teacher preparation programs, specifically with early childhood education preservice teachers, suggests that preservice teachers need to experience technology infusion throughout their teacher preparation programs (Donohue & Schomburg, 2017; Tondeur et al., 2012) and most definitely in their methods courses (Wetzel et al., 2014). The purpose of this exploratory study is to examine the experiences of early childhood education preservice teachers in a technology-infused social studies methods course offered during the COVID-19 pandemic. A context-specific, exploratory qualitative methodology with a constructivist theoretical underpinning was utilized to understand preservice teachers' descriptions of their experiences in their own words. Recognizing that experiences are influenced by individuals' perceptions and the meanings they derive from those experiences, it was critical to focus on the meanings that the preservice teachers constructed in their effort to make sense of their world (Merriam, 2009; Patton, 2002).

Accordingly, in this study, I explored how early childhood education preservice teachers articulated their understanding of technology integration as they engaged in a technology-infused methods course offered during the pandemic. I examined what they recognized as important to learning about intentional technology integration for their future teaching. Specifically, the following research questions guided this study:

1. How did early childhood education preservice teachers describe their attitudes towards and confidence in using technology upon entering a technology-infused social studies methods course during the COVID-19 pandemic?
2. What were preservice teachers' learning experiences with technology in a technology-infused social studies methods course?
3. What did early childhood education preservice teachers recognize as being important about integrating technology for themselves as learners and young children as learners?
4. How did early childhood education preservice teachers (a) engage with technology in a technology-infused social studies methods course and (b) envision engaging young children with technology in their future teaching?
5. How do early childhood education preservice teachers engaged in a technology-infused social studies methods course conceptualize creating learning experiences with technology for young children in their future teaching?

**Research Design**

The decision to use a qualitative methodology in this study corresponds with my views of reality and the acquisition of knowledge (Lather, 1986) and is also reflective of the research questions. According to Merriam (2009), a basic qualitative design lets researchers explore how people interpret their experiences and construct meanings of their lived experiences. A qualitative design lets the researcher "understand how people make sense of their lives and their experiences" (Merriam, 2009, p. 23). Qualitative research enhances understanding of individuals' experiences and situations as well as develops concepts that describe these experiences (Creswell & Plano Clark, 2011). Thus, allowing me to explore preservice teachers' perspectives or elaboration on the constructions, interpretations, and underlying assumptions (Denzin & Lincoln, 2011), something that is not available to me if I use quantitative research.

Exploratory research has been extensively employed as a research approach (Creswell & Plano Clark, 2011) and considered an appropriate approach in educational research (Cohen et al., 2013). Jupp (2006) embraces an "exploration-for-discovery" (pp. 2-3) that is the most appropriate representation of exploratory research in the social sciences. This particular study aimed to explore the experiences of early childhood education preservice teachers in a technology-infused social studies methods course, and thus, the methodologies used here attempt to uncover the process rather than get conclusive results (Worthington, n.d.). According to Merriam (2009), qualitative research attempts to understand the experiences and make sense of the phenomena from the participants' perspective at a particular point in time and in a particular context. In this study, I did not intend to solve the issue of technology integration in early childhood education but rather explore preservice teachers' experiences with technology and their description of those experiences in one early childhood education methods course.

The qualitative design fits with the social constructivist theoretical perspectives embraced by the researcher and the research goals that seek to explore the experiences of preservice teachers. As a researcher, my ontological perspective aligns with social constructivism. I map my epistemology with Maxwell and Mittapalli's (2010) definition of critical realism that retains ontological realism (i.e., the world exists) with epistemological relativism or constructivism (i.e., my understanding of the world is necessarily my construction, and multiple valid constructions of any phenomenon are possible) in a productive and inconsistent constellation (Maxwell, 2016). I consider myself a constructivist researcher because I agree with Maxwell (2011) that one's view of philosophy must be holistic rather than atomistic. I believe that individuals create their own reality based on their experiences; therefore, two versions of reality can exist at the same time (Hatch, 2002). Although I accept as true that for all humankind, there is one reality yet there are multiple versions of that reality that must co-exist. Hatch (2002) writes, "Science argues that multiple realities exist that are inherently unique because they are constructed by individuals who experience the world from their vantage points" (p. 15). Individuals construct their realities through lived experiences and interacting with others, yet everyone must make sense of their reality, which is often guided by a set of previously constructed social norms. This then leads to tensions among individuals who have differing perspectives, yet it is not up to anyone to tell any other individuals how they must feel.

As a researcher, I am interested in exploring how preservice teachers describe their lived experiences while constructing and co-constructing understandings (Hatch, 2002). For this particular study, I am interested in examining how preservice teachers experience learning with technology. Accordingly, as a researcher, I seek to understand their lived experiences and constructions of technology integration in a technology-infused methods course. In this regard, I believe my epistemology and ontology will serve me well as a qualitative researcher as I seek to understand individual experiences engaging in the processes.

This study lent itself well to context-specific exploration and conclusions made possible by an exploratory qualitative approach (Denzin & Lincoln, 2011). The study explored how preservice teachers experienced learning and teaching with technology in a particular context (i.e., an early childhood education social studies method course). Plus, this study was situated amidst the unique context of the COVID-19 pandemic that prompted the face-to-face course to transition to remote instruction.

The purpose of this study was to examine how preservice teachers describe their experiences in a technology-infused social studies methods course and to understand what they say about how the experiences influenced their knowledge and competencies related to technology integration, including their ability to design technology-integrated lessons. The research goals for this study were designed to gain insight into preservice teachers' thinking about their learning with technology in a technology-infused methods course. Thus, this study was designed using an exploratory qualitative approach that will gather and analyze data from preservice teachers in an Early/Primary Education PreK-3 technology-infused social studies methods course within the context of their teacher preparation program at a university in the mid-Atlantic region.

**University Context**

This study took place in a large, public, mid-Atlantic research university with a total reported enrollment of 37,863 students in 2019-2020. Within the University, the teacher preparation program has undergraduate and graduate pathways to Early/Primary

Education PreK-3 (EPK3) licensure. The social studies methods course is one of the required courses for students seeking EPK3 licensure. There were approximately 133 graduate students in the MEd in Early Childhood Education for Diverse Learners (ECDL)/EPK3 and 19 undergraduate students in the BSEd in Early Childhood Education for Diverse Learners. According to the undergraduate and graduate student's data on the university website, within the Early Childhood Education program focused on PK-3, approximately 95% of the student population were female, and 5% were male in Spring 2020. Additionally, 43% indicated their racial/ethnic background to be White, 7% as Black, 23% as Latinx, 16% as Asian, and 11% as other. The sample is representative of the early childhood education teacher population in the United States that estimates that 96.5% of the early childhood education graduates are female and white and about 50% are White (Deloitte et al., n.d.)

**Course Context**

The criteria for a technology-infused methods course were based on Buss et al.'s (2018) empirical study that required the methods faculty member to "model the use of technology in their teaching, teach about the idea of technology integration, align technology integration curriculum to course content, and require candidates to practice teaching with technology throughout the program" (p. 135). The social studies methods course was purposefully selected because the teacher educator teaching the course met Buss et al.'s (2018) criteria for a technology-infused methods course. In this section, I will provide the rationale for selecting the instructor who was teaching the social studies methods course.

### ***Identifying the Teacher Educator for the Course Context***

In 2018, I was part of the research team that conducted a study examining technology integration in one teacher preparation program. Five of the 22 full-time and part-time instructors from the Early Childhood Education program participated in the study that collected data from a 150-minute classroom observation followed by an in-person, semi-structured interview. Of the five teacher educators that were participating in the study, one emerged as a possible candidate for my dissertation study. The teacher educator's dispositions, pedagogy, and practice integrating technology into their own instructional teaching matched the criterion for my study. During the interview process, the teacher educator's description of her current practices revealed she subscribed to the constructivist approach of integrating technology in teaching. The teacher educator's approach to teaching highlighted collaborating, relating technology to the context of social studies, having a student-centered classroom, relying on group activities, learning from and with students when it comes to new technologies, and modeling the use of technologies. My memos from the observation, interview, and course assignments identified the teacher educator mapping all the seven elements of the International Society for Technology in Education (ISTE) Standards for Educators (ISTE, 2017) as well as components of the Teacher Educator Technology Competencies (TETC; Foulger et al., 2017). For example, the teacher educator identified with the *Learner* from the ISTE (2017) standards as an educator who would "continually improve their practice by learning from and with others and exploring proven and promising practices that leverage technology to improve student learning their practice by learning" (para. 1). A note from the reflective memo read, “[The teacher educator] was the only participant who talked about conferences and learning technology outside the university” (P. Shah, personal communication, April 17, 2018). I also mapped the interview with the TETC framework and noted similarities between her responses and the framework. For example, the teacher educator evaluated content-specific use of technology, identified the affordances of technology to fit the pedagogical goals of the class, and supported teacher candidates’ development of the knowledge and skills related to teaching with technology in their content area.

I contacted the teacher educator in Spring 2020 for permission to conduct the study during the Fall 2020 semester. This teacher educator was teaching two classes during Fall 2020, a literacy methods course, and social studies methods course, both for Early/Primary Education PreK-3. I further narrowed the course context to select the social studies methods course because researchers, like Beisser (1999), have long suggested the infusion of technology within the social studies enhances teaching and student learning in a complementary way. Friedman et al. (2009) alleged that

> Teaching technology skills holds a unique importance in social studies education… Students must have familiarity with technology, because many of the foundations upon which the American democracy rests are increasingly interwoven with technology. Social studies teacher educators, thus, are called upon to prepare teachers who will use technology to foster citizenship skills. (p. 477)

Similarly, for over 2 decades, the NCSS has asserted that technology integration in social studies education "can add important dimensions to students' learning" (NCSS, 1994, p. 165). Yet, there has been relatively little empirical research on how preservice teachers are prepared to use technology for the teaching and learning of social studies (Byker, 2014; Lee & Friedman, 2009). Byker (2014) asserted that teachers need a better understanding of how to combine pedagogical practices and social studies content with instructional technology to be able to fully integrate technology in their classrooms. Berson (2000) also emphasized that on rethinking teacher education pedagogy reform, one of the considerations should be to seamlessly "employ content-specific uses of technology as a means to evolve more effective social studies teaching and learning" (p. 128). Given the purpose of the study was to understand preservice teachers learning with technology in a technology-infused methods course and literature emphasizing the integration of technology in the social studies methods course, the early childhood education social studies methods course seemed to be a good fit for the context of this study.

***Course Details***

The social studies methods course focused on integrating social studies across the PreK-3 content areas for diverse young learners was a 3-credit required methods course in the licensure coursework for teacher licensure in Early/Primary Education PreK-3. The teacher educator had taught this course four times since Spring 2018: three face-to-face, campus-based courses, and one hybrid course blending face-to-face and asynchronous sessions. Hybrid courses combine instructional elements from traditional campus-based classes and online course formats (El Mansour & Mupinga, 2007). Though there are many ways to design a hybrid course, the inclusion of both online and face-to-face, campus-based class activities provides the common thread.

In the present study, the hybrid course comprised of seven synchronous sessions and seven asynchronous sessions, with a total of fourteen classes in seven weeks. There were two classes each week, with the first-class being a synchronous session followed by an asynchronous session. In the asynchronous session, the preservice teachers were engaged in instructional activities assigned through the University's Blackboard Learn™ (hereby referred to as Blackboard). Table 1 shows the course timing of the course.

| Class # | Dates | Class Format |
|---|---|---|
| 1st, 3rd,<br>5th, 7th, 9th, 11th,<br>13th | Aug. 24, 31<br>Sep. 7, 14, 21, 28<br>Oct. 5 | Synchronous online sessions |
| 2nd, 4th, 6th, 8th, 10th, 12th, 14th | Between asynchronous class meetings | Asynchronous online sessions |

**Table 1**
*Course Timeline*

The official university catalog specifies that the course explores social studies content, assessment, curriculum development, planning, and instructional practices. Examines strategies for guiding children's behavior, integrating social studies instruction across content areas, and planning and implementing community of learners inclusive of children with diverse abilities and cultural, linguistic, and socio-economic backgrounds

Prior to each synchronous online session, the teacher educator sent an email with the agenda and posted it on Blackboard. The agenda and post detailed all information regarding the content and the technologies that would be used during the class, along with the Zoom link to join the class (see Appendix I). After each synchronous online session, the teacher educator opened the content for the asynchronous class session on Blackboard. The students were expected to complete the required readings and asynchronous assignments between the synchronous online sessions.

**Participant Sampling**

This exploratory qualitative study used purposeful criterion sampling because the participants were members of a particular subgroup (i.e., early childhood education preservice teachers) that meet some predetermined criterion (i.e., registered in *the* technology-infused methods course) of importance (Patton, 1990). Purposive sampling is used when a researcher uses judgment to establish a sample population considering a particular element from the population that will be representative or informative about the topic of interest (McMillan & Schumacher, 2010). In this case, the researcher was interested in studying early childhood education preservice teachers' experiences in a technology-infused methods course. Therefore, the purposive criteria were to find a teacher educator in a university that taught a technology-infused early childhood education methods course. A course in which the teacher educator seamlessly integrated the use of various technological apps or web-based programs to support students' engagement in the curricular content (Foulger et al., 2015). The section above provided the rationale for choosing the Early/Primary Education PreK-3 social studies methods as the course that met the predetermined criterion.

In Fall 2020, I reached out to all 20 students enrolled in the Fall 2020 social studies methods course to request voluntary participation in the study. Out of the 20 students enrolled in the course, 15 agreed to participate in the study. Therefore, the participants in this study were a group of 15 early childhood education preservice teachers enrolled in the Fall 2020 social studies methods course.

#### ***Participants in the Course***

The course comprised of 20 students, a mix of undergraduate and graduate. Out of the 20 students, 15 agreed to participate in the study. Of the 15 participants, 14 participants (93%) identified themselves as female and one participant (7%) as male. For age range, four participants (26%) were between 18-22 years, nine participants (60%) were between 23-29, one participant (7%) between 30-39, and one between (7%) between 40-49. Four participants (26%) were enrolled in Bachelor of Science Degree in Education (B.S.Ed.) Early Childhood Education for Diverse Learners, 10 participants (66%) were enrolled in M.Ed., Curriculum Instruction for Early Childhood Education for Diverse Learners (ECDL), and 1 participant (7%) was a non-degree student. The data about their race/ethnicity was not collected. Of the 15 participants, four participants (three females and one male) agreed to the interview.

### **Participant Recruitment**

The Human Subject Approval from the Institutional Review Board (IRB) was done through the IRBNet of the University where the research was conducted. After a detailed conversation with the teacher educator and to get maximum participation, I conducted the informed consent in two parts. The first informed consent form was for the questionnaire, observations, artifacts, reflections, and lesson plans. The second informed consent form was for the interview. The IRB proposal included two recruitment scripts and two informed consent letters. I elicited consent for participation from the students on the two informed consents at different times during the study. I conducted recruitment for the Informed Consent for Observations and Artifacts (see Appendix A) at the end of the 1st synchronous session (see Table 2). I conducted recruitment for the Informed Consent for Interview (see Appendix C) during the 13th synchronous session (see Table 2).

| Class | Date | Consent |
|---|---|---|
| 1st synchronous session | Aug. 24 | Informed Consent for Observations and Artifacts |
| 13th synchronous session | Oct. 5 | Informed Consent for Interviews |

**Table 2**
*Consent Timeline*

***Informed Consent for Observations and Artifacts***

After briefing the information already on the Informed Consent for Observations and Artifacts form (see Appendix A) and explaining the risks, benefits, and confidentiality aspects of participation in the study, I allowed time for the students to ask any questions they might have regarding the study and their participation. The students were then directed to an online link for the Informed Consent for Observations and Artifacts form, which they signed and submitted. Once submitted, the same link took them to the Demographic Questionnaire. Fifteen participants agreed to participate in the study and were directed to the Demographic Questionnaire. Once the Demographic Questionnaire was submitted, the link took them to a reflection on Technology and COVID, which was part of the class activity. The students who did not agree to participate on the Informed Consent for Observations and Artifacts form were straight away directed to the reflection on Technology and COVID. I only used the responses of the 15 participants who agreed to participate in the study as data for the study.

***Informed Consent for Interviews***

After providing the study and procedures information, the students were directed to an online link that took them to the Informed Consent for Interviews form (see Appendix D) to sign and submit their decision of participation. Four participants agreed to participate in the interview, and all four were contacted via email to set up a Zoom meeting after the course was over.

**Procedures for the Class Sessions**

The early childhood education social studies methods course was conducted through a learning management system (LMS), Blackboard, where the teacher educator uploaded course content and modules, collected participants' tests and assignments, interacted with participants using integrated communication tools, and graded participants' work. The 7-week early childhood education social studies methods course was a 3 credit-hour class that met twice a week in a hybrid format. The first session of each week was a synchronous online class via Zoom, while the second session was an asynchronous class. During the first Zoom class session, the teacher educator established the following guidelines to help facilitate a collaborative and respectful learning environment:

- Hold up a hand to be recognized.
- Unmute to pose a question or make a comment.
- Use the chat bar to share information.
- Feel free to make makes mistakes and learn together.

In the next section, I have described the procedures for the class sessions in detail by explaining the utility of Blackboard, the facilitation practices for synchronous online classes, and the structure of the asynchronous class sessions.

***Blackboard Learn™***

Blackboard Learn™ (previously the Blackboard Learning Management System) is a virtual learning environment developed by Blackboard Inc©. It is web-based server software that features online course materials, grades, organizations, accounts, and more. The University's Blackboard Learn™ system was available 24 hours, seven days a week. All enrolled students, staff, and faculty members associated with the University had access to their Blackboard account. Students were added and dropped automatically based on their enrollment in a course using this system. Preservice teachers in this study accessed this system to view their course syllabus, access the course content, and communicate with their teacher educator. For virtual learning, the preservice teachers met through Zoom for their synchronous online class.

### *Synchronous Class Sessions*

Preservice teachers logged into the Zoom meeting ID they had received along with the agenda in an email from the course instructor before the class time. There was no virtual waiting room; therefore, students who logged in early socialized in the main meeting room. Once the class started, the teacher educator navigated everyone to the link for Google Slides. The Google Slides for this course usually included a 15-20 slide presentation for each class with embedded multimedia, such as images, videos, audio files, and clipart. The preservice teachers were logged into Google Slides and Zoom meetings concurrently. The Google Slides were used for interaction, while the Zoom platform was used for communication. The default setting for Google Slides is a view-only setting, which means only the teacher educator can see which preservice teachers are in the files and making changes. In a view-only setting, preservice teachers could open and view the file but were not able to make any changes. However, the teacher educator in this study changed the setting of the Google Slides and made her slides public, which means the preservice teachers could edit the files. Another feature of Google Slides is that if users are not logged in to their Google Account, their comments and suggestions get registered under anonymous. The teacher educator allowed the preservice teachers to edit the publicly shared Google Slides anonymously, so the identity of the commenter was not revealed unless they chose to do so.

During the first synchronous online class, the teacher educator also explicitly expressed her expectations for students regarding attendance and participation within these digital spaces. The teacher educator specifically said,

> You are going to have attendance and participation. So being here [Zoom] and participating in the slide and talking to your group will count for your participation and your engagement because I will be able to see your interactions on the slides that we're doing, and I will be able to hear you as we pop in and out of those groups.

The teacher educator did not require that participants keep their videos on. She specified that "because we are in Zoom, we are in a space where we can kind of personalize our own space in that regard as well." She requested, however, that the students keep their video on during group conversation for them to get to know each other better during discussions but reiterated that she is flexible if people do not feel comfortable doing so.

The teacher educator used Google Slides as a book with Hyperdoc. A Hyperdoc is an electronic document with hyperlinks to external websites or additional resources. The teacher educator embedded videos, images, and links to the Google Slide deck to make it interactive and allow preservice teachers to explore social studies concepts. Within the Google Slides, she embedded several external websites (e.g., Pear Deck, Nearpod, Podcast, Google Earth, etc.) to incorporate differentiated content throughout the seven weeks. A list of all the websites and technologies can be found in Appendix J. To enable active learning, she also permitted comments and edits on Google Slide so the preservice teachers could work on a single presentation without being in the same room together. They were also able to view their peers' inputs, which allowed them to learn from one another and work together as a group virtually.

Zoom recording provided the ability to re-watch the classes I observed "in person." Video recordings created a powerful new affordance because of their ability to rewind, enabling the researcher to transcribe and analyze data in sufficient detail (Krippendorff, 2004). I also used the conversation transcription (running vertically down a page) on the video recordings as a valuable data source—providing a stable transcript of class events and conversations.

***Asynchronous Class Sessions***

All asynchronous class sessions were stored in folders under Course Content on Blackboard. Each individual session was named chronologically with the respective session number and format (e.g., Class Session 4 Online). Each session folder had sub-folders detailing everything the preservice teachers needed to complete for the week. All the assignments were also accessible through the "Assignments" tab in a folder titled "Asynchronous Class Experiences." Although the assignments could be accessed through two places, they were all connected to the same file, so everyone accessed the same interactive files to complete class assignments (e.g., collective blog entry sharing your initial thoughts about the SAMR model, T-chart powerful social studies, and individual development and identity, Article share, etc.).

**Data Collection**

Data were collected from the 15 participants who agreed to participate in the study. Data collection for this study comprised of (a) demographic questionnaire; (b) technology and COVID reflection; (c) artifacts collected as part of course context; (d) participant in-class learning artifacts; and (e) interviews. Specifically, the data sources explored (a) preservice teachers' attitudes towards using technology that emerged because of the COVID-19 pandemic upon entering the course; (b) their learning experiences with technology in a technology-infused methods course; (c) what they recognized as being important about integrating technology for themselves as learners and young children as learners; (d) how they engaged with technology in a technology-infused social studies methods course and envisioned engaging young children with technology in their future teaching; and (e) how they conceptualized creating learning experiences with technology for young children.

**Data Sources**

Data sources for this exploratory qualitative research are outlined in Figure 5. The data sources for this study included (a) demographic questionnaire; (b) technology and COVID reflection; (c) artifacts collected as part of the course context; (d) artifacts collected as part of the in-class activities; and (e) interviews. A variety of data sources were used to gain insight into the research questions posed for this study. Specifically, the technology and COVID reflection was designed to identify early childhood education preservice teachers' attitudes towards and confidence in using technology at the beginning of the course considering the COVID-19 pandemic. To honor the constructivist nature of the learning that occurred in this methods course, the artifacts collected as part of the course context included observations of the synchronous and asynchronous sessions and content analysis of the agenda. The course context artifacts not only provided evidence of preservice teachers' learning in their technology-infused methods course, but it also opened spaces to understand what preservice teachers created as part of their learning and were used as part of their in-class learning artifacts. These participant in-class learning artifacts, Reflections on Technology Practice assignment, lesson plans, and interviews, informed what preservice teachers recognized as important about integrating technology for themselves and young children, and how they engaged with technology and envisioned engaging young children with technology. The data from the lesson plans also provided an understanding of how preservice teachers conceptualized creating learning experiences with technology for young children. Each data source is subsequently described in detail to characterize the different data sources and explain how each data source was used to understand preservice teachers' experiences and learnings within the technology-infused methods course.

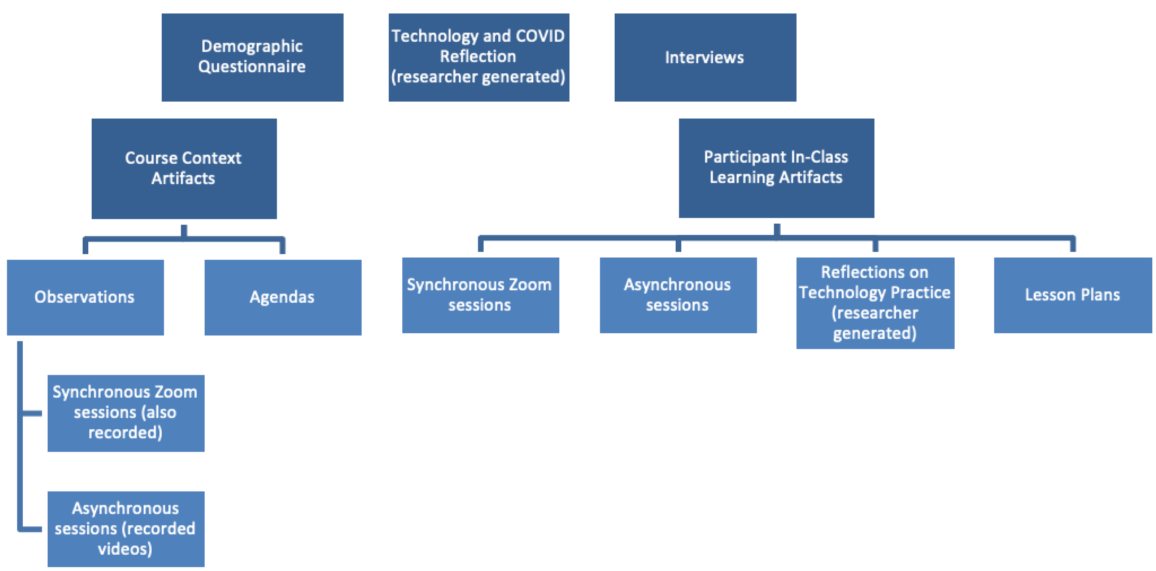


**Figure 5**.
*Data Sources*

***Demographic Questionnaire***

The Demographic Questionnaire (see Appendix B), which I created using Google Forms, was embedded with the Informed Consent Form for Observations and Artifacts. The brief questionnaire took about 3- to 5-minutes to complete and consisted of five questions: name, email addresses, gender, age-range, and major of study. The preservice teachers' responses to the demographic questionnaire provided basic information about their individual identities that were central to the purpose of the study.

***Technology and COVID Reflection***

The technology and COVID reflection, which I created using Google Forms, was embedded into the course as part of the first synchronous session. As the University moved coursework online for half of Spring 2020 and all of Summer 2020, I wanted to be sensitive to the fact that the preservice teachers could have been disproportionately impacted in some way by the COVID-19 pandemic. Accordingly, these questions were designed to understand how preservice teachers' experiences with technology during Spring 2020 and Summer 2020 may have influenced their thoughts about learning with technology.

