TECHNOLOGY INTEGRATION OF ELEMENTARY SCHOOL TEACHERS AT PRIVATE INTERNATIONAL SCHOOLS IN DUBAI, UAE: BARRIERS, SELF-EFFICACY, AND THE RELEVANCY OF THE COMMUNITY OF INQUIRY FRAMEWORK

By
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Abstract

Teachers at private international schools in Dubai often face barriers to technology integration that interrupt their ability to teach meaningfully with technology. A review of the literature identified both first-and second-order barriers to technology integration in elementary school classrooms. After identifying the barriers, a needs assessment was conducted that asked participants to what degree they experienced four barriers to technology integration: technology self-efficacy, pedagogical beliefs, quality of professional learning, and amount of time to experiment and plan with technology. Based on the findings of the needs analysis, an intervention was developed that aimed to adopt the Community of Inquiry framework (CoI; Garrison, Anderson, and Archer, 2001) to fit into the context of elementary school classrooms and train elementary school teachers how to integrate it. However, due to complications from Covid-19, the intervention was altered into a pilot study to examine the challenges elementary school teachers faced when integrating technology into hybrid and online instruction during the pandemic. Elementary school teachers attended five online coaching sessions about the CoI framework. The coaching sessions were aligned with Bandura's (1986) social cognitive theory and included the four sources of self-efficacy development as a mechanism to increase teachers' technology self-efficacy. Four of the five coaching sessions provided participants with opportunities to learn about and practice using teaching presence, social presence, and cognitive presence (the three presences of the CoI) when teaching with technology. To determine if the coaching sessions increased teachers' technology self-efficacy and if teachers perceived CoI framework to be relevant to their instructional practice, a mixed-methods data collection process was implemented. The findings from this small sample ($N = 4$) of elementary school teachers suggest that the technology self-efficacy beliefs of participants increased because of the coaching

sessions. In addition, data showed that teachers perceived the CoI framework to be relevant to their instructional practice when teaching with digital tools. Findings suggest that the CoI framework can be adapted into the elementary school context and elementary school teachers' technology self-efficacy may increase as result of using the framework.

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Secondary Readers: Dr. James Diamond and Dr. Laura Quaynor

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The student has made all necessary revisions, and we have read and approve this dissertation for submission to the Johns Hopkins Sheridan Libraries as partial fulfillment of the requirements for the Doctor of Education degree.

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Dedication

This dissertation is dedicated to my family:

To my daughter. Audrey, may you always reach for the stars, follow your dreams, and believe in yourself and your enormous ability to learn and grow. The role of being your mother has taught me more than any other role in my life.

To my nieces, Ella and Laurelai, who are talented, compassionate, and brilliant. Use your gifts to change the world and never stop persevering.

To my Daddy, Arthur Burrows, who has always been my greatest cheerleader, has never wavered in believing in and encouraging me, and has always guided me to be happy.

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Thank you to the incredible team of academics that I am fortunate enough to work with at Middlesex University in Dubai. Your capabilities and knowledge continuously amaze me and inspire me to continue to strive for excellence as a teacher, researcher, and leader.

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Executive Summary

The integration of technology (e.g., computers, mobile devices, applications) as the solution to increase student achievement remains unmet (Delgado, Wardlow, McKnight, & O'Malley, 2015; Escueta et al., 2017; OECD, 2015). Technology integration into classrooms will continue to have little effect on student achievement if educational tasks and activities do not align to sound pedagogical methods (Cuban, 2013). Effective technology integration is a complex process for teachers (Cuban et al., 2001, 2018; Ertmer & Ottenbreit-Leftwich, 2010; Mishra & Koehler, 2006) there are an assortment of factors impacting how teachers integrate technology into K-12 classrooms (Delgado et al., 2015; Escueta et al., 2017; Hew & Brush, 2007; Lim, Zhao, Tondeur, Chai, & Tsai, 2013). The factors that hamper effective technology integration are organized into two categories: First-order barriers and second-order barriers (Ertmer, 1999). First-order barriers to technology integration are obstacles that are external to the teachers (Ertmer, 1999) and include availability and types of resources, quality of infrastructure to support technology use, time to experiment with and learn about technology, duration and quality of professional learning, and institutional support (Ertmer, 1999; Ertmer & Ottenbreit-Leftwich, 2017; NETP, 2016). Second order barriers are internal to teachers and include teachers' pedagogical beliefs, attitudes self-efficacy, and willingness to change pedagogical practice and classroom procedures for technology integration (Cuban, 2018; Delgado et al., 2015; Ertmer, 1999; Ertmer & Ottenbreit-Leftwich, 2010; Mishra & Koehler, 2006).

Although the research supporting the positive relationship between student achievement and technology integration is limited (Cuban, 2018; Delgado, et al., 2015; Escueta et al., 2017) and teachers experience a multitude of obstacles to effective technology integration (Ertmer, 1999; Ertmer & Ottenbreit-Leftwich, 2010), education technology can still be beneficial when

integrated properly (Carver, 2016; Cheung & Slavin, 2013; Haelermans, Ghysels, & Prince, 2015; NETP, 2016). For example, technology can increase student engagement (Buckley & Doyle, 2016; Mayer, 2018), can assist students in developing critical thinking skills (Chai, Deng, Tsai, Koh, & Tsai, 2015; NETP, 2016), can provide different types of assessment to facilitate students in expressing their learning (Gronseth et al., 2010; Gunn & Hollingsworth, 2013) and can enable personalized learning experiences (Bouygues, 2019; Cheung & Slavin, 2013; Haelermans et al., 2015; NETP, 2016).

Problem of Practice

The integration of technology into classrooms is a challenging undertaking and many education organizations and teachers have failed to effectively integrate technology to increase student achievement (OECD, 2020). The empirical evidence about the relationship between technology integration and student achievement (Chueng & Slavin, 2013; Delgado et al., 2015; Lim et al., 2013) highlights the complexity of effective technology integration into classrooms (Cuban, 2001; Ertmer, 1999; Mishra & Koehler, 2006). Factors that impact how technology is integrated into K-12 classrooms include policy mandates (Barbour et al., 2011; Lightfoot, 2013; World Bank, 2014), access to technology resources and infrastructure (Cuban, 2018; Francom, 2013; Ruggiero & Mong, 2015), institutional supports (An & Reigeluth, 2011; Lim et al., 2013; Tondeur, van Braak, Ertmer, & Ottenbreit-Leftwich, 2017), time for teachers to learn about and experiment with technology **(**Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012; Mishra & Koehler, 2006; Pelgrum 2001) teachers' level of technology self-efficacy (Abbit, 2011; Ertmer, 2005; Ertmer & Ottenbreit-Leftwich, 2010; Miranda & Russel, 2011) quality of technology-related professional learning (Pittman & Gaines, 2015; OECD, 2015) and pedagogical approaches to technology integration (Archambault, Wetzel, Fougler, & Williams,

2010; Cuban, 2018; Delgado et al., 2015). The many factors that affect how technology is integrated into schools are evident in schools all over the world (Buckner, Chedda, & Kindreich, 2016; Cheung & Slavin, 2012; Delgado, et al., 2015; Escueta et al., 2017; OECD, 2015; OECD, 2020) and must be addressed to result in a positive relationship between student achievement and technology integration.

Theoretical Framework

The theory of first-and second-order barriers (Ertmer, 1999; Fullan & Stiegelbauer, 1991) to educational change was the framework used to explore factors that influence elementary school teachers' abilities to integrate technology into their classes. Ertmer (1999) defines first- and second- order barriers to technology integration as factors that impede effective technology use for teaching and learning. First-order barriers are obstacles that are external to the teacher and second-order barriers are internal to the teacher. First- and second-order barriers to technology integration are important because educators are fundamental to any change process that occurs in a school. Teachers themselves choose to adopt, adapt, or reject an instructional reform such as the integration of technology (Ertmer, 1999).

Needs Analysis

All teachers who participated in this needs assessment worked in an elementary school department of a private international school in Dubai that accommodated a K-12 grade span. The type and amount of education technology varied at each school; however, each teacher used various types of education technology in their classroom from smartboards to mobile devices. The needs assessment investigated factors that impact teachers when integrating technology into their classes to support student learning. These factors include participants' pedagogical beliefs about the role of technology in the classroom, perceptions about technology self-efficacy, quality

of technology-related professional learning (PL), and other supports provided to assist teachers in integrating technology.

Data was collected using a mixed-method research design that included a survey and focus group interviews. Findings from the needs analysis suggested conflicting findings about technology self-efficacy. The survey data indicated that elementary school teachers have high levels of technology self-efficacy, while findings from the focus groups showed that teachers have lower levels of technology self-efficacy. Findings from both the survey and interview data suggested that teachers' pedagogical beliefs support technology integration. Teachers reported that when they integrate technology into their classes it can increase student engagement, motivation, and improve learning. The data about quality of PL indicated that teachers reported they are not being provided with high-quality technology focused PL to enhance their ability to integrate technology effectively into the classroom. Finally, data suggest that teachers do not have enough time to learn about, plan with, or use technology in the classroom.

Theoretical Framework

The pilot used instructional coaching to address the first- and second-order barriers to technology integration identified in the needs analysis. Sociocultural learning theory (Vygotsky, 1978) framed the pilot-study. Several of the elements of learning identified by Vygotsky (1978) including dialogue, tools, the environment, and zone of proximal development (ZPD), were incorporated into the coaching sessions. Coaching can address teachers' varying ZPDs by using the sociocultural methods of scaffolding, active learning, and collaborative learning with digital tools to help teachers effectively teach with technology (Curwood, 2011; Desimone & Pak, 2017; Kopcha, 2012). The appropriate level of support that gradually moves students to reach deeper understanding and autonomy during the learning process is referred to as scaffolding

(Wood, Bruner, & Ross, 1976). Active learning ensues when students construct knowledge through interactions and exploration with tools, experts in their environments, and other learners (Vygotsky, 1978). Collaborative learning uses conversations with more knowledgeable others and with peers and to increase learners' skills and knowledge (Vygotsky, 1978).

Literature Review

The literature review explored research related to professional learning (PL) interventions that addressed the barriers to teacher technology integration that were uncovered in the needs analysis including time, quality of PL, and technology self-efficacy. First, research about the five essential components of teachers professional learning was presented and includes content focus, duration, active learning, collaboration, and coherence (Desimone, 2009). These components align to sociocultural learning theory because several of the elements consider teachers' zones of proximal development (Wood et al., 1976), and the active use of digital tools as well as collaborative dialogue can increase teachers' self-efficacy (Desimone, 2009). The research about teacher technology self-efficacy was also reviewed to determine what kind of skills and knowledge teacher need to acquire to positively affect their perceptions about their ability to effectively use technology.

Finally, the literature review focused on the Community of Inquiry framework (COI: Garrison et al., 2001). The CoI framework provides teachers with a structure to help facilitate the effective integration of technology into their instructional practice by delivering lessons that foster teaching presence, social presence, and cognitive presence (Garrison, Anderson, & Archer, 2000). Evidence-based frameworks that support teaching with technology, like the CoI, can help increase teacher' technology self-efficacy (Desantis, 2013; Kopcha, 2012; Perera, Calkins, &

Part, 2019) which may positively affect student attainment (Mojavezi & Tamiz, 2012; Shazad & Naureen, 2017; Tschannen-Moran & Barr, 2004).

Intervention: Pilot Study

The purpose of this pilot study was twofold. First, I wanted to gain a deeper understanding of the challenges elementary school teachers have faced when integrating technology into in-person, hybrid, and online instruction during the Covid-19 pandemic. Also, the pilot-study examined elementary school teachers' perceptions of the Community of Inquiry (CoI) framework and its relevancy to their instructional practice. The CoI framework is comprehensive enough to be applied to instructional practices regardless of what digital tool a teacher is using (Anderson, 2017). I coached elementary school teachers on the CoI framework, once a week for five weeks. In between coaching session, teachers practiced the skills they learned and participated in a chat group about their experiences. While the emphasis of this pilot study was not to bring about change, teachers' technology self-efficacy before and after participating in the coaching sessions was measured. In addition, teachers' perceptions of the relevancy of the CoI were examined to inform the adaption of the CoI framework into the elementary school context.

The pilot study explored seven research questions:

1. What are the challenges elementary school teachers experience when providing online and hybrid learning to students during the pandemic?
2. To what extent do teachers perceive they have provided high quality online instruction?
3. To what extent do teachers' feel a sense of agency when providing online and hybrid instruction?
4. What are elementary school teachers' perceptions of the relevancy of the parts of the

Community of Inquiry to their instructional practice?

5. To what extent does participation in a Community of Inquiry based coaching session change teachers' technology self-efficacy?

6. What are teachers' perceptions of the coaching process?

7. What was the attendance rate for the online sessions?

Data Collection and Analysis

To answer the research questions stated above, a convergent parallel mixed method design (Creswell & Plano-Clark, 2018; Shadish, Cook, & Campbell, 2002) was incorporated. This kind of research design enabled the collection of both quantitative and qualitative data about teachers' lived experiences using technology both before and during the Covid-19 pandemic, their perceptions of the CoI framework, and changes in their technology self-efficacy. However, this pilot study mostly relies on qualitative data collection because the study aims to describe elementary school teachers' experiences with online, hybrid, and face-to-face learning and understand teachers' perceptions about the relevancy of the CoI framework in the elementary school context.

Data analysis started with quantitative data and was followed by qualitative data. The quantitative data was collected from a modified version of the Technology Integration Confidence Survey: Version 3 (Gomez, Trespalacios, Hsu, & Yang, 2021). This survey evaluates teachers' self-efficacy in integrating technology in the classroom. The qualitative data was collected using embedded discussion questions that were integrated into the coaching sessions.

Findings

Findings from analysis of qualitative data suggest that teachers face various challenges when administering both hybrid and online learning. These challenges include difficulty in

providing meaningful online interactions, low levels of collaboration and engagement, in adequate time to prepare lessons, and invalid results on tasks and assessments. Also, teachers reported that they did not deliver high-quality instruction neither during online nor hybrid learning. Data about teacher agency indicated that teachers did not feel a sense of agency when conducting both online and hybrid teaching. This was attributed to a lack of collaboration and coordination between the students and the teachers in online and hybrid learning environments, turned off cameras, and teachers' inability to monitor students while they completed learning activities. Data regarding technology self-efficacy showed consistent quantitative and qualitative findings suggesting that the coaching sessions I contributed to an increase in teachers' technology self-efficacy.

The other pertinent research considered if elementary school teachers perceived the parts of the Community of Inquiry (CoI) framework to be relevant to their instructional practice. Data indicates that the teachers' believed all of the components of the CoI to be relevant to their instructional practice when teaching with digital tools and all teachers reported that will continue to use the framework. Finally, participants indicated that the coaching sessions were both insightful and impactful in that they taught teachers about the CoI framework and increased their technology self-efficacy.

Chapter 1: Introduction

Technology has been an intrinsic part of teaching and learning since the introduction of radio and film (Cuban, 2003; Escueta, Quan, Nickow, & Oreopoulos, 2017). With the invention of computer technologies, utilizing computers in teaching and learning has been widespread since the 1990s (Cuban, Kirkpatrick, & Peck, 2001). However, the integration of technology into formal education has not produced expected outcomes in terms of improving student achievement (Delgado, Wardlow, McKnight, & O'Malley, 2015; Escueta, et al., 2017; OECD, 2015).

The time and effort that schools are spending on integrating technology into classrooms is not resulting in widespread increased student achievement. Delgado et al., (2015) conducted a literature review of 90 empirical articles, dating from 1986-2014, measuring technology use in education and the effects of technology use on student achievement. Findings from this literature review indicate there is no effect of education technology use on reading, and a modest effect of technology use on math for students in K-12 environments. However, Delgado et al. (2015) note that when the larger effects sizes emerged suggesting a positive relationship between technology use and student outcomes, research inconsistencies were present including lack of a control group, limited verification of preliminary equivalence between treatment and control group, and problematic outcome measures. Another literature review (Escueta et al., 2017) examined the effects of technology use on student achievement. Included in this literature review were empirical articles that met clear and narrow research methodology conditions to provide valid and reliable data. Findings from this research suggest that education technology may be helpful in limited contexts and conditions, and educators and researchers do not agree about what types of education technology increase student achievement. The U.S. Department of Education issued

a National Education Technology Plan (NETP; 2016) that rigorously examined research about the effects of technology integration on student achievement. Findings from this report suggest that the existing research on the effectiveness of education technology on student achievement is very limited and that many schools across the U.S. are not using the pedagogies to use technologies effectively in a way that can improve student learning. As such, all the time, financial expenditures, and effort that schools are investing in technology integration has not translated into increased achievement for students.

Effective technology integration into classrooms is difficult to achieve because it is a complex process for teachers (Cuban et al., 2001, 2018; Ertmer & Ottenbreit-Leftwich, 2010; Mishra & Koehler, 2006) and a multitude of factors impacting how teachers integrate technology into K-12 classrooms have been identified (Delgado et al., 2015; Escueta et al., 2017; Hew & Brush, 2007; Lim, Zhao, Tondeur, Chai, & Tsai, 2013). The factors that hinder effective technology integration can be classified into two categories: First-order barriers and second-order barriers (Ertmer, 1999). First-order barriers to technology integration are obstacles that are external to the teacher (Ertmer, 1999) and include types and availability of resources, infrastructure to support technology use, time to learn about and experiment with technology, quality, and duration of training, and institutional support (Ertmer, 1999; Ertmer & Ottenbreit-Leftwich, 2017; NETP, 2016). Second order barriers are internal to teachers and include teachers' attitudes, pedagogical beliefs, self-efficacy, and willingness to change instructional practice and classroom routines for technology integration (Cuban, 2018; Delgado et al., 2015; Ertmer, 1999; Ertmer & Ottenbreit-Leftwich, 2010; Mishra & Koehler, 2006). Often, teachers experience both first-order and second-order barriers to technology integration concurrently, thus

hindering their ability to integrate technology to support student achievement (Ertmer, 1999; Ertmer & Ottenbreit-Leftwich, 2010; NETP, 2016).