The brief questionnaire asked preservice teachers to reflect on learning with technology as they began a fully online class during COVID-19 in the Fall of 2020 before the vaccinations were available. This reflection specifically asked the preservice teachers two questions: (a) how have your experiences during COVID-19 influenced your thoughts about learning with technology? and (b) how have your experiences during COVID-19 influenced your thoughts about learning to teach young children (PreK-3) with technology? These questions were asked only at the start of the course to gain insight into how the preservice teachers positioned themselves towards technology as they entered the program during the COVID-19 pandemic.

***Course Context Artifacts***

For the course context artifacts, I used the observation data from the synchronous and asynchronous sessions and the agendas to document the preservice teachers' learning experiences with technology in a technology-infused methods course. For the synchronous sessions, I viewed the engagement of preservice teachers in the live synchronous sessions and the recorded videos. For the asynchronous sessions, I relied on the recorded sessions that the teacher educator posted on Blackboard for the preservice teachers to engage with. The directions given by the teacher educator served as evidence of preservice teachers' learning experiences.

**Observations.** I observed the preservice teachers in (a) the synchronous online sessions that took place on Zoom (live and recorded) and (b) the recorded videos for the asynchronous sessions. Teaching observations are one of the most widely used assessment methods used to examine how knowledge transfers into practice (Porter et al., 2001). One way observation tools have been used to understand technology integration is by taking field notes and later coding them to assess enacted TPACK (e.g., Guzey & Roehrig, 2009; Margerum-Leys & Marx, 2004). For this study, I took notes on both digital and non-digital enacted technology integrations to get a holistic picture of the learning processes used in the class.

***Synchronous Sessions.*** To accurately document the technology-infused learning experiences the teacher educator used to engage students, I used the observation notes I gathered while observing the class in real-time, Zoom video recordings of the asynchronous class sessions, and running transcripts generated by zoom. In total, there were seven synchronous sessions on Zoom that were scheduled and recorded by the teacher educator. During each synchronous session, participants communicated via audio, video, and chat feature of the online collaboration platform Zoom. In the Zoom meeting, the teacher educator grouped the preservice teachers into smaller, interactive rooms called Breakout Rooms, a feature in Zoom meetings. The Breakout Rooms usually had three to four participants in the smaller interactive rooms. As a participant-observer, I observed the preservice teachers on Zoom as well as on the interactive Google Slides the preservice teachers worked on in small groups as well as when meeting with the whole class in Zoom's Main Room. I also took note of any chat discussions that took place in Zoom. During Breakout Rooms, I was initially assigned to anyone Breakout Room and did not have the ability to change rooms as only hosts are allowed that feature. After the second Zoom meeting, the teacher educator, who was also the host for the Zoom meetings, started tagging me along with her as she circled around the different Breakout Rooms for a brief observation or chat. The Main Room in Zoom was recorded, and the teacher educator shared access to the recorded Zoom meetings via Blackboard. However, the Breakout Rooms were not recorded. Therefore, I was only able to take notes of the discussions that happened in the Breakout Rooms that I visited.

Overall, my observational notes and memos reveal the verbal interaction in the Zoom meetings was limited. Most of the time, preservice teachers had their video cameras turned off and engaged in limited chat or talk during the Zoom meetings unless the preservice teachers were asked to share their Breakout Room discussions with the entire class as part of participation. While they were participating in live Zoom synchronous sessions, the preservice teachers were concurrently also working on an interactive Google Slide created by the teacher educator. Most of the interaction during the synchronous sessions happened on the Interactive Google Slides, which were part of the participants' in-class learning artifacts that I collected and analyzed.

***Asynchronous Sessions.*** The teacher educator designed seven asynchronous sessions that were embedded in the learning management system, Blackboard. The asynchronous sessions were comprised of readings and documents for the session; pre-recorded Prezi or YouTube video lectures; links to individual and group projects like writing activity, viewing a video, etc.; links to web-based documents to complete reflections; and links to collaborative web-based platforms to take part in discussions. Preservice teachers were expected to complete the class material independently at their own pace and before the next synchronous session. The pre-recorded Prezi or YouTube video lecture to engage/guide preservice teachers through the asynchronous sessions served as a rich data source for documenting the specific technologies the preservice teachers used to engage in content or demonstrate learning.

**Agendas.** Class session agendas, which were created by the teacher educator to organize synchronous and asynchronous remote class sessions, were used as stable documents providing evidence of the student experiences for each class. These agendas were shared with the preservice teachers ahead of the class sessions via email and posted on Blackboard. The agenda was created as a Word document. It outlined the key topics to be covered during the session along with embedded hyperlinks to online resources that the preservice teachers would use in the class. The agenda also had the Zoom invitation for synchronous class sessions. Agendas in conjunction with the other data sources in the synchronous and asynchronous sessions to further contextualize and understand preservice teachers' learning experiences with technology in a technology-infused methods course.

***Participant In-Class Learning Artifacts***

During the observation processes described in the previous section, I summarized a list of participant in-class learning artifacts that they created. The in-class learning artifacts included responses on the interactive Google Slides, posts on collaborative web platforms, a social studies scavenger hunt (Flip Grid), journal reflections on Blackboard, SAMR reflection, Podcast Explorations, T-chart reflection, article share, and final technology reflection.

Each of these participant in-class learning artifacts are defined and fully explained in the findings section (Chapter 4) to answer research question two, which is focused on the preservice teachers' learning experiences with technology in a technology-infused methods course. An extended analysis of these in-class learning artifacts provided insights into what preservice teachers recognized as being important about integrating technology for themselves and for young children and how they engaged with technology and envisioned engaging young children with technology. It is important to note that I only had access to the product and did not have access to the grades for any of the artifacts.

***Reflections on Technology Practice***

Reflection is a crucial cognitive practice in the research field (Dahlberg et al., 2020; Steier, 1995). The Reflections on Technology Practice that I created on Google Form (see Appendix G) were completed at the end of the 4th, 6th, and 8th scheduled asynchronous sessions (see Table 1). The Google Form was divided into sections that allowed preservice teachers to input their answers for each individual prompt. Each preservice teacher got access to an individual, private form so that no other preservice teacher could see it. After each reflective assignment, I accessed the data on the Google Form and created an Excel sheet with data for each preservice teacher who consented to the study. The goal of the Reflections on Technology Practice was to help preservice teachers reflect on how they build connections with their learning, especially with technology. Specifically, the reflections asked preservice teachers to respond to the following prompts:

1. Name one technology you used this week in the social studies methods course that resonates with you.
2. Briefly tell how this technology supported your learning this week.
3. Briefly tell how you would envision using this technology in the future with young children.

4. Is there any other technology tool or learning experience that you found particularly powerful?
5. Reflect on how it can be used to complement the ECE pedagogy and/or research-based teaching practices.

These reflections shed light on what preservice teachers recognized as being important about integrating technology for themselves and for young children. They also provided insights into how the preservice teachers engaged with technology and envisioned engaging young children with technology.

***Lesson Plans***

The preservice teachers completed the lesson plan assignment by creating two integrated lesson plans grounded in specific National Curriculum Standards for Social Studies and the state social studies standards of learning for kindergarten, first, second, or third grade. Each lesson plan related strategically to an authentic children's literature text. The preservice teachers were required to strategically integrate technology into at least one of the lessons. Between completing lesson plan one and lesson plan two, the teacher educator provided each preservice teacher with constructive, targeted feedback on how their lesson design appropriately integrated technology to support complex thinking skills in social studies. However, this feedback was not used as a data source for this study because it was feedback provided by the teacher educator rather than outcomes produced by the preservice teachers. The lesson plans were used to understand how preservice teachers conceptualized creating learning experiences with technology for young children.

### ***Interviews***

A standardized open-ended interview approach guided the interview protocol (see Appendix E) that was inspired by Buss et al. (2015), Molebash (2001), and Schmidt et al. (2009)**.** The purpose of the interview was to get a richer understanding gleaned from personal interaction. Four participants (*n* = 4) agreed to participate in the interview process. Each participant was emailed to set up an online meeting, and all four agreed to meet on Zoom according to their schedule. The interview had open-ended semi-structured, which was consistent with the exploratory qualitative approach. Each interview took between 40 to 60 minutes to complete. The interviews were recorded as the preservice teachers had given written permission on the Informed Consent for Interview form for audio-recording the interview to aid with transcription. I recorded the meeting on iCloud, which used Zoom's inbuilt recording capabilities, and on my iPhone's voice recorder as a backup recording device. I completed verbatim transcriptions of each interview for analysis purposes. To ensure confidentiality, all participant names, discussed names, or other identifying factors were assigned pseudonyms during the transcription process. The data from interviews were used to delve into what preservice teachers recognized as being important about integrating technology, how they engaged with technology, and how they conceptualized creating learning experiences with technology for young children.

Interviews were a data source that provided me with an opportunity for dialogue. Interviews provide insight into preservice teachers' thought processes and the value judgment that they bring to their learning (Atkins & Wallace, 2012). Although I would have preferred to conduct the interviews face-to-face, given the COVID-19 circumstances and the format of the course, the interviews took place over Zoom. A standardized open-ended interview approach guided the interview protocol (see Appendix E). The interviews were open-ended, which was consistent with the exploratory qualitative approach; however, the semi-structured format provided me the freedom to follow the statements and questions that arose during the interview (Patton, 2002). Open-ended questions allowed an opportunity for conversation between the preservice teachers and me (Patton, 2002). I used structured discovery while conducting these interviews, which Roy et al. (2004) define as "a method in which in-depth interviews and observations focus on specific topics yet allows enough flexibility to capture unexpected findings and relationships" (p. 170). Using structured discovery allowed me to ensure that the same content is discussed with each preservice teacher while also allowing enough flexibility to change confusing wording or probe deeper into a preservice teacher's response. To allow preservice teachers to reflect deeply and meaningfully, I also extended my analysis from the artifacts and/or lesson plans as interview prompts. Using prompts from the preservice teachers' own work allowed me to intentionally engage the preservice teachers in this study as co-constructors of meaning during the interview process, trying to counteract imbalances of power through a collaborative interviewing approach (Kvale & Brinkmann, 2009). Interviews in this study helped me explore what preservice teachers recognized as being important about integrating technology for themselves and young children, how they engaged with technology and envisioned engaging young children with technology, and how they conceptualized creating learning experiences with technology for young children.

**Data Analysis**

Data analysis for this study used an inductive approach. Influenced by grounded theory strategies defined by Strauss & Corbin (1994), I used coding practices, strategies, and conceptual tools described by Saldaña (2016) and Maxwell (2013) to interpret the diverse data sets. Each data point for this study influenced the development of conceptual categories for specific research questions of this study (see Table 3).

| Data Source | Research Questions | | | | |
|---|---|---|---|---|---|
| | RQ1 | RQ2 | RQ3 | RQ4 | RQ5 |
| Demographic Questionnaire | | | | | |
| Technology and COVID Reflection (researcher generated) | ✓ | | | | |
| Course Context Artifacts | | | | | |
| Observations - Synchronous Zoom sessions (also recorded) | | ✓ | | | |
| Observations - Asynchronous sessions (recorded videos) | | ✓ | | | |
| Agendas | | ✓ | | | |
| Participant In-Class Learning Artifacts | | | ✓ | ✓ | |
| Reflections on Technology Practice | | | ✓ | ✓ | |
| Lesson Plans | | | ✓ | ✓ | ✓ |
| Interviews | | | ✓ | ✓ | |

**Table 3**
*Research Question and Data Source Table*

As this was an exploratory qualitative study, I approached the data without a preconceived set of categories and let the data present patterns. To organize the data and begin the analysis process, I used a variety of different data sources to collect data instead of relying on just one type. Glaser and Strauss (1967) termed this as "slices of data" (p. 65). The slices of data in this study are mapped out in Table 3. In line with Maxwell's (2013) recommendation, this research also included "reading and thinking about… interview transcripts and observation notes, writing memos, developing coding categories and applying these to…data, analyzing the narrative structure and contextual relationships, and creating matrices and other displays [as they] are *all* important forms of data analyses" (p. 105). These strategies were applied according to how they fit the data as it answered the research questions, as well as addressed any potentially serious validity threat by reducing "the risk of chance associations and of systematic biases" (Maxwell, 2013, p. 128). Once each data set was filtered into excel sheets, I worked to code and categorize this data to generate emerging themes. Each data source and the process of its analysis is expanded upon below.

***Technology and COVID Reflection***

Fourteen of the 15 participants completed the technology and COVID reflection. The reflection specifically asked two questions: (a) how have your experiences during COVID-19 influenced your thoughts about learning with technology? and (b) how have your experiences during COVID-19 influenced your thoughts about learning to teach young children (PreK-3) with technology?

I employed In Vivo Coding to focus on individual "participant's own language" (Saldaña, 2016, p. 97). As I was focusing on preservice teachers' language, it became evident that they frequently expressed their feelings and attitudes towards technology. I realized that even though my expectation was that preservice teachers would refer to more specific learning experiences during COVID-19, that is not how the majority of participants answered the question. Instead, preservice teachers expressed their feelings about technology and perceptions of their confidence in technology in describing their learning experiences during the COVID-19 pandemic. Only one participant's response articulated their specific learning experiences during COVID-19 and will be shared as a stand-alone finding to contextualize how some preservice teachers may have experienced learning during this time but did not express it.

During my first round In Vivo Coding process, I picked up on preservice teachers' words such as "worthwhile," "useful," "horrible," "frustrated" to express their attitudes towards technology. Since these expressions reflected preservice teachers' attitudes towards technology, I employed Value Coding strategy (Saldaña, 2016). Value Coding is used to analyze how participants reflect on their "values, attitudes, and beliefs, representing his or her perspectives or worldview" (p. 298). During this process, I picked up on preservice teachers' responses that were phrased "I feel..., I am scared of…" to describe their emotions about learning with technology. Since "emotions are intricately interwoven with one's values system," I used Emotion Coding as a "complementary method" to understand how preservice teachers' positioned themselves towards technology (Saldaña, 2016, p. 136).

To get to the appropriate "sentiment[al] analysis" (Saldaña, 2016, p. 86), in my second round of coding, I applied two rounds of Magnitude Coding to the In Vivo Codes that surfaced participants' values and emotions. Magnitude Coding is useful as a supplemental “subcode to an existing coded datum” to tentatively plot the evaluative data (Saldaña, 2016, p. 295). In one round, I used the Magnitude Codes: positive, negative, or mixed. Words like “lucky to have,” “valuable,” and “convenient” captured positive attitudes toward technology, whereas words like “horrible,” “challenging,” and “difficult” were coded as negative attitudes towards technology. Participants who described their feelings as “mixed” or with a coordinating conjunction like “It is great… but” or “… love to use technology to learn, but…” were coded as mixed emotions towards technology.

In the second round of Magnitude Coding, I used confident and unconfident to document how preservice teachers characterized their confidence with technology. Statements such as “I am not confident…,” “it has been a process to adapt,” and “I am not as savvy” were coded as unconfident about their own technology skills, whereas statements such as “I've learned how to manage,” and “Yes, now I can use new technology” were coded as confident about their own technology skills.

Although Magnitude Coding provides some insights about preservice teachers' attitudes towards technology, I recognize that participants’ responses offer only a snapshot in time and surface only what they chose to answer at the time of the reflection. This doesn’t necessarily mean that, if further probing had occurred, they would not have expressed other emotions or values, thereby revealing additional attitudes and confidences towards technology.

As I looked across the Magnitude Codes, I found an overlap of data between the participants’ attitudes (i.e., positive, negative, or mixed) towards using technology and their perception of their confidence with technology (i.e., confident or unconfident). I put the data into a matrix to show how data may interconnect. Arranging the data into a matrix helped to get an “at-a-glance analysis” (Saldaña, 2016, p. 88) of preservice teachers’ attitudes and confidence towards technology. However, it does not capture the complexity of the context and its relation to their positionality. Nonetheless, it does communicate, at a glance, the preservice teachers articulated diverse attitudes and confidence levels for technology during the COVID-19 pandemic.

Finally, as I was reflecting across the data to consider how preservice teachers positioned themselves towards technology, I noticed another code in my initial rounds of In Vivo Coding that fell beyond the Magnitude Coding scales but seemed as relevant. Over half ($n$ = 9) of the preservice teachers used phrases like “desperate to learn,” “want to explore,” and “open-minded now to learn.” These phrases suggested a positionality towards technology that is important to document as students enter a fully online course. These expressions were coded as “willingness to learn.” To honor participants' voices, this finding will be described the Chapter 4 as a complement to the Magnitude Coding described above.

***Course Context Artifacts***

For the data analysis for course context artifacts, I first coded the agendas using content analysis to systematically and objectively identify all technology integrated into the coursework (Berg, 2001). This content analysis of the agenda helped narrow down all the learning experiences that preservice teachers were engaged in with technology. During the first cycle of coding for the video recordings, I wanted to capture the types of learning experiences with the identified technologies that the preservice teachers used (see Appendix J). The content analysis of the agendas informed what in-class artifacts preservice teachers created as they were immersed in a technology-infused methods course.

In the second-round coding, I documented how students used the technology to understand course content. I used gerund-based Process Coding to label the “actual or conceptual actions relayed by participants” (Saldaña, 2016, p. 78) as they engaged with technology in their synchronous and asynchronous sessions. For example, Group 1 was given a few websites to investigate in one of the synchronous sessions. I coded this as “searching.” Then they discussed their thoughts on the Landforms of Venezuela in their respective Breakout rooms. I coded this as “collaborating.” After the groups reconvened with the entire class, some of the things they discussed following from the Google Slides were history and who has the power to tell history, use of the term explored vs. discovered in history, how has history been portrayed in the text. I coded this as “critically reflecting.” As I made connections between the use of technology and pedagogy, I used the codes to make a summary table to filter the activities and Process Codes. As I was discovered Process Codes, I went back to the literature to understand how other researchers have categorized preservice teachers’ learning experiences with technology. I used what I found from the literature to help narrow the Process Codes into six categories. I later used the same categories as a priori Provisional Codes (Saldaña, 2016) to gain an understanding of how preservice teachers conceptualized creating learning experiences with technology for young children.

### *Participant In-Class Learning Artifacts*

The data analysis process for the participant in-class learning artifacts were built on the course context analysis of the agenda and what preservice teachers produced in their synchronous and asynchronous sessions. Accordingly, each learning artifact was analyzed as part of the participant in-class learning artifacts.

The coding process happened in multiple phases. In the first round of coding, I focused on coding the participant in-class learning artifacts that specifically focused on providing insight about preservice teachers' experiences about technology integration (e.g., participants' responses on the interactive google slides, journal reflections on Blackboard, SAMR reflection, and final technology reflection). I then grouped the items according to different patterns found in the data (e.g., *discussing with peers, believe it's a great resource).* Using an eclectic coding approach, as outlined in Saldaña (2016), multiple different types of codes were applied simultaneously, which maximized the amount of information coded at a time. An eclectic combination of In Vivo, Structural, and Process was applied to the qualitative data (Saldaña, 2016). To honor the individual learning perspectives, I used In Vivo Coding (Saldaña, 2016). Accordingly, I utilized preservice teachers' exact words to ground the analysis in their perspective. Using an iterative process of coding, pattern finding, code development, and interpretation, I used Structural and Process Coding in relation to the two research questions: (a) preservice teachers views and opinions about what important and which factors influenced their understanding of technology integration and (b) how preservice teachers engaged with technology, how they envisioned engaging young children with technology. I color-coded the participant in-class learning artifacts by research question (research question#1 (themselves) = blue, research question#1 (young children) =green, research question#2 (themselves)= yellow, research question#2 (young children) =orange). Then I employed Descriptive Coding of the codes that had emerged from the data to categorize the breadth of information stated by the preservice teachers into shorter keywords or phrases unless I found the In Vivo code had a strong statement (Saldaña, 2016).

Then I coded the rest of the participant in-class learning artifacts (e.g., posts on collaborative web platforms, social studies scavenger hunt, journal reflections on Blackboard, podcast explorations, t-chart reflection, and article share) using the same color codes in relation to the research questions.

***Reflections on Technology Practice***

The data analysis process for the participant in-class learning artifacts and the Reflections on Technology Practice started as the course sessions were in progress and throughout the course. To capture the salient themes contained within the participant in-class learning artifacts and the Reflections on Technology Practice, I engaged in a series of coding techniques to ensure I had accurately captured what preservice teachers noticed about their experiences with technology throughout the course. To ground the analysis from individual learning perspectives, I used In Vivo Coding (Saldaña, 2016), primarily to honor preservice teachers' voices. For example, one preservice teacher said, "By listening to podcasts this week I was able to learn a lot about what has happened in the world." I coded this statement as "listening to podcast - helped learn about what has happened in the world." I used Structural Coding to organize the In Vivo Codes with relation to the two research questions. First, I analyzed the data to understand what the preservice teachers recognized as being important about integrating technology for themselves as learners and young children as learners. Second, I analyzed how the preservice teachers engaged with technology and how they envisioned engaging young children with technology in their future teaching. During this coding phase, I color-coded each reflection by research question (research question#1 (themselves) = blue, research question#1 (young children) =green, research question#2 (themselves)= yellow, research question#2 (young children) =orange).

For my second round of coding, I engaged in Descriptive Coding of the Structural Coding of data with my research questions as it allowed me to categorize the breadth of thoughts stated by the preservice teachers into shorter keywords or phrases. Unless I found the In Vivo code had a strong statement (Saldaña, 2016), in which case I used the In Vivo code as the descriptive code. For instance, *learning from peers* emerged as a Descriptive code from the Structural Code, *generating and sharing knowledge for themselves*. I did not use the second cycle of coding as the categorization methods of In Vivo, Structural, and Descriptive Coding seemed sufficient for the analysis (Saldaña, personal communication, June 3, 2020). To further condense the codes, I summarized and compared them by making tables with the Structural Codes in one column and the Descriptive Codes in an adjoining column (Saldaña, 2016). This is usually helpful to get a frequency count of the Descriptive Codes. Because I was not looking to quantify the use of technology, I used the table to solidify categories that were similar in nature and identify Process Codes that look alike and feel alike (Lincoln & Guba, 1985). Then I collapsed similar codes like *watching, listening,* and *looking* into a broader category called *passively interacting*.

### *Lesson Plans*

For the data analysis of the lesson plans, I first coded the data using Process Coding to sort activities that specified technology to engage young children (Saldaña, 2016). I did not use the course rubric to code the lesson plans as technology was only one part of the lesson plan. Instead, to make connections between preservice teachers learning and conceptualization, I used the a priori codes (a) understand; (b) engage; (c) explore/examine; (d) reflect; (e) collaborate/share; and (f) extend constructed from the observation data to understand preservice teachers' learning experiences as Provisional Codes (Saldaña, 2016). I then compared the Process Codes and Provisional Codes to generate final codes (Saldaña, 2016) that best describe how preservice teachers in this study conceptualized creating learning experiences with technology for young children.

### *Interviews*

To honor preservice teachers' voices and ground the analysis in their perspective, I started with In Vivo Coding and then engaged in Structural Coding to organize the In Vivo Codes with relation to the two research questions. First, I analyzed the data to understand what the preservice teachers recognized as being important about integrating technology for themselves as learners and young children as learners. Second, I analyzed what preservice teachers said about how they engaged with technology and how they envisioned engaging young children with technology in their future teaching. During this coding phase, I used the same color codes from the participant in-class learning artifacts and the Reflections on Technology Practice to be consistent in data analysis (research question#1 (themselves) = blue, research question#1 (young children) =green, research question#2 (themselves)= yellow, research question#2 (young children) =orange).

For the second cycle of coding, I engaged with Descriptive Coding, which is a low inference coding that summarizes in a word or short phrase that "is talked about" (Saldaña, 2016, p. 76). The Descriptive Coding allowed me to "help identify patterns" (Glesne, 2011, p. 202) and categorize the breath of opinions across the four participants (Saldaña, 2016) in line with the codes from the participant in-class learning artifacts and the Reflections on Technology Practice data.

Once I had identified the main codes from participant in-class learning artifacts, Reflections on Technology Practice assignment, lesson plans, and interviews, I looked at the codes emerging from all the data sets together using Themeing the Data as my organizational technique (Saldaña, 2016). Themeing the data is not particularly a coding strategy but a way to reflect on the generated themes while looking at what kind of relationships exist between the themes (Saldaña, 2016). For example, *real-life social interactions, creative ways to learn and present concepts,* and *beyond the constraints of physical spaces* were integrated under *multimodal affordances of technology.* As I tried to pull together the categories, I also looked back at the reflective, analytic memos to check my interpretations on the themes rather than simply relying on the codes emerging from data (Saldaña, 2016).

**Summary**

Once I had identified the categories and codes for each research question, I utilized Saldaña’s (2016) *code weaving* process to integrate the codes and categories into a narrative form to see how the pieces fit together. In doing so, I started with specifying the properties and dimensions of a major category and then identifying the most relevant examples. During the entire process, I constantly considered my role and positionality as it influenced any research decisions. I reflected on my analytic memos, along with the final categories and preservice teachers' quotes, to explain the major findings for each research question.

**Researchers Memo**

Memos are a way to elaborate on researchers’ understanding by making written notes or thoughts that can later help articulate the interpretation the researcher made during data collection (Hatch, 2002). To make sense of the data collected and to maintain a clear vision of the position as a researcher within the study, I wrote reflective memos throughout the study, especially during analysis. Using an analytical memo helped me bracket my personal bias and preconceived notions (Tufford & Newman, 2012) about technology, technology use, and technology integration as I tried to discover preservice teachers’ understanding in the developing codes and categories.

**Researchers Role**

I recognize that just by entering the research context, I impacted the dynamics of discourses, relationships, and the environment of the context. For this study, I was mindful that my presence and the discourse interacted and influenced, in varying degrees, all the other elements of the research. For example, during Zoom meetings, I realized that when I entered a Breakout Rooms, the preservice teachers would stop talking or get self-conscious. Even though I was not their instructor, it seemed they perceived me as someone who was there to judge them.

The insider versus outsider researcher positionality is also relevant to this qualitative research (Dwyer & Buckle, 2009). Hancock and Algozzine (2017) emphasized that the goal of qualitative research is "to understand the situation under investigation primarily from the participants', not the researcher's, perspective. This is called the *emic* or insider's perspective, instead of the *etic*, or outsider's perspective" (p. 8). In a conscious effort to give voice to the preservice teachers, I took an emic perspective in this study (Tellis, 1997) during my data analysis, thus providing insight into experiences of early childhood education preservice teachers as described by them.

***Trustworthiness***

To conduct high-quality qualitative research, it was imperative to ensure my research and findings were valid. Validity in qualitative research is focused on the credibility and trustworthiness of the researcher (Lincoln & Guba, 1985). However, Maxwell (2013) notes that it is up to the researcher to decide the specific validity threats for their research and the best strategies to deal with them. Below I expound on the threats and strategies that posed threats to the validity of this study and how I countered them.

**Member Checking.** In order to achieve trustworthiness in this study so that the quality of the analysis holds up to scrutiny, I used member checks or—as Maxwell

(2013) calls them—respondent validations. These are “systematically soliciting feedback about…data and conclusions” (Maxwell, 2013, p. 126) from the preservice teachers. All four participants who were interviewed were given opportunities to review their interview transcripts to check for accuracy and to clarify any potentially misleading information.

**Reflexivity.** Part of qualitative research is researcher positionality and reflexivity (Hatch, 2002). Positionality refers to the researchers’ ontology and epistemology and how the researcher chooses to adopt that view in relation to the study being done (Holmes, 2010). My positionality in relation to this study has been explained in the earlier section. Hatch (2002) defines reflexivity as a process of deeply reflecting, personally and academically, on the researchers’ own lived experiences to track their influence on the study. In an attempt to counter my obvious biases, I used reflexivity in my commitment to ensure the validity of the analysis by repeatedly returning to how I am situated in work. Recognizing that it is imperative for me to keep track of my influence on the study and the preservice teachers, I tried to keep my biases in check and monitor my emotional responses in my analytical memos (Hatch, 2002, p. 10).

I also utilized a critical friend who was not involved in the study. After the initial coding of the data, I asked the critical friend to go over my data and codebook as a form of reliability. Together, we analyzed one mini-reflection and one interview together over Zoom meeting. First, we both coded individually according to the coding book and then discussed what we thought was happening. This helped me support my findings and added to the trustworthiness of my data and findings.

**Triangulation.** Maxwell (2013) and Miles et al. (2016) write that triangulation does not immediately offer validation of one's findings. The purpose is to utilize various forms of collected data to credence against one another and provide complementary evidence of those findings. I used multiple sources (i.e., observations, artifacts, and semi-structured interviews) and analyzed the data at different time points during the study. According to Krefting (1991), analyzing data across multiple sources can help minimize misrepresentation of the findings interpreted from a single data source.

### *Potential Limitations*

This study sought to explore the experiences of early childhood education preservice teachers in a technology-infused social studies methods course. As with all qualitative research, the researcher is an integral part of interpreting the data. In this study, I collected and analyzed all the data. Thus, my unique positionality and the relationship with research participants influenced the lens through which I view each data source. Although my direct interactions were minimal, I did experience class sessions with them as a participant-observer.

Another limitation of this study was the timing of the study. Prior to COVID-19, the original research design consisted of face-to-face course sessions. To comply with "social distancing" policies during COVID-19, the structure of the course was changed from face-to-face to a hybrid format, blending asynchronous and synchronous sessions for seven weeks. From an ethics point of view, there were no key differences between face-to-face and online sessions as both required the usual ethical procedures, such as gaining informed consent and ensuring anonymity, privacy, and confidentiality of the participants' identity. The data collection methods were also adapted to meet this change. The observations and interviews took place over Zoom meetings, and all the artifacts were collected using multiple platforms. Arguably, seven weeks is not a long enough time for preservice teachers to deeply experience technology when they must grapple with all the other content of the methods course. More follow-ups will be required to understand the full impact of a technology-infused methods course on preservice teachers' acceptance and integration of technology in their teaching practice.

The hybrid format of the course also may have affected the participation rate for the interview as I was not able to build the type of rapport that builds trust and confidence. It was also hard to contact the preservice teacher who did not respond or did not submit assignments. Reasons could include technical difficulties, family reasons, etc. Observation of the study was especially difficult as the preservice teachers chose to keep their video and audio off, and there was not much verbal communication in the classes. Even if this was an online format, having my presence impacted the responses and sometimes even more as I moved around in Breakout Rooms. I realized that when during session one preservice teacher suddenly interrupted the other and said, "You know that another girl is in our room," implying that I had joined their Breakout Rooms.

There were advantages to having a hybrid condensed structure, as well. Because the course happened over seven weeks, it may have afforded preservice teachers' a better memory of the experiences during the interview of what they experienced a few weeks ago. In terms of data sampling techniques, there was a wealth of data archives available because of all the in-class discussions happening on Google Slide or other online platforms (e.g., Padlet, Blackboard Journals, etc.). I also noted that because learning over technology was a learning curve for everyone, preservice teachers were very flexible and helpful to each other. For example, if a preservice teacher was stuck on a technological issue, another one of their classmates would walk the preservice teacher through the process.

Additionally, this study relied on how preservice teachers described their experiences and influences of the experiences for their future teaching. Thus, a potential limitation is the self-reported nature of data collection from the preservice teachers. The information provided by self-report is reliant upon their recollection of events and, therefore, subject to lapses in memory, embellishment, or trivialization. And even though the reflections and interviews may provide rich accounts of preservice teachers' thinking in the process of planning, organizing, and implementing technologies, they are still generated from the perspective of the preservice teachers. Further, I also recognize that preservice teachers may have reported the perceived ideal answer, which may differ from the real behavior the preservice teachers would have adopted in such situations. One advantage of self-report, however, is that this measure is nonintrusive. Nevertheless, the combination of data sources has provided a reliable measure of preservice teachers' understanding.

***Delimitations***

The sample in this study was small and limited in scope and time because this study was limited to one early childhood education social studies methods course. Because I was particularly interested in gaining an in-depth understanding of early childhood education preservice teachers' experiences in a technology-infused methods course, I did not intend to gather shallow information from a large sample to be generalized to the larger population. As a constructivist researcher, I acknowledge that knowledge gained from one context may not necessarily have relevance in other contexts or even in the same context at a different time. For that reason, I provided a thick description of the research context and maximized memoing to remain honest and grounded in my research approach. Lincoln and Guba (1985) asserted thick description to achieve a type of external validity in qualitative research. By providing detailed descriptions of the research context, sampling decision, my role in the study, and the data collection methods, I allow the readers to make informed judgments about whether the findings reported here are relevant to their situation.

**Summary**

In this chapter, I explained the methodology of this study. I began by introducing my research questions and the foundational elements of my methodological approach. This included an explanation of why I chose an exploratory qualitative study. I also described my research design, including a rationale for the context and sampling. Afterward, I outlined the data sources, including the demographic questionnaire, observations, artifacts, and interviews. Subsequently, I described the procedures for collecting and analyzing each data source. In the next chapter, I provide a verbal and visual depiction of the findings from the analysis.

# Chapter Four

The primary focus of this study is to explore how a technology-infused social studies methods course shaped early childhood education preservice teachers' learning about technology integration. Specifically, I investigated how preservice teachers described their attitudes towards and confidence in using technology. I explored how preservice teachers engaged with technology in a technology-infused early childhood education social studies methods course. In addition, I examined how they described their experiences with technology and how they conceptualized their understanding of creating technology-infused learning experiences for their future teaching with young children.

More specifically, the following questions were addressed:

1. How did early childhood education preservice teachers describe their attitudes towards and confidence in using technology upon entering a technology-infused social studies methods course during the COVID-19 pandemic?
2. What were preservice teachers' learning experiences with technology in a technology-infused social studies methods course?
3. What did early childhood education preservice teachers recognize as being important about integrating technology for themselves as learners and young children as learners?
4. How did early childhood education preservice teachers (a) engage with technology in a technology-infused social studies methods course and (b)

envision engaging young children with technology in their future teaching?

5. How do early childhood education preservice teachers engaged in a technology-infused social studies methods course conceptualize creating learning experiences with technology for young children in their future teaching?

As explained in Chapter 3, a demographic questionnaire, technology and COVID reflection, artifacts completed as part of course context and participant in-class learning activities, and interviews were collected and analyzed to answer the research questions. In this chapter, I share the findings for each of the research questions. The preservice teachers came into the course expressing their positive, negative, or mixed *attitudes towards technology*. In addition, they articulated their self-perceptions of technology skills as confident, unconfident, or both confident and unconfident. As they continued in this technology-infused methods course, they *experienced technology* to understand, engage, explore/examine, reflect, collaborate/share, and extend their knowledge about social studies. As they experienced different technologies throughout the course, preservice teachers *recognized technology* as a space for building a community of learners to share and generate knowledge and build learner agency. They also identified technology as a multimodal tool to support learning that simulates realistic experiences, provides creative outlets, and expands opportunities for learning. The preservice teachers described *engaging with technology* passively, actively, and critically by noticing, extending, and evaluating technology. Their lesson plans *conceptualized using* *technology* with children in many of the same ways they engaged in technology in the course. Specifically, they created experiences that encouraged young children to explore/examine, collaborate/share, and extend their learning. Each of these broad categories is expounded upon in the sections below.

**Attitudes Towards and Confidence in Using Technology**

The first research question in this study explored preservice teachers' attitudes towards and confidence in using technology as they entered the fully online course during the COVID-19 pandemic. This early childhood education social studies methods course took place in Fall 2020, almost 6 months after the university and local schools pivoted to virtual teaching and learning environments and before vaccinations were available. Within the program, the course is taken after taking foundational prerequisite courses which means the students typically take this course during their third semester in the program. Although examining the specific influences of the COVID-19 pandemic on the preservice teachers' attitudes and confidence is beyond the scope of this study, it is important to note that the findings are situated within experiences during the COVID-19 pandemic, which may have shaped some of their attitudes towards and feelings about using technology.

Fourteen of the 15 participants responded to the Technology and COVID-19 Reflection. However, only one of the 14 preservice teachers specifically noted their learning experiences with technology during the COVID-19 pandemic to share how the digital learning contexts may have influenced their thinking and learning. One explanation for this disparity could be that the preservice teachers did not have enough experience with or knowledge of how to plan effectively with technology in mind or reflecting on their pedagogical practices. In hindsight, another reflection at the end of this technology-infused course could have helped get a better understanding of how they understand their experiences with technology. Revealing a negative experience, the participant specifically described the following:

> Yes, my experiences during COVID-19 influenced my thoughts about learning with technology due to technical difficulties. For example, [all the] classmates including me have trouble getting into blackboard collab and having to switch to Zoom, which can take some time away from our class time.

In the above example, the participant specified how challenges experienced in using technology during the COVID-19 pandemic affected their thoughts about learning with technology. All other participants described their attitudes towards and confidence about using technology as they entered the class but did not provide specific details as to what and how their experiences of learning with technology during the COVID-19 pandemic may have influenced them. Further analysis of the data provided insights into preservice teachers' overall attitudes towards and confidence in using technology as they entered the course.

The overall analysis of the data revealed that preservice teachers ($n$ = 14) expressed their attitude towards technology as positive, negative, or mixed. A mixed attitude was coded when preservice teachers described both positive and negative conceptualizations of technology use instead of comments that may have indicated a feeling of indifference about the value of technology. The preservice teachers also revealed perceptions of their confidence in their ability to use technology as confident, unconfident, or both confident and unconfident for their learning and young children's learning (see Table 4).

| Confidence Towards Technology Ability | Attitudes Towards Technology | | | Total |
|---|---|---|---|---|
| | Positive | Negative | Mixed | |
| Confident | 4 | 0 | 2 | 6 |
| Unconfident | 3 | 1 | 3 | 7 |
| Confident and Unconfident | 1 | 0 | 0 | 1 |
| Total | 8 | 1 | 5 | 14 |

**Table 4**
*Attitudes Towards and Confidence in Using Technology*

### *Attitudes Towards Technology*

More than half of the preservice teachers (n = 8) described a positive attitude towards technology. For example, the preservice teachers described their experiences with technology using phrases like "super important." Only one preservice teacher (n = 1) described a negative attitude towards technology. This preservice teacher described their experiences with technology using words like "scared," "horrible," etc. Less than half of the preservice teachers (n = 5) described a mixed attitude towards technology. They described their experiences with technology using phrases like "both a good thing and a bad thing."

**Positive attitude towards technology.** The majority of the preservice teachers conveyed a positive attitude towards technology. They expressed that technology enhances learning in general or that it enhances learning when used in face-to-face learning. For example, one participant noted, "Technology is an important part of our civilization that will help us in the long run and therefore help teach young children better because they all have different ways of learning." Similarly, another participant said, "I believe that it [technology] enhances it [learning] by far, even when there isn't a pandemic." In addition, one participant described valuing technology and noted that current experiences had influenced their attitudes about the importance of technology. This participant expressed, "I am more aware now of its importance and how it can be valuable." While the same participant described a positive attitude through their willingness to accept technology, another participant held a positive attitude towards technology if technology was used in an in-person classroom. Specifically, they mentioned, "If it's in person classroom setting, the use of technology would be exciting, because it may help many students strengthen their learning experience." While they did not specify their thoughts on technology in other spaces, they did state, "I am not a fan of long distance learning."

**Negative attitude towards technology.** Only one preservice teacher conveyed a negative attitude towards technology. This preservice teacher described their experiences with technology using the words "scared," "horrible," "hard," "exhausting," and "distracting." They expressed their views about virtual learning as they described their experiences with technology. Specifically, the preservice teacher stated the following:

Scared to be honest. Technology isn't for everyone. Trying to teach others will be the difficult part in my option and also having to seat [*sic*] down for 2 or more hours will be exhausting. Paying attention while using technology is also hard.

In addition, the preservice teacher spoke about online learning and described the negative psychological and physical health effects they had with technology that had caused them to feel anxious about teaching young children with technology. They also pondered on the issues of equity and accessibility. Relating their own experience to anticipate similar experiences for young children, they questioned the following:

> I can listen for about an hour max and than [*sic*] I start to get tired. How will the students do? Will there [*sic*] parents seat [*sic*] next to them during the virtual learning to make sure they are paying attention? Technology is a pain. What if some students can't afford technology how will they attend school? What if they lost the laptop or Ipad? I just think that paper is the way to go. I know trees are dying :(

**Mixed attitudes towards technology.** Five of the preservice teachers conveyed mixed attitudes towards technology when describing their experiences about learning with technology during the COVID-19 pandemic. Mixed attitudes were coded when preservice teachers demonstrated having both positive and negative attitudes about technology. Their attitude was not neutral or unsure, but rather they did not take a stance on how they particularly felt about technology. Three of the five preservice teachers explicitly stated that they had mixed feelings towards technology. For example, one participant noted, "I have mixed feelings about learning with technology. I think that using technology can be fun and challenging at the same time. I think that needs to be a balance between the use of technology and teaching in person."

Similarly, another participant identified, "I think technology can be both a good thing and a bad thing." Stating the negative thing about technology, they explained that "sometimes children can get distracted using technology." However, this participant also noted, "Technology also introduces children to a lot of different features." Another participant also showed a mixed attitude towards technology as they specifically stated, "I have [a] mix feeling [about] using technology." They further explained that "I feel that using technology to teach multiple subjects can help but I am a bit uneasy about it."

Two of the five preservice teachers did not specifically mention having mixed attitudes about technology, but their stance towards technology articulated a mixed attitude about the benefits of technology. For example, one participant specified the following:

> I will definitely utilize technology when I can but will try not to use to too often. It's no substitute for old fashion teaching but I think can be a great compliment [*sic*] and having it integrated in the curriculum is important.

Although the same participant felt that integrating technology in the curriculum is important, they specified that they would use it sparsely, showing that they do not completely embrace the positive role of technology. Similarly, another participant specified that technology is a "useful tool but must be used in moderation." They further clarified their dual stance in their belief in technology as they detailed, "I do think this generation has to be proficient in utilizing all that technology has to offer but children need to learn through exploring, feeling touching, seeing and hearing as well."

### *Confidence Towards Technology Ability*

On the technology and COVID reflection, preservice teachers ($n = 14$) expressed they were confident, unconfident, or both confident and unconfident in their ability to navigate technology. Less than half of the preservice teachers ($n = 6$) described themselves as confident in their ability to navigate technology. Half of the preservice teachers ($n = 7$) described a lack of confidence in their ability to navigate technology. One preservice teacher ($n = 1$) expressed being both confident and unconfident.

**Confident.** Out of six preservice teachers who expressed confidence in their ability to navigate technology, four preservice teachers described their confidence in their ability to navigate technology in the context of their own learning. For example, one preservice teacher said, "I am proficient in using ZOOM and now learning Blackboard and GOOGLE SLIDES." Two preservice teachers described their confidence in the context of young children's learning. For example, another preservice teacher said, "I will use technology to assist content class… that motivate children to learn."

Articulating their confidence in navigating technology in the context of their own learning, one participant described the affordances of technology, stating the following:

> Writing on a computer allows you to more easily change things and edit compared to pencil and paper. I think it can also be a great way for you to stay organized. I use calendars and make schedules on my computer which is useful. I

> also think there are a ton of useful resources using technology, such as videos or virtual simulations which can help enhance learning.

Similarly, another participant described their confidence in their ability to use technology tools in the context of their own learning by specifically stating, “I've learned how to manage my time and learned how to use the tools available to succeed [in] my learning.” This participant further detailed that they have used technologies like “computer, webinars, podcasts” in their “coursework” and in their “past learning experiences.”

Comparably, describing the technology in the context of young children’s learning, one participant articulated their confidence in their ability to navigate technology. In particular, they acknowledged the challenges and identified how they would make it work. Specifically, they stated, “It may be challenging to teach remotely but I do not think that it is impossible. Also, there are many tweaks that we can make to help fit the needs of each individual child!” Similarly, another participant expressed the following:

> In my future classes, I will use technology to assist content class, I need to find ways that motivate children to learn and create opportunities that are interesting, motivating and engaging for them.

**Unconfident**. Seven of the preservice teachers expressed their lack of confidence in their ability to navigate technology. Of the seven, four preservice teachers expressed a lack of confidence in the context of their own learning, and the other three preservice teachers expressed a lack of confidence in the context of young children’s learning. For example, one participant described a lack of confidence in their ability to use technology for themselves as they noted, “It is very difficult for me.” Their lack of confidence seemed to stem from having a virtual teaching environment more than fear of technology as they further described themselves as a tactile learner. They added, “I am such a hands[-]on [person] and learning in a class setting that having to do [with] distance learning has become a challenge for myself.” They also expressed, “[I am] rethink[ing] about changing my career just because who knows how teaching will be as time goes by.” Similarly, another participant described a lack of confidence in their ability to use technology for themself as they reflected, “I have come to the realization that I am not as savvy with technology as I thought I was.”

One participant speculated that their future classroom would have diverse children with diverse learning needs and voiced their lack of confidence about navigating different forms of technology for young children. They stated the following:

> I don't have my own classroom yet, but part of me is praying that this will all be over by the time I do get my own classroom. It seems overwhelmingly difficult to juggle both synchronous and asynchronous classes with children who come from a variety of backgrounds and bring an assortment of learning needs.

**Confident and Unconfident.** One participant expressed being both confident and unconfident in their ability to navigate technology. On the one hand, they specified being “proficient” in their ability to navigate technology for themselves. But on the other hand, they said, “There is no question that despite my upbringing with technology, I am not confident that I would be able to provide anywhere near what’s proficient on my own.” They described feeling confident navigating technology for themselves but unconfident navigating technology for young children. This participant exemplified the group of preservice teachers who have grown up with technology and have proficiency using technology for themselves but are not confident in their ability to use the technology to teach young children.

### *Willingness to Learn*

The majority of the preservice teachers ($n$ = 8) revealed a willingness to learn how to use technology for themselves and/or in their future teaching. Specifically, they expressed a willingness to learn to use technology and design and integrate technology-based activities into young children's curriculum. For example, one preservice teacher identified a willingness to learn to use technology when they stated:

> Technology is super important, and every educator should be given the appropriate training and resources to be able to provide their learners with the same learning experience that they would have in the classroom.

Another preservice teacher expanded on these thoughts by expressing a willingness to learn to design and integrate technologies into the curriculum:

> I want to explore as many technologies as possible and provide curriculum that includes technology one way or another so that I can help them develop their interests and promote different methods of learning in the future.

And in another example, a participant expressed their willingness to learn to integrate technology because they envisioned technology as a part of their future teaching. They conveyed the following:

> This whole experience with the virus might increase the use of technology in the class, making it more important for me as a future teacher to understand how to use it. There is also a chance that by next fall when I start teaching it could still be virtual, meaning it's good to be familiar with virtual teaching tools.

Overall, the preservice teachers also recognized that they still had more to learn. For example, one preservice teacher stated, “I'm desperate to learn.” In another example, a preservice teacher shared, “I feel that there are many things that I may need to learn going forward.”

**Summary**

Analysis of preservice teachers’ responses to their Technology and COVID-19 reflection revealed that preservice teachers described diverse attitudes towards technology and different confidence levels as they entered the course. Their attitudes towards technology could be categorized as positive, negative, or mixed. At the same time, they articulated feeling confident, unconfident, or both confident and unconfident as they expressed thoughts about their ability to navigate technology. Moreover, the majority of the preservice teachers indicated a willingness to learn to use technology and to design and integrate technology-based activities into young children’s curriculum. Overall, these findings suggest that preservice teachers’ attitudes towards using technology to learn are mostly positive even though more than half indicated a lack of confidence in their ability to navigate those technologies when they initially entered the technology-infused social studies methods course.

**Learning Experiences with Technology**

Analysis of course learning experiences revealed that the 15 preservice teachers in this study engaged in learning using various technologies (Appendix J) to create a variety of learning artifacts in their synchronous and asynchronous sessions (see Figure 6). In the section below, I will describe the artifacts and then present the findings from the analysis of the artifacts.

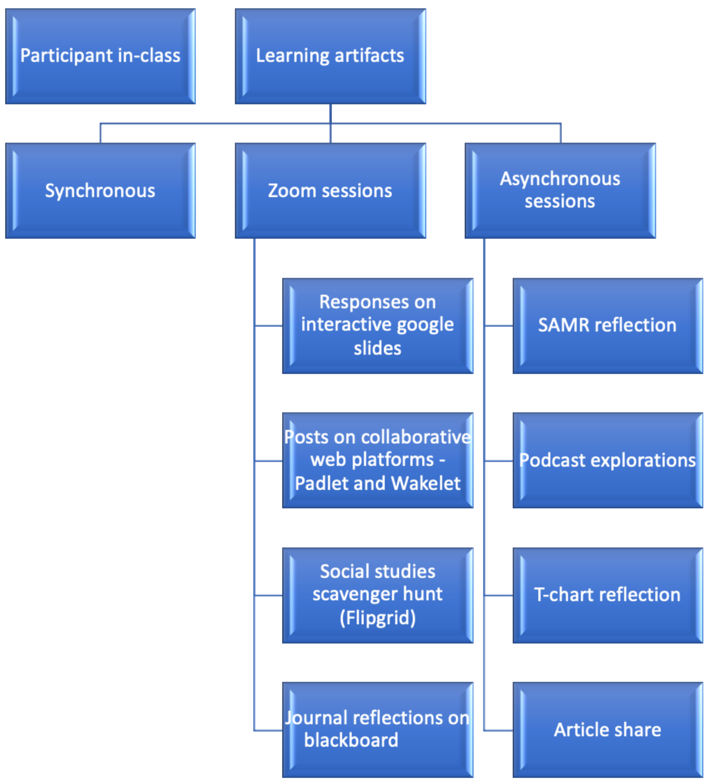


**Figure 6**.

*Participant In-Class Learning Artifacts*

### *Participant In-Class Learning Artifacts*

**Interactive Google Slides.** The Interactive Google Slide is an online presentation app to create and format presentations and work. The teacher educator used this app as a dynamic, interactive presentations program to engage preservice teachers in all synchronous class sessions. There were seven Google Slides created by the teacher educator that the preservice teachers engaged with during synchronous sessions. The preservice teachers' responses on these slides were analyzed as participant in-class learning artifacts.

**Posts on Collaborative Web Platforms.** The teacher educator used two cloud-based collaborative web platforms, Padlet and Wakelet, during synchronous session # 7. Padlet allowed preservice teachers to post notes on a common page, including links, videos, images, and document files. Wakelet allowed preservice teachers to curate links, social media posts, videos, and images into private or public collections on their web platform. Preservice teachers' responses on both web platforms were analyzed as participant-in-class learning artifacts.

**Social Studies Scavenger Hunt.** The social studies scavenger hunt was a Flipgrid assignment that students participated in across the semester. Flipgrid is a free app and web-based program that allows users to create short videos, also called grids, to facilitate video discussions. All 15 preservice teachers selected five challenges created by the teacher educator to connect their understandings of social studies themes and concepts to their own world and recorded their responses on Flipgrid.

**Journal Reflections.** Journal reflections, created by the teacher educator, were assignments created on Blackboard's discussion board as part of preservice teachers' personal reflections on teacher educator given prompt. These individual reflections were posted after synchronous sessions #3, #5, #7, #9, and #11. There was a total of fifty-nine reflections that were posted and analyzed as participant in-class learning artifacts.

**SAMR Reflection.** The SAMR Reflection, created by the teacher educator, was an assignment created as a Blackboard blog for asynchronous session #2. As the preservice teachers viewed their first Prezi video for their first asynchronous session, they paused after reading through the SAMR lesson examples to consider how the use of the SAMR model shaped the way lessons for learners are structured. After reviewing the entire Prezi, all 15 preservice teachers wrote a quick note in the Blackboard blog space about what they were wondering about now with the SAMR Model.

**Podcast Explorations.** Podcast explorations were a reflection collected by the teacher educator on Google Docs for asynchronous session #2. Preservice teachers listened to various podcasts that explained the applicability and affordance of various available technologies for the social studies curriculum. After listening to the podcasts, they were given time to play with at least one of the technologies discussed in the podcast. Fourteen of the 15 preservice teachers reflected on their understanding of the technology by answering these specific prompts: (a) identify the tool you worked through and share your experiences with us; (b) how could you use each tool meaningfully in the ECE classroom?; and (c) where does the tool "fit" when thinking about the SAMR model?

**T-Chart Reflection.** T-Chart reflection was an assignment created by the teacher educator on Google Docs for asynchronous session #4. All 15 preservice teachers read two articles and used the T-chart document to write (a) essential elements from Powerful Social Studies in the column on the left and (b) examples from the Fitts & Gross (2010) article that are representative of the Powerful Social Studies ideas.