Although the research supporting the positive relationship between technology integration and student achievement is limited (Cuban, 2018; Delgado, et al., 2015; Escueta et al., 2017) and teachers face barriers to effective technology integration (Ertmer, 1999; Ertmer & Ottenbreit-Leftwich, 2010), education technology is still beneficial when used appropriately (Carver, 2016; Cheung & Slavin, 2013; Haelermans, Ghysels, & Prince, 2015; NETP, 2016). For example, certain forms of information technology can help students develop critical thinking skills because, through its access to multiple sources of information, it enables learners to think about a concept in several ways and in multiple contexts (Chai, Deng, Tsai, Koh, & Tsai, 2015; NETP, 2016). Technology can also increase student engagement by providing access to materials that students are interested in (NETP, 2016) by enabling multimedia presentations and providing multiple representations of ideas (Buckley & Doyle, 2016; Mayer, 2018). Education technology can also support student learning by enabling personalized learning experiences that are aligned to students' ability levels (Bouygues, 2019; Cheung & Slavin, 2013; Haelermans et al., 2015; NETP, 2016). Digital books, specialized websites and software, features such as text-to-speech, modifiable color contrast, and choice of different reading levels are some examples of various ways that different students can approach information through technology use to increase their learning (Bouygues, 2019; Gronseth et al., 2010; NETP, 2016). Technology can provide students with multiple means of assessment so that students can express what they know through online concept mapping, writing, video presentations, blogging, and by employing speech-to text programs (Gronseth et al., 2010; Gunn & Hollingsworth, 2013). The US Department of Education report that sets the national vision and plan for learning with technology is grounded

in the concept that, “Digital learning tools can offer more flexibility and learning supports than can traditional formats. Using mobile devices, laptops, and networked systems, educators are better able to personalize and customize learning experiences to align with the needs of each student”(NETP20, 2016, p. 19) . As such, if technology is integrated effectively, benefits to the student learning experience and achievement can be realized (NETP, 2016; Gronseth et al., 2010; Haelermans et al., 2015).

Teachers who use technology effectively in their classrooms employ technical, pedagogical, and content knowledge (TPACK) when teaching a particular subject to a particular student or group of students (Mishra & Koehler, 2006). Technical knowledge refers to the skills teachers need to operate digital tools, including operating systems, hardware, software, and various devices. Due to the fast-changing nature of technologies, teachers must be able to learn to use and adapt quickly to new digital tools (Mishra & Koehler, 2006). Pedagogical knowledge is the understanding of cognitive, developmental, and social learning theories and how they can be effectively applied to students to support their learning. Finally, content knowledge refers to the degree of knowledge a teacher has about a specific subject. Teachers who effectively integrate technology have a nuanced understanding of the intricate relationship between technology, pedagogy, and content, and use this understanding to create meaningful, student-centered, developmentally appropriate, content and context-specific teaching and learning strategies that incorporate digital tools (Howland, Jonassen, & Marra, 2014; Mishra & Koehler, 2006, 2007). However, many teachers continue to maintain traditional teacher-centered practices and do not consider TPACK when both planning and teaching with technology (Cuban, 2018; Cuban et al., 2001).

Besides TPACK, another indicator of effective technology integration is the degree to

which teachers incorporate the Community of Inquiry (CoI) framework into their instructional practice when teaching in online environments (Garrison, Anderson, & Archer, 2001). The CoI framework provides teachers with a structure to support their ability to effectively integrate technology into their instructional practice through attending to three components: social, cognitive, and teaching presence (Garrison, et al., 2001). Teaching presence is defined as the interaction with students that teachers engage in when moderating the cognitive and social processes (Garrison et al., 2001). The degree to which students feel both socially and emotionally connected to other participants, identify with the community, intentionally communicate, project their dispositions, and build relationships within the course is social presence (Garrison et al., 2001; Turner & Foss, 2018). The extent to which learners can construct and use evidence to verify their knowledge, participate in discourse, and engage in learning activities and reflection defines cognitive presence (Garrison et al., 2001; Vaughan & Garrison, 2005). The way in which teaching presence, social presence, and cognitive presence interact, during both synchronous and asynchronous instruction, can affect the learning of the student (Garrison, Cleveland-Innes, & Fung, 2010). Teachers who effectively use technology design and deliver lessons that facilitate the three presences and exhibit TPACK skills (Mishra & Koehler, 2006). However, many teachers resist changing their instructional practice (DeSantis, 2013; Mishra & Koehler, 2006; Tonduer, Van Braak, Ertmer, & Ottenbreit-Leftwich, 2017) because they feel that change is being done to them, rather than by them, and because they are often comfortable with their familiar routines (Fullan, 2009; Tondeur et al., 2017)

The Debate About Technology Integration

Over the last 40 years, the increasing use of education technologies in the classroom has triggered debates about the effect of technology integration on student learning (Clark, 1983;

Clark, 1994; Kozma, 1994). The Clark (1983, 1994) and Kozma (1994) debate is a testament to how long this complex issue has endured. Clark (1994) contended that "technology not only does not influence learning, but it will never influence learning, and that media is neither sufficient for nor necessary to learning" (p.23). From this perspective media is a vehicle through which instruction is delivered but does not influence learning (Clark, 1994). Kozma's (1991, 1994) counterargument delineated the multifaceted relationship between media, content, and the interaction of the student with the environment. Kozma (1994) contended that different media affect cognitive processes and structures and can be leveraged to support learning. Although technology and education technology have changed over the 30 years of this debate, the underlying theme regarding if and how media affects learning is still relevant today.

There is widespread opposition to technocentrist approaches to technology integration that view a technological device itself as the solution to instructional challenges and disregard the importance of pedagogical approaches to using technology in the classroom (Zinger, Tate, & Warschauer, 2017). However, there are still proponents of the technocentrist approach to technology integration that undermine the emphasis on pedagogy (Zinger et al., 2017). A recent technocentrist approach to technology integration occurred at the Los Angeles Unified School District (LAUSD) where a one-to-one iPad initiative was implemented, and 43,261 iPad were purchased for students (American Institute for Research, 2015). This initiative failed to support student achievement because professional learning focused on device management and ignored the importance of teaching practice and pedagogy. In these cases, the argument that technology improves student achievement was not upheld. However, if pedagogical factors that affect the success of technology integration on student achievement had been addressed, the other side of the debate may have been affirmed. As such, the debate about the effect of technology

integration on student learning and achievement persists and research should continue to explore the specific affordances education technologies can provide and evaluate the pedagogies that can support technology integration the most effectively.

The debate about the effect of education technology on student achievement is reflected in more recent research (Chueng & Slavin, 2013; Delgado et al., 2015; Escueta et al., 2017; OECD, 2015). Currently, there is an argument that education technologies impair student learning (Delgado et al., 2015; OECD, 2015) and an opposing argument that education technologies can moderately improve student achievement (Chueng & Slavin, 2013). The middle ground of this debate stems from evidence that there is not a major difference in outcomes of students who do and do not use education technology (Escueta et al., 2017; Reboot Foundation, 2019).

The effect of technology use on student achievement varies among grade levels, assessments, pedagogical practices of teachers, and the reported technologies that are being used (Bouygues, 2019: Means, 2010; U.S. Department of Education, 2016). The Reboot Foundation's report of student achievement in contexts where education technology is used supports both sides of the debate (Bouygues, 2019). Drawing on findings from an analysis of a large dataset from the Program for International Student Assessment (PISA) and the 2017 National Assessment of Educational Progress (NAEP) of the United States of America (USA), the Reboot report suggests there is "little evidence of a positive relationship between student performance on PISA and their self-reported use of technology, and some evidence of a negative impact" (Bouygues 2019, p. 2). Furthermore, after controlling for factors such as prior performance and wealth, findings suggest a negative relationship between students' performances on PISA and their reported use of technology. On the other hand, the data from NAEP on American students' achievement suggest

the importance of the pedagogical approach in which technology is used to increase student achievement.

Problem Of Practice Statement

The integration of technology into classrooms is a challenging undertaking and many education organizations and teachers have failed to effectively integrate technology to increase student achievement (OECD, 2020). The empirical evidence about the relationship between technology integration and student achievement (Chueng & Slavin, 2013; Delgado et al., 2015; Lim et al., 2013) highlights the complexity of effective technology integration into classrooms (Cuban, 2001; Ertmer, 1999; Mishra & Koehler, 2006). Factors that impact how technology is integrated into K-12 classrooms include policy mandates (Barbour et al., 2011; Lightfoot, 2013; World Bank, 2014), access to technology resources and infrastructure (Cuban, 2018; Francom, 2013; Ruggiero & Mong, 2015), institutional supports (An & Reigeluth, 2011; Lim et al., 2013; Tondeur, van Braak, Ertmer, & Ottenbreit-Leftwich, 2017), time for teachers to learn about and experiment with technology (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012; Mishra & Koehler, 2006; Pelgrum 2001) teachers' level of technology self-efficacy (Abbit, 2011; Ertmer, 2005; Ertmer & Ottenbreit-Leftwich, 2010; Miranda & Russel, 2011) quality of technology-related professional learning (Pittman & Gaines, 2015; OECD, 2015) and pedagogical approaches to technology integration (Archambault, Wetzel, Fougler, & Williams, 2010; Cuban, 2018; Delgado et al., 2015). The many factors that affect how technology is integrated into schools are evident in schools all over the world (Buckner, Chedda, & Kindreich, 2016; Cheung & Slavin, 2012; Delgado, et al., 2015; Escueta et al., 2017; OECD, 2015; OECD, 2020) and must be addressed to result in a positive relationship between student achievement and technology integration.

Theoretical Framework

The theory of first- and second-order barriers (Ertmer, 1999; Fullan & Stiegelbauer, 1991) to educational change provides a framework to explore factors that influence technology integration in schools. Ertmer (1999) defines first-and second- order barriers to technology integration as factors that impede effective technology use for teaching and learning. She categorizes first-order barriers as obstacles that are external to the teacher and second-order barriers as factors that are internal to the teacher.

In one of the earlier studies on barriers to change in education, Ertmer (1999) identifies first-order barriers such as technical and logistical issues, and second-order barriers including personal fears and pedagogical concerns, as obstacles affecting technology integration in teaching. Ertmer (1999) argues that "any one of these barriers alone can significantly impede meaningful classroom use" (p. 2). These first- and second-order barriers that affect teachers are important because teachers are vital to the change processes that occur in schools and teachers often choose to adopt, adapt, or reject an instructional reform such as technology integration (Ertmer, 1999). Table 1.1 represents first- and second-order barriers to technology integration.

Table 1.1

First- and Second-Order Barriers to Technology Integration (Ertmer, 1999)

First-Order Barriers	Second-Order Barriers
Access to technology	Teacher's knowledge about technology
Infrastructure to support technology	Teachers' technological skills
Institutional supports	Teachers' technology self-efficacy
Time to learn about with technology	Teachers' pedagogical beliefs
Time to learn experiment with technology	Teachers' willingness to change
Quality of professional learning	pedagogical practices
Quality and availability of digital resources	

First-order barriers. First-order barriers are the external factors that impede a teacher's ability to integrate technology such as the types and availability of resources, infrastructure to support technology use, time to learn about and experiment with technology, quality and duration of training, and institutional support (Ertmer, 1999). The first-order barriers are mostly about resources and as such, they are considered as the barriers that can be easily addressed (Ertmer, 1999). Through proper allocation of budget and resources, including digital tools and teacher professional development and support, effective technology integration may be realized (Ertmer, 1999; McLeod, Richardson, & Sauers, 2015)**.** However, the lack of resources or problems with access to and training support for resources often causes delays and other challenges in the integration process. In many cases, the elimination of first-order barriers reveals the second-order barriers (Ertmer, 1999).

Second-order barriers. Second-order barriers are internal to teachers and include teachers' attitudes, pedagogical beliefs, self-efficacy, and willingness to change regarding technology integration (Ertmer, 1999). Second-order barriers are more difficult to address than first-order ones, as they are deeply ingrained in educators, and teachers would not automatically integrate technology in their classes even if the first order barriers were removed (Brickner, 1995; Ertmer, 1999). Since effective technology use requires a shift in pedagogical approaches (Ertmer, 1999), curriculum implementation (Harris & Hofer, 2011), and classroom management (Cuban, 2003) teachers often face difficulties in implementing technology in meaningful ways (Howland et al., 2014; Ertmer & Ottenbreit-Leftwich, 2010). Thus, both first- and second-order barriers contribute to the technology integration process, but-second order barriers often present the most critical challenges (Ertmer, 1999).

Literature Review

The adoption of educational technology into schools has not always translated into meaningful learning in the classroom (Cuban et al., 2001; Ertmer, 2005) because of first- and second-order barriers. First-order barriers to technology integration such as unclear external mandates, lack of time to learn about technology, teacher attrition, the international environment, and inadequate professional learning need to be overcome for teachers to integrate technology to increase student achievement (Cuban et al., 2001; Ertmer, 1999; Lightfoot, 2013; Tondeur et al., 2017). Additionally, technology use as an integral component of instruction may require teachers to overcome second-order barriers to technology integration such as altering their levels of confidence with technology and shifting their pedagogical practices, beliefs, and attitudes about using technology as an instructional tool (Ertmer, 1999, Ertmer & Ottenbreit-Leftwich, 2010, Mishra & Koehler, 2006). It is important for teachers to engage in pedagogical approaches where meaningful learning with technology takes place and includes learning tasks that are intentional, constructive, authentic, collaborative, and active for students (Howland et al., 2014). For this to happen, teachers need to be provided with support to overcome both first-order and second-order barriers to technology integration. This literature review discusses how first- and second-order barriers affect the integration of technology into schools both globally and in the United Arab Emirates (UAE). The focus on the UAE is of particular importance to the researcher because Dubai (a city in the UAE) has been her home and place of work for 13 years.

First-order barriers to technology integration. First-order barriers to technology integration exist in K-12 schools throughout the world (OECD, 2015). The first-order barriers that will be addressed in this section include unclear policy mandates, standardized tests, school culture, teacher turnover, lack of time to learn about technology, and inadequate professional

learning. These barriers were specifically selected due to their prevalence globally and within the context of the United Arab Emirates.

The United Arab Emirates Vision 2021. The UAE Vision 2021 (2010) is a national strategic plan to reform the social and economic development of UAE citizens by improving sectors such as education, and manifests as one of the first-order barriers to education technology integration. The UAE Vision 2021 mandates within the education sector are aimed at increasing student achievement, however they are a challenge to accomplish due to the lack of a definition of education technology, a strategy to integrate education technology to increase student achievement, and a focus on standardized tests as a measure of success. These factors are external to the teachers who are tasked with the mandate and represent first-order barriers to technology integration.

Smart systems integration into all UAE classrooms. One of the mandates of the Vision 2021 (2010) is to integrate smart systems into all classrooms as a basis for all teaching methods to help the UAE reach its goal of developing a first-rate education system. This mandate manifests as a first order barrier to technology integration, one that is external to the teacher, because there is no definition of what smart systems are. The UAE Vision 2021 (2021) states:

> Education is a fundamental element for the development of a nation and the best investment in its youth. For that reason, the UAE Vision 2021 National Agenda emphasizes the development of a first-rate education system, which will require a complete transformation of the current education system and teaching methods. The National Agenda aims for all schools, universities, and students to be equipped with smart systems and devices as a basis for all teaching methods, projects, and research. (2010**,** First rate education system, ¶ 1.)

According to The European Technology Platform on Smart Systems Integration (EPoSS) smart systems are "an assembly of technologies that build products from components, that combine functions in products and systems, that connect and network systems to other systems, and, importantly, enable systems to receive and store a 'knowledge base' – the software that makes them 'Smart'" (EPoSS, 2020,). The sectors that most commonly integrate smart systems are transportation, healthcare, manufacturing, energy, natural resources, and security (EPoSS, 2020). The UAE Vision 2021 (2011) does not specify its definition of smart systems and therefore administrators and teachers may be confused about what technology to acquire and how to integrate it. For the purposes of this dissertation, smart systems will be referred to as education technology, which is the hardware and software used in classrooms for the purposes of teaching and learning (Cuban et al., 2001; Delgado, 2015). This definition integrates the EPoSS (2020) definition of smart systems into education because it recognizes the importance of using hardware and software to support learning, connect to networks and the internet, and to access a knowledge base.

Education technology policy. Education policy is the compilation of laws and rules that regulate the operation of school systems (Barbour et al., 2011). Because education policy is decided on a federal level, it can manifest as a first-order barrier to technology integration because teachers have no input into or control over the policy (Ertmer, 1999). The integration of technology into schools has been an essential element of education policy in the U.S. since a government funded report entitled *A Nation at Risk* (1983) recommended that computer science be added to school curricula. Since the time of this report. the recommendation to include computer science into school curricula was and still is an area of education policy focus in the U.S. and in other countries throughout the globe (Barbour et al., 2011; Zhao, Tondeur, Chai, &

Tsai, 2015). Over the last 40 years countries around the world have created federal policy to promote the integration of education technology into K-12 schools (Barbour et al., 2011; Culp et al., 2005; Lightfoot, 2013).

Although education technology reforms have been at the forefront of education policy, these policies tend to be general and focus on the amount of devices required in schools, access to software and the internet, connectivity, and infrastructure (Barbour et al., 2011; Culp et al., 2005). As such, policy about education technology neglects to understand the needs and capacity of individual school systems and teachers, present evidence-based research that guides technology integration to improve teaching and learning in similar contexts, and monitor the effects of technology implementations before they are scaled up (Culp et al., 2005; Zhao et al., 2015). These policies demand schools integrate technology but do not provide educators with how-to knowledge about effective technology integration (Lightfoot, 2013; Zhao et al., 2015). On the local level, schools are responding to federal education technology policy and mandates without context specific guidance and knowledge about how to effectively integrate technology into their context (Barbour et al., 2011; Culp et al., 2005; Zhao et al., 2015). Therefore, education technology policy manifests as a first-order barrier to technology integration in many parts of the world.