**Article Share.** Article share was an assignment created by the teacher educator that required preservice teachers to explore the concepts of economics as examined in an assigned text. The teacher educator asked them to do the following: (a) select a digital platform that will allow you to guide learners through your lesson experience and (b) works collaboratively to create the project. All 15 preservice teachers completed the assignment that was analyzed as participant in-class learning artifacts.

**The Final Reflection.** The final reflection was created by the teacher educator on Google Docs for asynchronous session #10. All 15 preservice teachers answered these questions: (a) what are your thoughts on the use of technology to improve/enhance your own learning? and (b) what are your thoughts on the use of technology to improve/enhance PreK-3 students' learning?

***Analysis of Participant In-Class Learning Artifacts***

A secondary analysis of the content of preservice teachers' in-class learning artifacts provided insight into how preservice teachers experienced technology to (a) *understand*; (b) *engage*; (c) *explore/examine*; (d) *reflect*; (e) *collaborate/share*; and (f) *extend* their knowledge about social studies content across all their 14 class sessions. In this section, I examine how the synchronous and asynchronous in-class learning artifacts described in the previous section provide insight into the types of learning (or learning experiences) these artifacts afforded.

**Understand.** Preservice teachers used technology in their synchronous and asynchronous social studies methods course that was designed to help them gain an understanding of course content. In all 14 sessions (i.e., synchronous and asynchronous sessions), the teacher educator engaged preservice teachers in learning through audio and video recordings, images, and virtual learning platforms. The technology tool (i.e., the app or web-based programs /platform) is used to support understanding of the content depending on the instructional mode and learning goals. For example, in all seven synchronous sessions, the preservice teachers received instruction and participated in the course using the interactive tool Google Slides. Similarly, in all seven asynchronous sessions, preservice teachers were provided opportunities to understand the content and expectations of assignments through pre-recorded presentations on Prezi (see Figure 7) or Youtube.

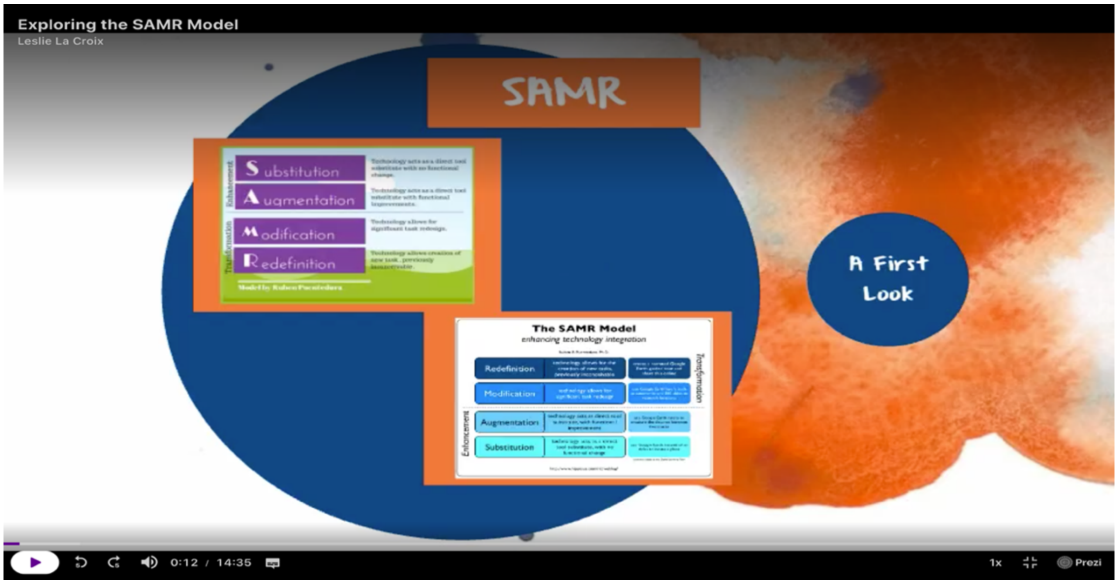


**Figure 7.**

*Exploring the SAMR Model: Asynchronous Session 2*

**Elicit and Engage.** Preservice teachers engaged in experiences with technology that were designed to generate their interest in the topic and elicit their prior knowledge about the topic. The preservice teachers were engaged in such learning experiences with technology in all seven synchronous sessions and five of the asynchronous sessions. The preservice teachers were introduced to a narrative, video, or resource designed to capture their interest. They then engaged in thinking about how their activity (narrative, video, or resource) relates to the content they were learning. For example, in one of the synchronous class sessions, the preservice teachers were first introduced to a hook (a picture book) to draw their interest. Next, they were invited to curate fun facts from the book as it related to social studies on the content curation platform, Wakelet (see Figure

8). In response to the teacher educator’s prompts, the preservice teachers shared what they already know or think they know about the topic that was being taught. In another synchronous session, the preservice teachers used a Know-Want-Learn (KWL) graphic organizer on Google Slides to draw upon their prior knowledge to write their thoughts (see Figure 9).

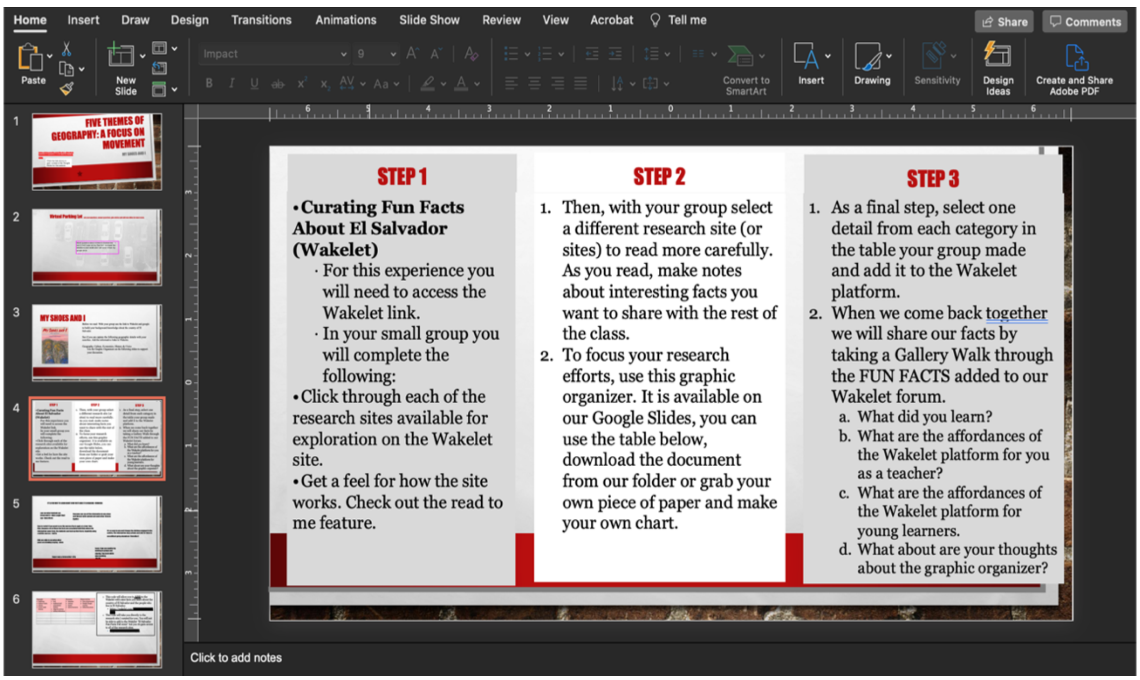


**Figure 8**.

*Five Themes of Geography Google Slide: Synchronous Session 7*

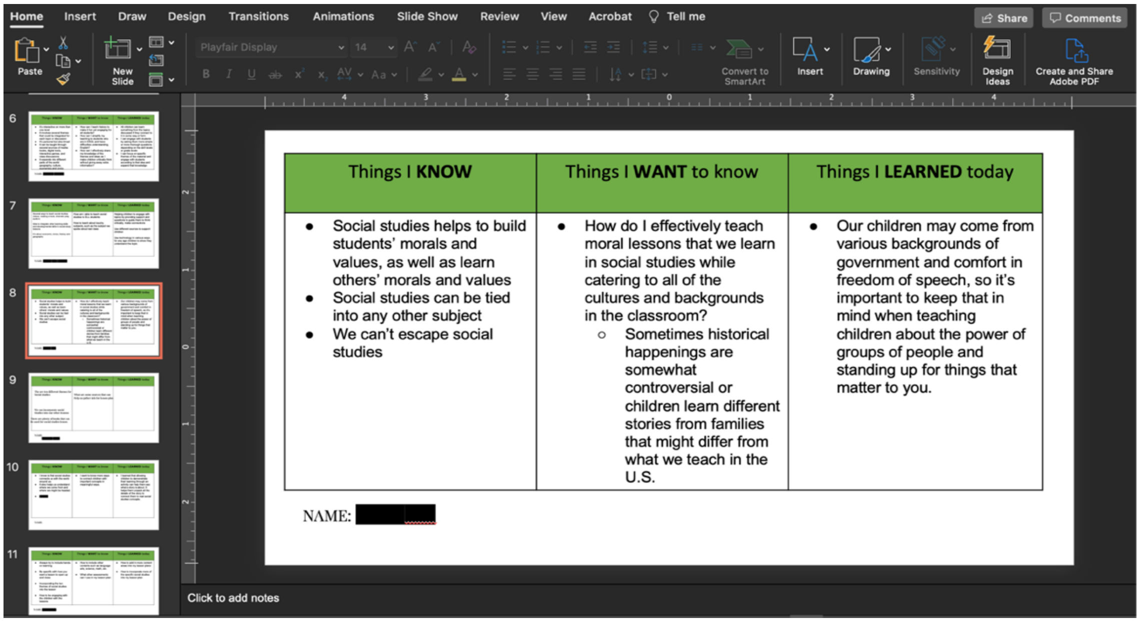


**Figure 9**.

*The Streets Are Free Google Slide: Synchronous*

**Explore.** Preservice teachers were also provided experiences with technology designed to enable them to explore new topics and deepen their understanding of concepts. The preservice teachers explored their learning individually and in groups through various experiences with technology in all seven synchronous sessions and six of the asynchronous sessions. For example, in one of the synchronous sessions, the preservice teachers were engaged in an activity designed to help them learn about the topic they were studying by reading a storybook. They took expository notes on a graphic organizer that the teacher educator had created using Google Docs (see Figure 10). In another asynchronous session, preservice teachers explored the content and documented their learning by completing a T-chart on Google Docs (see Figure 11).

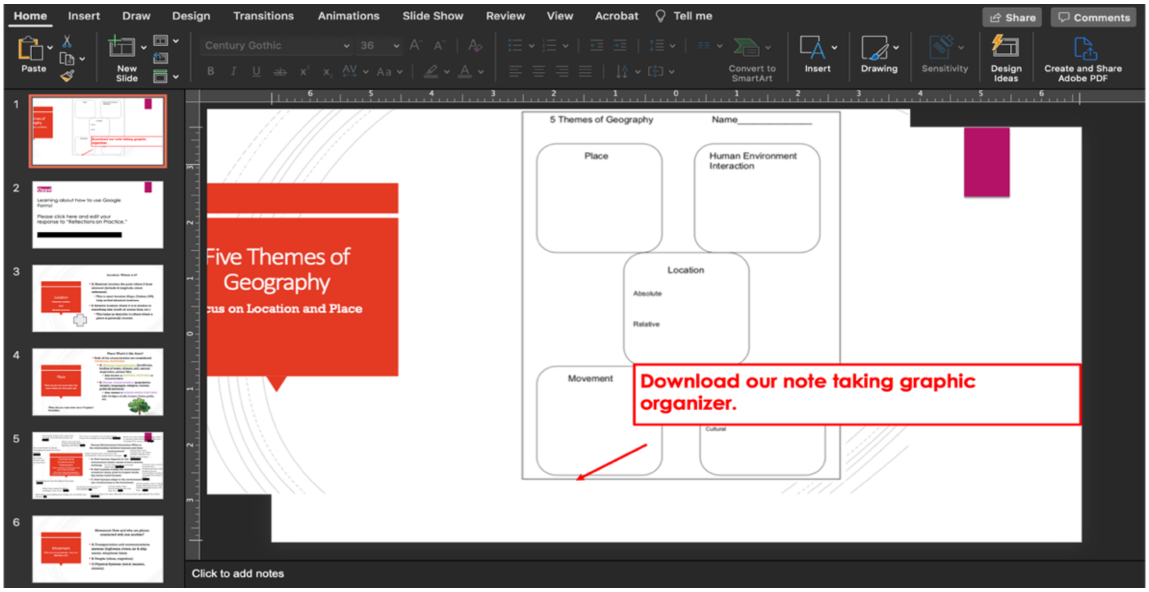


**Figure 10**.

*Human and Environment Interaction Google Slide - Session 5*

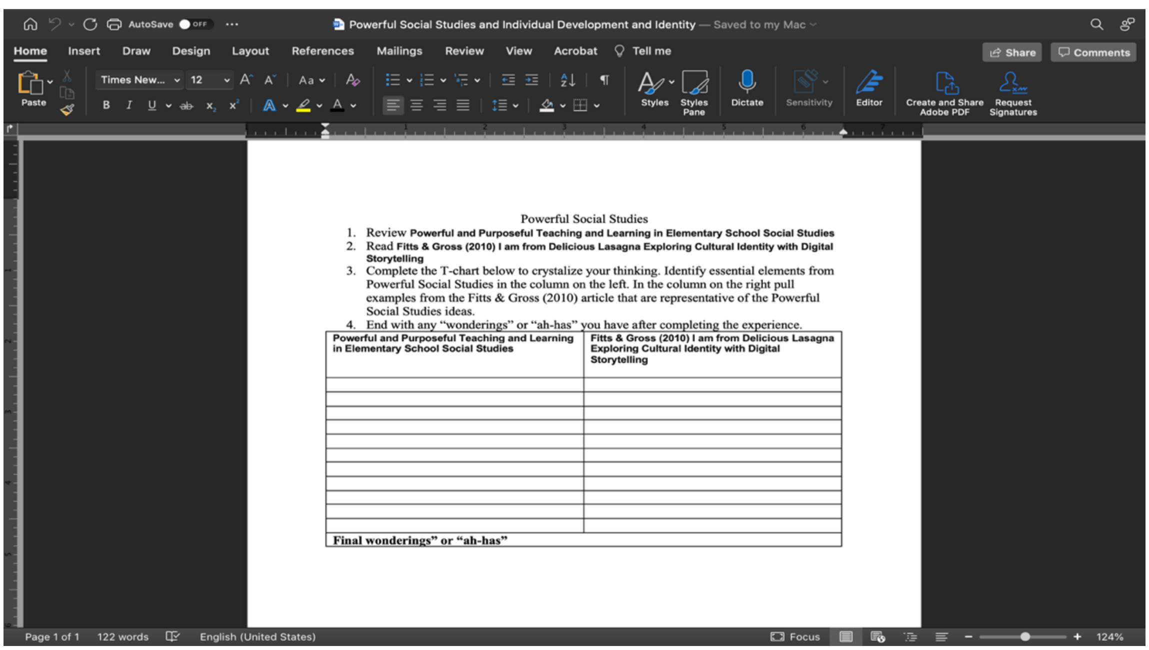


**Figure 11.**

*Powerful Social Studies Session 4*

**Reflect.** Using multiple modalities and technological tools, the preservice teachers engaged in activities designed to encourage them to reflect on their own learning. They were asked to critically examine their own learning and/or consider children's learning as it related to the content. The preservice teachers reflected on the learning experiences in all seven synchronous sessions and six of the asynchronous sessions. For example, in one of the synchronous sessions, the preservice teachers read a story and looked at primary resources curated on Google Drive (see Figure 12). The preservice teachers then used Zoom breakout groups to reflect on their learning and discuss their thoughts within their group. Similarly, in one of the asynchronous sessions, they used Google Docs as an analysis tool to reflect on their observation and learning about primary sources (see Figure 13).

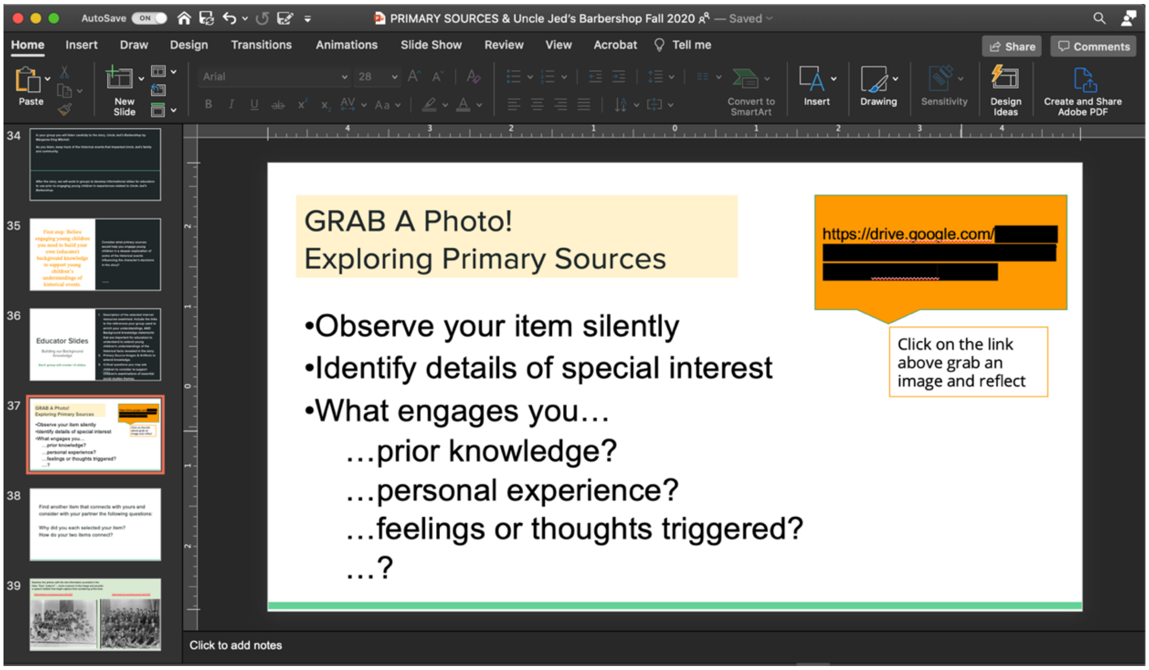


**Figure 12**.

*Primary Sources Google Slide Session 1*

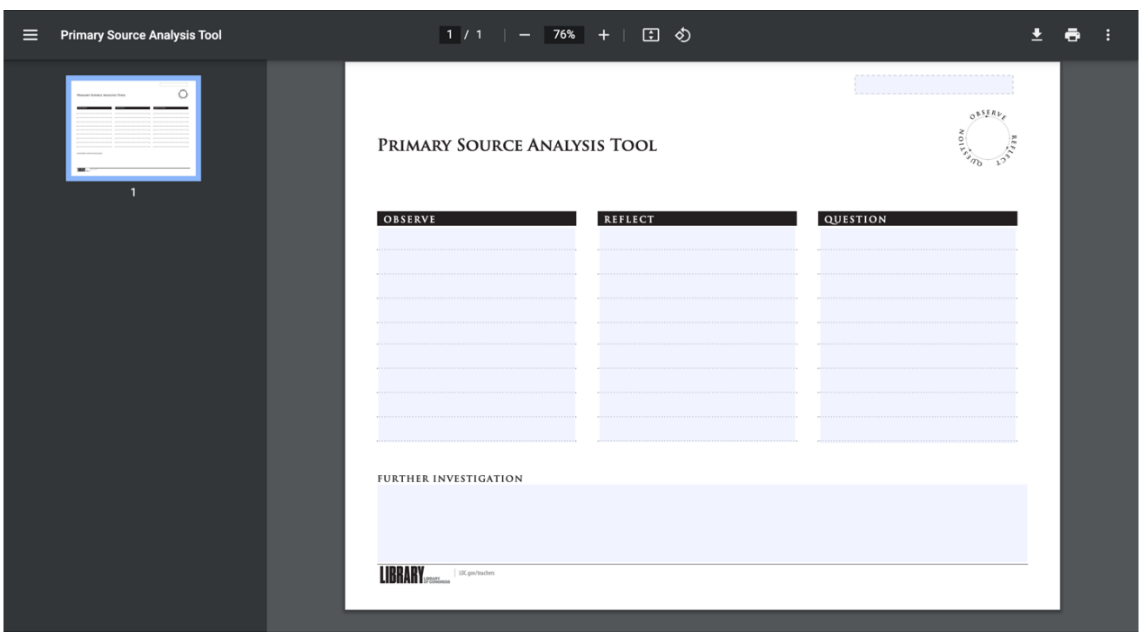


**Figure 13**.

*Primary Sources Analysis Tool Session 10*

**Collaborate.** The preservice teachers also used technology designed to provide opportunities for them to collaborate and work together. For the synchronous sessions, break-out rooms and Google Slides were used as a primary shared learning environment where all students worked together. For example, preservice teachers used breakout rooms on Zoom to discuss their thoughts about a story they read and simultaneously collaborated on Google Slide (see Figure 14). Preservice teachers worked with their respective break-out group members to record their thinking on writing prompts. Similarly, in asynchronous sessions, the teacher educator asserted, "You are with the rest of the class on a Google Slide. You won't do these at the same time, but you will collaboratively end up creating slides together in an asynchronous time" (Teacher Educator, 2020, September 8-15).

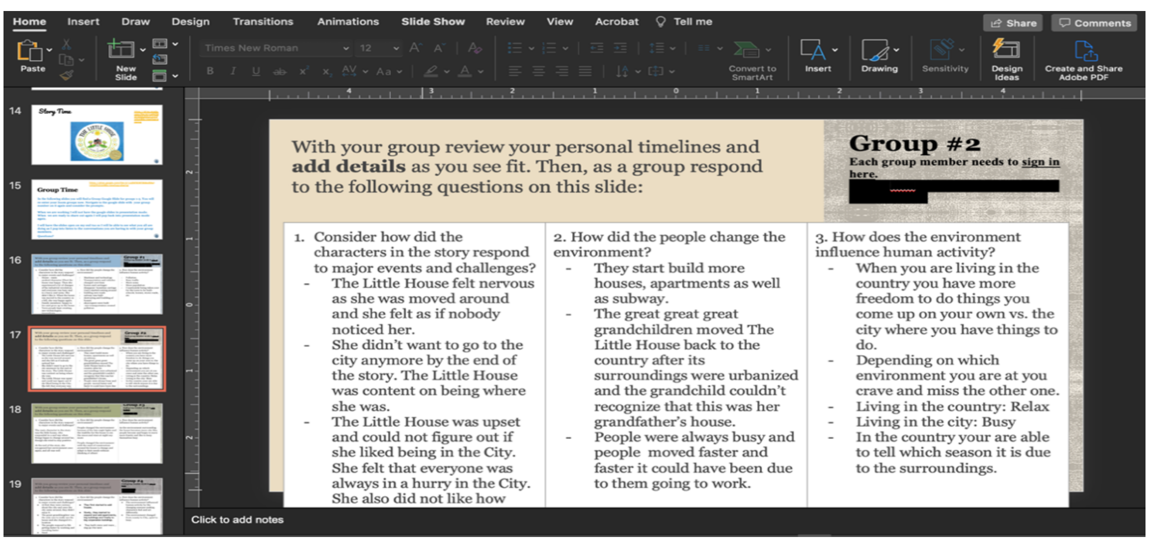


**Figure 14**.

*The Little House Facilitation Google Slides Session 3*

**Extend.** Preservice teachers were provided opportunities to use technology to extend their learning by creating something to showcase what they have learned and sharing that creation with their classmates. The teacher educator had shared the following with students during the first synchronous online class session:

> You'll be working together to share one of your lessons that come from here in an online space. So, when we go into exploration and we continue through, you'll actually develop a content and in an online class people will rotate through everybody's presentations, so you have a broad understanding of what economic principles are with young children. (Teacher Educator, 2020, August 24)

During different asynchronous sessions, preservice teachers created their Flipgrid, Economic Share, and the Lesson Plans individually and then shared their creations with small and whole groups during their last synchronous session (see Figure 15).

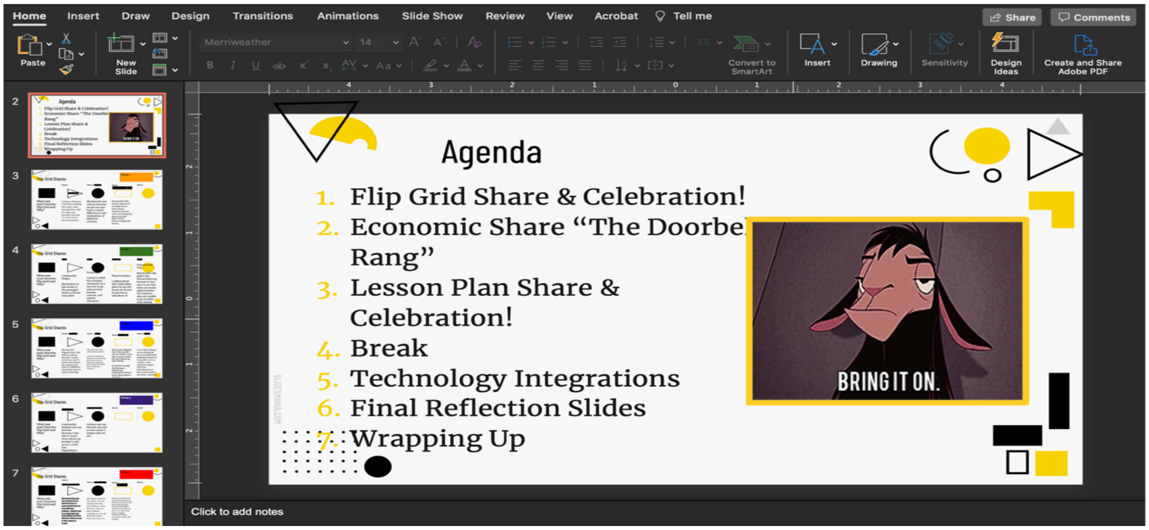


**Figure 15**.

*Last session Google Slides Session 13*

## Summary

In this section, I described the in-class learning artifacts preservice teachers created as documentation of their work, learning, and growth. Analysis of these artifacts revealed that within this virtual context, the preservice teachers engaged in a variety of technologies. For the synchronous Zoom sessions, the preservice teachers engaged with interactive Google Slides, collaborative web platforms like Padlet and Wakelet, and journal reflections on Blackboard. For the asynchronous sessions, the preservice teachers engaged with SAMR reflection, Podcast explorations, T-chart reflection, a social studies scavenger hunt (Flipgrid), article share, and the final reflection. Secondary analysis of the in-class learning artifacts revealed that the preservice teachers were provided experiences with technology to (a) *understand*; (b) *engage*; (c) *explore/examine*; (d) *reflect*; (e) *collaborate/share*; and (f) *extend* their knowledge about social studies content across all their 14 class sessions. Across these opportunities, the preservice teachers engaged in experiences with technology that were designed to understand the content, elicit their prior knowledge, and engage them in their learning, explore new topics and deepen their understanding of concepts, reflect on their own learning, collaborate, and create something to share their learning with their classmates. In the next section, I describe what preservice teachers said about their experiences engaging with various technologies in their technology-infused methods course.