Education technology policy in the UAE. Another first-order barrier manifested by the Vision 2021 is that there are no strategies or recommendations regarding how to integrate education technology into schools. Education technology integration decisions are being made by the administrators at the Ministry of Education (Ministry of Education, 2015) and individual private international schools (KHDA, 2019) who have not been provided with the knowledge of what education technology is and a strategy about how to use it. The UAE Computer Science

and Technology Standards (Ministry of Education, 2015) is a 280-page document that focuses on grade-span learning expectations and outcomes about computer science skills. However, the document does not provide guidance about the technological and pedagogical skills needed for teaching with technology to improve student-outcomes.

Providing educators with 'how-to' guidance leads to high-quality technology integration in classrooms (Howland et al., 2014). This how-to guidance includes identifying the kinds and amount of digital tools available, the technological skillset of the students and teachers, the pedagogical practices of teachers, and teachers' beliefs about education technology use (Desantis, 2013; Ertmer & Ottenbreit-Leftwich, 2010; Howland et al., 2014; McLeod et al., 2015). Once these factors are identified, administrators can develop a continuous professional learning plan for teachers that focuses on their technological, pedagogical, and content knowledge skills (Curwood, 2011; Mishra & Koehler, 2006; Zinger et al., 2017). The professional learning will provide teachers with a systematic and evidence-based strategy for planning technology integrated instruction to help them overcome barriers to technology integration (Thoma, Hutchison, Johnson, Johnson, & Stromer, 2017). However, teachers in the UAE face barriers to technology integration because the UAE Vision 2021 (2010) requires schools to integrate education technology to help achieve a first-rate education system but does not provide a strategy or guidance regarding how to use it.

Standardized tests. Teachers identify standardized tests as one of the major barriers to technology integration (Ertmer et al., 2012; Hew & Brush, 2007). A study investigated teachers' beliefs and practices regarding technology use and aimed to determine barriers to technology integration (Ertmer et al., 2012). Twelve K-12 teachers, selected due to their award-winning classroom technology use, participated in observations and interviews about their instructional

practice. The findings suggested that because of the emphasis on standardized tests, teachers are slow to adopt new education technology and the pedagogical practices needed to use them effectively. Similarly, a meta-analysis of 48 studies conducted in K-12 schools regarding (Hew & Brush, 2007) identified standardized testing as a barrier to technology integration in multiple contexts because the pressure to perform well on these tests detracted teachers from taking the time to try new digital tools and instructional methods to support effective technology use. As such, the emphasis on standardized tests impedes effective technology integration because teachers focus their time on improving students' test scores rather than learning to use technology to support instruction.

Standardized tests as a measure of technology integration. The UAE Vision 2021 (2010) also represents a first-order barrier to technology integration because of its emphasis on standardized test scores. Eight of the 13 key performance indicators (KPI) in the Vision 2021 use international standardized tests to track progress towards gaining a first-rate education system (UAE Vision 2021, 2010) whereas no KPI is included to measure progress with technology integration. These tests include the Trends in International Math and Science Study (TIMMS; TIMSS & PIRLS International Study Center, 2020) and Program for International Assessment (PISA; OECD, 2016). The UAE Vision 2021 (2010) "has set as a target that our students rank among the best in the world in reading, mathematics and science exams" (First Rate Education System, Para 2) as measured by international standardized test scores. Given the emphasis on standardized test scores, educators in the UAE may have difficulty integrating technology effectively because their priority is to improve students' scores**.** Also, the focus on standardized test scores (UAE Vision 2021, 2010) may detract professional development effectively (Ertmer et al., 2012; Hew & Brush, 2007).

The UAE Vision 2021 (2010) has placed pressure on both public and private school operators, administrators, and teachers to implement and oversee technology without the guidance that is needed for educators to learn how to use technology to support instructional practice that promotes student achievement. This lack of technology integration strategy and guidance has translated into policy documents aimed to measure and support the quality of education in the UAE that disregard meaningful technology use. As such, first-order barriers to technology integration have emerged.

School culture. Throughout the world teachers and students within schools are becoming more culturally diverse (OECD, 2015). The culture of a school is framed by two levels, *school* culture and *national* culture, and their effect on education reform (Bray, 2014; Ertmer & Ottenbreit-Leftwich, 2010; Fullan, 2009). School culture relates to "existing values, beliefs, and practices of the teachers and administrators in the school" (Ertmer & Ottenbreit-Leftwich, 2010, p.264). Culture can also be defined in terms of national culture (Bray, 2014; Hofstede, 1993; Taylor, 2017), which are the deeply internalized beliefs and values that are shared and normalized by the majority of individuals in a culture, which were learned in early childhood (Hofstede, 1993). Although teachers contribute to their school culture, for the purposes of this section, school culture will be considered a first-order barrier to technology integration because the culture of the school lies outside of the teacher.

The national cultural differences of educators within a school may inhibit technology integration progress because of differences in the way people respond to change are often grounded in their national culture (Bray, 2014; Wink, 2011). Teachers from different national cultural groups vary in their beliefs and attitudes towards education technology integration (Almekhalfi & Almeqdadi, 2010; Bray, 2014). National cultural differences can instigate

misunderstandings, conflicts, and grievances when people from various cultural backgrounds interact (Banks et al., 2001).

Teachers from diverse national cultures may have challenges forming a positive school culture which is necessary to effectively implement reforms (Banks, 2014; Wink, 2011). A positive school culture is one where individuals feel valued and respected, that supports collaboration, and recognizes teachers as primary developers of school culture (York-Barr & Duke, 2004). Effective technology integration is more likely to occur in schools with a positive school culture (Zhao & Frank, 2003) where staff share beliefs, values, and instructional practices regarding technology integration. A study examined school technology uses and how various factors, including a positive school culture, may affect technology use in schools (Zhao & Frank, 2003). Data collection focused on teacher beliefs regarding technology, policy, technology infrastructure, and investment. The results derived from surveys, staff interviews, and observations indicated that teachers were more likely to integrate technology into their practice in a positive school culture with shared beliefs.

School culture in the UAE. The various national cultures within private international schools in Dubai (Abu Dhabi Statistics Center, 2020) may impede the development of the positive school culture needed to effectively integrate technology (Ertmer, 1999; Zhao & Frank, 2003) and thus both national and school culture appear as a first-order barrier to technology integration. The dominance of expatriate educators in private international schools in the UAE makes the education sector an international environment that accentuates first-order barriers to technology integration. The teaching population within the 580 English speaking international schools in the UAE (ISC Research, 2022) is very diverse and very few teachers are Emirati (Abu

Dhabi Statistics Center, 2022). Table 1.2 represents the number of private international schools in Dubai and Abu Dhabi and their respective proportions of Emirati and expatriate teachers.

Table 1.2

The International Education Environment of Dubai and Abu Dhabi 2021-2022

Emirate	Number of Private International Schools	Population of Emirati Teachers	Population of Expatriate Teachers
Dubai	281	29	19,946
Abu Dhabi	151	286	28,045

Given the international context of UAE, both the culture of a school and the national culture of the UAE may manifest as a first-order barrier to technology integration.

Teacher turnover. A first-order barrier to technology integration is a high rate of teacher turnover, which can interrupt the quality of school performance (Darling-Hammond, 2003; Ingersoll, 2001). Teacher turnover, often described as a *revolving door*, is defined as the rate of teachers who leave a school each year (Ladd & Sorenson, 2019). Teacher turnover can contribute to an inequitable distribution of high-quality teachers (Ingersoll, 2001), and can negatively impact student outcomes (Ronfeldt, Loeb, & Wyckoff, 2017). If a school is attempting to integrate technology into their curriculum as a mechanism for teaching and learning, the effectiveness of this integration is likely to be affected by the teachers who come and go each year (Ingersoll, 2001; Ronfeldt et al., 2013). Teachers who are adept at teaching meaningfully with technology may be among the leaving teachers, thus taking their skills and ability to help other teachers adapt to a new teaching environment and therefore, teacher turnover appears as a first-order barrier to technology integration.

Teacher turnover also affects the instructional program coherence of the school (Ronfeldt et al., 2013). When teachers leave a school the organizational knowledge necessary for the effective implementation of an instructional program that integrates technology to meet its goals goes with them. Additionally, incoming teachers may lack the critical skills and knowledge to implement an instructional program that is necessary to maintain instructional program coherence (Ingersoll, 2001; Ronfeldt et al., 2013). This manifests as a first-order barrier because the organizational knowledge carried by the highly skilled teachers is no longer available to the school or the teachers learning the technology skills.

Teacher turnover in the UAE. High teacher turnover rates in private international schools and public schools may negatively affect the overall quality of education in the UAE (Buckner et al., 2016). Although the rate of teacher turnover is difficult to assess in private international schools in Dubai due to lack of public data, several researchers assert that teacher turnover is extremely high (Ahmed, 2011; Alkheyli & van Ewijk, 2018; Mancuso, Roberts, & White, 2010). Mancuso et al. (2010) reported an average teacher turnover rate of 17% for teachers in American curriculum private international schools in the Middle East and South Asia from 2006-2009, with some schools experiencing 60% teacher turnover. Ahmed (2011) reported a 60% teacher turnover rate at some private international schools in Dubai between the years 2010 and 2011. A more recent report by the OECD (2015) shows that the UAE continues to grapple with high teacher turnover rates. Because of the persistent and high rates of yearly teacher turnover in UAE (OECD, 2015), schools and teachers are likely to be continuously starting over rather than making progress on the integration of instructional programs that incorporate technology. A lack of progress on program implementation affects the design and delivery of long-term professional development programs aimed to help teachers integrate

technology in meaningful ways (Desimone, 2009). Instructional program coherence that relies on technology use will be difficult to sustain if the teaching population of the school is changing year by year.

Amount of time to integrate technology. Time appears as a first-order barrier to teacher technology integration in studies conducted throughout the world. Adequate time is needed for teachers to learn about technology (Ertmer et al., 2012; Pelgrum, 2001; Zinger et al., 2017), enhance their technical skills (Curwood, 2011; Kopcha, 2012) participate in technology related professional development (Almekhlafi & Almeqdadi, 2010; Kopcha, 2012), integrate technology into curricula (Pelgrum, 2001: Tabari, 2014) and shift their pedagogy to include technology in meaningful ways (Ertmer, 1999; Howland et al., 2014; Ibrahim et al., 2013). Teachers in the UAE report a lack of time to implement educational reforms, including technology integration, and therefore time appears as another first-order barrier to technology integration.

Time to learn about and plan with technology. When teachers are not given enough time to learn about and plan with technology another first-order barrier emerges (Ertmer et al., 2012; Mishra & Koehler, 2006; Pelgrum 2001). Time is described as the number of hours scheduled for teachers to learn how to use technology (Ertmer et al., 2012; Pelgrum, 2001; Zinger et al., 2017), plan lessons that use technology (Kopcha, 2012; Lim & Khine, 2006) and shift pedagogical approaches to integrate digital tools into teaching (Ertmer, 1999; Lim & Khine, 2006; Kopcha, 2012).

Insufficient teacher time to learn about and plan with technology was found as an important first-order barrier to technology integration based on teachers' perceptions (Lim & Khine, 2006; Pelgrum, 2001; Rohanna, 2017). A large-scale investigation, including participants from 26 countries, aimed to identify educators' perceptions regarding obstacles to the technology

integration goals of their schools (Pelgrum, 2001). The survey, administered to national representative sample of primary, lower secondary, and upper secondary schools, addressed technology integration topics including curriculum, infrastructure, staff development, management and organization, and innovative practices. Participants reported that lack of time affected the quality of curriculum development, staff development, and innovative practices regarding technology integration.

Lim and Khine (2006) also identified lack of time as a barrier to technology integration through a collective case study approach that incorporated classroom observations and interviews to identify first and second-order barriers to technology integration (Lim & Khine, 2006) in four Singapore schools. Results show that teachers needed more time to prepare lessons that use digital tools than lessons that do not use digital tools. Also, teachers indicated that it takes time to apply the technical skills they learned in workshops into a pedagogical practice that can be integrated into curriculum. Therefore, teachers need more time to effectively integrate technology by participating in technology related professional learning activities that enhance their technical skills and pedagogical skills (Lim & Khine, 2006; Mishra & Koehler, 2006; Kopcha, 2012).

Time to train teachers. The lack of time invested in training teachers on technical skills and instructional practices is one of the main reasons for the failure of technology integration programs (Kopcha, 2012; Schnellert, Butler, & Higginson, 2008; Zinger et al., 2017). With the Los Angeles Unified School District (American Institute for Research, 2015) one-to-one iPad initiative, described earlier, teachers only partook in two or three days of training and had very limited time to practice the skills learned in training. If teachers are not given the time to learn about technology and reflect on their learning through practice and planning, they may be less

likely to benefit from professional learning activities (Kopcha, 2012; Schnellert et al., 2008).

Lack of time in the UAE. Teachers in the UAE also report lack of time as a barrier to technology integration (Almekhalfi & Almeqdadi, 2010). Almekhalfi and Almeqdadi (2010) investigated factors affecting education technology implementation in the UAE. Teacher participants completed a questionnaire about their self-perceptions of their technology ability, student use of technology, problems impeding technology integration, and incentives that encourage technology integration. Additionally, 20 teachers expressed their perceptions of technology integration during focus group interviews. Results indicated that teachers who are not provided with enough release time to attend technology integration related professional development and to plan for effective technology use perceive lack of time as a major obstacle that impedes technology integration.

Pre-service training and in-service professional learning. Teacher preparation and professional learning programs are a first-order barrier to technology integration because they are not always successful in preparing teachers to effectively use technology to improve student achievement (NETP, 2016). Current education technology training focuses on providing access to technology and technical skills rather than preparing teachers to effectively use technology as an instructional tool or to select engaging and relevant content (NETP, 2016). Until pre-service and in-service training provides high-quality professional learning (Desimone, 2009) and focuses not only on technical skills but pedagogical skills (Mishra & Koehler, 2006), this first-order barrier is likely to continue.

Pre-service teacher training programs. Teacher education programs do not prepare future teachers to effectively use technology in their classrooms (Darling-Hammond, 2012; Starkey, 2020; Tondeur, Roblin, van Braak, Voogt, & Prestridge, 2017). Modern teacher

education programs do not provide future teachers with teaching with technology experiences that are integrated throughout the curriculum (NETP, 2016; Tondeur et al., 2017) and are not informed by empirical evidence from research about how to effectively teach with technology (Darling-Hammond, 2012). If pre-service teachers continue to receive their professional training in this fashion, inadequate teacher education programs may persist as a first-order barrier to technology integration.

The empirical research does not reach a consensus about what technology integration teaching methods facilitate student achievement in schools (Delgado et al., 2015; Kaufman, 2014) and no single coherent group of technology competencies exist to guide teacher educators' development of curricula for teaching the pedagogical beliefs and skills that future teachers need to effectively integrate technology (Graziano, Fougler, Schmidt-Crawford, Slykhuis, 2017; Tonduer, et al., 2017). Although the National Education Technology Program (NETP, 2016) and the International Society for Technology Education (ISTE, 2019) provide frameworks and standards for technology use in schools, these agencies do not provide frameworks or standards for how teacher educators can instruct pre-service teachers to use technology to increase student achievement. Institutions that prepare teachers rarely work with each other to co-create an evidence-based framework for preparing teachers to use technology as an instructional tool to support learning (Kaufman, 2014). Because of this, pre-service teacher training programs may continue to manifest as a first-order barrier to technology integration.

In addition to the lack of teacher-education technology framework, the frequently changing nature of education technology (Escueta et al., 2017; Hall, 2010) also inhibits teachers from developing and implementing a curriculum that can provide pre-service teachers with the skills they need to teach effectively with technology (Kaufman, 2014). Faculty at teacher

education programs struggle to stay abreast of best practices with recent education technologies because they rapidly change (Gronseth et al., 2010; Kaufman, 2014). If faculty at teacher education programs can't gain expertise with certain education technologies (Kaufman, 2014), it is unlikely they will be able provide students with the knowledge they need to effectively integrate these technologies. Until teacher education programs consistently provide instruction about a coherent group of technology competencies that teachers should acquire to be effective technology integrators, this first-order barrier will remain.

In-service professional learning. In-service professional learning (PL) can be a first-order barrier to effective technology integration when it is not sustained over time (Desimone, 2009), does not connect technology use to actual classroom curricula and practice (Kaufman, 2014; Zinger et al., 2017) and when it concentrates solely on technical skills (Kopcha, 2012; Mishra & Koehler, 2006). Professional learning that is provided to teachers tends to be short-term (Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009) which precludes it from altering teachers' existing beliefs about technology and the reinforcement of learning through on-going follow-up (Tondeur et al., 2017). A 2009 review of a status report of teacher development in the US claimed that "most professional development for teachers comes in the form of occasional workshops, typically lasting less than a day, each one focusing on discrete topics with their connection to the classroom left to teachers' imaginations" (Darling-Hammond et al., 2009, p. 44). A more recent study suggests (Desimone & Garet, 2015) that teachers in other developed countries face similar obstacles to effective teacher PL as the ones faced teachers in the US.

A meta-analysis of 1300 studies of PL analyzed amount of time for in-service professional learning and found that teachers who received 49 contact hours of PL on average, positively affected their students' learning (Guskey& Yoon, 2009). This same research indicated,

however, that 93% of American school districts participating in government-funded PL received an average of 25 contact hours of PL, with a median score of 15 hours. The limited hours that teachers engage in professional learning may manifest as a first-order barrier to technology integration because they may not be provided with enough time to acquire the technological and pedagogical skills needed to use technology effectively.

Technology-related professional learning (PL) can be less than adequate for effective technology integration in classrooms because the content of the PL may not address teacher technology-related needs (Pittman & Gaines, 2015). A study investigated the effect of PL on the technology use of 75 elementary school teachers in Florida (Pittman and Gaines, 2015). Survey results suggest that 13% of teachers who did not participate in technology-focused PL reported technology use, whereas 47% of teachers who partook in PL reported technology use in classrooms. However, results also indicated that most survey respondents indicated their PL was not useful because it lacked "tailored professional development or mentoring experiences illustrating specific strategies for technology integration designed to be immediately adopted into the classroom (Pittman & Gaines, 2015, p. 548).

The effects of PL on technology integration in the Middle East as well as in the UAE is scarce, however the research that exists show that the content of PL does not address teachers' technology-related needs (AlKhatani, 2017). A study in four public schools in Saudi Arabia investigated teacher challenges to technology integration and found that PL opportunities for teachers to develop effective technology integration skills are inadequate (AlKhatani, 2017). Eleven teachers and five principals completed a survey and participated in focus-group interviews. Results from this study suggest that teachers who participated in this study found technology related PL programs were too theoretical and focused on computer programming

rather than computer literacy skills. In an earlier study, AlKhatani (2009) found that a lack of availability of and irrelevant professional learning is one of the major barriers to teachers' effective technology integration.

Teacher training programs in the UAE. Teachers in Abu Dhabi are not being provided with the PL experiences necessary to effectively integrate technology into their classrooms (Almekhlafi & Almeqdadi, 2010). A study investigated teachers' perceptions of technology integration in K-12 Abu Dhabi schools (Almekhlafi & Almeqdadi, 2010). Researchers distributed a survey to 100 teachers and conducted focus group interviews with 20 purposively selected teachers. Results indicated that a lack of training on how to integrate technology effectively is among the problems that teachers encountered. Teachers reported that they "depend on self-learning" (Almekhlafi & Almeqdadi, 2010, p. 169) and that "schools should provide teachers with affordable and/or free professional development subjects" focusing on technology integration (Almekhlafi & Almeqdadi 2010, p. 170).

More recently, a general study of PL in the UAE suggested that it was repetitive in content, not engaging, and did not align to teachers' specific curriculum and pedagogical needs (Buckner et al., 2016). Researchers triangulated data from the 2015 TALIS survey (OECD, 2015) and interviews with 20 public school teachers (Buckner et al., 2016). Teachers at these schools commented on the irrelevance of the training they received, and one stated that "we want training that has a direct relationship to our teaching. We need something directly related to the curriculum; a lot of training has little relevance" (p.7). Another teacher indicated that the style of professional development "treats those with 15-20 years of experience the same as they do little experience" (p. 6). Another participant commented, "we have to sit and listen to things that are repeated over and over" (p. 6). Considering the complexity of technology integration and the

necessity of technological and pedagogical skills (Mishra & Koehler, 2006), this kind of irrelevant, redundant, and undifferentiated PL that is typical in the UAE is likely to be inadequate in preparing teachers to integrate technology effectively.

Collaboration between schools in Dubai rarely occurs and therefore schools that may be integrating technology effectively are not sharing knowledge and skills with schools that are not integrating technology effectively (World Bank, 2019). High-quality professional learning (PL) includes frequent opportunities for teacher collaboration by allowing teachers to share ideas and work together in their learning (Darling-Hammond, Hyler, & Gardner, 2017). A report entitled "Collaboration Road: Dubai's Journey towards Improved School Quality" (World Bank, 2019) examined an ongoing Knowledge and Human Development Authority (KHDA) initiative that encourages schools to collaborate with each other and provides free events where teachers from different schools can network and learn from experts. Researchers collected surveys from 331 teachers and 39 school leaders across private international schools in Dubai, to examine the amount of collaboration within and between schools (World Bank, 2019). Over 90 percent of teachers reported that they frequently discuss teaching practices with other teachers at their schools and 50% reported that their school administrators arrange a network of teachers and mentors within their school context. Also, just 56% of teachers reported that they have individually, or as part of their school, attended an event organized by the KHDA since 2014. These results are important because they suggest that most of the collaboration that occurs between teachers happens inside of their own school. As such, it is unlikely that the private international schools in Dubai that need to collaborate with schools that use technology effectively are not participating in or enabling opportunities to do so. Therefore, the lack of

collaboration between schools, as an aspect of PL, persists as a first-order barrier to technology integration.

Second-order barriers to technology integration. First- and second-order barriers contribute to the technology integration process, but second-order barriers often present the most difficult challenges (Ertmer, 1999). Second-order barriers are more difficult to address than first-order ones, because they are deeply ingrained in educators, and educators would not automatically integrate technology in their classes even if the first-order barriers did not exist (Brickner, 1995; Ertmer, 1999). Teachers' technology beliefs and attitudes, self-efficacy, pedagogical beliefs, and workplace stress are the second-order barriers discussed in this section.

Technology beliefs and attitudes. Teachers' beliefs manifest as second-order barriers to education technology integration because they are a critical factor in determining whether or how teachers integrate technology into their classrooms (Ertmer & Ottenbreit-Leftwich, 2012; Hew & Brush, 2007; Inan & Lowther, 2009). Teachers who do not use technology as part of instruction report lacking technical skills to use technology effectively (Becker, 2000), express doubt regarding the benefits of technology for instruction (Miranda & Russell, 2012) and report low levels of confidence with their ability to use education technology (DeSantis 2013; Wang, Ertmer, & Newby, 2004). These three attitudes interact and contribute to teachers' effectiveness in integrating technology into the classroom (Miranda & Russell, 2012; Tondeur et al., 2017).

Teachers who use technology frequently and value technology as an instructional tool are more likely to incorporate it into their lessons (Miranda & Russell, 2012). Miranda and Russell (2012) investigated teacher-level factors which have the greatest effect on teachers' use of education technology and how these factors interact to affect teachers' use of education technology Survey results from 1,040 elementary school teachers from 81 schools in 21 school

districts in Massachusetts indicated that teachers who are experienced with technology and believe it is important to instruction are more likely to use it in the classroom as compared to teachers who do not share these beliefs. Furthermore, data showed that there is a large effect between teachers' perceived importance of using technology for instruction and their experience with technology. That is, "as teachers use technology more often, they begin to value technology more as an instructional tool and as their perceived importance of IT for instruction increases; they are more likely to guide their students to use technology (Miranda & Russell, 2012, p. 663).

Miranda and Russell (2012) also found that teachers who have more experience with technology have higher technology self-efficacy. This finding suggests that teachers' confidence may be a moderating variable between experience and perceived importance of technology use for instruction. This is important because teachers who perceive that their ability to use technology as an instructional tool is low, are less likely to use it and are more likely to be challenged by this second-order barrier (Ertmer & Ottenbreit-Leftwich, 2010; Parkman, Litz, & Gromik, 2018; Wang et al.,2004).

Self-efficacy. A contributing factor to teachers' beliefs about education technology use is their level of self-efficacy (Ertmer, 2005; Parkman et al.,2018). Self-efficacy refers to a person's perception about their ability to successfully complete a task (Bandura, 1982). People with high self-efficacy are motivated, excel at complex tasks, plan tasks successfully, and are excited by challenges (Abbitt, 2011; Bandura, 1982). Teachers with high levels of technology self-efficacy feel confident that they can integrate technology effectively into their classrooms for instruction (Albion, 2001; Wang et al., 2004) and use it more frequently than teachers with low levels of technology self-efficacy (Miranda & Russell, 2011).

Teachers who have low self-efficacy regarding using technology as an instructional tool use it less frequently (Hechter & Vernette, 2013; Miranda & Russell, 2012). Miranda and Russell (2012) discovered that when a technology failure occurred, the issue of infrequent use was compounded; teachers with low self-efficacy were even less likely to use technology in the future. Thus, the experience of technology failure may decrease teacher's comfort levels with using technology and perceptions of technology self-efficacy which may result in decreased classroom technology integration (Hechter & Vernette, 2013) and negatively impact beliefs that technology is beneficial for instruction (Miranda & Russell, 2011). As such, self-efficacy appears as a second-order barrier to technology integration.

Teachers in Dubai may not have sufficient opportunities to engage in technology mastery experiences to increase their technology self-efficacy due to first-order barriers that include time (Ibrahim et al., 2013; Tabari, 2014), quality and content of professional development (Buckner et al., 2016), and attrition of teachers with technology integration expertise (Ahmed, 2011). Self-efficacy can be increased through mastery and vicarious experiences, positive emotional and physiological states, and social influences. Among these factors, mastery experiences are the most effective in enhancing self-efficacy (Bandura, 1982). Education technology mastery experiences can occur when teachers are provided with the time (Ertmer et al., 2012) and training (Buckner et al., 2016) necessary to build technical and pedagogical knowledge (Mishra Koehler, 2006) and the opportunity to collaborate with other teachers that result in a successful experience using technology in the classroom. However, many teachers in Dubai may not have access to these provisions (Almekhlafi & Almeqdadi, 2010; Buckner et al., 2016; Ibrahim et al., 2013) and therefore low levels of technology self-efficacy are likely to persist as a second-order barrier to technology integration.

Pedagogical beliefs. Teachers' pedagogical beliefs about technology can manifest as second-order barrier to technology integration (Ertmer et al., 2012; Koehler et al., 2007; Tondeur et al., 2017). Pedagogical beliefs are teachers' beliefs about their roles as educators, methods of providing instruction, and how students learn (Ertmer 2005). Teachers' pedagogical beliefs about technology refer to the attitudes and values teachers hold about the role of technology in the classroom, its effectiveness for teaching, and how learning occurs through its use (Ertmer & Ottenbreit-Leftwich, 2012; Tondeur et al., 2017). Teachers whose pedagogical beliefs do not support the use of technology to enhance student achievement are less likely to effectively integrate technology (Kopcha, 2012; Tondeur et al., 2017).

Teacher-centered and student-centered pedagogical beliefs. Teacher-centered beliefs and instructional practices are a second-order barriers to technology integration because these beliefs may impede effective classroom technology use (Ertmer et al., 2012; Harris & Hofer, 2011; Hsu, 2016). Within the field of educational technology, two categories of teachers' beliefs about pedagogy have been delineated: student-centered beliefs and teacher-centered beliefs (Cuban et al., 2001: Ertmer & Ottenbreit-Leftwich, 2010; Liu, 2011). Teacher-centered beliefs assume that delivery of knowledge from teacher to student, through repetition and memorization, where the teacher acts as the authority in a tightly controlled and structured classroom environment is best practice (Ertmer & Ottenbreit-Leftwich, 2010; Tondeur et al., 2017). In contrast, student-centered pedagogy emphasizes the contexts and interests of individual students (Ertmer & Newby, 1999) and places the responsibility to learn on students through active experiences that enable them to construct knowledge (Ertmer & Ottenbreit-Leftwich, 2010; OECD, 2009; Tondeur et al., 2017). Teachers who espouse student-centered pedagogical beliefs are more likely to effectively integrate technology into the classroom (Ertmer 2005; Ravitz et al.,

2001; Hsu, 2016; Tondeur et al., 2017) because it is a tool that can facilitate knowledge construction (An & Reigeluth, 2011; Harris & Hofer, 2011).

Teachers who practice teacher-centered pedagogy often perceive technology as inessential to the teaching and learning process (Tondeur et al., 2017) and implement technology into their classrooms in a low-level way that does not reflect best practices (Cuban et al., 2001; Ertmer & Ottenbreit-Leftwich, 2010). Low-level use consists of using technology for word processing, presentations, and internet searchers (Becker, 2001; Cuban et al., 2001) and typically sustains teachers' existing teacher-centered practices (Ertmer & Ottenbreit-Leftwich, 2010). Teachers with student-centered beliefs, on the other hand, may exhibit high-level uses of technology by employing it as interactive tool to retrieve and synthesize information and to help students develop critical thinking and problem-solving skills (Lowther, Inan, Ross, & Strahl, 2012; Tondeur et al., 2017).

Teacher-centered approaches to instruction are less compatible with technology integration than student-centered approaches where the teachers act as a facilitator. A study investigated barriers to technology integration among 152 elementary school teachers in the Midwest United States (Hsu, 2016). Researchers distributed a survey to 152 teachers and conducted interviews and observations with eight teachers. Findings suggest that education technology can enable student-centered learning that enables students to facilitate their own learning and independently conduct research (Ertmer et al., 2012) whereas teacher-centered instruction inhibits students from doing so. That is, teachers who are student-centered in their pedagogy are more likely to integrate technology in ways to students that support their learning (Hsu, 2016).

Similar studies found that teachers who espouse teacher-centered pedagogical beliefs are

less likely to effectively integrate technology into the classroom to support student achievement (Hsu, 2016; Lowther et al., 2012; Tondeur et al., 2017). An examination of the Michigan Freedom to Learn project showed that technology integration, when coupled with teacher professional learning that supports student-centered teaching, was associated with increases in critical thinking and problem-solving skills of students. This study investigated what strategies teachers employed during the integration of over 20,000 laptops into 82 schools and if computer integration affected student achievement (Lowther et al., 2012). Three hundred and eighty teachers and 5,770 students from 90 schools completed online surveys and 599 classrooms in 82 schools were observed to assess how teachers were using technology, how often they used technology in a lesson, and if student achievement was affected by technology use. Findings show that teachers who practiced teacher-centered instruction and displayed low-levels of technology use were less effective in fostering important student skills.

Teachers who practice student-centered pedagogy use technology more effectively than those who espouse teacher-centered pedagogy, second-order barriers related to pedagogical beliefs are likely to manifest in private international schools across the UAE. The Abu Dhabi Education Council (ADEC), which oversees both public and private schools, and the KHDA both acknowledged the occurrence of teacher-centered pedagogies in the UAE (Badri, 2014). Because of this, ADEC developed the New School Model to promote a more student-centered learning approach focusing on problem solving capacities rather than memorization of knowledge (Badri, 2014). The KHDA has acknowledged the occurrence of teacher-centered pedagogy in the School Inspection Framework (SIF) and several measures on the SIF assess teacher effectiveness by determining whether student-centered approaches to instruction are being applied. The school ratings, measured by external inspectors, for the 2018-2019 school

show that 57 schools are rated weak or acceptable, 74 are rated good, and 45 are rated very good or outstanding in their overall performance (KHDA, 2019). Findings from the SIF reports indicate that teachers within many schools are not effectively practicing student-centered approaches to teaching. Therefore, the student-centered beliefs and practices necessary to effectively integrate technology may continue to appear as a second-order barrier to technology integration.

Workplace stress and emotional responses to education change. Workplace factors, such as the rapid pace of education change, affect teachers' level of stress and job satisfaction which manifests as a second-order barrier to technology integration (Green, Brown, Abenavoli, 2016; Hargreaves, 2004; Skaavlik & Skaavlik 2015. High levels of workplace stress may cause teachers to divest from new program implementations (Hargreaves, 2004) such as technology integration, and may negatively impact job satisfaction (Skaavlik & Skaavlik, 2015). Teachers in the UAE report feeling exhausted by the frequent and fast pace mandated education changes placed upon them and therefore may not possess the energy and motivation to effectively implement reforms including technology integration (Ibrahim et al., 2013; Tabari, 2014).

Workplace stress. Job-related stressors may bring about negative emotional states in teachers that consequently affect job performance (Harmsen, Helms-Lorenz, Maulana, & van Veen, 2018; Skaalvik & Skaalvik, 2010). Teachers report greater workloads and higher levels of job stress than other professionals (Harmsen et al., 2018). Teachers may experience a rising number of responsibilities, implementation of programs, and a more chaotic workday (Hargreaves, 2004; Skaalvik & Skaalvik, 2010😊 which can bring about feelings of stress and exhaustion (Skaalvik & Skaalvik, 2015).

Teachers who experience stressors from job demands report feeling stress responses that can negatively affect teacher practice and lead to attrition (Harmsen et al., 2018).
A study investigated the relationship between stress causes, stress responses, teacher behavior and teacher attrition in 143 beginning teachers in the Netherlands. Teachers completed a questionnaire about their work experience and were observed by researchers Findings from this study suggest that teachers' stress causes including negative organizational aspects, negative school culture, lack of professional learning opportunities, negative student behavior, and high cognitive and emotional task demands have a positive relationship with the stress response feelings of tension, negative emotions, and job dissatisfaction. Additionally, 20% of participants left their school after one year and six teachers left the profession.

Job related stress also has negative impacts on in-service teachers (Rentner, Kober, Frizzell, Ferguson, & Aigner, 2016). Rentner et al., (2016) used a 67-question survey to assess education issues and professional issues of a nationally representative sample of 3,328 K-12 teachers in America. While most teachers surveyed reported entering the profession for altruistic reasons, 60% of teachers reported losing their enthusiasm for teaching; 49% indicated that stress and discontent from the external mandates and administrative pressures from their district "aren't really worth it"; and 49% stated that if they could get a higher paying job, they would leave teaching profession (Rentner et al., 2016, p. 3). A similar study of American teachers (Greenberg, Brown, & Abenavoli, 2016) revealed teaching is one of the most stressful professions in the US. Factors such as escalating job demands, limited work resources, lack of leadership and positive school climates "are affecting teacher well-being, causing teacher burnout, lack of engagement, job dissatisfaction, poor performance, and some of the highest turnover rates ever (Greenberg et al., 2016, p. 2). It is likely that if teachers experience burnout,

disengagement, and dissatisfaction, their ability to successfully integrate technology into their classroom will be negatively affected.

International studies point to how teacher stress and emotional exhaustion interfere with teachers' ability to work, attrition levels, and job satisfaction (Hakanen, Bakker, & Shaufeli, 2006; Leung & Less, 2006; Skaalvik & Skaavlik, 2010). Hakanen et al., (2006) showed that emotional exhaustion negatively correlated with ability to work and self-rated health among teachers in Finland. In Hong Kong a study of teachers found that emotional exhaustion and level of burnout predicted teachers' intentions of abandoning the profession (Leung & Lee, 2006). In a study of Norwegian teachers, researcher found that high levels of emotional exhaustion related to lower levels of job satisfaction (Skaalvik & Skaalvik, 2010a). It is likely that the complexity of technology integration (Cuban, 2003; Ertmer, 1999; Mishra & Koehler, 2006) necessitates that factor such as stress, exhaustion, lack of well-being, resistance to change, and job dissatisfaction be kept at a minimum so teachers throughout the globe can focus their attention and energy on learning how to use technology as an instructional tool to support student achievement.