**Understanding Technology**

Through participant in-class learning artifacts and interviews, all 15 preservice teachers ($n$ = 15) reflected on what they recognized as being important for intentional technology integration for themselves as learners as well as for young children as learners. In their reflections, they acknowledged that experiencing technology integration as learners affects their thinking about what is important for children. During their reflections about their learning and their future practice with young children, it was evident that preservice teachers recognized technology as a space for building a community of learners and as a multimodal tool to support learning and teaching (see Figure 16). Specifically, preservice teachers' descriptions of technology as a space revealed how technologies supported learning by providing opportunities to generate and share knowledge and by building learner agency. Preservice teachers' descriptions of technology as a multimodal tool recognized how technology simulated realistic experiences, provided a creative outlet, and expanded opportunities. These perceptions are presented in more detail in the sections below.

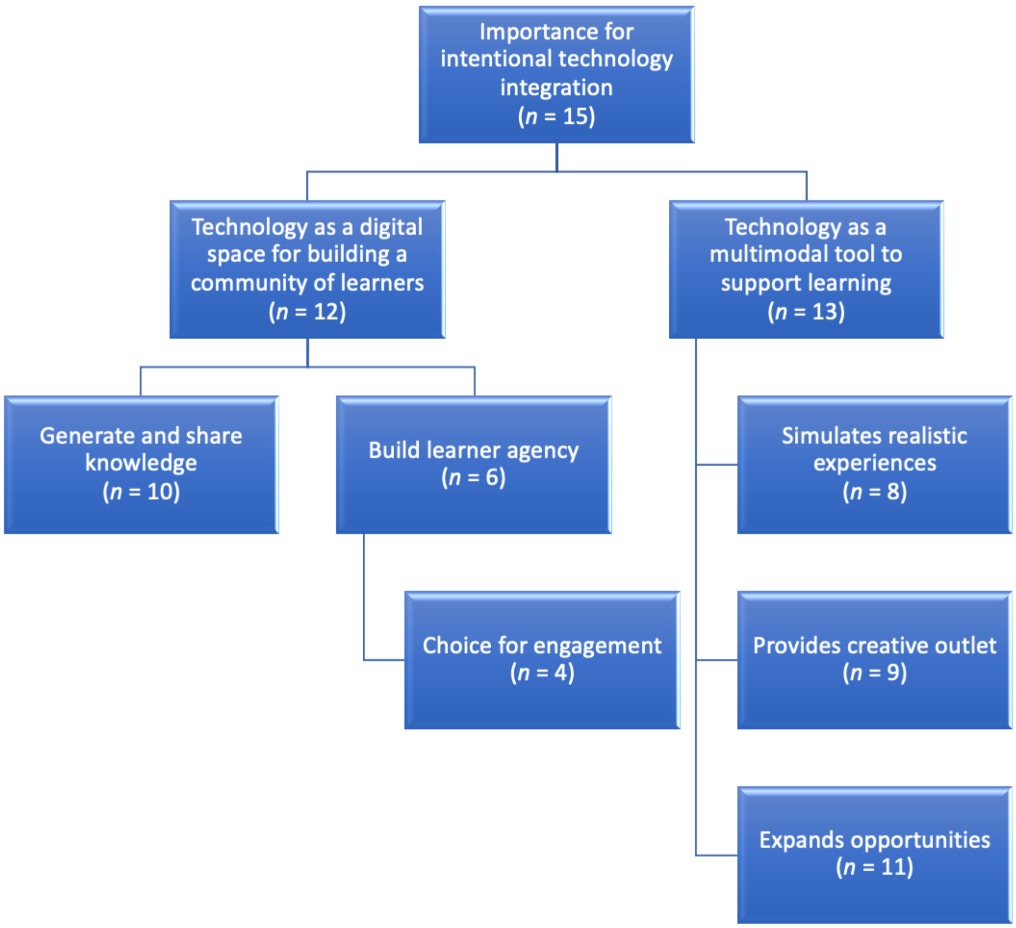


**Figure 16**.

*Intentional Technology Integration*

Twelve of the 15 preservice teachers framed their idea of technology as a digital space for building a community of learners (see Figure 17). In this regard, digital was a space for participation, socialization, and knowledge creation. The majority ($n$ = 11) of the preservice teachers noted that digital spaces supported their learning by allowing them to build a community of learners. Some preservice teachers talked about the digital platform that enabled them to mostly connect with their classmates and, in a few instances, with the instructor. For example, talking about their classmates, one participant documented, “When we need to have online courses, Zoom could be the tool to help us connect to each other.” Other preservice teachers shared how applications (hereby described as apps) such as Flipgrid contributed to their sense of community. For example, another participant stated, “I really like the idea of creating your own personal video and sharing it with your peers, also being able to watch your peers’ videos gives you more insight about them.”

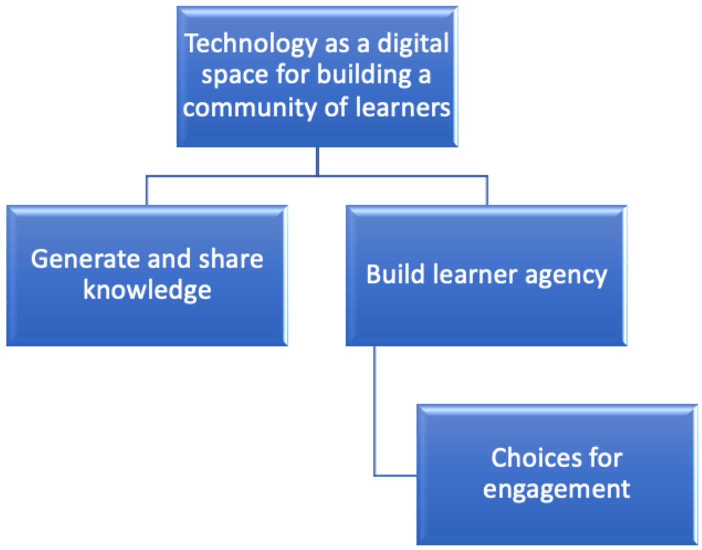


**Figure 17**.

*Technology as a Digital Space*

Many (*n* = 9) also mentioned how digital spaces supported young children's social interaction, thus helping them build a community of learners. Similar to the discussions of building their own sense of community, the preservice teachers noted that the digital platform also enabled young children to connect. For example, one participant identified, "[Zoom] is a new way for students to engage, like video breakout rooms, polling, and group chats add a new level of engagement to virtual and hybrid classes. They further added, "Google slides is easy to use for a group of students, and we could share individuals' opinions simultaneously." Preservice teachers also specified how apps or web-based programs also could contribute to young children's sense of community as when children connect— they build a sense of community. For example, one participant noted, "Flipgrid is a great way to have younger children share their thoughts." They elaborated by stating it is "also great for social interaction, being able to work in groups and come up with ideas together." Whereas another participant stated, "This tool [Book Creator] could be used to help children make their own projects individually or in groups. A class wide project could also be done to allow every student an opportunity to create a small portion of a story and put it all together." In all the above examples, preservice teachers noted how apps and web-based platforms enabled young children to build relationships by engaging, interacting, and sharing in group activities, thereby learning together.

In addition, some preservice teachers made connections between how apps or web-based programs contributed to building a sense of community for themselves as well as for young children. For example, one participant commented, "Padlet could let us share our thought immediately and we could comment on it." They further expanded, "I could use this as an opinion board in 2nd and 3rd grade class, we could share our ideas after … reading or watching videos." In this way, preservice teachers made connections between the benefit to their own learning as well as potential advantages for children.

**Generate and Share Knowledge.** The preservice teachers ($n$ = 10) perceived that technologies provided opportunities to generate and share knowledge through their exchanges with the educator and their peers as well as through their interactions with the content. Nine of the 10 indicated that technologies supported their own learning, and eight of the 10 discussed young children's learning. They perceived technology as a digital space that allowed themselves as students to contribute, ask questions, understand peers, and engage in discussions. The nine preservice teachers who thought technologies were important to their learning perceived the technologies provided social affordances related to generating and sharing knowledge. In their expositions about their personal experiences with technology within the course, they stated that particular web-based programs, such as Google Slides, contributed to their learning as they collaborated with classmates and reflected on their learning. For example, one participant noted about Google Slides, “I was able to add my reflections and participation in class and see in real time what the professor was referring to in their discussions.” Similarly, another participant stated, “I like how interactive google slides are and that we can work on something at the same time as our group members.” In both the above examples, preservice teachers were talking about how technology opened spaces for sharing and generating personal knowledge with their teacher educator and their peers.

Additionally, the eight preservice teachers who thought technologies were important to young children’s learning indicated that technologies enabled children to generate and share knowledge. Preservice teachers recognized particular apps or web-based programs, such as Padlet, Google Slides, Flipgrid, and more, allowed young children to get along with peers and communicate with classmates. It also enabled children to express their thoughts, opinions, and/or questions, thus building and sharing knowledge within their community of learners. For example, one participant stated, “This [Padlet] tool would be useful for children to share pictures and information of their discoveries in quick and proficient ways.” While a participant talked about sharing to learn from each other, another detailed interacting to learn from each other as they shared, “I feel that using Google slide will help the young learners to interact with each other, see different opinions and/or answers their peers came up with.” Talking about using Flipgrid, Chatterpix, and Bitmoji to do group work to work towards an outcome, one participant added, “These technolog[ies] can be used especially during the pandemic and can create an interactive space where they can talk with each other and do group work together.” In the above examples, preservice teachers were talking about sharing, interacting, and working together as ways young children could generate and share knowledge.

Two of the 10 preservice teachers recognized that the use of technologies was important in expanding the learner community to include *families* as they generate and share knowledge. Preservice teachers recognized how particular apps, such as YouTube, helped them interact with families. For example, one participant stated, “We use YouTube initially to share videos of stories, circle time and activities, initially but then worked through BOX and now have just begun working with procare to interact with families safely (pre-K/K).” In another example, one participant talking about YouTube noted, “I believe it's a great resource to tell parents if they don't already know.” Both the preservice teachers talked about using YouTube to involve parents in creating a community based around young children’s learning.

**Build Learner Agency in Digital Spaces.** Several preservice teachers ($n$ = 6) stated that technologies were important in building learner agency in digital spaces. The description of social affordances related to building learner agency emerged when preservice teachers talked about autonomy and being active learners who can make choices and participate in the learning communities. Four of the six preservice teachers reflected on how technologies supported their own learning by talking about how they developed a sense of agency in digital spaces. Preservice teachers described particular apps, such as Padlet and Flipgrid, that allowed them to understand the perspectives and learnings of peers within their learning community, thereby building their own agentic learner attribute. For example, talking about Padlet, one participant stated, “This tool [Padlet] help me to be able me to understand what my classmates think about when they are reading the articles.” Similarly, another participant noted the following:

> Flipgrid is a great interactive tool that includes real life experiences and social interaction. I really like the idea of creating your own personal video and sharing it with your peers, also being able to watch your peers videos give[s] you more insight about them.

Five of the six preservice teachers recognized that technology as a space was important for building young children’s learner agency. Preservice teachers identified that engagement, self-regulation, and active-learning in digital spaces led to building young children’s learner agency. For example, one participant recognized that using particular apps, such as Padlet, within the routines and norms of their classroom led to active-learning and thus contributed towards building young children’s autonomy as a learner. They detailed their vision to use technology for young children by stating the following:

> I believe that Padlet could be used [] as creative play (recording experiments or experiences and sharing it with class), real-life experiences, physical movement (if you're making your students get up and record a video, as well as social

> interaction (we are sharing with one another our thoughts and this can open room for discussions).

Four preservice teachers connected their learning with technologies to young children's learning with technology in the context of developing learner agency. Preservice teachers highlighted how particular apps, such as Padlet and Wakelet, can make learning easier and relevant to the development of the agency. For example, one participant extended their collaborative learning experience with Padlet to young children's learning by stating, "It can help… students that are having a difficult time with the lesson get a better understanding." In another instance, one participant conceptualized active learning from peers and building learning capacity as agentic attributes that was facilitated using apps. Referring to their own learning, they stated, "This tool [Wakelet] was really neat to use. It allowed me to use different resources to fill out the chart about El Salvador. This tool also allowed me to expand my learning from my peers." Later, they extended the use of Wakelet to describe how the tool allowed young children to reflect and expand their knowledge, thereby building the capacity to learn. In particular, they noted the following:

> This tool [Wakelet] can be used in any grade level. I believe it is an interesting tool to use for children who are working individually or together. This tool allows children to reflect and expand their knowledge on the specific topic.

***Expand choices for engagement.*** Four preservice teachers stated that their experiences with technologies were important for expanding young children's choice for engagement in digital spaces as it afforded them the potential of anonymity. Preservice teachers recognized this potential of anonymity helped build young children's learner agency in digital spaces. All four preservice teachers perceived online anonymity as positive as it allowed for more active conversations and engagement in young children's learning with particular apps or web-based programs, such as Padlet, Wakelet, and Google Slides. Talking about anonymity as an affordance of technology, one participant stated, "Students can interact with others on online platforms with different activities and even games, which helps break the ice and allows them to feel comfortable with their peers." In another instance, one participant noted that Padlet "can be anonymous for those that might not feel comfortable showing or sharing their work." And another participant distinguished, "Google slides is a great tool for overall classroom engagement since some kids are more shy than others and it's nice to have them learn to use technologies and create and share their ideas in new ways." In all the above examples, preservice teachers indicated that the potential of anonymity allows young children to feel comfortable with their peers and express their ideas without feeling inhibited.

***Recognizing Technology as a Multimodal Tool to Support Learning***

Thirteen of the 15 preservice teachers recognized technology as a tool that afforded multiple modes (e.g., video, image, audio, print, text, and comment) to support learning (see Figure 18). The majority ($n$ = 9) described how the visual, audio, tactile, and spatial capabilities were important to support their own learning and teaching. In addition, eight preservice teachers indicated it supported young children's learning. For example, one participant said, "This app [Geo Bee] supported my learning this week by showing me what Geography is and also gives me a refresher of what we learned last class about geography and to locate a specific place." Many preservice teachers ($n$ = 8) also described how this multimodal affordance supported young children's learning. For example, one participant wrote, "I love how visual this [Google Maps] technology is, and helps children see where everything is located." Preservice teachers also made connections between how technology as a multimodal tool benefitted their own learning and how it promotes children's learning. For example, one participant said, "The technology [IORAD] supported my learning this week by [being] able to help relax and play with sounds, music, and body movement." Recognizing this multimodal affordance of IORAD for young children, they further stated, "You can use music and rhythm, especially for kids that have, I guess… like disabilities or like need hearing aid, something more visual for them."

Preservice teachers recognized that the multimodal constituents of technology (e.g., visual, audio, tactile, and/or spatial) allowed them to simulate realistic experiences, provide a creative outlet, and expand opportunities for their own and young children's learning. Each of these categories is presented in detail below.

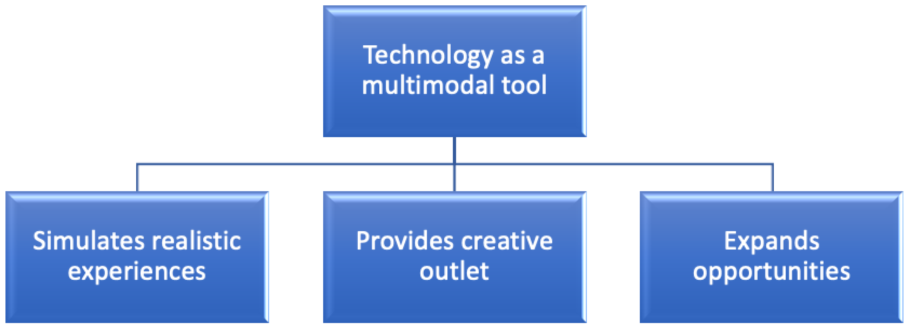


**Figure 18**.

*Technology as Multimodal Tool*

**Simulating Realistic Experiences.** The majority of the preservice teachers (*n* = 8) stated that the use of technologies was important to support learning because technologies simulated realistic experiences of being in the classroom for themselves and young children. Preservice teachers perceived that the multimodal affordances of technology helped them relate their experiences in digital spaces to something resembling real-life experiences. Three of the eight preservice teachers described how the multimodal affordances of technology approximated their own online experiences with real-life experience. None of the three preservice teachers expanded on their thoughts; however, all three maintained a positive outlook towards how technology simulated realistic experiences. For example, talking about replicating real-life social interactions, one participant said, “I think these technologies really help with social interaction because in a virtual environment it helps you get to know your peers better and be able to work with them almost like you are in face to face learning." Similarly, when talking about Prezi to help reproduce real-life learning, another participant said, "It makes me feel like I know what I need to focus on throughout the class session and it gives me an experience as though I'm actually in class learning the necessary material." In both the above examples, preservice teachers considered the affordance of technology to translate interaction and learning of being in a real-life classroom into the digital spaces as important for intentional technology integration.

Similarly, six of the eight preservice teachers stated how the simulation of real-life experiences afforded by the multimodalities of technologies supported young children's learning. For example, acknowledging how technology simulates real-life classrooms for young children, one participant reflected, "Zoom is another tool that I thought is useful. It gives us a place to get-together like a virtual classroom; students meet with teachers to communicate like we are in the school." In another instance, further expanding on the augmented reality afforded by Zoom, they added, "Students could shoot short videos about the topic that teachers provided. They could practice their speech, critical thinking, and real-life experience to make their videos attractive enough." Relatedly, another participant commented on the navigational aspect of Google Maps when they detailed, "I love how visual this [Google Maps] technology is, and helps children see where everything is located. This would be great for creative play and real life experience learning." In the above examples, preservice teachers analyzed how apps like Zoom and Google Maps presented a perceived affordance for young children to simulate and augment real-life experiences.

One preservice teacher also connected their learning with technologies that simulated realistic experiences to young children's learning with technology in the same context. In two different instances, they first noted how technologies allowed young children to learn "like you are in face to face [*sic*] learning." Then talking about how technologies allow for young children's hands-on experiences, they remarked, "I believe that children love technology, it's fun and exciting for them! They get to work hands-on with touch screen devices like iPad."

**Providing Creative Outlet.** The majority of the preservice teachers ($n$ = 9) stated that the use of technologies was important as it provided creative outlets that supported learning. One of the nine preservice teachers expounded that the multimodality of technology helped their own learning and provided a creative outlet to teach young children. Noting that the ability to watch YouTube videos helped their own learning, one participant stated, *"*Watching the videos on YouTube helped me understand assignments coming up better. Using a YouTube video is a great tool to use during distance learning times." Adding how the videos provide more ways to deliver the content, they added, "The video can be used for many different purposes such as teaching a lesson or for extra assistance on a particular subject or theme." In this example, the participant explained how the video modality of YouTube offered multiple creative ways to learn and present concepts to young children.

Eight of the nine preservice teachers recognized that multi-representational technologies were important in providing a creative outlet for young children's learning. Preservice teachers perceived that these multimodal affordances of technology provided opportunities for young children to learn in creative ways and enhance their creative expressions. For example, one participant described learning content knowledge through games, which is usually connected to play. They stated, “I believe that using technology in core content areas like science and math would actually make the subject more appealing for young learners (especially if it involves games!).” Another participant recognized that technology might make learning contents like science and math more likable for young children as games are more enjoyable than textbooks, lectures, or worksheets.

In another example, one participant expressed how multimodal affordances of technology can enhance young children’s interactions and creativity around technology. They stated the following:

> Technology allows children to freely explore touch screens loaded with a wide variety of developmentally appropriate interactive media experiences that are well designed and enhance feelings of success. In addition, it captures photos of block buildings or artwork that children have created; videotape dramatic play to replay for children. Also, it records children’s stories about their drawings or their play; make digital audio or video files to document their progress.

They recognized that technologies provide one more outlet for young children to demonstrate their learning and that young children may be able to develop a sense of accomplishment as they explore, create, record, and document their work using a variety of media.

Similarly, by identifying a more specific technology, Wakelet, one participant, valued how multimodal affordances of technology can enhance young children's interaction and participation around technology. In particular, they reflected, "Students could jump in to show their attitude with text, image, videos or put the link of other website resources."

In all the above examples, preservice teachers acknowledged that the multimodal affordance of technology is providing creative ways for young children to explore and learn, thereby making learning more appealing and enhancing young children's interaction, creativity, and participation.

**Expanding Opportunities.** The majority of the preservice teachers (n = 11) stated that the multimodal affordances of technologies were important as they recognized how technology expanded opportunities that allowed learning beyond the classroom walls. Seven of the 11 preservice teachers described how these affordances allowed for their own learning to happen in spaces that transcend physical boundaries. Preservice teachers emphasized how technology extended the traditional classroom, library, or field trip beyond the constraints of physical spaces. For example, one participant stated that technology expanded opportunities to gain information and knowledge by allowing learning to "expand… outside of sources that are physically available, and search… for more options." They further added that technology expanded opportunities by extending access to content like a vast supply of digital books "beyond the physical books that you have access to." In another instance, one participant appreciatively reflected the following:

> We're fortunate to live in a very historic area, but not everyone in the country is blessed with that. Yet, there are so many virtual tours of museums, battlefields, etc. that you can experience without physically going, which would be much more favorable to a student living in Oregon who wants to walk through the fields where George Washington led his troops.

The same participant elucidated that technology expanded opportunities to gain information and knowledge by augmenting experiences, while another participant described how technology is expanding opportunities for information through the aural element. They stated, "By listening to podcasts this week I was able to learn a lot about what has happened in the world." In all the above examples, preservice teachers emphasized how technology expanded opportunities beyond the constraints of physical spaces to gain information and knowledge by extending access, augmenting, and providing an aural experience.

In addition, five of the 11 preservice teachers explicitly shared that the use of technologies was important for young children's learning as the multimodal affordances expanded their opportunities for learning. Although online spaces can still have physical elements, preservice teachers perceived that learning in these online spaces is no longer defined by the physical constraints of time, space, and place. For example, one participant noted that technology allowed young children to explore the physical world from their classrooms. Specifically, they stated the following:

> Google Earth can be used in a ECE classroom environment because this can allow young children to be creative in what places they want to know or are curious

> about. Google Earth can show you literally anything you want to know about this specific place/location... Children can work while using google earth. It helps extend their learning of the environment, earth, and its surroundings. They are able to explore different places on the earth.

According to the same participant, Google Earth's multimodal affordances expanded opportunities for young children's curiosity and exploration. It allowed young children to get a more concrete understanding of the outside world as it provides a real-life view of the place and environment the young child wants to learn about. In another example, one participant stated the following:

> Technology can be used to help young learners get a better visual for learning. For example, seeing a clip or reenactment from an event from history can help put images to an event and help them better learn about that event.

This participant identified that the multimodal affordances of technology expanded opportunities for young children to gain information and knowledge by eliminating the barrier of actually having to be at an event in order to be knowledgeable about what has occurred. In both the above examples, preservice teachers perceived that the multimodal affordances of technology expanded opportunities for young children's learning by creating an interactive and visual link with the outside world.

Five of the preservice teachers also made connections between how technology as a multimodal tool expanded their own learning and how it promoted children's learning. Talking about how GeoBee expanded their opportunities to gain information and knowledge, one participant shared, "This app supported my learning this week by showing me what Geography is and also gives me a refresher of what we learned last class about geography and to locate a specific place." They specified that the geospatial affordance of technology helped them retrieve information and navigate locations. They then connected this learning to young children's learning as they stated the following:

> I can use this GeoBee app with future young children in 4-5th grade. This will be used after the children learn about geography. Additionally, they can use this app to learn new information and where places are around the world.

In another example associating how the multimodal functionalities expanded preservice teachers' own and young children's opportunities, one participant wrote, "Google Earth - showed me a 3D representation of places on Earth. I used it while doing my map on google slides." They further extended their learning to young children by stating, "I think young children will enjoy using this feature. It allows them to pick a place on the map and explore it." In both the above examples, preservice teachers associated how the multimodal functionalities of the geospatial technologies expanded their own opportunities to gain information and knowledge and then connected it to young children's opportunities to gain information and knowledge in geography education. They recognized the interactive maps and geo-enabled capabilities of technology as important in planning intentional technology integration.

**Summary**

In this section, I discussed what early childhood education preservice teachers recognized as being important about integrating technology as they engaged in a technology-infused social studies methods course. Preservice teachers in this study found the social and multimodal affordance of technology to be important for themselves as learners and for young children as learners. In particular, the preservice teachers described a range of learning spaces and multimodal affordances of technology that expanded a community of learners, increased engagement, enriched the learning experience, and liberated learning from physical constraints. Preservice teachers also made connections between how technology as a multimodal tool expanded their own learning and how it promoted children's learning. In the next section, I characterize early childhood education preservice teachers' technology experiences as they describe their engagement with technology that informs their development of content-specific, technology-infused learning.

***Engaging with Technology in a Technology-Infused Social Studies Methods Course***

Participant in-class learning artifacts, interviews, and my reflective, analytical memos revealed how all 15 preservice teachers engaged with technology in their technology-infused social studies methods course and how they envisioned engaging young children with technology. Across data sources, preservice teachers frequently noted some kind of interaction with technology. Preservice teachers described their engagement with technology through their participation in activities like sharing, reading, watching, listening, playing, exploring, and creating. A deep analysis of reflective, analytic memos divulged that these interactions could be grouped into three large categories: (a) passive interaction; (b) active interaction/seeking; and (c) critical interaction. Further, preservice teachers' critical interactions with technology revealed that the processes of their interaction could be categorized as noticing, noticing, and extending, and noticing and evaluating (see Figure 19).