There is a lack of research that directly investigates the relationship between UAE's teachers' levels of stress and resistance to change and technology integration. However, the studies that have indicated UAE teachers' negative perceptions of and reactions to education reforms (Ibrahim et al., 2013; Tabari, 2016) occurred during a time when the technology integration mandate was enforced (UAE Ministry of Education, 2019; UAE Vision 2021, 2010). It is likely that teacher reports of resistance to change and levels of stress are, in part, due to increasing the use of technology in their classrooms, suggesting a negative relationship between technology integration and teacher resistance and stress. Internationally, teachers have high

levels of stress (Greenberg et al., 2016; Hakanen et al., 2006; Leung & Less, 2006; Renter et al., 2016; Skaalvik & Skaalvik, 2010) and teachers at private international schools in Dubai can be included in this statement (Ibrahim et al., 2013; Buckner et al., 2016). Therefore, the second-order barrier of workplace stress and emotional responses to education reform are likely to continue to affect teachers and may impede their ability to integrate technology to improve student achievement.

Stress and education reforms. Teachers have negative emotional experiences that include resistance to change in response to external reform mandates (Hargreaves, 2004). External reform mandates are policy initiatives created by government, school-district level employees, or any person or entity outside of the school and often, these mandates are not contrived using the ideas and opinions of teachers (Hargreaves, 2004). Hargreaves (2004) illustrated how the frequency of education reform and the lack of teacher involvement in instigating these reforms causes teachers to divest from their implementation. This study investigated teachers' emotional responses to educational changes. Researchers individually interviewed 50 teachers in 15 elementary and secondary schools in Canada and conducted additional focus groups. Many of the teachers associated education reforms with *change-related chaos* and *initiative overload* and resisted engaging in the reform process (Hargreaves, 2004, p. 292). One teacher said, "I think that the concept of education change has worn teachers down to expect something that is going to be very temporary and that something else is going to be coming down the road, so we shouldn't get too enthused about it: we should continue to do what we really do, and we will just sort of outlast this change" (Hargreaves, 2004, p. 292). This finding is applicable to external mandates such as technology integration in the UAE as teachers who work in environments with frequent reforms related to technology may divest themselves

from the effective integration of these reforms.

When teachers associate education reforms with external mandates imposed upon them, they are likely to withdraw support for the reform (Hargreaves, 2004), resist the reform (Tabari, 2014), and feel overwhelmed by the extra responsibilities placed upon them (Ibrahim et al., 2013). These factors may impede the effectiveness of a reform relating to technology integration. The terms *initiative overload* and *change-related chaos* (Hargreaves, 2004, p.292) could be terms used to describe teachers' reactions to education reforms in the UAE (Ibrahim, 2013; Tabari, 2014;).

The amount of education reforms in the UAE (UAE Vision 2021, 2010; Warner, 2018) has placed a large degree of pressure on teachers who are primarily responsible for implementing education changes (Tabari, 2014; Warner, 2018). Teachers' participation in and response to education reforms such as technology integration can affect the implementation and effectiveness of such reforms (Bryk, Gomez, Grunow, & LeMahieu, 2015; Tabari, 2014). Teachers in the UAE have not been involved in the discussions and decisions about education reforms (Tabari, 2014; Warner, 2018), the importance of involving them in the reform decision making processes (Bryk et al., 2015; Hargreaves, 2004). Because of this, if the UAE continues to place new mandates on teachers, it is likely that their resistance to implementing these reforms will increase and initiatives, like effective technology integration, will be hindered.

A study of 96 teachers in Ras Al Khaimah, a neighboring Emirate of Dubai, explored teachers' responses to education reforms (Tabari, 2016). Results indicated that teachers felt the pace of the reforms was too fast and their working hours had increased because of the reforms. Teachers also expressed that external mandates were implemented too quickly, and they did not

receive adequate time and resources needed to effectively implement these reforms (Tabari, 2014). Similarly, a study conducted in Abu Dhabi showed that teachers felt overwhelmed with extra responsibilities and worried about the extra-working due to external mandate implementation and felt that education reforms were imposed upon them (Ibrahim et al., 2013).

Conclusion

Both first-order and second-order barriers to technology integration interfere with teachers' ability to integrate technology to increase student achievement. Throughout this literature review, various empirical studies highlight the depth and breadth of teachers' barriers to technology integration. The first-order barriers that impact technology integration include education policies, school culture, teacher turnover, inadequate time, and quality of professional learning. Education technology policies tend to be generalized and neglect to understand the needs and capacity of individual school systems and teachers. Teachers from diverse backgrounds vary in their beliefs and attitudes towards education technology integration. High rates of yearly teacher turnover cause schools to be continuously starting over rather than making progress on the integration of instructional programs that incorporate technology. Adequate time is not given to teachers to learn about technology, enhance their technical skills, participate in technology related professional development, and shift their pedagogy to include technology in meaningful ways. Finally, teacher preparation and professional learning programs are not always successful in preparing teachers to effectively use technology to improve student achievement.

Second-order barriers to technology integration are more difficult to address than first-order ones, because they are deeply ingrained in educators. These barriers include teachers' technology beliefs and attitudes, technology self-efficacy, pedagogical beliefs, workplace stress, and responses to education reforms. Teachers who do not believe that technology is a valuable

tool for instruction are less likely to use technology and integrate it effectively. Teachers with low levels of technology self-efficacy are less likely to use technology which interferes with their ability to effectively integrate technology to increase student achievement. Teachers whose pedagogical beliefs are teacher-centered do not support the use of technology to enhance student achievement and are also less likely to effectively integrate technology. Finally, because of workplace stress and resistance to education reforms, teachers often divest their efforts from effectively integrating technology into their classroom practice. Second-order barriers can be affected by first-order barriers thus compounding the problem of effective technology integration for teachers.

This literature review served to provide context and understanding about the factors that foster the problem, and informed future research within the context of private international schools in Dubai. As such, the first-order barriers of time and professional learning and the second-order barriers of technology self-efficacy and pedagogical beliefs were identified as actional and measurable variables for an intervention in this dissertation study. The research about time, professional learning, technology self-efficacy, and pedagogical beliefs guided an empirical needs assessment study in the context of private international schools in Dubai. The needs assessment is detailed in the following chapter of this dissertation.

Chapter 2: Needs Assessment

An Organization for Economic Cooperation and Development (OECD, 2015) study assessed the effects of technology integration in schools in 64 countries and found no improvements in math, reading, and science outcomes in nations that made substantial investments in technology. Like other OECD countries, the United Arab Emirates (UAE) is experiencing significant education reforms that rely on the use of technology to meet its goals (UAE Vision 2021, 2010). The government of the UAE mandates that all schools implement technology to use as the primary tool for teaching, learning, and research by 2021 to increase student achievement and enable the UAE to remain competitive in the global economy (UAE Vision 2021, 2010). Much of the responsibility of education technology integration falls on the shoulders of administrators and teachers in the UAE who face first- and second-order barriers to technology integration (Almekhlafi & Almeqdadi, 2010; Ibrahim et al., 2013; UAE Ministry of Education, 2019). First-order barriers are the external factors that impede a teacher's ability to integrate technology such as policy mandates, school culture, teacher turnover, time to learn about and experiment with technology, and quality of professional learning (Ertmer, 1999). Second-order barriers are internal to teachers and include teachers' attitudes, pedagogical beliefs, self-efficacy, and willingness to change instructional practice regarding technology integration (Ertmer, 1999).

While concerted efforts have been made to improve the quality of technology integration in schools (Means, 2010; Tondeur et al., 2017; Zinger et al., 2017), first-order and second-order barriers remain (Ertmer, 1999) and continue to interfere in the success of technology integration across schools (OECD, 2015). First-order barriers are obstacles external to the teacher and second-order barriers are factors internal to the teacher (Ertmer, 1999). Although there are many

first- and second-order barriers to technology integration as identified in the literature review, this needs assessment focused on the second-order barriers technology self-efficacy and pedagogical beliefs, and the second-order barriers of amount of planning time and professional learning (PL) of teachers at private international schools in Dubai. These factors were chosen because the literature review consistently identified them as potential barriers to technology integration and because they directly affect teachers' technology use (Ertmer, 1999; Ertmer et al., 2012; Zinger et al., 2017).

Context of the Study

This needs analysis occurred in June 2019 at K-12 private international schools in Dubai. All teachers who participated in this needs assessment worked in an elementary school department of a private international school that accommodated a K-12 grade span. The type and amount of education technology varied at each school; however, each teacher used various types of education technology in their classroom from smartboards to tablets. As such, the needs assessment focused on factors that may affect teachers when integrating technology into their classrooms to support teaching and learning. Described below are the purpose, design, participants, and results of the interviews and surveys.

Statement of the Purpose

The purpose of this study was to examine how certain factors affect classroom teachers' ability to integrate technology in the classroom. These factors include participants' perceptions about technology self-efficacy, pedagogical beliefs about the role of technology in the classroom, quality of technology-related professional learning, and other supports, including planning time, provided to help teachers integrate technology. Research indicates that these

factors may manifest as barriers to teachers' ability to integrate technology effectively into their classrooms (Ertmer et al., 2012; Zinger et al., 2017)

Research questions included:

1. What are the levels of technology self-efficacy of teachers at private international schools in Dubai?
2. What are teachers' pedagogical beliefs about the role of technology in the classroom at private international schools in Dubai?
3. How do teachers describe the quality, relevance, and collaborative potential of professional learning provided to help them integrate technology into private international school classrooms in Dubai?
4. In what way does time effect teachers' ability to integrate technology into classrooms at private international schools in Dubai?

Method

This needs assessment used a convergent parallel mixed method research design to collect and analyze data. Mixed methods research combines both quantitative and qualitative data within a single investigation (Lochmiller & Lester, 2017). Convergent parallel design enables the researcher to conduct quantitative and qualitative research simultaneously and merge the data to understand the problem under investigation (Lochmiller & Lester, 2017). The convergent parallel design for this research included a survey and focus-group interviews. The surveys collected demographic information about participants and addressed the aforementioned factors that may affect teacher technology integration. The subsequent focus-group interviews gathered information about teachers perceived technology self-efficacy, technology related

pedagogical beliefs, quality of technology related professional development, and amount of time to learn about and plan with technology.

Participants

The respondents (N = 245) for this study included a purposeful sample (O'Leary, 2014) of elementary school teachers employed at 12 private international schools in Dubai. Classroom teachers are homeroom teachers that spend most of the school day with students; this excludes teacher aides, or specialist teachers such as music, art, or physical education. Semi-structured interviews were conducted with teachers *(n* = 8) from the original sample, to examine the factors that may affect technology integration.

The majority of participants were women *(n* = 209) with men comprising a smaller number *(n* = 32). Participants were primarily between the ages of 18 – 50 (n = 228) with 13 participants over the age of 50. Other demographic information collected included years of teaching experience and level of education. Table 2.1 describes key demographic information.

Table 2.1

Key Demographics of Participants

Attribute	Label	Count	Percent
Gender	Female	209	85.3
	Male	32	13.1
Age	18 – 25	12	4.9
	26 – 30	49	20.0
	31 – 40	110	44.9
	41 – 50	57	23.3
	51 – 60	10	4.1
	60+	3	1.2
Year of Teaching	0 – 3	89	37.9
Experience	4 – 6	36	15.3

	7 – 10	17	7.2
	11 – 20	36	15.3
	20+	57	24.3
Level of Education	High School or		
	Associates Degree	5	2.1
	Bachelor's Degree	133	56.6
	Master's Degree	97	41.3
Country of Origin	America	53	22.6
	Canada	27	11.5
	United Kingdom	41	17.5
	India	61	26.1
	Other European	11	4.7
	Australasia	14	6.0
	Other	27	11.5

Measures and Instrumentation

The components of teacher technology integration measured include, 1) technology self-efficacy, 2) pedagogical beliefs about the role of technology in the classroom, 3) quality of technology-related professional learning, and 4) amount of planning time. Participants indicated their responses to questions about the constructs through the completion of a questionnaire. The questionnaire combined two surveys (The Computer Technology Integration Survey and The Technology Integration Survey) with demographic information questions (see Appendix A) about the participants. Additionally, some of the respondents (n = 8) participated in semi-structured interviews.

The Computer Technology Integration Survey. The Computer Technology Integration Survey (CTIS; Wang et al., 2004) measures teachers' level of self-efficacy in using education

technology for instruction (see Appendix B). The CTIS measurement (Wang et al., 2004) includes 21 positively worded statements associated with perceived self-efficacy regarding the use of technology during instructional practice. Items were rated using a 5-point Likert scale (5 = Strongly Agree, 4 = Agree, 3 = Neutral, 2 = Disagree, 1 = Strongly Disagree). Two subscales divide the term self-efficacy into two factors: (1) Self-efficacy related to teacher computer capabilities and strategies, and (2) self-efficacy related to external influences of computer technology uses. Table 2.2 shows the subscales and sample questions for each subscale. Combined item scores of all items on each subscale of the CTIS are averaged to indicate teachers' levels of perceived self-efficacy toward technology use for instructional practice, with higher scores suggesting higher levels of technology self-efficacy. The instrument's creators found Cronbach alpha coefficients of .94 and .96 for a pre-and post-survey respectively. Cronbach alpha coefficients for the subscales were not reported by the researchers.

Table 2.2

Subscales and Questions in the CTIS (Wang et al., 2004)

Self-Efficacy Subscale	Question
Teacher computer capabilities and strategies	I feel confident that I can successfully teach relevant subject content with appropriate use of technology.
	I feel confident that I have the skills necessary to use the computer for instruction.
	I feel confident in my ability to evaluate software for teaching and learning.

External influences on computer technology uses	I feel confident about keeping curricular goals and technology uses in mind when selecting an ideal way to assess student learning. I feel confident that I can develop creative ways to cope with system constraints (such as budget cuts on technology facilities) and continue to teach effectively with technology. I feel confident that I can carry out technology-based projects even when I am opposed by skeptical colleagues.

The Technology Integration Survey. The Technology Integration Survey (TIS) measures teachers' beliefs about five constructs that may affect technology integration (Kopcha, 2012; see Appendix C). These constructs include three identified constructs in this needs analysis; pedagogical beliefs about the role of technology in the classroom, quality of technology-related professional learning, and amount planning time provided to help teachers integrate technology. This scale measured two additional constructs that may affect technology integration: access to technology and school vision for technology use (Kopcha, 2012). Access refers to the availability of technology and the reliability of its working condition (Ertmer, 1999; Kopcha, 2012). Vision refers to administrative support for and communication about how to reach educational goals using technology integration (Kopcha, 2012). Although this needs analysis aims to measure self-efficacy, pedagogical beliefs, quality of PL, amount of planning time, and other supports given to teachers to integrate technology, the additional constructs of

access and vision in the TIS survey can add depth to the understanding of how certain factors affect education technology integration in Dubai and may apply to future research.

The TIS (Kopcha, 2012), a 15-item survey, asks participants to rate items using a five-point Likert scale (4=Strongly Agree, 3=Agree, 2=neutral, 1=Disagree, 0=Strongly Disagree). Items on the survey about pedagogical beliefs included "I believe using computers with students increases their learning" and "It is easy to design learning activities that incorporate computers" (Kopcha, 2012 p. 1114). "I was given time to learn to integrate technology into my lesson" and "I have enough time to plan and prepare lessons that use technology" (Kopcha, 2012 p. 1114) were items to assess time as a barrier to technology integration. Items on the survey about professional learning included "The training I received could be easily applied in my classroom" and "I feel adequately trained on the skills needed to use technology" (Kopcha, 2012 p. 1114). The scores for the TIS are determined by calculating the average of every item on the survey. Lower scores on the TIS suggest that participants disagree with the items, whereas higher scores suggest that participants agree with the items being measured (Kopcha, 2012). A pre- and post-survey exploratory factor analysis confirmed the validity of the instrument (Kopcha, 2012) with a Cronbach's alpha for the completed survey as .93 and the Cronbach's alpha for each barrier was above .70. Cronbach's alpha coefficients for each subscale were not reported by the researcher. Table 2.3 depicts the constructs and example items of each construct on the TIS.

Table 2.3

Examples of Components and Items in the TIS (Kopcha, 2012)

Construct	Construct Item Example
Pedagogical Beliefs	I believe using computers with students increases their learning

Time	I was given time to learn to integrate technology into my lesson
Professional Learning	I feel adequately trained on the skills needed to use technology
Vision	I am expected to use technology to support content objectives
Access	The technology available is, for the most part, useful for teaching

Interview protocol. The researcher conducted semi-structured interviews with participants. The semi-structured interview process combines a pre-determined group of questions with the opportunity for the researcher to investigate themes elicited by the participants (Lochmiller & Lester, 2017; Miles, Huberman, & Saldana, 2014). This qualitative approach to research can successfully bring depth to answers to questions and allow for the researcher to ask probing follow-up questions to further access participants' experiences (Lochmiller & Lester, 2017).

The researcher created ten questions to focus the interview on teachers' experiences with technology integration (see Appendix D). The items in the questionnaire were piloted with one doctor of education student and one education technology expert, in separate cognitive interviews. The first five interview questions intended to elicit responses from participants regarding technology use, beliefs, and challenges associated with integrating technology. Sample questions include "What technology do you use in the classroom including devices and apps?" and "What are the benefits of technology integration to you and student learning?" The last five

interview questions refer to the support that teachers receive to integrate technology, with a focus on professional learning (PL). These questions aim to obtain an understanding of the type, duration, and perception PL provided to teachers, by their administrators, to enhance technology integration into curricula and classroom instruction. Sample questions include "Is the professional development you receive regarding technology integration relevant to your teaching?" and "What kind of professional development do you need to support your use of technology in the classroom?"

Procedure

The following paragraphs describe the procedure of this needs assessment. First, the method of data collection is presented which includes an explanation of the sampling process and participants. Next, the steps for both the quantitative and qualitative data analysis are presented.

Data collection. Participant recruitment occurred through convenience sampling during the months of March and April 2019. Convenience sampling is a kind of non-probability sampling that gathers participants from part of the population that is close by and convenient for the researcher (O'Leary, 2014). As such, the researcher emailed principals of K-12 private international schools in Dubai that she was previously acquainted with and asked their permission to administer a survey to their elementary school teachers. The researcher also requested that principals ask their elementary school teachers to volunteer to participate in a survey for a doctoral students' research. Principals of the school who responded positively signed a consent form and scheduled a date to administer the survey.

Data collection occurred through survey distribution and interviews during June 2019. The web-based survey, administered through Qualtrics, was disseminated to participants by their administrators through an emailed link. The survey was administered at schools during teacher

planning time. All respondents completed the same survey and did not receive an incentive to participate. Participants read and signed an electronic consent form on Qualtrics before taking the survey (Appendix E).

After the participants completed the surveys, the researcher sent an email to the principal of each school inviting them to ask their teachers that completed the survey, if they would like to volunteer to participate in an interview. The participants who agreed to the interview coordinated a time to meet with the researcher. Focus group interviews were conducted at three different schools with eight elementary school teachers *(n* = 8): Four teachers at the Desert School; three teachers at the Oasis School; and one teacher at the Jabal School. To protect the anonymity of these schools, their names are pseudonyms.

Table 2.4

Focus Group Participants

Name of School	Number of Teacher Participants
The Desert School	4
The Oasis School	3
The Jabal School	1

Data analysis. The following section describes the steps in the data analysis for this needs assessment. Analysis started with quantitative data and was followed by qualitative data analysis. Finally, the results from both quantitative and qualitative data were analyzed to look for confirming, disconfirming, and further results.

Quantitative data analysis. The first step of the data analysis was to examine the results from the combined survey. Survey data were imported into a software package that performs

statistical analysis of data. Descriptive statistics were conducted for the whole sample regarding the research questions. This analysis included frequencies, means, and standard deviations of each scale, subscale, and individual item. Additionally, an analysis of comparison of means occurred for the constructs technology self-efficacy and pedagogical beliefs. The subgroups that were compared included country of origin, age, years of teaching, and level of education.

Qualitative data analysis. The researcher used a combination of deductive and inductive coding during the qualitative data analysis. Deductive coding – or predetermined coding – uses a priori codes to organize data during the analysis (Miles, et al., 2014). The inductive analysis of data allows researchers to find themes in the data and make discoveries along the way (Lochmiller & Lester, 2017; Miles et al., 2014). This approach to analyzing data accounts for unexpected codes that emerged after reviewing the transcripts of the interviews (Miles et al., 2014).

The data were analyzed using several cycles of coding following the method of Miles et al. (2014). Primarily, the data were examined to garner a general understanding of how the constructs under examination affect teachers' technology integration. During the first cycle of coding the researcher organized the data into the following five a priori codes: technology self-efficacy, pedagogical beliefs, PL, access, and time. In the next cycle of coding, themes were created within the five a priori codes to further organize and the data. Finally, to explicate each theme, dialogue was transcribed under the corresponding code .

Results

The following section summarizes the findings of the data analysis. The information provided uses both qualitative and quantitative data to answer each research question.

Technology self-efficacy. The first research question of this study asks what the levels of technology self-efficacy are of teachers at private international schools in Dubai. Overall, data indicate conflicting findings in that survey data indicate that teachers have high levels of technology self-efficacy, while analysis from the focus group data suggests that teachers have lower levels of technology self-efficacy.

Data from the Computer Technology Integration Survey (CTIS; Wang, Ertmer, & Newby, 2004) shows that teachers feel confident that they have the skills necessary to use the computer for instruction ($M = 4.14$, $SD = 0.97$). Teachers also felt confident that they could integrate technology into their lessons appropriately to support student learning ($M = 4.11$, $SD = 0.96$). Also, teachers reported their self-efficacy about helping students address student technology needs will improve over time ($M = 4.40$, $SD = 0$ .75). The items for Table 2.5 were selected to show areas where teachers indicated higher levels of self-efficacy.

Table 2.5

Higher Technology Self-Efficacy Scores from the CTIS (Wang et al., 2004)

Item	n	*M*	*SD*
I feel confident that, as time goes by, my ability to address my students' technology needs will continue to improve	224	4.40	0.75
I feel confident that I have the skills necessary to use the computer for instruction.	224	4.14	0.97
I feel confident I can regularly incorporate technology into my lessons, when appropriate to student learning	222	4.11	0.96

Areas where teachers reported less confidence in technology integration pointed to their ability to assign and grade technology-based projects, evaluate software, and select appropriate technology. Of the 21 items on the CTIS, the item "I feel confident that I can mentor students in

appropriate uses of technology" received the lowest mean score (M = 3.03, SD = 0.93). This finding indicates that teachers feel less confident in guiding and advising students about how to use technology to support their learning. Two other areas where teachers reported less confidence were about the item "I feel confident in my ability to evaluate software for teaching and learning" (M = 3.73, SD = 1.10) and "I feel confident about assigning and grading technology-based projects" (M = 3.64, SD = 1.04). Table 2.6 shows the mean scores for some of the items on the CTIS where teachers indicated lower levels of self-efficacy.

Table 2.6

Lower Technology Self-Efficacy Scores from the CTIS (Wang et al., 2004)

Item	n	*M*	*SD*
I feel confident about assigning and grading technology-based projects	225	3.64	1.04
I feel confident in my ability to evaluate software for teaching and learning.	226	3.73	1.01
I feel confident about selecting appropriate technology for instruction based on curriculum standards.	223	3.89	0.94

Similarly, findings from the qualitative data suggest that all teachers (N = 8) reported low levels of technology self-efficacy when they are presented with digital tools that they have not used before, when they must evaluate software, and when they are required to change digital tools or major software programs such as Microsoft or Google Classroom. (Pseudonyms are used hereafter for the participants and the schools). Audrey, a teacher at a K-12 British Curriculum School called the Desert School, described feeling low technology self-efficacy when the entire elementary school staff was required to use a green screen recording studio with students to create videos of assignment presentations: "If I want to use the recording studio, I have no clue

what to do. I haven't used any kind of tech like that before and they didn't give us any training on it." Audrey's colleague Amanda also spoke about how she too was not confident in using the recording studio**,** "How am I going to do this next year when I don't actually know how it works. I could only do it this time because our technology lead did the actual lesson, and I was a bystander."

In both cases, the teachers describe not having the technology-related knowledge and skills that Bandura (1982) would argues cultivates self-efficacy. Suzie, another teacher at the Desert School, also expressed lower levels of technology self-efficacy due to insufficient knowledge and skills and expressed how the loss of the technology lead (a resource to education technology integration) is another barrier to the development of their technology self-efficacy. "I was thinking about how we are going to use this next year when the technology lead is gone, and we don't actually know how it works." Farah, a teacher at the Oasis School, a K-12 British Curriculum School, shared similar concerns about not having the knowledge and skills that necessitate technology self-efficacy and the low level of technology self-efficacy in the school overall:

> I think there are a lot of resources in the school which are not being used because no one knows how to use them. So, for example, we had this staff meeting where they had all of this technology and I was like 'who',' I didn't know that we've got all this stuff. We've got VR headsets and I don't know how to use them. I would love to use them in my class, but I don't have a clue how to even start.

All eight of the teachers interviewed during the focus groups described their lack of knowledge and confidence in knowing if an application was appropriate for instruction and if its use

contributed to student learning. Suzie indicated that she did not have the knowledge to select and evaluate apps.

> It is difficult to find the most appropriate app for your lesson. I'm not sure if it's relevant or supporting their learning. I can't tell if the new spelling app is helping them more than the way we were doing it before.

When faced with the challenge of integrating new or uncommon digital tools, rather than familiar tools like Microsoft Office, Google Classroom, or YouTube, teachers indicated that their degree of self-efficacy declined because they didn't know how to use these new or uncommon tools. Audrey spoke about the unfamiliar digital tools in her school: "I wouldn't know how to operate them, what to do with them, I wouldn't have a clue. So, I think there are some good apps we can be using, but I don't even know how to start."

Arthur, an upper-elementary school teacher at The Jabal School, a K-12 American curriculum school, described limitations in teachers' knowledge when there is a change in the digital tools that are available for use at the school:

> Like, if you are going to switch from one app or system to another, you need to recognize the impact it will have on the staff and students. We don't always know how to use the new technology. You can't just pull stuff out and put stuff in, they are not identical products. With some of the staff here and me, if you change something we are lost.

Self-efficacy is an important factor in a teachers' decision to integrate technology into instruction (Ertmer, 1999; Miranda & Russell, 2011). The conflicting findings about teachers' levels of technology self-efficacy are important when it comes to classroom technology use. Teachers with high levels of technology self-efficacy feel confident that they can integrate technology effectively into their classrooms for instruction (Albion, 2001; Wang et al., 2004) and

use it more frequently than teachers with low levels of technology self-efficacy (Miranda & Russell, 2011). However, data analysis from the focus groups indicates that teachers' level of technology self-efficacy decreases when they are asked to use digital tools that they are not familiar with or required to change from one software package such as Google Classrooms or Microsoft 365 to another. This decrease could occur because teachers may not have sufficient knowledge and skills about the technology to develop their self-efficacy regarding its use (Ertmer & Ottenbreit-Leftwich, 2010). Also, the difference in self-efficacy levels could be related to training and support. If teachers lack confidence in their ability to use new digital tools and software packages, they are less likely to integrate them into instruction (Abbitt, 2011; Miranda & Russell, 2011). Also, when teachers with low self-efficacy in relation to the use of new digital tools and software packages integrate them into the classroom, they are more likely to use them in low-levels ways (Cuban et al., 2001) that support teacher-centered instruction (Lowther et al., 2012; Tondeaur, 2017).

These divergent findings captured different aspects of teachers' technology self-efficacy, and both can be considered important considering the UAE Vision 2021 (2010) that mandates technology be integrated into all classrooms throughout the country. As classroom technology integration continues to proceed in the UAE, school administrators need to know teachers' levels of technology self-efficacy so that this factor does not become a barrier to technology integration in private international schools in Dubai. Additionally, if teachers are not aware of the aspects in which they do not feel confident using technology, they may not be in a position to ask for help and devise an action plan to improve their technology self-efficacy.

Pedagogical beliefs. The second research question asked, what are private international schoolteachers' pedagogical beliefs about the role of technology in the classroom? Overall

findings from both the survey and interview data indicate that teachers' pedagogical beliefs support the use of technology in the classroom. Teachers believe that when they incorporate technology into their lessons it can increase student motivation, engagement, and improve learning. I analyzed pedagogical beliefs using three items from the Technology Integration Survey (TIS; Kopcha, 2012) that were relevant to the research question and data from the semi-structured interviews.

The average mean score for the pedagogical beliefs' subscale ($M = 4.01$, $SD = 0.95$) was the highest mean score of all the subscales within the TIS (Kopcha, 2012) which is comprised of professional learning, time, access, and vision. Teachers agreed that computers can increase students learning, are easy to use for designing learning activities, and make their job easier. The item receiving the highest mean score was "I believe using computers with students increases their learning," whereas the item "It is easy to design learning activities that incorporate computer" received the lowest mean score of the three items in the subscale and. Table 2.7 depicts the three pedagogical beliefs-related items on the TIS and their respective mean scores.

Table 2.7

Pedagogical Beliefs Scores from the TIS (Kopcha, 2012)

Item	n	*M*	*SD*
I believe using computers with students increases their learning	222	4.13	0.95
It is easy to design learning activities that incorporate computers	221	3.87	1.00
I believe that technology makes my job easier as a teacher	222	4.03	0.95

Results from the semi-structured interviews are similar to the findings from the quantitative data. Analysis of the interview data showed that teachers ($N = 8$) have pedagogical

beliefs that support the integration of technology into the classroom. Clara, a lower-elementary school teacher at The Oasis School, a K-12 British curriculum school, believes technology helps her students learn and increases their engagement,

> I have a lot of students who need to develop speech and language. So, like, just by giving them an iPad they swap roles of talking and listening and they're automatically more engaged with a speaking activity than just through learning partners. So, I use the iPad a lot for that.

Ava, another teacher at the Oasis school who also believed technology increases student engagement, stated that "apps are really good for children's engagement. As soon as we started using them in our lessons, they were automatically more engaged." Arthur, an upper-elementary school teacher at The Jabal School, also espoused pedagogical beliefs that support classroom technology use as well as student-centered instruction. Arthur explained how Google Docs helps him teach writing and facilitates collaboration among students,

> I like using Google docs during writing lessons. I can watch kids type and add comments in real time as they are writing. You can have kids, like four kids in different parts of a room typing on the same document, and like adding their thoughts, and collaborating...collaborating that way.

Amanda, at the Desert School, also described using technology to support student-centered instruction,

> We had this app where I could individually set it students ability level and interests. I could see what the kids were doing, and I could see what was going wrong and then I directed my teaching to what was going wrong. You could pull the kids in who needed support and then send them off right there and then.

Data from the interviews are consistent with results from the surveys about teachers' positive beliefs regarding technology use in the classroom to support learning. However, teachers did not feel that they were using technology in a way that increased their pedagogical skills or resulted in using technology in meaningful ways to support instruction. Ava, who works at the Oasis School indicated, "Sometimes I feel like I have to use it, just because. And it's not relevant. Its ticking a box." Clara, also from the Oasis school, commented, "I don't feel like we are using technology at high-level. We are just kind of using it to replace textbooks, notebooks, and DVD's."

Teachers' pedagogical beliefs and level of self-efficacy regarding technology integration are considered reliable predictors of their classroom technology use (Inan & Lowther, 2010; Miranda & Russell, 2012). Participants in this needs analysis have pedagogical beliefs that support technology integration and report that they are integrating technology into the classroom. This finding is consistent with research that suggests that teachers who believe that technology is useful for classroom teaching, are more likely to use digital tools than those who do not espouse this belief (Ertmer & Ottenbreit-Leftwich, 2010; Lowther et al., 2012; Miranda & Russell, 2021). With the call to integrate technology into all classrooms in the UAE by 2021 (UAE Vision 2021, 2010) these data supporting teachers' positive beliefs about technology integration may support the efficiency of this mandate and do not appear as a second-order barrier to technology integration (Ertmer, 1999).

Professional learning. The third research question investigated the quality, duration, relevance, and collaborative potential of professional learning (PL) provided to teachers to help them integrate technology. Overall findings indicate that teachers do not feel they are being provided with the technology focused PL needed to increase their ability to integrate technology

into the classroom. Teachers reported that much of their PL was self-directed learning that occurred during their personal time and that they rarely collaborated to share technology related best practices. I analyzed PL using three items from the Technology Integration Survey (TIS; Kopcha, 2012), a five-point Likert scale, that were relevant to the research question and data from the semi-structured interviews and data from focus-group interviews.

Survey data shows that teachers feel that although they can apply technology-related PL, they are not receiving high quality PL or given enough time to learn about technology from each other as indicated by the PL subscale (TIS; Kopcha, 2012). Findings from the first item related to PL in general show that teachers somewhat agree that they can apply the technology-related PL in their classroom. The next item on the PL subscale shows that participants feel less adequately trained in the skills that they need to use technology. Finally, teachers neither agree nor disagree that they are given "enough opportunities to share technology lessons with other teachers". This particular item on the TIS subscale related to PL, was the lowest rated single item on the combined survey. Table 2.8 shows the three PL related items on the TIS (Kopcha, 2012) and their respective mean scores.

Table 2.8

Professional Learning Scores from the TIS (Kopcha, 2012)

Item	n	*M*	*SD*
The training I received could be easily applied in my classroom	223	3.89	0.99
I feel adequately trained on the skills needed to use technology	221	3.49	1.17
I have enough opportunity to share technology lessons with other teachers	222	2.97	1.15

During the semi-structured interviews, teachers at all three schools spoke about how the professional learning (PL) provided to them by their administration was insufficient and inadequate. Teachers indicated that PL is delivered as a one-shot workshop, is irrelevant to their practice, and does not offer opportunities for collaboration during or after the workshop. Arthur, a teacher at the Jabal School, talked about how the PL given by trainers from technology companies was too short in duration,

> We don't get that much training. Most of the training is good on the one session you are sitting in the computer lab with the trainer from the tech company. But once the trainer leaves you are on your own. What we really need are experts inside of the school who know how to do things so we can just walk down the hall and ask them questions and get help.

Teachers at The Desert School also commented that having a one-time training by a technology company did not meet their needs. They expressed that the technology experts that deliver the PL have no training or experience as teachers and cannot provide them with the relevant strategies and skills to leverage technology to support student learning. Suzie spoke about the need to have an available technology expert inside of the school who can provide on-demand training that is relevant to classroom practice and can provide frequent on-demand support,

> We can ask our technology lead to come in and give us professional development or help. He can do it, but it's a bit of a hassle. You have to book him weeks and weeks in advance, and he can only come to help for like one class period. He always comes across as stressed and uggghhhhhh. He has all of this other stuff to do for the whole entire school so he can't give us the training we actually need when we need it.

Teachers at both The Oasis and Desert school discussed how their administrations did not provide relevant PL or meet their PL needs. Amanda, at The Desert school, indicated,

> The administrators tried to send us to that Microsoft educator program. It's a program that you do online that takes forever to complete and then you get a badge of honor that says you're a Microsoft certified educator. But I already know how to use all of the Microsoft programs and I need training on other tech stuff. Why would I waste my time on a training I don't need for a badge?"

Clara, at The Oasis School, also commented on how her administration did not provide her with the PL necessary to meet her goals. She remarked, "At the beginning of the year we filled out a sheet with areas where we felt we really needed professional development in. And then nothing was ever done with that. I don't even think the principals read them."