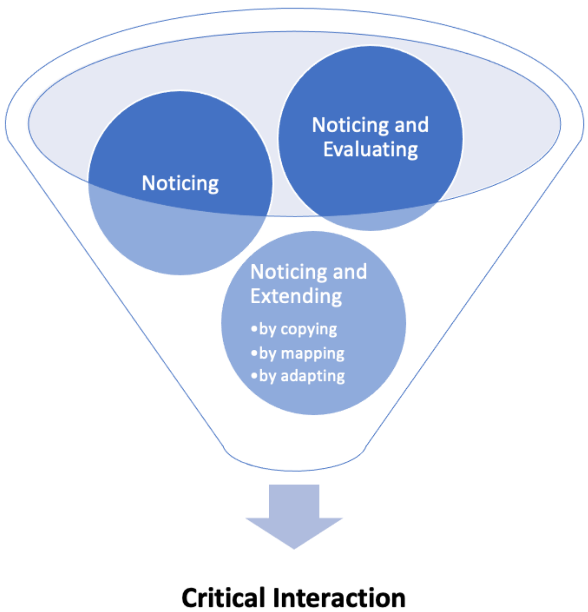


**Figure 19.**

*Critical Interactions with Technology*

**Passive Interaction.** Seven of the 15 preservice teachers described engagement with technology as a passive interaction in which information only flowed in a single direction, meaning there was no active engagement or interaction with the technology. Two preservice teachers described their own interaction with technology in this way. In their reflections, both preservice teachers specified only passive participation, like looking at maps and listening to the message as their engagement with technology. For example, one participant indicated passively using Google Maps to search up a place when they said, “I liked how it [Google Maps] zoomed in where I needed when I searched up a place.” Similarly, another participant mentioned passively listening to YouTube videos when they said, “I was able to listen to the Misty's Copeland message about success.”

Five preservice teachers envisioned engaging young children with technology in a passive way. Preservice teachers’ description of how they planned to engage young children with technology pictured young children more like an audience who were passively using the technology rather than engaging with it. For example, one participant envisioned young children using a YouTube video for passively listening when they stated, “I would definitely use YouTube as a read-aloud experience.” Similarly, another participant proposed that young children would passively watch Google Slides when they said, “I would just use the slides to share my own presentation about the lesson.” In all the above examples, preservice teachers described their own and young children’s engagement with technology as passive participants (i.e., watching and/or listening).

**Active Interaction.** Four preservice teachers indicated that as they used technology, they also actively sought interaction to achieve their specific learning goals. Three of these four preservice teachers described using technology with a thoughtful purpose that benefited their own learning. For example, one participant stated, “Watching the videos on YouTube helped me understand assignments coming up better.” In this example, they sought a specific purpose of understanding their assignments as they watched videos on YouTube. Similarly, another participant listened to the digital audio files on a podcast because they "was able to learn a lot about what has happened in the world." In both of the above examples, preservice teachers described actively seeking a learning objective about an assignment or the world as they interacted with technology.

Only one preservice teacher specifically described engaging young children with technologies to actively seek a learning objective. One participant planned to show Google Maps to young children with a goal to show them the different countries. They wrote, "A way that I can incorporate technology in this lesson is by pulling up a [Google] map to show students where different countries are." In another example, they did not directly describe how they would engage young children with technology. However, their reflection indicated that they appreciated how virtual read-aloud could give young children the opportunity to hear the authors bring their stories to life. They wrote, "Instagram also has read-aloud sources, one of them being the authors themselves reading their books." In all the above examples, preservice teachers described actively seeking purposeful interactions with technology to achieve their specific learning objectives.

**Critical Interaction or Divergent Thinking.** All 15 preservice teachers described critical interaction with technology. While making sense of their experiences, they indicated noticing, extending, and evaluating the nuances of the technology they were using. All 15 preservice teachers also described engaging young children critically with technology. Ten of the preservice teachers described critically interacting with technology through examples of their own engagement with technology. For instance, while talking about a simple task like searching for something on their laptop, one participant described how they thought through the process to successfully complete the task. They detailed the following:

> Because to search [for] a topic, you need to come up with a key word, which means that you need to be somewhat knowledgeable about the topic, and if the key word doesn't bring you what you want, you need to know other words to search.

While noticing the technology they engaged with, preservice teachers described developing a more critical lens to discern not only what makes that technology purposeful but also meaningful and worth consuming for young children. For example, one participant noticed that Google Slides could be used for making timelines and then further noted that it "can help students learn about their life experiences in chronological order." In addition, it was evident that as preservice teachers critically engaged with technology that they were becoming mindful of their interactions with technology. These critical interactions led to preservice teachers noticing, noticing, and extending, and noticing and evaluating technology for their own and young children's learning (see Figure 19). These findings are presented in more detail below.

***Noticing.*** Ten of the 15 preservice teachers not only stated the technology they used but also described something they noticed about the technology (e.g., an affordance, an experience, or learning). The noticing did not include a conversation about that particular technology, but rather just a statement recognizing something relevant about the technology. All 10 preservice teachers' noticing related to their own use or learning with technology. For example, one participant noticed Google Slide and stated the reason for their liking it but did not extend this thought to wonder if they would use this technology for the same reason or how they could adapt it for their teaching. For example, they wrote, “I have really been liking our use of google slides and how we can all work on the same slide and use it to interact.”

In addition, preservice teachers recognized new uses of technology or discovered new technologies they had never experienced before. For example, one participant noted, “I had never really thought of using a radio segment or a podcast in a lesson before this class and I think that is something new and useful.” Similarly, another participant also seemed to have realized that they were able to do something new with Google Slides that they may not have thought of before as they penned, “I was able to add my reflections and participation in class and see in real time what the professor was referring to in her discussions.” Relatedly, discovering a new technology, ProWritingAid, another participant noted, “I never heard of this tool; however, I might use this tool more often. It is very easy to access.”

Only one preservice teacher described their noticing as it related to young children’s learning. They noticed that the media affordance of an app is useful for assessing young children’s understanding and progress in real-time. Then, they expanded on identifying the possibilities of that affordance for their future teaching of young children. They stated that Socrative “is an easy formative assessment [tool]... it’s particularly important to make sure students understand how events are building upon one another and influencing what comes next.” They further added, “The app offers exit tickets and quick clicker services." In this instance, they identified how they might use it for their future teaching.

***Noticing and Extending.*** All 15 preservice teachers described engaging with technology by extending their noticing. Four preservice teachers noticed and extended their thoughts to how the technologies are useful for their own learning, and all 15 described extended their noticing to how the technologies are useful for young children's learning. For example, one participant noticed that Wakelet "was really neat to use." Then they extended their noticing to organize the content of their learning and stated, "It allowed me to use different resources to fill out the chart about El Salvador." They further extended their noticing to young children's learning by mapping it in the context of a grade and pedagogy as they added, "This tool can be used in any grade level. I believe it is an interesting tool to use for children who are working individually or together." In this example, adding information through a variety of resources helped them recognize how they can use it to let young children add and share ideas.

Preservice teachers extended their noticing for young children's learning in three ways: by copying, mapping, or adapting the technology. When copying, the preservice teachers extended their intention to use the technology to stay as close as it could be to its original intended use. When mapping, the preservice teachers often extended their intention to use the technology by mapping it to particular age, grade, or pedagogy. While adapting, the preservice teachers extended their intention to use the technology in a novel way or modified it to complement their own context. These extensions of their noticing are expanded in detail in the sections below.

***Extending by copying.*** Ten preservice teachers described engaging with technology by noticing a technology and then extending its use by copying (i.e., making meaning other than an intended one by interacting with different affordances offered in the digital interface). In one example, a participant extended their noticing about field trips, such as a digital tour of the ocean or zoo to take guided exploration through the world wide web. They described that virtual field trips afforded opportunities "to explore the world around them that especially these days may not be open or available… to go in person." They extended this noticing to their own learning as they stated, "I used to explore the ocean, and zoo animals during our studies." Extending their experience to young children's learning, they stated, "I would use it to either introduce the kids to a Concept (the Ocean) or as a transitional activity to continue to expand the children knowledge base." In the above example, the participant described engaging with virtual field trips to explore a concept and then extended their intention to use field trips as an introductory or a transitional activity for young children to explore new concepts and expand their learning.

Similarly, another participant described their use of the technology, Creatability, and remarked that it "makes arts more accessible to students with possible disabilities. It offers a keyboard that you can use to draw or make music using different movements using body, face, mouse or keys to create different designs or music." Recognizing how Creatability makes art and creativity more accessible for differing physical abilities, they extended its usability to their learning and young children's learning by stating the following:

> I could use this tool to explore sounds, music, and arts as we visualize and explore what music sounds and feels like as we express our feelings. This is a great tool for schools that don't have music tools because students can play music using computers or Ipads available to them at hand.

In the above example, they described how they envisioned extending technology for young children's exploration, expression, and potential for play.

In another example, a participant recognized the general use of ProWritingAid as a creative way to teach writing by noting, "ProWritingAid helps writers strengthen their papers. It makes writing a lot easier for writers. This tool is basically an online mentor who reviews the entire paper." They noticed how this platform makes writing easier and stronger. Further noticing how this platform helps in evaluating children's writing without the need of a teacher, they extended its use for young children by noting that they would use ProWitingAid when young children "are writing their paper or report on a computer instead of writing in a journal with a pencil. The children will also receive feedback from the tool instead of the teacher."

***Extending by mapping.*** Five preservice teachers described engaging with technology by extending their noticing through mapping, as they proposed using technology to meet their specific purpose. All five extended their noticing by mapping it to how they think the respective technologies would support children's learning. They described their understanding by providing more specific details about how they mapped the use of technology for young children to an age or pedagogy.

In their exploration of a web-based program, Symbaloo, one participant noticed that it is "an organizational tool [that] has [been] found to be helpful in libraries and social studies classes, especially for younger students." They then mapped their noticing to young children's utility by adding that

> The desktop or mobile app helps keep track of websites students are often using, displaying them as an easy-click icon. Kids can quickly click on the application they need, eliminating slow typing and saving a lot of class time. It [is] good for kindergarten and up level students.

In the above example, the preservice teacher noticed the organizational media affordance of the web-based program and extended it for an age-appropriate use as a social visual bookmarking tool that is easy to use, saves typing time, and monitors online activities.

Only one preservice teacher mapped their noticing to their own learning and then connected it to young children's learning. They noted that IORAD "supported my learning this week by [being] able to help relax and play with sounds, music and body movement." While extending this noticing, they specified that "I would use this technology in the future with young children (3rd grade) for playing activity games together as a whole. This can also be used for a mini projects within a lesson plan." In this example, the participant engaged with the technology, IORAD. They described that its visuospatial affordance helped him, and young children relax and play.

***Extending by adapting.*** Nine preservice teachers extended their noticing about technologies by describing what they would do with the technology such that the use of technology goes beyond its intended use. All nine preservice teachers extended their noticing by adapting the technology for content areas as the respective technologies would support children's learning. For example, talking about Book Creator, a digital book creating app, one participant stated, "I could use this in an ECE classroom… for writing; students would have the opportunity to create their own stories and be able to create it by how they envision it." Creating a book is related to literacy, but they extended their noticing and adapted it to a different content area when they detailed, "For a science lesson students could write about observations they saw, predictions, hypotheses, etc and display what they saw/what they think they will see."

Similarly, another participant adapted Flipgrid, a video-making app, and tailored it to meet their content needs and pedagogies. They reported, "How I would use it would be, sharing book reviews, practicing world language skills, building student portfolios, inviting outside speakers." And another participant extended an online art platform, Playmeo, and creatively adapted its use for a math lesson. Specifically, they added, "How I would use the art tool would be, after a math lesson, instead [of] using white boards and markers they would go on this tool and write out numbers and practice doing math!" In all the above examples, preservice teachers extended their noticing by adapting the technology for different content areas using strategies like creating, writing, displaying, sharing, building, and collaborating.

Two of the nine preservice teachers adapted a technology tool and aligned it to different content areas but did not really detail how they would use it. For example, one participant said that they could use the ProWritingAid tool "meaningfully in the ECE classroom across all subjects, but it will be more beneficial for language arts and their writing skills." Explaining the benefit of the tool for language and writing, they added that it could be used by young children to independently check grammar, build teamwork, and identify their academic attributes. Specifically, they wrote the following:

> The students can use this tool to check their grammar instead of raising their hand[s] or waiting on a teacher. This tool will help teamwork on their independent writing. This tool can also help teachers figure out the strengths and weaknesses of each student.

In these instances, preservice teachers described engaging with technology by extending their noticing through copying, mapping, or adapting the technologies to their learning objectives.

***Noticing and Evaluating.*** Eight preservice teachers in this study described moments of engaging with technology by noticing and evaluating its connection to their learning and how they envision using it in their future practice. All eight preservice teachers described how they evaluated technology as it pertains to young children's learnings. For example, after having used Google Slides in the synchronous class for a few weeks, one participant detailed why they thought Google Slides would not be a good fit for younger students to use. They stated the following:

> I like how interactive google slides are and that we can work on something at the same time as our group members. I will definitely [*sic*] use this with older students but with the younger ones I would just use the slides to share my own presentation about the lesson.

In a similar manner, another participant commented on what the technology allowed them to afford learning for young children. In doing so, they evaluated age-related differences as they noted the following:

> It helped me share my thoughts on a nicer space which made me more relaxed and focused. This tool would be useful for children to share pictures and information of their discoveries in quick and proficient ways. 3rd grade up to 6th grade will probably have easier time with it unlike 2nd graders and down would need practice and guidance along the way.

In both the above examples, preservice teachers extended their noticing by evaluating the developmentally appropriate use of the technology as it allowed for sharing and working simultaneously.

**Summary**

In this section, I illustrated how preservice teachers described engaging and envisioning young children's engagement with technology. The preservice teachers engaged passively, actively, and critically with technology. During passive interactions, the early childhood education teachers described interacting with technology passively, without any active engagement with the technology. During active interactions, preservice teachers described seeking something out of the technology they were interacting with. And when interacting critically with technology, they indicated noticing, extending, evaluating the nuances of the technology they were using. While the three main interactions (passive, active, and critical) were defined as distinct for the purpose of description, preservice teachers' engagement with technology did not always fall under one category rigidly. Neither were their interactions linear. In other words, one preservice teacher may have described engaging with technology passively, actively, and critically at different times during the course. Thus, my intent was not to frame the participants into any particular category of engagement but to rather provide an overview of how the preservice teachers described their engagement and envisioning young children's engagement with technology after experiencing a technology-infused social studies methods course.

***Conceptualization of Technology Integration***

Thus far, I have introduced and described what preservice teachers described as being important for intentional technology integration for themselves and for young children (research question number one) and how they described their and young children's engagement with technology in this technology-infused early childhood education studies methods course (research question number two). In this third research question, I focused on how the preservice teachers conceptualized creating learning experiences with technology for young children. I also analyzed preservice teachers' lesson plans to understand how they conceptualized creating learning experiences with technology for young children in their future teaching. Figure 20 provides a visual summary of the results.

Out of the 15 preservice teachers, two did not discuss technology in their lesson plans. Thirteen preservice teachers described how they would use technology with young children to engage, explore, collaborate, and extend their learnings. None of the preservice teachers envisioned using technology as a medium to foster young children's reflection even though the teacher educator demonstrated using it for their reflective practices.

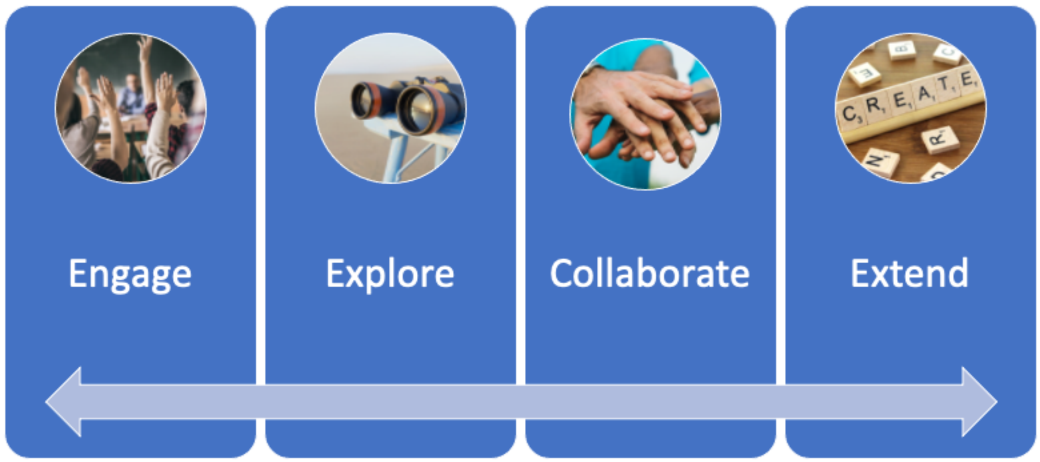


**Figure 20**.

*Preservice Teachers Conceptualization of Technology*

**Engage.** Seven of the 15 preservice teachers integrated technology in their lesson plans to engage young children in ways designed to generate interest and activate prior knowledge. For example, one participant created the following plan for young children to use Chromebook and career town game website by generating interest:

> This game [career town] website will help children look at various jobs and see what it’s like to be in that position[]. This will help engage children to learn about the various jobs they never learned or are interested from their parents[’] jobs. Additionally, the children will increase their knowledge of a specific occupation they want to be and gain confidence as an individual.

In this example, they envisioned engaging young children by generating their interest to find typical and specific career fields that they might think they want for their future.

Similarly, another participant created a lesson plan for students to use Google Earth to conduct a virtual field trip to the International Space Station by activating prior knowledge. They wrote, “Google Earth will give students the opportunity to explore the moon, visualize, and connect to what they’ve previously learned.” They visualized engaging young children by activating their prior knowledge about space and helping them see the connections through exploration and visualization.

In a similar vein, another participant planned to engage young children by having them organize resources to develop their understanding of previous knowledge. They recognized, “Wakelet [as] a great technology tool that actively engages young learners.” Using Wakelet to develop a timeline template after a story read aloud, they further added that “This activity is allowing the students to conceptualize the knowledge from the story.” In all the above examples, preservice teachers integrated technology in their lesson plans to engage young children by generating interest in their future and having them make connections between new learning and their prior knowledge.

**Explore.** Five of the 15 preservice teachers conceptualized using technology to allow for further exploration of the content they planned to teach. For example, one participant planned to use laptops/iPads “during the research portion of this activity” to allow young children to “get more information about the country they are researching that week.” Preservice teachers also described asking a question or giving a task that allowed young children to discover the facts and make connections to learn the content.

For example, another participant used Google Tour Creator with young children to create a virtual field trip for the country they were learning about and then dig deeper into the geography and history of the country, stating, “When students have a general understanding of the country’s geographic environment, they could find some local historical sites which may include some significant resources or interesting places in the assigned country and edit them on the Google Tour Creator.” They further detailed:

> At this point, students learn where people and places are located and why they are there. They examined the influence of physical systems, such as climate, weather and seasons, and natural resources, such as land and water, on the human populations (NCSS, 2010).

In this example, the participant conceptualized using Google Tour Creator to provide an immersive experience where young children can visualize and examine in depth the points of interest they are learning about.

**Collaborate.** Preservice teachers also articulated using technology with young children for collaboration. Six of the 15 preservice teachers explicitly described processes in their lesson plans that turn young children’s knowledge into collaborative action. For example, one participant explained that they would make “students use technology like Google Slide.” They elaborated, “The extension writing activity is all about sharing their thoughts, helping each other, and working as a team.” They used technology to make young children’s learning visible to others through knowledge sharing and teamwork.

Similarly, another participant recognized that technologies not only allow students to share their ideas and understanding through writing and art but also allow teachers to plan, implement, and interact with students. They explicated the following:

> I will be using Wixie as my technology which is an online tool that lets kids publish their art and writing online. I can design lessons on it and include written instruct[ions] and attach links and other documents. I can also interact with the students.

In both of the above examples, preservice teachers articulated using technology to make them and young children feel like their learning is collaborative and connected to the world around them.

**Extend.** Four preservice teachers in this study extended technology in their lesson plans where they allowed young children to create a product and share what they have created with others. For instance, one participant extended the use of technology by blending technology and tactile materials in an effort to increase young children's autonomy, creativity, and engagement. They made the young children create their own Google Slide instead of just using the ones the teacher created for them to use. They wrote:

> Students will be utilizing google slides during this lesson. After they create their books, they will select one page from their book that is their favorite. They will then turn this page into a slide in a group [of] google slides that is shared with the whole class. That way students will be able to display one of their pages on the projector while reading their book to the class. The class will also have access to

> this google slide and can refer back to it. This will allow them to put their work into a different format that will be more easily shared with the class and will also give them practice on how to make a slide on google slides, which can be used in other lessons.

In another example, a participant recognized using technology in another meaningful way for young children to create and collaborate online:

> I will ask students to make their own money. Then they will share with their friends on Padlet of what kind of money they made. They can see what their friends have created on there too. It will support the children's learning because they will be able to understand how to take a picture and write how much their money is worth. We will draw different pictures of people that mean something great to us on their coins or money like they do in real life. It will keep the children engaged with each other and explore money and its value.

In both these examples, preservice teachers envisioned extending young children's learning by allowing them to create, access, share and collaborate. Further, they appreciated the visual affordance of the apps or web-based programs to amplify the collaborative experience.

In summary, preservice teachers in this study conceptualized the use of technology to engage, explore, collaborate, and extend young children's learning. They provided opportunities with technology for young children to dig deeper into the concept they were learning by utilizing prior knowledge, existing knowledge, and new knowledge. They evaluated, selected, and integrated technology to deliver instruction and create technology-infused experiences for young children that they believed would enhance children's learning process.

**Summary**

In this chapter, I presented the findings from a semester-long study on the experiences of 15 early childhood education teachers in a technology-infused social studies methods course from my analyses of preservice teachers' demographic questionnaire, technology, and COVID-19 reflection, artifacts collected as part of course context and participant in-class learning artifacts, Reflections on Technology Practice assignment, lesson plans, and interviews as well as my reflective analytical memos. In order to best understand the experience of early childhood education teachers, I explored: (a) early childhood education teachers' attitudes towards and confidence in using technology during the COVID-19 pandemic; (b) their learning experiences with technology in a technology-infused methods course; (c) what they recognized as being important about integrating technology for themselves as learners and young children as learners; (d) how they engaged with technology in a technology-infused social studies methods course and envisioned engaging young children with technology in their future teaching; and (e) how they conceptualized creating learning experiences with technology for young children.

The first research question shed light on their attitudes towards and confidence in technology in three ways: (a) *positive*; (b) *negative*; and (c) *mixed*. It also revealed their self-perceptions of confidence in their ability to navigate as (a) *confident* and (b) *unconfident*. Despite their positionalities towards technology and their technology skills, the preservice teachers came into this fully online course with a *willingness to learn* how to integrate technology in education. In the second research question, I explored ways in which they experienced technology to (a) *understand*; (b) *engage*; (c) *explore/examine;* (d) *reflect;* (e) *collaborate/share; and* (f) *extend* their knowledge about social studies, in this technology-infused methods course. In the third research question, I explained that early childhood education preservice teachers recognized envisioning technology as a (a) *space for building a community of learners* and (b) *multimodal tool to support learning*. In the fourth research question, I described preservice teachers' engagement with technology in a technology-infused social studies methods course as a (a) *passive interaction*; (b) *active interaction/seeking*; and (c) *critical interaction*. In the fifth and last research question, I described how preservice teachers conceptualized using technology to (a) *engage;* (b) *explore;* (c) *collaborate; and* (d) *extend* young children's learning.

In Chapter 5, I discuss the findings in light of existing literature. In doing so, I will state my interpretations of the findings in the context of the study, acknowledge limitations and delimitations, describe the implications and predictions for future research, and state my conclusions.

# Chapter Five

In this study, I examined the experiences of 15 early childhood education preservice teachers in a technology-infused social studies methods course. Using an exploratory qualitative approach, I sought to better understand their attitude towards and confidence in using technology as they entered the course during the COVID-19 pandemic. In addition, I also examined their learning experiences with technology in a technology-infused methods course and explored what they recognized as being important about integrating technology for themselves as learners and young children as learners. I also investigated how they engaged with technology and envisioned engaging young children with technology. I also considered how they conceptualized creating learning technology-infused experiences in their future teaching with young children. I collected data using a demographic questionnaire, technology and COVID reflection, artifacts collected as part of course context and participant in-class learning, Reflections on Technology Practice assignment, lesson plans, and interviews, as well as my reflective analytical memos to answer the research questions. I identified themes related to each research question: attitudes towards and confidence in using technology, willingness to learn, learning experiences with technology, the importance of intentional technology integration, engagement with technology, and conceptualization of technology for future teaching. In this chapter, I discuss the findings related to each research question in light of existing literature. Next, I discuss the limitations of the study. I conclude with implications for practice and future research.

## Attitudes Towards and Confidence in Using Technology

The findings from the first research question revealed insights into the preservice teachers' attitudes towards technology and their perceived confidence in using technology as they entered a fully online methods course amidst the COVID-19 pandemic. Teachers' attitudes toward technology use in early childhood education is a highly complex issue (Mertala, 2019b). This issue came to the forefront in early 2020 as the COVID-19 pandemic significantly shifted education from traditional in-person learning to virtual instruction. Although the preservice teachers did not explicitly discuss the impact of the COVID-19 pandemic on their attitudes and confidence, the descriptions of their experiences contribute to understanding the complexity of values and emotions these preservice teachers may have experienced during the COVID-19 pandemic. Therefore, it is important when examining the preservice teachers' attitudes towards and confidence in using technology to recognize that their responses were shared within the context of the COVID-19 pandemic.

When asked about the influence, the COVID-19 pandemic had on their thoughts about learning with technology, the preservice teachers in this study expressed positive, negative, or mixed attitudes. They also identified feeling confident or unconfident in their ability to use technology. Although they did not specifically link their attitudes and feelings to the COVID-19 pandemic, their responses provided important insights into their thinking within the context of the pandemic. This examination of their attitudes towards and confidence in using technology is especially important because researchers have found that attitudes towards technology significantly influence preservice teachers' confidence to integrate technology into learning and teaching (Akturk et al., 2015).