One of the dominant themes that emerged from the qualitative data is that teachers do not collaborate often about how they are using technology in their classrooms. Peer-collaboration is considered a form of PL and can help sustain teachers' skills with technology over time (Kopcha, 2012). Farah, an upper elementary school teacher at The Oasis School said, "There is no structure in place for us to collaborate or to go and observe teachers or have teachers come and observe us teaching or help us use technology." Audrey at The Desert School also remarked, "It's not very often that we have time to sit together and show each other how different technology works or how it can be used to help students." Arthur, at The Jabal School, indicated, "There isn't much collaboration. We need time in our schedules to learn from each other and watch each other."

Finally, analysis from the semi-structured interviews indicates that teachers are learning how to use various digital tools independently and outside of school rather than as part of more

formal PL within the school. Amanda, at the Desert School expressed, "people are trying to implement technology. The will to do it is there. The training just isn't there. It's just really self-directed. We play around with apps on our own and during our own time." Ava at The Oasis School made a similar remark, "A teacher may be able to get me logged in, but then I have to go play with it and teach myself." Farah, also at The Oasis School, said "I am just trying to learn technology as I go." Arthur, a teacher at the Jabal School reported, "I am pretty ambidextrous with technology. I try to just learn how to use it on my own."

Effective teacher PL is imperative to student achievement (Darling-Hammond et al., 2017; Resources for Learning, 2017). Teachers who can improve their practice through participation in high quality technology-related PL are more likely to use technology as a tool to support instruction and improve student outcomes (Curwood, 2011; Lawless & Pellegrino, 2007; Tonduer et al., 2017). However, results from this needs analysis indicate that teachers at private international schools in Dubai do not feel that the quality of technology-related PL is effective in supporting their technology integration.

Professional learning that supports teachers' technology integration is most likely to be effective when it is sustained over time (Desimone, 2009) and when it connects technology use to classroom curricula and practice (Kaufman, 2014; Zinger et al., 2017). However, data from this needs analysis suggests that technology related PL is delivered as a one-shot workshop and does not prepare teachers to effectively use technology as an instructional tool. Short-term PL precludes reinforcement of learning that would otherwise occur through longer-term PL and ongoing follow-up (Tondeur et al., 2017). Participants in this needs analysis reported that the PL they receive emphasizes the affordances and limitations of digital tools instead of focusing on how technology can enrich their pedagogy or foster students' learning. These findings about

technology focused PL, rather than pedagogy focused, are consistent with previous research (Curwood, 2011; Kopcha, 2012; Mishra & Koehler, 2006).

Additionally, teachers at private international schools in Dubai consider most of their learning about technology to be self-directed and occurring in isolation rather than through productive collaboration. Effective PL provides teachers with the space and time to participate in open dialogue and prolonged collaboration (Darling-Hammond et al., 2017; Resources for Learning, 2017). Teachers expressed the desire to have various experts in the school who are easily and frequently accessible to help them with technology integration. Effective PL connects teachers with experts inside of the school who can provide just in time support thus encouraging collaboration with peers and application of newly learned skills in daily practice (Bill & Melinda Gates Foundation, 2014; Resources for Learning, 2017).

As such, the professional learning (PL) in private international schools in Dubai manifests itself as a first-order barrier to effective technology integration (Ertmer, 1999) because it is not sustained over time (Desimone, 2009), does not connect technology use to actual classroom practice (Kaufman, 2014; Zinger et al., 2017), concentrates on technical skills rather than pedagogy (Kopcha, 2012; Mishra & Koehler, 2006), and precludes collaboration and consultation with peers (Resources for Learning, 2017). With the mandate to integrate technology into all classrooms in the UAE by 2021 (UAE Vision 2021, 2010) these findings indicating the inadequate and scarce nature of technology-related PL may be inhibiting the efficiency and effectiveness of technology integration at private international schools in Dubai.

Time. The fourth research question asked, "In what way does time affect teachers' ability to integrate technology into classrooms at private international schools in Dubai? Overall findings indicate that teachers do not have enough time to plan with, learn about, or use

technology in the classroom. Three items from the Technology Integration Survey (TIS; Kopcha, 2012) that were relevant to the research question and data from the semi-structured interviews measured how time affects teachers' ability to integrate technology.

Data analysis from the survey shows that teachers neither agree or disagree that they have enough time to plan lessons, learn about, and integrate technology into their classroom. The item on the time subscale that received the highest score was "integrating technology takes less time than I thought it would" whereas the item "I was given time to learn to integrate technology into my lessons" received the lowest score. Also, teachers neither agreed nor disagreed that they have enough time to prepare lessons that use technology. The time subscale of the TIS (Kopcha, 2012) received the lowest mean score when compared to the pedagogical beliefs subscale of the TIS, the professional learning subscale of the TIS, and both of the subscales on the Computer Technology Integration Survey (CTIS: Wang et al., 2004). Table 2.9 depicts the time related items on the TIS, and their respective mean scores and Table 2.10 shows the means for the three subscales in the TIS and the mean for the two subscales in the CTIS in descending order.

Table 2.9

Time Results from the TIS (Kopcha, 2012)

Time Subscale Item	*n*	*M*	*SD*
Integrating technology takes less time than I thought it would	222	3.45	1.1
I was given time to learn to integrate technology into my lessons	222	3.05	1.27
I have enough time and prepare lessons that use technology	222	3.07	1.28

Table 2.10

Means Scores of two subscales from the CTIS (Wang et al., 2004), and three subscales from the TIS (Kopcha, 2012)

Subscale	*M*	*SD*
Pedagogical Beliefs	4.01	0.97
Self-Efficacy: External influences on computer technology uses	4.00	0.93
Self-Efficacy: Teacher computer capabilities and strategies	3.96	0.97
Professional Learning	3.45	1.10
Time	3.19	1.22

Data analysis from the semi-structured interviews was consistent with quantitative data about the lack of time given to teachers to plan with, learn about, and integrate technology. Amanda, a teacher at The Desert School said, “There isn’t enough planning time to figure out how to include technology in a way that’s meaningful for the students.” Clara, a lower-elementary school teacher at The Oasis School, talked about crammed teacher timetables.

> We only have one grade-level team meeting for about an hour each week to talk about everything. We don't have time to observe each other either. It’s not that we don't want to, we just don't have time. I mean, the timetable is a real hindrance. How are we going to plan with technology? I am a middle-leader, and I don't even have time to observe other teachers in their classrooms.

Audrey, at The Desert School, stated, “I have so much other stuff to do. When do I have time to learn to use new apps and devices and stuff?”

Time was not only expressed as a barrier to technology integration in terms of planning

and learning, but it was also mentioned as an obstacle regarding the actual use of digital tools. “Sometimes it takes far too much time to get the devices, so I don't bother” mentioned Suzie. Amanda agreed, “I don’t have enough time to find the iPad trolleys, bring them to the classroom, and set them up for the students.” Arthur noted how trouble-shooting devices and apps takes away from instructional time.

> I only have a certain amount of time in the day to teach reading. If one of the apps has an error or something, I have to tend to that and then I lose teaching time. And the students get all distracted because I am trying to help resolve the error or the frozen app. It’s just not worth the time.

Time to plan with and learn about technology to effectively integrate it into instruction is one of the largest barriers to technology integration (Ertmer, 1999; Kopcha, 2012; Pittman & Gaines, 2015; Tondeur, et al., 2017). Data from this needs analysis shows that time is a first-order barrier to technology integration because teachers do not have sufficient time to learn about and practice with technology to increase its effectiveness as an instructional tool.

Teachers not only referred to time as a barrier to technology integration but also as a factor that contributed to other barriers to technology use. For example, teachers indicated that they do not have time to find devices in the school and bring them to their classrooms, charge devices, or trouble shoot when errors occur. Some teachers expressed that they intentionally avoid using technology at times because taking the time to access the technology is “not worth it.” Teachers also reported that they do not have time to collaborate or engage in PL to support their classroom technology use. As such, time appears as a barrier to PL. This finding is consistent with research that suggests one-shot PL is less effective than PL that is sustained or provided over the long-term (Desimone, 2009; Learning Forward, 2011). If teachers are not

given time to engage in collaboration and PL about technology, it is unlikely that their ability and confidence in using technology will improve (DeSantis, 2013; Miranda & Russel, 2011).

These data indicating the insufficient amount of time given to teacher to learn about, plan with, and integrate technology into classrooms at private international schools in Dubai, may negatively affect the mandate to effectively integrate technology into all classrooms in the UAE (UAE Vision 2021, 2010).

Conclusion

The needs assessment examined how technology self-efficacy, pedagogical beliefs, professional learning, and time affect classroom teachers' ability to integrate technology into elementary school classrooms at private international schools in Dubai. Data from this examination suggested that technology self-efficacy, PL, and time manifest as barriers to technology integration. Findings about teachers' technology self-efficacy was inconsistent. The quantitative data showed teachers generally have high levels of technology self-efficacy whereas the qualitative data suggested that teachers have low levels of technology self-efficacy when it comes to using unfamiliar digital tools and evaluating technology. Lack of time appeared as the largest barrier to technology integration in both the quantitative and qualitative data. The quality, relevance, and collaborative potential of PL was the second largest barrier to technology integration indicated by both the quantitative and qualitative data. Teachers' pedagogical beliefs do not manifest as a barrier to technology integration among this sample because these beliefs support the use of technology in their classrooms. The next step in this research is to determine potential interventions to these first-and second-order barriers to technology integration and examine if these interventions can be implemented at private international schools in Dubai.

Chapter 3: Intervention Literature Review

The empirical, theoretical and needs analysis findings described in the previous chapters uncover the first-order and second-order barriers that hinder elementary school teachers' ability to effectively integrate technology into their classrooms at private international schools in Dubai. First-order barriers are external factors that hinder teachers' ability to effectively integrate technology including time to learn about and experiment with technology, quality and duration of professional learning, the availability and types of digital tools, infrastructure to support technology use, and institutional support (Ertmer, 1999). Second-order barriers are internal to teachers and include teachers' self-efficacy, pedagogical beliefs, attitudes, and motivation to change instructional practice to assist with technology integration (Ertmer, 1999).

Findings from the needs analysis suggest an insufficient amount of time, a first-order barrier, appeared as the largest barrier to technology integration. Teachers feel they do not have enough time to learn about, plan with, and successfully integrate technology into curricula and instruction. Findings from both the qualitative and quantitative data suggest that quality of professional learning (PL) is another first-order barrier to technology integration for teachers. Participants indicated that they are not provided with the technology-focused PL needed to increase their ability to effectively integrate technology into the classroom. Teachers reported that much of their PL was self-directed learning that occurred during their personal time and that they were rarely provided with opportunities to collaborate and share technology related best practices. Finally, findings from qualitative data suggest that teachers have low levels of technology self-efficacy - a second-order barrier to technology integration - when it comes to integrating unfamiliar digital tools and evaluating technology.

These findings suggest that a high-quality PL program, that includes sufficient time, can help increase teachers' technology self-efficacy and ability to effectively integrate technology into their curricula and instructional practice. When teachers are given time to engage in collaborative PL about technology, it is likely that their ability and confidence in using technology will improve (DeSantis, 2013; Miranda & Russel, 2011). Professional learning is an approach to enhance teachers' instructional practice (Garet et al., 2001) and should align with the evidence-based components of effective PL (Desimone, 2009). Garet et al. (2001) measured the effectiveness of PL on teacher practice and student outcomes and suggested teacher practice is often not improved by PL. However, by integrating the evidence-based components of effective PL (Desimone, 2009) into a technology-focused PL program, teachers' technology self-efficacy may improve (DeSantis, 2013; Kopcha, 2012; Miranda & Russel, 2011).

Self-efficacy refers to a person's perception about their ability to successfully complete a task (Bandura, 1982). Self-efficacy is different from other notions of *self* because it is specific to a particular domain (Tschannen-Moran & Hoy, 2007). Bandura (1982) argues that domain specific knowledge and skills are components of self-efficacy and can help an individual increase their domain related self-efficacy. The domain specific to this study is the effective use of technology in teaching and findings from the needs analysis suggest the need for the development of teachers' technology self-efficacy. When teachers do not have sufficient knowledge and skills about specific digital tools, it is unlikely they will be able to increase their self-efficacy regarding their use (Ertmer & Ottenbreit-Leftwich, 2010). Evidence-based PL may serve as an effective intervention to address the need of improving teachers' technology self-efficacy (DeSantis, 2013; Kopcha, 2012; Wang et al., 2004).

Theoretical Framework

The sociocultural learning theory (Vygotsky, 1978) can frame a professional learning (PL) program to address the first- and second-order barriers to technology integration identified in the needs analysis. Several of the components of learning identified by Vygotsky (1978), including dialogue, the environment, tools, and zone of proximal development, are explored below. These components can be leveraged to attend to the technology integration needs of teachers at private international schools in Dubai and can likely increase their technology self-efficacy.

Sociocultural learning theory is a framework that delineates the importance of social relationships, language, and the physical environment during the process of learning (Vygotsky, 1978). Social relationships play a role in learning through interactions and dialogue with peers and experts, and the use of tools occurs in physical environments (Gee, 2008; Vygotsky, 1978). Language develops from social interaction and is a tool by which children receive information from adults. Vygotsky (1978) states that the internalization of language facilitates cognitive development. The culture where learning takes place has a specific set of tools, including language, that have been developed over time and used for particular purposes (Vygotsky, 1978). As such, discourse and conversations about effectively teaching with technology are an important component of implementing a PL program to address teachers' barriers to technology integration. Within the culture of private international schools in Dubai the educational technology tools that pertain to the needs analysis included hardware and software, and the learner that uses these tools is the classroom teacher and students.

Within the sociocultural learning theory, Vygotsky (1978) delineates the zone of proximal development (ZPD) of the learner. The ZPD is the spectrum of what the learner can

achieve independently on one end, and the level of potential achievement with the help of experts on the other (Vygotsky, 1978). The needs analysis suggested that the zones of proximal development of teachers at private international schools in Dubai vary in their ability to effectively integrate technology into their classrooms. In this case, the zone of proximal development is the teachers' perceptions about their ability to use technology to improve their teaching practice and student learning outcomes, a barrier identified in the needs analysis. This is consistent with findings that suggest educators in general have various starting points within the ZPD spectrum when it comes to effective technology integration (Kopcha, 2012; Mishra & Koehler, 2006; Saudelli & Ciampa, 2016; Thoma et al., 2017)

Professional learning can address teachers' varying ZPDs by incorporating the sociocultural methods of scaffolding, active learning, and collaborative learning with digital tools to help teachers effectively teach with technology (Curwood, 2011; Desimone & Pak, 2017; Kopcha, 2012). Scaffolding refers to providing the appropriate level of support that progressively moves students to reach greater understanding and autonomy during the learning process (Wood, Bruner, & Ross, 1976). Active learning occurs when students construct knowledge through exploration and interactions with tools, other learners, and experts in their environments (Vygotsky, 1978). Collaborative learning uses conversation and academic discourse with peers and more knowledgeable others to build learners' skills and understanding (Vygotsky, 1978). Scaffolding, active, and collaborative learning can be leveraged to address the barriers of quality of PL and technology self-efficacy of teachers at private international schools in Dubai.

Literature Review

This literature review explores research related to professional learning (PL) interventions that address the factors uncovered in the needs analysis of time, quality of PL, and technology self-efficacy. First, the research about the five essential components of teachers professional learning is presented and include content focus, duration, active learning, collaboration, and coherence These components align to sociocultural learning theory because several of the components consider teachers' zones of proximal development (Wood et al., 1976), and collaborative dialogue and the active use of digital tools can enhance teachers' self-efficacy (Desimone, 2009). The research about teacher technology self-efficacy is also reviewed to determine what kind of knowledge and skills need to be taught to affect teachers' perceptions about their ability to effectively use technology. Finally, the literature review focuses on the community of inquiry framework (COI: Garrison et al., 2001).

The community of inquiry (CoI) framework resulted from the need to develop an instructional strategy to create deep and meaningful online learning experiences (Cleveland-Innes, 2019; Garrison, et al., 2001). The CoI framework provides teachers with a structure to support their ability to effectively integrate technology into their instructional practice by focusing on delivering lessons that foster teaching presence, social presence, and cognitive presence (Garrison et al., 2001). Teaching presence is defined as the interaction with students that teachers engage in when moderating the cognitive and social processes in the CoI (Garrison et al., 2001). The degree to which students feel both socially and emotionally connected to other participants, identify with the community, intentionally communicate, project their dispositions, and build relationships within the course is social presence (Garrison et al., 2000; Turner & Foss, 2018). The extent to which learners can construct and use evidence to verify their knowledge,

participate in discourse, and engage in learning activities and reflection defines cognitive presence (Garrison et al., 2000; Garrison et al., 2001).

Sociocultural theory plays a role in the CoI framework as scaffolding, active learning, and the use of language and digital tools support teaching, social, and cognitive presences. The literature will explore how teachers can leverage the CoI presences to teach meaningfully with technology and increase their technology self-efficacy. Evidence-based frameworks about teaching with technology, like the CoI, are likely to increase teacher' technology self-efficacy (Desantis, 2013; Kopcha, 2012; Perera, Calkins, & Part, 2019) which can positively affect student achievement (Mojavezi & Tamiz, 2012; Shazad & Naureen, 2017; Tschannen-Moran & Barr, 2004).

Professional learning. Professional learning (PL) is the range of specialized training intended to facilitate the development of educators' knowledge, pedagogy, skills, and strategies to enhance student achievement (Desimone, 2009; Gaumer-Erickson et al., 2017; Guskey, 2002). Frequently, PL is given to in-service educators as a short, one-shot workshop in which teachers are passive recipients of knowledge, content is not connected to practice, and delivery occurs outside of classrooms and school environments, without follow-up (Darling-Hammond et al., 2017; Desimone, 2009; Learning Forward, 2011). Professional learning that includes the five essential components of PL (Desimone, 2009) on the other hand, can affect teacher effectiveness resulting in an increase in student learning and teacher self-efficacy (Desimone & Garet, 2015; Learning Forward, 2011; Tschannen-Moran & Mcmaster, 2009). The following sections defines and discusses the five essential components of PL and how each supports development of teachers' professional practice.