Positive attitudes include hope, value, enthusiasm, while negative ones include fearfulness, hopelessness, and worry. Overall, the preservice teachers believed that technology not only helped their learning but is vital for young children's learning and development. These findings are consistent with studies that examined preservice teachers' perceptions. For example, Alelaimat et al. (2020) concluded that early childhood education preservice teachers held positive perceptions on the importance of integrating technology in education. Similarly, Aguilar-Cruz (2021) found that preservice teachers in the Colombian Amazon region preparing to teach English had positive perceptions about the role of technology in online language learning and teaching.

Preservice teachers described a great variation in terms of their perceptions of confidence in their ability to navigate technology. Overall, the preservice teachers expressed a lack of confidence in their ability to use technology. They reported a lack of confidence in technology despite, as one participant stated, being a "generation that grew up with technology." This finding aligns with Lei's (2009) study of preservice teachers who were digital natives, a term that is often used to describe the younger generation who have grown up with technology (Prensky, 2001a, b). Lei found that preservice teachers who were digital natives reported strong positive beliefs in technology yet moderate confidence. Over 20 years have passed since the Prensky defined the image of digital native generation as tech-savvy. And more scholars (e.g., Bennett et al., 2008; Kirschner & De Bruyckere, 2017) have insisted that growing up with technology (access) has little to contribute to ones' ability to navigate technology for learning (knowledge). More specifically, learning to use technology for personal use does not necessarily translate into using "technology critically, wisely, or meaningfully" (Lei, 2009, p. 88). Another point that runs counter to the digital native claims is the fact that most teachers teach the way they were taught (Meske, 1985) and so if the digital natives learned without technology, there is no reason to assume they will teach with technology. This is a reminder of the importance of not assuming that preservice teachers, whether digital natives or not, will be able to integrate technology just because they have grown up in a digital age.

Interestingly, preservice teachers were more positive towards their orientation towards technology use in education despite sometimes being unconfident about their own technology skills. It is important to note that this study did not aim to establish any relationships between preservice teachers' attitudes towards technology and their confidence in their ability to use technology. However, it was evident that preservice teachers' confidence in their technology skills did not necessarily indicate a positive attitude towards technology use. This finding differs from Morgan's (2018) study that reported that preservice teachers' dispositions towards learning with technology were influenced by their ability to engage with technology. One possible explanation is that when the COVID-19 pandemic happened, teachers' personal and professional realities were interrupted, but the discourse of their teaching and learning continued to be demanding. To navigate these realities and discourses, preservice teachers had to reconceptualize some of their professional values and pedagogies to this new modality of teaching and learning (e.g., Burns et al., 2020; Myung et al., 2020). These new demands added to preservice teachers' already full workload, which even before COVID-19 affected teacher attitudes towards technology (Ferguson et al., 2012). This may explain why some of the preservice teachers described appreciation towards technology with a concern for themself, their teaching values, and/or their future students, while others described an apprehension towards technology even though they were confident in their skills to navigate it.

Preservice teachers in this study also navigated their emotions and orientation towards technology with a willingness to learn. Similar to the early childhood education preservice teachers in Alelaimat et al.'s (2020) study who wanted to learn more about technology integration in education, the preservice teachers in the current study consistently declared that they wanted to learn more about technology integration, engage children in technology-based activities, and design technological tools to facilitate children's learning. They exhibited a mindset that was generally positive and focused on seeking to learn and develop abilities to integrate technology.

**Learning With Technology**

The findings from the second research question revealed preservice teachers' learning experiences with technology in a technology-infused methods course. One of the most common uses of technology in education has been to design and deliver learning experiences (U.S. Department of Education, Office of Educational Technology, 2017). The National Academies of Sciences, Engineering, and Medicine (2018) states that technology is used to present content and engage learners' interests. This approach to using technology was evident in the current study through the artifacts they produced. The various artifacts (e.g., Google Slides, FlipGrid, Journal Reflections, etc.) that preservice teachers created as part of their course assignments revealed the different ways (e.g., understand, engage, explore, etc.) they interacted with technology apps or web-based programs.

By having opportunities to use a variety of technological apps or web-based programs in a technology-infused methods course, the preservice teachers had opportunities to learn as they used technology to (a) *understand*; (b) *engage*; (c) *explore/examine;* (d) *reflect;* (e) *collaborate/share; and* (f) *extend* their knowledge about social studies content. Some of these opportunities were similar to the authentic learning environments that preservice teachers experienced in Luo et al.'s (2017) study while using an online environment to develop online learning experiences for their future students. Although in a different content area, both studies provided preservice teachers with multiple opportunities to explore a variety of tools within the context, reflect upon what was learned, collaborate in groups, and extend their knowledge through creating a final work. These opportunities are similar to not just the characteristics of an authentic learning environment but also active learning. Some of those characteristics of active learning as specified by Bonwell and Eison (1991) are: (a) students are engaged in activities (e.g., reading, discussing, and writing); (b) there is an emphasis placed on expressing ideas and feelings; (c) there is an emphasis on the exploration (positive participation); (d) there is an emphasis on motivation that includes showing enthusiasm and activating prior knowledge; and (e) students are involved in higher-order thinking (e.g., refection). The opportunities provided in this study and the learning characteristics of authentic and active learning are closely associated with social constructivist theories as they reside in the learners' social relationships, which are often authentic, contextual, and cultural (Amory, 2014; Lave & Wenger, 1991).

Preservice teachers were given opportunities to understand the content delivered in an online format via various technologies. There is a growing body of research that looks at how technology advances the delivery of content, mostly framed around online formats (e.g., Allen & Seamon, 2007; Carlson et al., 2012; Young, 2006). More recently, Chiero et al.'s (2015) and O'brien, et al.'s (2011) looked at how general and special education preservice teachers understood the content of their courses through online instruction. However, Clark's (1983) seminal work on online (distance) learning has long asserted that technologies are "mere vehicles that deliver instruction" (p. 457). Technologies have drastically changed since Clarks' assertion, and so how content is delivered and understood in the online format has also changed. Technologies now provide opportunities for learners that go beyond just understanding content as it allows learners more control over their learning (Gao & Lehman, 2003; Vasquez & Slocum, 2012).

Technological opportunities provided to preservice teachers engaged them in their learning by generating interest and eliciting their prior knowledge. These findings are consistent with Chen (2010) and Rashid and Asghar's (2016) work that found a positive relationship between technology and undergraduate students' engagement. Past researchers have also reported disengagement with technology (Howard et al., 2016;

Popenici, 2013) and stressed the "development of digital pedagogies" to overcome it (Selwyn, 2016, p. 1020). However, the conceptualization of engagement (e.g., participation/interaction/involvement) is a complex construct (Kahu & Nelson, 2018). In this regard, preservice teachers' description of engaging with technology by generating interest and eliciting prior knowledge is important because, as Moje and Lewis (2007) point out,

> what makes learning so complex—and more than just participation—is that people bring their histories of participation to bear on each new act or moment of participating . . . (p. 16)

Technological opportunities provided to preservice teachers also allowed them to explore their learning by providing a space to think, investigate, and organize collected information. This finding is similar to Roschelle and Pea's (2002) study that found that wireless Internet learning devices can provide new kinds of space for students to organize, exchange, compare and share information as topological representations. One interpretation of these findings is that technologies offer opportunities to summarize and organize thoughts, allowing preservice teachers to understand their learning in a conceptual way.

With the opportunities afforded by technology, preservice teachers reflected on their own learning using various technologies such as Google Slides, Google Forms, Google Docs, and journal blogs. Reflecting in this study involved providing opportunities for preservice teachers to analyze, evaluate, be critical, create new ideas, or apply multiple perspectives, something that is also a characteristic of active learning. This finding is similar to how Yang (2009) posited using blogs to enhance critical reflection amongst English as a Foreign Language teachers in Taiwan. In another study, Shoffner (2009) found that secondary English methods courses used MS Word, weblog, webpage, and email to reflect. Given the value reflection has amongst the teacher education community (Gore & Zeichner, 1991) and educators (Ward & McCotter, 2004), technology offers teacher educators an authentic way to engage preservice teachers in reflective practice (Shoffner, 2009).

Technological opportunities provided to preservice teachers allowed them to collaborate through various technologies moderated by the teacher educator. This finding is complementary to Papert's view of technology as a powerful medium for constructing knowledge through collaboration and visualization (Powell, 2017). With technology, preservice teachers can collaborate on almost anything. In a similar study, Hakami (2020) showed that preservice teachers were provided collaborative opportunities with one website and digital app, Nearpod, by adding digital quizzes, polls, drawings, and open-ended questions. Literature also backs this finding as it appropriates technological platforms like Google Suite; social network sites like Facebook and LinkedIn; wikis blogs; micro-blogging services like Twitter; video-sharing services like YouTube for communication, information sharing, and collaboration (Doyle & Nagle, 2019).

Technology afforded preservice teachers' opportunities to extend their learning by providing opportunities to create, showcase, and share their learning with their classmates. This finding closely aligns with the concept of documentation in the early childhood education context that serves as a way to make the "what we learn" visible

(Alaçam & Olgan 2021). Preservice teachers in this study used Flipgrid, Economic Share, and the Lesson Plan as spaces to document and share learning. The pattern of the findings is consistent with Karakaya's (2019) study in which preservice teachers in an undergraduate learning technologies minor program designed and shared a makerspace manifesto to share learning.

While technology has the potential for engagement, exploration, reflection, and collaboration (Bowen et al., 2017), these activities do not happen in isolation but rather through interactions within the learning experiences. For example, during a collaborative task, the students may explore and reflect (Educational Broadcasting Corporation, 2004), while a collaborative exploration may involve a reflective task (Morrison, 2013). Thus, the findings for this research question provide an initial window into some of the preservice teachers' interactions with technology that helps them construct meanings of their experiences (Dewey, 1938).

**Understanding Technology**

The third research question addressed what early childhood education preservice teachers recognized as being important about integrating technology for themselves and young children as learners. The preservice teachers in this study envisioned two main affordances of technology as they engaged in a technology-infused social studies methods course: (a) technology as a space for building a community of learners and (b) technology as a multimodal tool to support learning.

### *Technology as a Space*

When considering technology as a space for learning, the early childhood education preservice teachers in this study found that technology opened up spaces to generate and share ideas and build learner agency to engage with the social studies methods content, the instructor, and classmates. They considered technologies as digital spaces to create and participate in communities of learners for themselves and for young children. Digital space is space constructed by new media, technology, and the internet (Ash et al., 2018). According to these preservice teachers, platforms such as ProWritingAid, Playmeo, and Zoom; and apps such as Padlet, Wakelet, Flipgrid, and Google Slides provided a space for preservice teachers to share feedback, exchange ideas, utilize writing, and connect with their peers and teachers. Literature has often touted that interpersonal communication is an important use of the Internet, if not its most important use" (Cummings et al., 2002, p. 103). According to Newton et al. (2018), higher education faculty and students have often described engagement within digital platforms as limited because of the deficiencies of the platform deployed and the ineffective construction of learning activities. However, in their department-wide study, they found one such digital platform, Yellowdig™, "promote[d] more community, connection and interactivity from their virtual learners, robust discussions, and social construction of meaning" (p. 1008). Similarly, looking at video-conferencing platforms like Zoom, Maher (2021), who studied third-year undergraduate preservice teachers, found that digital platforms allowed preservice teachers to collaborate and learn actively. Frangou and Keskitalo (2021) looked at primary school teacher education programs in Finland and stated that apps like Padlet, Flipgrid, and Adobe Connect supported interactive and dialogical working. Preservice teachers in this study also shared that digital platforms and apps promoted community of practice and learning through interactive assignments, conversations, collaboration, and sharing.

As the preservice teachers interacted and collaborated with each other in these digital spaces using a variety of web-based tools and apps, they recognized the social affordance of using technologies. While understanding technology as a space, McCrae (2014) argues that educators need to further explore the discourse around the "celebration and revolutionary transformation of education deployed about the socially networked online environment" (p.31). Although collaborations in digital spaces may differ from those found in physical classrooms, the preservice teachers indicated they were able to use technology to express their thoughts, opinions, and/or questions, thus generating and sharing knowledge within their community of learners. As the preservice teachers utilized different technologies in their virtual early childhood education social studies methods course, they also recognized that technology allowed a variety of collaborations from simple interaction to teamwork, networking, and dialogue not only between their peers and the teacher educator but also for young children. Preservice teachers talked about "build[ing] relationships" and "sharing their thoughts, helping each other, and working as a team" to describe the use of technology. They indicated that after participating in a technology-infused class, they perceived technologies as promoting effective collaboration through active engagement, interaction, communication, and co-creation as well as sharing of content (Garcia & Rose, 2007; Hilburn & Maguth, 2012; Walton & Slater-Stern, 2006).

As the preservice teachers explored technology tools, learned how the tools worked, planned lesson plans that integrated those tools, they also recognized that their understanding of technological affordances was important for shaping their learner agency. Through sharing their thinking and projects with their community of learners, the preservice teachers took an active role in constructing their own learning in these digital spaces. Their consideration of agency was parallel to Osborne's (2015) recognition that it is "not simply 'what can I *do* in this environment' but more importantly from a learning perspective 'what will happen when I do this in this environment'" (p. 419). This perspective on technologies has implications for teacher education programs. If preservice teachers perceive the affordances of technologies based on the learning goals, it helps address the 'visioning dilemma' (Lawrence, 2014) that teachers face where they are often unable to visualize how emerging technologies can potentially be used in their future classrooms.

The preservice teachers also considered technology as a space to build young children's learner agency. James and James (2008) define agency as "the capacity of individuals to act independently" (p. 9). However, agency, a key concept in early childhood education, is also conceptualized based on children's social participation as well as the ability to act autonomously (Oswell, 2013). The preservice teachers perceived these technologies afforded young children's opportunities to monitor, instruct, and communicate with one another, displaying agency in learning through social interaction.

This finding aligns with the discussions by Danby et al. (2018), who demonstrate how children collaborate with intense communication and problem solving during digital gameplay. Preservice teachers also perceived that technologies allow for self-regulation and active learning, which they believe further contributes to young children's capability to shape their own lives and knowledge. Their perception is supported by the findings of Sáez-López et al. (2016), who examined the practice of using coding and visual blocks with primary school students. In this capacity, as preservice teachers recognize the social affordances of technology as a space to build young children's community of learners, they may develop a more dynamic and agentic view of technologies where learners co-construct independent, cohesive, and collaborative knowledge.

***Technology as a Multimodal Tool***

The preservice teachers in the current study valued the opportunity afforded through technology to move beyond their own classroom as it evoked a perception of the real world that would not have been possible otherwise. In preservice teachers' descriptions, the multimodalities of digital technologies blurred the separation between the digital world and the non-digital world. This was similar to Shoffner's (2009) finding that technology, like a weblog, could be used to replicate individual, diary-like writing. However, such affordance of technology as a multimodal tool has not widely been studied in the context of preservice teacher methods courses (Kajder & Parkes, 2012) and even less in the early childhood education studies context.

Multimodality of technology tools helped preservice teachers translate digital experiences into their non-digitally mediated interactions as they shared ideas and collaborated with the classroom and beyond it. Social interaction is a key principle of engagement (Egbert & Shahrokni, 2019) and a part of everyday life in the real world. Preservice teachers in this study approximated their social interactions in the digital world as an abstraction of interaction and learning of being in a real-life classroom, similar to early/elementary preservice teachers' experiences while designing digital books in a reading methods course (Eutsler, 2021). Such an experience gave the preservice teachers a feeling that they had greater control over the time, place, and pace of how they learned.

Preservice teachers in this study also extended their interpretation about multimodal affordances of technology to young children's experiences with technology. In this study, preservice teachers noted that modern time is shaping a world of opportunities that has preservice teachers perceived that technology afforded young children physical and social manifestations of learning by simulating realistic experiences. These findings are similar to an older research study that discovered that digital learning resources offer the potential for young children to work with realistic multimodal simulations of the world around them (Shaffer, 2009).

Conversely, some researchers also argue that technology constrains young children's tactile and direct hands-on experiences (e.g., Dong & Mertala, 2019; Istenic Starčič et al., 2016; Palaiologou, 2016). However, the teachers in Dong and Mertala's (2019) study conceptualized technologies as screen-based, whereas preservice teachers in this study compared technologies to the traditions of play in early childhood education. The affective and multimodal qualities embedded in digital images or sound were perceived as potentialities of play. Conceptualizations highlight the relational nature of how preservice teachers seek out educational technology (Johnson et al., 2016). This explains why preservice teachers considered multimodal affordances of technology and the opportunities it may provide to support social interactions for young children.

**Engagement with Technology**

In the current study, the preservice teachers described their engagement with technology in three ways: without any active interaction, to seek something out of the technology they were interacting with, and critical interaction that helps them make sense of their experiences. According to Koehler and Mishra (2009), the developers of the TPACK framework, an important aspect of technology integration is how preservice teachers engage with technology. While many studies are looking at how preservice teachers are engaged with technology in a teacher preparation program, none of them considered preservice teachers' accounts of their engagement with technology.

In their active and critical interactions, they used their experiences with technology as an avenue to have intellectual and analytic discourse about technology. As the preservice teachers had opportunities to make sense of their experiences, they connected the experiences to what they deemed important for their future teaching and learning with technology. They described noticing an affordance, an experience, or a learning. They then extended their noticing by copying, mapping, or adapting the technology for their own learning or young children's learning. Preservice teachers in this study also found moments when they noticed conflicts as they connected their learning to how they envision using technology for their future practice. Kolb (2014) identified that, for reflective noticing of the new experience, it is important to notice any inconsistencies between experience and understanding. When technology is used in ways other than intended, breaking norms and perceived restrictions, they reflect innovative thinking as it bends the rules of the digital construct (Marsh et al., 2016).

The three interactions with technology (passive, active, and critical) were described distinctly for analysis purposes; however, preservice teachers' descriptions of these interactions were not always rigidly categorized or ranked. It did not necessarily mean that preservice teachers did not gain knowledge or information while interacting passively with technology. They did not explicitly describe any engagement with the technology like the way they did in active and critical interaction. Moreover, preservice teachers engaged with technology passively, actively, and/or critically at different times during the course. As they continued to grow and learn in the course, they did not abandon one type of interaction to take hold of another. Instead, they had different interactions with technology based on its purpose and value.

Preservice teachers in this study point out that consuming (interacting) with technology does not have to be a passive exercise. It can be adventurous, imaginative, and necessary to become a creator of technology. However, literature that pushes for users of technology to become creators with technology has a negative connotation for consumers of technology (Bindel, 2021; Donohue & Schomburg, 2017; Larizadeh, 2014). Often with technology, it has been touted that when students make, code, or become creative in their use of technology, they are creators (Hsin et al., 2014). This is because creating or building with technology leads to higher-order thinking skills and creativity

(Bers, 2018b). While when students learn content delivered by technologies, they are consumers. Most of the technologies are designed for users to consume digital content by staring at a screen, in a passive viewer position. In this regards, creating leads to a shift in cognitive demand that incorporates the "the six Cs" relevant in our digital world—content creation, creativity, communication, collaboration, community building, and choices of conduct (Bers et al., 2012). Passive use of technologies does not benefit users unless they are allowed to express their creative abilities or problem-solve when they consume this information. However, preservice teachers described becoming critical consumers of technologies when they mapped, adapted, and evaluated technology in their active and critical phases of interactions. This finding is similar to secondary methods preservice teachers in Merideth et al.'s (2000) study who moved from critically utilizing a FileMaker Pro™ 3.0 database to applying that information in their lesson activities. Technology is never what makes a difference but rather what is done with the technology that matters (Koehler & Mishra, 2009). The preservice teachers critically reflected on specific reflection prompts after their interaction with technology, which allowed them to think deeply about their use of technology and how they anticipate using the particular technology in their future teaching. This connection is what seems to be an important bridge that connects the noted disconnection in the literature between preservice teachers' courses and their intention to use technology in their future teaching (Sprague & Katradis, 2015).

The preservice teachers also envisioned engaging young children with technology, like how they engaged with technology. Often "the way teachers teach relates strongly to the way they have been taught" (Barak, 2006, p. 131). In this regard, the importance of preservice teachers' engagement with technology plays an important role in developing their perception of technology for teaching and learning. Preservice teachers' perception of technology is based on their instructional goal and whether they think technology can help their students achieve that goal (Watson, 2006). When preservice teachers are introduced to a new tool, they often judge whether the tool is relevant to their future practices.

Moreover, the term "preservice teacher" means teachers before they begin their service in the field. In other words, they do not have experience teaching yet. Therefore, the more the preservice teachers judge a technology tool to be useful, the more likely they will use it in the future (Zhao et al., 2002). There are other factors like modelling of technology integration by education faculty and clinical educators (Polly et al., 2020), that may also influence use of technology. However, with a different group of researchers (Martin et al., 2020), she also found that higher education faculty rated benefit to learning as the most influential factor affecting their use of digital technologies. The findings in this study supported the discussion in Chapter 2 that states that when teachers learn how to use technology within their specific content areas and/or grade levels, they are better prepared to transfer that knowledge to their own classrooms (Friedman & Hicks, 2006; Whitworth & Berson, 2002). Hughes (2005) noted that "the more content-specific the example, the more likely the teacher will see value and learn it" (p. 295). The preservice teachers in this study also aligned the extension of their noticing to either the age or content, mostly early childhood education studies. These interactions echo the findings of previous research studies that found creating digital storybooks (Özüdoğru & Cakir, 2017), linking to historical activities (Bafumo & Noel, 2014), and geocaching (Wagner, 2019) as valuable.

**Conceptualizing Technology**

Preservice teachers in this study conceptualized their ideas for technology integration for their future classrooms by indicating a willingness to use technology in early childhood education contexts. These findings are consistent with the findings of Angeli and Valanides's (2005) study, where elementary preservice teachers offered examples of their deliberate thinking about technology tools to support young children's learning and even taught those lessons later on. However, preservice teachers' lesson plans in this study revealed only the first two dimensions (planning and designing) of the four dimensions of planning technology presented by Liu and Velasquez-Bryant (2003), including planning, designing, implementation, and evaluation.

As preservice teachers experienced using technology for themselves, they also conceptualized using technology to allow for further exploration of the content they planned to teach. This is contrary to Redman and Trapani's (2012) findings with second-year preservice teachers who could not articulate an educational vision for the technologies they experienced in teacher preparation programs to their future primary classroom practices. Preservice teachers in this study conceptualized the learning activities in their lesson plans with detailed technological-pedagogical information. This suggests that early childhood education preservice teachers conceptualized technology integration with pedagogy and content after their technology-infused experience in the social studies methods course. It is noteworthy that the social studies content was also sufficiently present in the lesson plans, and so were content-related statements in preservice teachers' rationale for technology integration.

Preservice teachers' conceptualization of technology to engage, explore, collaborate, and extend young children's learning was parallel to some of how their teacher educator provided opportunities (i.e., understand, engage, explore/examine, reflect, collaborate/share, and extend) for them to use technology in the social studies methods class. This finding aligns with Wetzel et al.'s (2014) advice that technology-infused courses for candidates preparing to teach P–12 can be improved by increasing instructional and pedagogical modeling of technology. However, simply having preservice teachers watch examples of technology applications appears helpful but not sufficient (White & Geer, 2013). Observing in combination with discussing and reflecting collaboratively, as well as practicing it in class, helps them to see the value of the integration of technology into class instruction (cf. Lim & Chan, 2007). It is more important for preservice teachers to develop a thinking-with-technology perspective than developing complex technology projects to successfully integrate technology (Doering et al., 2003).

**Implications for Teacher Preparation Programs**

This study aimed to investigate how preservice teachers described constructing their understanding about technology integration in a technology-infused social studies methods course. The findings in this study present similar discoveries to that of previous studies that look into preservice teachers' experiences with technology, a multi-faceted construct. However, by uncovering the pieces of evidence from their actual experiences and reflections, this study provides a preliminary understanding of the complex endeavor, preservice teachers' attitudes, engagement, and conceptualizations towards technology that reside below the surface. Based on the findings of this study, teacher educators within higher education institutions are encouraged to provide preservice teachers with technology-infused methods courses that provide new spaces and multimodal affordances of engagement. This study also cautions against narrowly defining engagement in these digital spaces and encourages educators to embrace the more nuanced understanding of technology experiences. Teacher educators should provide preservice teachers with meaningful constructivist experiences with technology and caution against characterizing young people simply because of their exposure to digital technologies.

The findings from this study imply that new technologies provide new spaces and multimodal affordances that allow preservice teachers to understand, engage, explore, reflect, collaborate, and extend their learning. Teacher educators should be aware of these engagements and consider them when designing their curriculum (Tondeur et al., 2012; Yelland, 2005). Such engagements can significantly impact preservice teachers' perceptions about their ability to integrate technology (Koch et al., 2012). In addition, teacher educators should avoid narrowly defining engagement (Goedde, 2016) as long as the technology interactions are critical and challenged (Figgins et al., 2008). This study complements Oliver's (2015) suggestion that rather than focusing on the binaries like high-tech/low-tech and consumer/creators, consideration should be given to how "boundaries around education are both constructed and overcome" to explore how they are permeable (p. 373) and “what kinds of openness should be pursued” (p. 382). Meaningful interactions with technology should be encouraged as the power of consuming technology may make way for the much called for – critical interactions with technology.

This study also highlights the variation in attitudes towards technology and confidence in their abilities to integrate technology amongst preservice teachers. Although many of these preservice teachers identified themselves with the young generation who are regular users of technology, only a couple described themselves as confident in their ability to use technology with young children. This finding cautions against taking a simplistic view of preservice teachers’ technology skills based on the generation they belong to. Rather, more emphasis should be given to providing preservice teachers, regardless of their age, with experiences that help them identify the enabling conditions of technology integration.

The findings in this study implied that creating a constructivist learning environment where preservice teachers experimented, discussed, and wondered with new technologies allows preservice teachers to interact with technology meaningfully. Experiences can be catalysts for future discourse or progressive discourse (Bereiter, 1994), wherein individuals share and arrive at a new understanding of their experiences. At the same time, sociologists have long argued that modernity brought in its wake the decline of the community (Bellah, 1985; Putnam, 2000). Preservice teachers in this study found technology as a space and a tool that created a community of learners and built learner agency. These experiences are what help preservice teachers to shift from “what I do with technology" to "what will happen when I do this with technology," a process of discovery (Bruner, 1961; Piaget, 1958) that is also central to constructivist theories. By understanding how preservice teachers build their understanding of community in the digital spaces, teacher preparation programs can design program curriculum that integrates technology effectively in and across the content areas.

A key takeaway from the findings of this study is that when learners are provided opportunities to learn with and through technology, it opens possibilities for their thinking with technology. Such opportunities allow preservice teachers to engage with technology that allows them to see the value of technology beyond just entertainment. The nature of relationships amongst preservice teachers and technologies in a teacher preparation program will shape their thinking and learning with technologies. Therefore, it is important to provide meaningful contextual opportunities for preservice teachers to engage with technologies in a teacher preparation program.

**Future Directions**

Whereas the study's findings answered the research questions I posed at the beginning of the study, they also led me to want to investigate further. Several new questions, which future researchers could examine, emerged from the data. These are presented in this section.

This study was limited to an online social studies methods course. It would be valuable to do a similar study in a face-to-face format of a social studies methods course to investigate the impact of a technology-infused face-to-face course on the preservice teachers' thinking about technology integration.

Preservice teachers in this study established using technology through four learning activities in the lesson plans: engagement, exploration, collaboration, and extension. Due to the limitations of this study, this data was collected from the first two dimensions of technology integration (planning and designing). Thus, it would be useful for future research to develop and investigate the additional dimensions of technology integration (implementation and evaluation) for it to be assessed more thoroughly. It would also be valuable to follow up with the current preservice teachers to see if they implemented technology in their future classrooms.

In some capacity, this study supports the literature that states that preservice teachers can generate future applications for technology integration within their content area when they experience technology in their methods courses in their teacher preparation programs (Brooks, 2011; Hare et al., 2002; Hammond, 2012; Jackson & Ford, 2008; Merryfield, 2000). As this study was limited to a social studies methods course, future research should investigate if and to what extent preservice teachers' subject-specific knowledge and beliefs influence their thinking process about technology integration during lesson design.

Further, I acknowledge that the findings from this study cannot be easily generalized due to the methodological limitation concerns regarding the relatively small scale of the study. This was due to feasibility reasons such as the size and scope of the study and imposed time limits. This study did not collect pre-collaboration data from prior methods courses, which made comparative analyses impossible. Finally, this study was limited to one semester; a longitudinal study with the student participants going forward or a study on the same topic over several methods courses would likely result in richer data. Social situations are never sufficiently similar, across space and time, to make a complete replication; however, I invite further researchers to investigate how preservice teachers describe their experiences with technology over several methods courses in early childhood education teacher preparation programs. It is also important to bring preservice teachers' voices into research.

**Conclusion**

This study provides depth and understanding to the greater literature regarding engaging preservice teachers with technology in teacher education. Because of the knowledge gleaned here, there is evidence to believe that the early childhood education preservice teachers immersed in a technology-infused social constructivist environment in their methods course were able to engage in meaningful and authentic learning experiences. The semester-long exploration provided a clearer picture of how the preservice teachers engaged with technology, what they recognized as important when envisioning using technology, and how they conceptualized using technology with young children. These interactions with technologies also manifested in their emerging understanding of what they thought was important about technology integration for themselves and young children.

The impetus of the research presented here was to add to the early childhood education teacher education literature on technology integration. This study offers new insights into preservice teachers' understanding about technology integration embedded in their interactions with technology, the conceptualization of those interactions, and recognition of what is important for their future practices with young children. It is imperative that preservice teachers are provided with the experiences necessary to become familiar with content-specific technology. Preservice teachers also need to be provided with time to collaborate with their peers and co-construct knowledge about how to successfully implement these tools for young children. This, in turn, can lead to the development of preservice teachers' comfort with learning new technologies as they evolve, the ultimate goal of all educators.

**Appendix A**
**Informed Consent Form**
**Observation and Artifacts**

*An exploratory study: How early childhood preservice teachers construct their understanding of technology integration in a technology-infused social studies methods course*

RESEARCH PROCEDURES

This research is being conducted to explore the experiences of early childhood preservice teachers in a technology-infused social studies methods course. The focus of this research is on exploring how early childhood preservice teachers describe their learning experiences with technology in a methods course and what they recognize as being important to learning about intentional technology integration for their future teaching. If you agree to participate, you will be agreeing to complete a small demographic questionnaire and you will be granting the researchers permission to utilize course artifacts (i.e., assignments and synchronous and asynchronous in-class activities) and observations of your class experiences as evidence of your learning.

RISKS

There are no foreseeable risks for participating in this research.

BENEFITS

There are no benefits to you as a participant other than to further research in the field of teacher preparation programs that supports preparing early childhood preservice teachers' construction of technology integration knowledge and skills for their future teaching.

CONFIDENTIALITY

The data in this study will be confidential. As a participant in the study, you will be assigned a pseudonym and a case number. Upon completion of the course and prior to data analysis, your name will be removed from all collected artifacts and replaced with your pseudonym and case number. Using an identification key, the researchers will be able to link your survey and other course artifacts to your identity. Only the researchers will have access to the identification key. The de-identified data could be used for future research without additional consent from participants. While it is understood that no computer transmission can be perfectly secure, reasonable efforts will be made to protect the confidentiality of your transmission. The Institutional Review Board (IRB) committee that monitors research on human subjects may inspect study records during internal auditing procedures and are required to keep all information confidential.

PARTICIPATION

The students must be 18 years of age or older to be eligible to participate. The participant must be enrolled in the Fall 2020 XXXX 000/000 social studies methods course to participate in the study. Your participation is voluntary, and you may withdraw from the study at any time and for any reason. If you decide not to participate or if you withdraw from the study, there is no penalty or loss of benefits to which you are otherwise entitled. The decision to participate or not participate will not impact your standing or grade in the class and you are expected to complete regular tasks/assignments as usual. There are no costs to you or any other party.

CONTACT

This research is being conducted by Payal Shah, a doctoral candidate in College of Education and Human Development at X University. She may be reached at (XXX) XXX-XXXX or by email, pxxxxxx@xxx.edu, for questions or to report a research-related problem. This research is under the supervision of Dr. X, who can be reached at (XXX) XXX-XXXX or jxxxx@xxx.edu. If you have any questions or comments regarding your rights as a participant in the research, please contact the X University Institutional Review Board office at irb@xxx.edu or (XXX) XXX-XXXX.

This research (IRBNet number: 1632289-1) has been reviewed according to X University procedures governing your participation in this research.

CONSENT

Please provide your first and last name: *

Your answer

I have read this form; all of my questions have been answered by the research staff. *

YES - I agree to participate in the study

NO - I do not agree to participate in the study

Submit

**Appendix B**
**Demographic Questionnaire**

Demographic Questionnaire

Please provide a preferred email address to receive a copy of the Informed Consent *
Your answer

Gender *
Male
Female
They

Age range *
18-22
23-29
30-39
40-49
50-59
60+

Major *
Non-degree
Bachelor of Science Degree in Education (B.S.Ed.), Early Childhood Education for Diverse Learners
M.Ed., Curriculum Instruction for Early Childhood Education for Diverse Learners (ECDL)(Non-Licensure)
M.Ed., Curriculum Instruction for Early Childhood Education for Diverse Learners (ECDL) (Licensure)
Other:

Submit

**Appendix C**
**Informed Consent Form**
**Interview**

*An exploratory study: How early childhood preservice teachers construct their understanding of technology integration in a technology-infused social studies methods course*

RESEARCH PROCEDURES

This research is being conducted to explore the experiences of early childhood preservice teachers in a technology-infused social studies methods course. The focus of this research is on exploring how early childhood preservice teachers describe their learning experiences with technology in a methods course and what they recognize as being important to learning about intentional technology integration for their future teaching. If you agree to participate, you will be agreeing to participate in a 45- to 60-minute audio-recorded interview at the end of the course. After the interview has been transcribed, you will be given an opportunity to review the transcription to check for accuracy and to clarify any potentially misleading information.

RISKS

There are no foreseeable risks for participating in this research.

BENEFITS

There are no benefits to you as a participant other than to further research in the field of teacher preparation programs that supports preparing early childhood preservice teachers' construction of technology integration knowledge and skills for their future teaching.

CONFIDENTIALITY

The data in this study will be confidential. As a participant in the study, you will be assigned a pseudonym and a case number. Upon completion of the course and prior to data analysis, your name will be removed from all collected artifacts and replaced with your pseudonym and case number. Using an identification key, the researchers will be able to link your survey and other course artifacts to your identity. Only the researchers will have access to the identification key. The de-identified data could be used for future research without additional consent from participants. All identifying information will be removed during transcription. Only the researchers have access to the audio files and the transcribed interviews. The digital audio files and the digital transcription files will be destroyed 5 years after the conclusion of the study. While it is understood that no computer transmission can be perfectly secure, reasonable efforts will be made to protect the confidentiality of your transmission. The Institutional Review Board (IRB) committee that monitors research on human subjects may inspect study records during internal auditing procedures and are required to keep all information confidential. Participants may review Webex's website for information about their privacy statement. https://www.cisco.com/c/en/us/about/legal/privacy-full.html. Participants may review Zoom's website for information about their privacy statement. https://zoom.us/docs/en-us/privacy-andsecurity.html?zcid=3736&creative=430738468987&keyword=%2Bzoom%20%2Bprivacy&matchtype=b&network=g&device=c&gclid=CjwKCAjwm_P5BRAhEiwAwRzSOx1bYT-EO7oG9TSaC2O1V8sbbMQ28bhdMl67mN1NaBCGJWwcu923YRoCdrIQAvD_BwE. Participants may review Microsoft's website for information about their privacy statement. https://privacy.microsoft.com/en-us/privacystatement

PARTICIPATION

The students have to be 18 years of age or older to be eligible to participate. The participant must be enrolled in the Fall 2020 XXXX 000/000 social studies methods course to participate in the study. Your participation is voluntary, and you may withdraw from the study at any time and for any reason. If you decide not to participate or if you withdraw from the study, there is no penalty or loss of benefits to which you are otherwise entitled. The decision to participate or not participate will not impact your standing or grade in the class and you are expected to complete regular tasks/assignments as usual. There are no costs to you or any other party.

CONTACT

This research is being conducted by Payal Shah, a doctoral candidate in College of Education and Human Development at X University. She may be reached at (XXX) XXX-XXXX or by email, pxxxxxx@xxx.edu, for questions or to report a research-related problem. This research is under the supervision of Dr. Julie K. Kidd, who can be reached at (XXX) XXX-XXXX or jxxxx@xxx.edu. If you have any questions or comments regarding your rights as a participant in the research, please contact the X University Institutional Review Board office at irb@xxx.edu or (XXX) XXX-XXXX. This research (IRBNet number: 1632289-1) has been reviewed according to X University procedures governing your participation in this research.

CONSENT

I have read this form; all of my questions have been answered by the research staff.

Please provide your first and last name: *

Your answer

I have read this form; all of my questions have been answered by the research staff. *

YES - I agree to participate in the interview.

NO - I do not agree to participate in the interview

CONSENT cont...

I have read this form; all of my questions have been answered by the research staff. *

YES - I allow the researcher to audio-tape the interview

NO - I do not allow the researcher to audio-tape the interview

CONSENT cont...

THANK YOU so much for your consideration and agreeing to participate in the interview. I really appreciate your time. Please provide your contact information and I will reach out to you in the next two weeks to arrange for an interview at your convenient time.

Phone#

Your answer

Email

Your answer

Other (Whatsapp, Twitter, etc...)

Your answer

Submit

## Appendix E
## Interview Protocol

***inspired by Buss et al. (2015); Molebash (2001); Schmidt et al. (2009)***

These interview questions are for a dissertation study that is focused on understanding technology integration in a technology-infused methods course from a preservice teacher learning perspective. *Technology is a broad concept that can mean a lot of different things. For the purpose of this study, technology is referred to digital technology/technologies — that is, the digital tools we use such as computers, laptops, iPods, handhelds, interactive whiteboards, software programs, etc. as well as mobile apps, and online digital platforms like social media, etc.* that can be used in conjunction with effective pedagogy to support student learning.

You were provided with a copy of the Informed Consent Form prior to our interview time today. Do you have any questions about this research study or the interview that will take place today? If so, what are they? If not, please understand that participating in this interview means that you fully understand the Informed Consent and are voluntarily participating in this interview process.

This interview will be limited to 60 minutes and will focus on the questions listed below. However, follow-up questions from your responses may be asked to capture more insight into your experiences and how that has influenced your understanding of technology integration practices.

Your responses will be kept completely confidential, and you will be permitted to review the transcription of this interview to make corrections or any changes you feel necessary. This interview will be recorded to ensure accuracy during the transcription process, do you agree to this interview being recorded?

Thank you for your participation!

1. Please describe how the experiences in your social studies methods course has influenced you to use technology as a PreK-3 social studies teacher.

*Follow up questions:*

   a. Tell me about a specific experience in this course that was most effective in your understanding of learning with technology in the social studies context.
   b. Tell me about a specific experience in this course that was least effective in your understanding of learning with technology in the social studies context.

2. What else, outside the course, has influenced your use of technology as a tool for learning and teaching?
3. Tell me about a time during the social studies methods course that made you think deeply about how technology could influence the teaching approaches you may use in your future instruction.

*Follow up questions:*

a. Please walk me through a specific episode in this course where your instructor effectively demonstrated or modeled her thinking deeply about how technology influenced the teaching approach.
b. Tell me more about how that episode affected your understanding of intentionally using technology for instructional purposes.

4. At what point in the social studies methods course did you feel that you were prepared to teach PreK-3 students to use technology to work toward their social studies content standards? (Virginia Standards of Learning and Virginia's Foundation Blocks for Early Learning: Comprehensive Standards for four-year-old)

*Follow up questions:*

a. Please walk me through that lesson or assignment.
b. Were there any supports that you received during that lesson or assignment?

(e.g. (Lack of) time, training, or integration ideas)

c. Were there any supports that you wished you received?

5. Please describe a specific episode in this course when your instructor effectively demonstrated reflecting on her decision to intentionally use/not use a particular technology.

*Follow up questions:*

a. Tell me more about how that episode affected your understanding of intentionally reflecting on the use of technology for instructional purposes.

6. Show the artifact slideshow

In which one of these assignments did you feel that you intentionally took a critical view of technology and then decided on/decided against using a technology?

*Follow up questions:*

a. Please walk me through that lesson or assignment.
b. What were some of the key factors that you considered about that technology?
c. What factors were most important in thinking critically about technology?
d. How did taking a critical view of technology help you make an intentional decision about using/not using the technology?

7. Now that you have had these learning experiences using variety of technology tools for different pedagogical reason, what are your thoughts on how important is it to teach PreK-3 students to make intentional decisions about the use of technology? (to problem solve and become critical thinkers)

*Follow up questions:*

a. Please tell me an example that you have seen or thought of where PreK-3 students intentionally used/can use technology to problem solve and become critical thinkers.

8. In your lesson plan, you provided an example of how you would teach a PreK-3 lesson with student use of technology. You also wrote a rationale for your decision. Please talk me through your decision process again on how and why you decided to use that technology.

*Follow up questions:*

a. What was your intended goal in using that particular technology?
b. What were the key affordances of this particular technology that lent itself to your intended goal?
c. What other technologies did you contemplate about before you made your decision?
d. Why did you think a technological approach could be better than an approach without technology for this learning goal?
e. Were there any ethical matters you considered while using technology with young children?

9. What do you envision as the next most useful technology tool(s) to be used in your future classroom/school?
10. Do you think you are representative of other preservice teachers in being able to integrate technology?

Those are the questions that I have for you today. Do you have anything that you would like to add before we conclude? Do you have any questions about this interview or any of the questions you were asked to answer today?
Can I get back to you with a follow-up email, of I have any further questions or clarification?

Thank you again for participating. This recorded interview will be transcribed, and you will be provided with the transcript to make corrections or any changes you feel necessary. Please do not hesitate to contact me if you have any questions.

## Appendix F
## Technology and COVID-19 Reflection

Technology is a broad concept that can mean a lot of different things. For the purpose of this experience, technology is referred to as digital technology/technologies. These could be but are not limited to the digital tools we use such as computers, laptops, iPods, handhelds, interactive whiteboards, software programs as well as the mobile apps, and online digital platforms like social media (e.g., Facebook, Instagram). These digital technology/technologies will be ones that are used in conjunction with effective pedagogy to support learning.
Please answer the questions to help understand how your learning with technology has been impacted by the COVID-19 pandemic experiences during the COVID-19 pandemic.

Please provide first name *
Your answer

How have your experiences during COVID -19 influenced your thoughts about learning with technology? *
Your answer

How have your experiences during COVID -19 influenced your thoughts about learning to teach young children's (PreK-3) with technology? *
Your answer

Submit

## Appendix G
## Reflection on Practice

Thinking about your class experiences between the synchronous and asynchronous class THIS week, think about the technologies you used and experiences you had. Identify and reflect on the learning experiences to answer the following:

* Required

Please provide first name *

Your answer

Name one technology you used this week in the social studies methods course that resonates with you *

Your answer

Familiarity with the tool - This technology was *

New to me

Known to me

Other:

Briefly tell how this technology supported your learning this week *

Your answer

Briefly tell how would you envision using this technology in the future with young children? *

Your answer

Is there any other technology tool or learning experience that you found particularly powerful? *

Your answer

Select one of the technologies and reflect on how it can be used to complement the ECE pedagogy and/or research-based teaching practices? *

Your answer

Back

Submit

**Appendix H**
**Codebook Template**

| Code | Brief descriptions/meanings | Example of the reference | Non-example of the reference for its exclusive criteria |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

**Appendix I**
**Agenda Example(s) - Synchronous and Asynchronous Session**

**Synchronous Session**
**Session Overview**

- Introducing History and Social Sciences Themes and Standards
- Examining What We Know: Understanding the Knowledge, Skills, and Processes of History and the Social Sciences
  - Asking appropriate questions and summarizing points to answer a question
  - Establishing the importance of developing fluency in content vocabulary and comprehension of verbal, written, and visual sources
- Developing Understandings of the Relationship Between Human Activity and the Physical Environment in the Community and the World with Diverse Young Children
  - Using geographic skills to explain the interaction of people, places, and events to support understanding of events in history
  - Comparing and contrasting people, places, and events in history
  - Explaining connections across time and place

**Reading:**
*National Curriculum Standards for Social Studies* (NCSS, 2010) p. 3-12
NCSS, (n.d.) Scholarly Rationale for the C3 Framework **(pp. 82-91)**
Odhiambo et al., (2016) **Chapter 1**

**Learning Process:**

- Initiating Inquiry (Google Slides) - **https://drive.google.com/......**
  - Click the link above and then proceed to your group's section. Discuss the pages and add your notes collaboratively as you go. We will regroup in about 30 minutes.
- Another way to engage - (we will probably not use this tonight ☺) Consider and Connect Photos of A River Ran Wild (Primary Sources) (Google Slides) - **https://drive.google.com....**
- A River Ran Wild and the 10 Themes of Social Studies (Google Jamboard - **https://jamboard.google.com....**
- The following is a link to NCSS with a brief description of each theme - https://www.socialstudies.org/standards/national-curriculum-standards-social-studies-executive-summary
- Each group has been assigned two themes. Visit the NCSS link above and then do the following:
  1. Read the theme and connect the story we read to the theme.
  2. Brainstorm questions for young learners connected to the theme that will prompt them to engage more meaningfully with the story using this thematic lens.

3. Then DO IT ☺
4. Be creative use images, post-it notes, tables, drawings to engage meaningfully with the text. (you and children)
5. Be prepared to share with the group the overall definition of the theme and how you decided to engage young learners.

**Asynchronous Session**

- Exploring History and Social Sciences Themes With Diverse Young Children
- Standards as the Foundation for Teaching History and Social Sciences to Diverse Young Children
    1. *National Curriculum Standards for Social Studies*
    2. *Virginia Standards of Learning for History and Social Sciences*
    3. *Virginia's Foundation Blocks for Early Learning: Comprehensive Standards for Four-Year-Olds*
- Integrating Technology to Support Diverse Young Learners' Knowledge and Skills
- Using the SAMR model to make decisions
- *Exploring Digital Technology Tools to Enhance and Extend Young Children's Learning and Engagement* **(initiated)** - You will add to it over the course of the semester.

**Reading:**

- NCSS (2010) Chapter 2 (**p. 14 - 23**)
- C3 Framework (NCSS, n.d., **p. 17-21**)
- NCSS C3 Framework Dimension 1 Developing Questions & Planning Inquiries (NCSS, n.d., **p. 23 - 29**)
- *Virginia Standards of Learning for History and Social Sciences*
- *Virginia's Foundation Blocks for Early Learning: Comprehensive Standards for Four-Year-Old*

**Learning Process:**

For this session you will complete the following:

1. A collective blog entry sharing your initial thoughts about the SAMR model.
2. A Google Doc entry sharing the new tech tool you explored
3. A Reflection on Practice completed via Google Forms

For the SAMR and Early Childhood Education

- Review the Prezi for this class session.
- Pause to respond to the Blog prompt
- Complete Podcast Explorations
- Share your new Tech Tool with the class on the shared Google Doc.

All links are also available in our assignments tab in the Asynchronous Class Session Folder on Blackboard.

## Appendix J
## Agenda-Identified Technology Overview

**Session 1:**

1. Class Session (Zoom)
2. Initiating Inquiry (Google Slides)
3. A River Ran Wild and the 10 Themes of Social Studies (Google Jamboard)
4. Consider and Connect Photos of a River Ran Wild (Primary Sources) (Google Slides)
5. A River Ran Wild (Prezi Presentation)
6. Websites:

→ link to NCSS with a brief description of each theme.
**https://www.socialstudies.org/standards/national-curriculum-standards-social-studies-executive-summary**

**Session 2 (Asynchronous):**

1. SAMR Model (Prezi Presentation with Audio)
2. Reflection on SAMR Model (Blog on BB)
3. Pause and Reflect on Technology and ECE - COVID (Google Form)
4. Podcast Explorations (Websites)
5. Allowed to play with a "new" technology tool and reflect on the experience (Google doc)

Website
→ 8 Examples of Transforming Lessons Through the SAMR Cycle
**https://www.emergingedtech.com/2015/04/examples-of-transforming-lessons-through-samr/**
→ Podcast Explorations (Google document with website)
**https://docs.google.com/document/....**

**Session 3:**

1. Class Session (Zoom)
2. Powerful and Purposeful Teaching and Learning in Elementary School Social Studies (Google Slide)
3. Teaching Chronology (Google Slide)
4. Story Time - *The Little House* (Zoom)
5. Learning Preferences Survey https://forms.gle/

**Session 4 (Asynchronous):**

1. Session overview (YouTube)
2. Examining Powerful Social Studies *T-Chart* (Blackboard/Google docs)
3. Story Time – *Firebird*
    a. *Journal Reflection* (Blackboard)
    b. *Timelines* (Google Slide)
4. Reflection on Practice (Google Form)
5. Assignment Exploration for Authentic Literature

Website
→ **https://www.socialstudies.org/sites/default/files/images/Bulletin112_Excerpts.pdf**
**Session 5:**
1. Class Session (Zoom)
2. Five Themes of Geography - Human and Environment Interaction (Google Slides)
3. Introducing the Flip Grid Challenge (FlipGrid)
4. Story Time - *Miss Rumphius* (Zoom)
    a. Note Taking (Google Slide)
    b. MAP her journey (Google Slide)
5. Final Journal (Blackboard)

**Session 6 (Asynchronous):**
1. Session Overview (Prezi Presentation with Audio)
2. Mapping Our World (Google Slide)
3. Geography and Young Learners (Google Slide)
4. Children's Literature and Social Studies Theme (Journal Reflection on Bb)
5. Reflection on Practice (Google Form)
6. Exploring Maps through different apps

**Session 7:**
1. Class Session (Zoom)
2. Directions for "Curating Fun Facts About El Salvador" (MS Word)
3. Curating Fun Facts about El Salvador (Wakelet)
4. Story Time – *My Shoes and I* (Zoom)

**Session 8 (Asynchronous):**
1. Session Overview (Prezi Presentation with Audio)
2. Mapping Our World (Google Slide)
3. Geography and Young Learners (Google Slide)
4. Children's Literature and Social Studies Theme (Journal Reflection on Bb)
5. Reflection on Practice (Google Form)
6. Exploring Maps through different apps

**Session 9:**
1. Class Session (Zoom)
2. Pause and Reflect (Google Slide)
3. Learning about Venezuela (Research on Internet/ Google)
4. Story Time – *The Streets are Free* (Zoom)
5. Thinking about Pedagogy in the ECE Classroom (mini lecture) (Prezi)
6. Journal Reflection (Blackboard)

**Session 10 (Asynchronous):**
1. Session Overview (Prezi Presentation with Audio)
2. Learning about Primary Sources (Pinup)
3. Exploring the Library of Congress Resources (Government website)
    a. Journal reflection (Blackboard)
4. Technology Pedagogical Reflection on Your Experiences (Google Form)
5. Economics Project (Google Slide)

a. Present on a digital platform of choice (Internet)

**Session 11:**

1. Class Session (Zoom)
2. Exploring Primary Sources (Google slides)
3. Technology Reflection (Google Slides)
4. Mini-Lecture Economics

**Session 12 (Asynchronous):**

1. Session Overview (Prezi Presentation with Audio)
2. Economics (Google Slide)
3. Journal Reflections (Blackboard)

**Session 13:**

1. Class Session (Zoom)
2. Flip Grid Share & Celebration (FlipGrid)
3. Economic Share “The Doorbell Rang” (Google Slide)
4. Lesson Plan Share & Celebration (Jamboard)
5. Technology Integrations (Google Slide)

**Session 14 (Asynchronous):**

1. Session Overview (Blackboard)
2. Lesson Plan Share (Blackboard)

Other technologies identified:

- Book Creator
- Creatability
- GeoBee
- Google Books
- Google Earth
- Google Maps
- IORAD
- Padlet
- Podcast
- Symbaloo
- Online interactive videos
- The Radio Segment
- Working on Timeline
- Youtube

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