Content focus. Content-focus refers to the degree in which PL pertains to a specific subject (Desimone, 2009) and addresses both pedagogy and content knowledge (Mishra & Kohler, 2006). Professional learning that is provided to teachers is often ineffective because it is frequently generic in its content (Buckner et al., 2016; Desimone, 2009; Garet et al., 2001), whereas effective PL specifically targets relevant content and pedagogical skills to improve student learning (Desimone, 2009; Mishra & Kohler, 2006). There is a difference between the subject-matter teachers are required to teach and the pedagogical methods teachers are required to integrate (Garet et al., 2001). Content-focused PL addresses both factors and considers the link between specific content and teachers' knowledge about how students learn that content (Desimone, 2009; Garet et al., 2001).

Professional learning that includes content-focus has a self-reported positive effect on skills, knowledge, and instructional practice (Garet et al., 2001). A study examined the relationship between characteristics of PL (including content-focus) and changes in teachers' knowledge, skills, and instructional practice (Garet et al., 2001). A national probability sample of science and math teachers (N = 1,027) completed a survey that measured: (a) the degree to which PL activities include content-focus (b) the amount of active learning involved in PL experiences; and (c) the degree to which PL experiences are coherent with teachers' goals and curricula. Results from a regression analysis show that relevant content-focus and the alignment of content to curricula, teacher knowledge, and teachers' goals had a positive effect on the knowledge and skills of teachers. This suggest that PL activities that emphasized content-focus can contribute to the improvement of teachers' skills and knowledge.

Duration. Professional learning that occurs over a longer duration, 30 hours or more, is related to teacher learning and may also positively affect student achievement (Darling-

Hammond, Hyler, & Gardner, 2017; Garet et al., 2001; Guskey & Yoon, 2009). Effective PL affords educators with sufficient time to learn, practice, implement, and reflect on the new knowledge and skills acquired through PL (Penuel, Fishman, Yamaguchi, & Gallagher, 2007). Duration refers to the amount of time spent on PL and is measured by both contact hours and the total time span of the PL program from beginning to end (Desimone, 2009; Penuel et al., 2007). Contact hours refer to the amount of a time a teacher spends in a PL activity (Desimone, 2009). For example, 30 contact hours of PL could be compressed into five consecutive days or spread throughout a full academic year. Frequently, PL is offered as a one-shot workshop which excludes follow-up or reinforcement of learning (Buckner et al., 2016; Darling-Hammond et al., 2017; Desimone, 2009; Penuel et al., 2007).

The time spent on PL matters most when the effective components of PL, such as content focus, active learning, and collaboration are integrated into teacher learning programs (Guskey & Yoon, 2009). Guskey and Yoon (2009) conducted a meta-analysis of 1300 PL studies to determine what components of PL are positively related to student achievement. Findings suggest that PL can help teachers adapt new curricula, acquire more relevant content knowledge, and implement new instructional practices when the contact hours provided are 30 or more and combined with experiences that integrate content-focus, active learning, and collaboration. This finding is consistent with other studies that investigated the influence of time spent on PL on change in teacher practice and student achievement (Darling-Hammond et al., 2017; Desimone, 2009; Garet et al., 2001). However, time spent on PL that focuses on ineffective and irrelevant instructional practices does not yield improvements in teachers instruction practice and do not translate into increased student achievement (Guskey & Yoon, 2009).

The more time a PL program takes, the more likely it is to include active learning experiences (Desimone, 2009; Garet at el., 2001; Guskey & Yoon, 2009), content-focus (Desimone, 2009; Garet et al., 2001), activities relating to coherence (Desimone, 2007; Garet at el., 2001; Guskey & Yoon, 2009; Penuel et al., 2007), and collaboration with other teachers (Darling-Hammond et al., 2017; Desimone, 2009; Guskey & Yoon, 2009), all of which influence teacher-reported increases of knowledge and improvement of instructional practice. A large-scale study by Garet et al., (2001) examined the relationship between the duration of PL, and self-reported changes in teachers' skills, knowledge, and instructional practices. The participants derived from a US national probability sample of 1,027 teachers that participated in a federally funded program that provided professional development for teachers. Garet et al., (2001) collected data using the federally funded program evaluation survey and through participant written self-reports about their experiences and behaviors. Included in the data collection was the amount of contact hours participants spent engaged in PL activities. The average amount of PL contact hours per year was 25 and the median amount was 15. As such, teachers received less than one hour of PL per week or a very small duration.

More recently, Darling-Hammond et al., (2017) conducted a meta-analysis of studies of PL and found that effective PL provides educators with sufficient time to learn, practice, integrate, reflect upon, and apply new approaches in their classroom practice. These researchers completed a review of the literature of PL studies over the last three decades and selected 35 studies for the meta-analysis that met their methodological criteria: The studies included an experimental or comparison group design, or they used to statistical controls for student traits and context variables when analyzing student outcomes. Darling-Hammond et al., (2017) indicate that although research has not delineated a specific number of hours that results in

effective PL, it does show that PL that results in changes in teacher practice cannot occur in a single workshop or over a short period of time. Also, many of the studies within this meta-analysis suggest that when teachers are learning collaboratively over a sustained period, their self-efficacy increases. Like Garet et al. (2001), Darling-Hammond et al. (2017) suggest that sustained PL is effective because it offers teachers multiple opportunities to be involved in learning about concepts both during PL contact hours and between contact hours when teachers can apply new skills in the classroom.

Active learning. Active learning provides opportunities for teachers to become engaged in PL through experiences and tasks such as peer observations, giving and receiving feedback, analyzing student work, delivering presentations, and hands-on experimentation with classroom resources including digital tools (DeSantis, 2013; Desimone, 2009; Hew & Brush, 2007). When teachers use digital tools during all segments of the training as part of an active learning experience during technology-focused PL, their technology self-efficacy increases (Curwood, 2011; Kopcha, 2012). In addition, hands-on experience that embeds digital tools into the learning process is likely to increase teacher engagement and increase their ability to effectively integrate technology into lessons to support student learning (Curwood, 2011; Kopcha, 2010, 2012).

Active learning tasks during PL that contribute most to teachers' effective technology integration include hands-on learning experiences with digital tools (Curwood, 2011; Desantis, 2013; Kopcha, 2012), sustained conversation regarding teachers' curricular goals and intended learning outcomes (Curwood, 2011; Darling-Hammond et al., 2017), and the ongoing analysis of students' work produced with digital tools (Curwood, 2011). An ethnographic case-study examined the influence of technology-focused professional learning (PL) on high school English teachers' (n = 8) and media specialists' (n = 2) use of digital tools (Curwood, 2011). Learning

experiences included hands-on learning with digital tools, the integration of technology into lessons, analysis of student artifacts, and dialogue and reflections about instructional practice. Results from this exploratory study indicated that teachers who participated in PL grounded in active learning experiences increased their self-reported perceptions about their ability to effectively integrate technology into their classrooms to support curricular goals and learning outcomes.

Coherence. Coherence refers to the degree to which PL is aligned to teachers' pedagogical beliefs and subject-knowledge (Desimone, 2009), other PL experiences they have participated in (Desimone, 2009; Garet et al., 2001), as well as the real-world context and policies of where teachers live and work (Desimone, 2009; Johnson, Sondergeld, & Walton, 2013). Research suggests that coherence as a core component of effective PL can help improve instructional practice (An & Reigeluth, 2011; Curwood, 2011; Laura M. Desimone & Pak, 2017; Penuel et al., 2007). Attention to coherence contributes to effective PL because both first-order and second-order barriers to change can derive from the teachers' beliefs about the usefulness of technology, their technology self-efficacy, and the degree to which their school environment supports technology use (Ertmer, 1999; Johnson et al., 2013).

Coherent PL that is aligned to teachers' pedagogical beliefs, subject-knowledge, and school policies and context is effective in increasing teacher knowledge and skills (Johnson et al., 2013). Johnson et al. (2013) conducted a study that examined a PL program designed to change the pedagogical practices of elementary school (n = 132) and secondary school (n = 62) math and science teachers. Three interrelated components were measured and integrated into the PL program: teacher content knowledge and instructional practice, school culture, and district policy. This longitudinal study was implemented in three year-long phases and occurred in a

southwestern United States district comprised of 13 elementary, four middle, and three high schools. The provision of PL occurred through summer workshops (ten days in year one, three days in years two and three) and eight release days throughout each year, teacher planning time, and grade-level team meetings. Researchers measured teacher content knowledge and instructional practice before and after the intervention using an observation protocol that included lesson design, lesson implementation, classroom culture, and math or science content. Results suggest that the coherent PL facilitated an improvement in teachers' instructional practice by addressing their beliefs and attitudes about teaching.

Collaboration. Collaboration can help teachers feel less isolated in their teaching practice as it promotes the establishment of frequent meetings that include collaborative discussions to improve teaching strategies (Garet et al., 2001; Desimone, 2009; Learning Forward, 2011). One of the advantages of collaboration is that is enables teachers who work together to discuss concepts and skills, solve problems, and share instructional materials and practices during PL activities, team meetings, and through informal discussions within their day-to-day work (Darling-Hammond, 2017; Garet et al., 2001). Collaboration can occur between two teachers, small groups of teachers, or the entire staff at a school (Desimone, 2009).

Including opportunities for collaboration during grade-level team PL can improve pedagogical practice and increase student achievement (Darling-Hammond et al., 2017; Saunders, Goldenberg, & Gallimore, 2009). A mixed methods study examined if the implementation of grade-level teacher teams that explicitly concentrated on increasing student learning affected student achievement (Saunders et al., 2009). The sample included 15 schools in the same district: Nine schools implemented the treatment and six schools acted as the control group. This five-year study was divided into two consecutive phases: (a) for two years during

phase one, only training for principals was provided; (b) for phase two, school-based training was given to teacher leaders and principals regarding the use of specific protocols for grade-level meetings to implement during collaborative team meetings. Phase two of training focused on improving collaboration during team meetings by implementing the following protocols: Collaboratively analyzing standardized and formative assessments, grade-level team instructional design and planning, and collectively learning how to identify and address common student needs. Results indicate that phase one did not generate any differences in student achievement between experimental and control schools. However, experimental group schools that incorporated the phase two collaborative protocols into team meetings, improved their quality of instruction at a faster rate than control group schools as measured by greater student achievement over three years on standardized tests. Also, this study showed that grade-level teacher teams persisted in collaboration after the intervention when the goals of the teams were coherent and aligned to district policy.

Coaching as effective professional development. Coaching is another strategy that aligns to the effective components of professional learning (PL; Desimone, 2009; Desimone & Pak, 2017) and can be embedded into a technology-focused training program for teachers. Coaching that is situated inside of schools can provide content-focus, active learning, coherence, collective participation and can be sustained in duration (Desimone & Pak, 2017). External instructional coaches, experts who work outside of the school, give continuous support to teachers through demonstrations, modeling, observations, and feedback about teaching practices (Resources for Learning, 2017). Additionally, internal instructional coaches, or teacher-leaders, can mirror the actions of external coaches and sustain the duration of time needed for learning to occur (Dagen & Bean, 2014; Youngs & Lane, 2014). Coaching aligns with the sociocultural

theory of learning as new ideas and practices are acquired through the use of dialogue and tools among participants in the environment (Vygotsky, 1978).

Research has demonstrated that coaching can help teachers learn how to implement new instructional frameworks and strategies (Desimone & Pak, 2017; Youngs & Lane; 2014). Teachers who are engaging in PL to increase their technology self-efficacy skills can benefit from a coach who uses a variety of techniques including demonstration, shadow coaching, and side-by-side coaching (Griffith et al., 2014). A demonstration occurs when the coach teaches a class while the teacher who is learning observes the content presentation, pedagogical strategy, and classroom management of the coach. Shadow coaching is a method by which the coach models a technique, and the teacher applies what the coach demonstrated in the classroom environment. Side-by-side coaching is a three-part process occurring over many lessons in which (1) the coach provides a demonstration lesson; (2) the coach and teacher apply the instructional practice with new content; and (3) finally the teacher applies the new strategy as the coach observes (Griffith et al., 2014). Through these three types of coaching, coaches can provide job-embedded PL aligned to teachers' technological and pedagogical ability level.

Instructional coaching is a potent tool for teacher learning because it reflects the five features of effective PD (Desimone & Pak, 2017). A study examined the effects of coaching on middle school sciences teachers' ability to employ inquiry-based teaching methods (Mchenry et al., 2017) Inquiry-based teaching aligns to the constructivist teaching in that students guide their own learning through active-experiences and build on prior-knowledge (Howland et al., 2014; Richey, Klein, & Tracey, 2011). Nine teachers participated in a two-year case study that embedded coaching into the PL plan (Mchenry et al., 2017). Coaching was provided by university professors and offered teachers an opportunity to practice inquiry-based learning.

Additionally, coaching was used to impart feedback, examine lesson plans, and reflect on practice. Findings from this case study indicated that as a result of coaching, teachers shifted their instruction to more student-centered practices, adopted inquiry-based approaches to teaching, and began to view science as a dynamic subject rather than a set of discrete concepts. Results from this study support instructional coaching as a mechanism to change teacher practice over time (Mchenry et al., 2017).

Besides working alongside teachers in the classroom through various coaching techniques, a coach can facilitate professional conversations in formal and informal meetings about new instructional practices (Rohlwing & Spelman, 2014; Youngs & Lane, 2014). Coaches can observe teachers in their classroom contexts and provide feedback regarding the quality of the application of a new strategy. Tschannen-Moran and Chen (2014) suggest that coaches can cultivate teacher efficacy beliefs by providing feedback to teachers who are incrementally making gains in implanting a new instructional practice. Additionally, because teachers obtain substantial support in learning about and implementing new practices through coaching, they are more likely to achieve success which can further enrich their self-efficacy beliefs (Bandura, 1982; Desimone & Pak, 2017). Ultimately, the goal of coaching is to enable teachers to use constructive criticism to improve their instructional practice, share their practice with experts and peers, and become responsive to feedback that can improve their skills and practice (Youngs & Lane, 2014). Technology-focused PL that integrates coaching can help teachers create agency and provide direct assistance during teaching with technology which may increase teachers' sense of self-efficacy.

Technology self-efficacy. According to Bandura (1982, 1986), self-efficacy is a person's perception about their ability to successfully complete a task. People with high self-

efficacy are motivated, excel at complex tasks, plan tasks successfully, and are excited by challenges (Abbitt, 2011; Bandura, 1982). Teachers with high levels of technology self-efficacy feel confident that they can integrate technology into their classrooms in a way that increases student engagement and student learning (Albion, 2001; Miranda & Russell, 2011; Wang et al., 2004) and use digital tools more frequently than teachers with low levels of technology self-efficacy (Miranda & Russell, 2011). A second-order barrier found in the needs analysis that influences the effectiveness of teacher technology use is teachers' level of technology self-efficacy (Ertmer, 1999, 2005).

Bandura (1982; 1986) delineates four sources of self-efficacy development: mastery experiences, verbal persuasion, vicarious experiences, and emotional arousal. A mastery experience can occur when a learner practices a skill and receives corrective feedback until the learner can successfully complete the skill independently (Bandura, 1982; 1986). Mastery experiences signify teachers' perceived successes in instructional practice or enabling student learning (Tschannen-Moran & Hoy, 2007). Mastery experiences as a source of self-efficacy have been positively correlated with increases in teaching self-efficacy among both in-service and pre-service teachers (Morris & Usher, 2011; Tschannen-Moran & Hoy, 2007). As a result of a mastery experience, individuals increase their expectations for future goal attainment (Bandura, 1982; Usher & Pajares, 2008) and are more likely to be protected from the loss of self-efficacy due to any forthcoming failures (Usher & Pajares, 2008). Verbal persuasion, another source of self-efficacy development, refers to external feedback and encouragement about an individual's ability (Bandura, 1982). When verbal persuasion comes from respected and trustworthy colleagues it can also influence teachers' self-efficacy (Tschannen-Moran & Hoy, 2007; Tschannen-Moran & McMaster, 2009). Another source of self-efficacy development, vicarious

experiences, occurs when individuals see another person succeed at a specific task (Bandura, 1982). Teachers' self-efficacy can be improved by vicarious experiences because these experiences enable teachers to witness effective practice (Tschannen-Moran & Hoy, 2007). Emotional arousal, the last source of self-efficacy development, is the potentially negative effect a stressful or anxious emotional state has on an individuals' perceived ability (Bandura, 1982, 1986). Bandura (1982, 1986) and other researchers (Tschannen-Moran & Hoy, 2007; Tschannen-Moran & McMaster, 2009) assert that mastery experience is the most effective method to increase self-efficacy whereas emotional arousal is the least effective.

The most effective form of professional learning (PL) embeds a mastery experience in the teacher's own context (Tschannen-Moran & McMaster, 2009). A study of 93 kindergarten through second grade teachers investigated the development of teachers' sense of self-efficacy (Tschannen-Moran & McMaster, 2009). The study design included four different treatment groups that participated in various PL approaches. The first treatment group received one three-hour workshop that used verbal persuasion as a source of self-efficacy development. For the second treatment group, the three-hour workshop provided 20 minutes of vicarious experience where the trainer taught struggling readers to use a reading strategy. In the third treatment group, the three-hour workshop was extended by another hour and a half where teachers experienced a protected mastery experience in which they worked in groups to practice an instructional method and integrate it into curricula. A protected mastery experience is a contrived mastery experience designed to make failure less likely to occur, whereas an authentic mastery experience occurs in a natural environment (Bandura, 1982; Tschannen-Moran & McMaster, 2009). The fourth treatment group built upon the third by placing the trainer in the classroom as a coach to support teachers during implementation of the reading strategy. Pre and posttest findings show a

significant positive gain in self-efficacy for treatment group four (pretest $M = 6.96$: posttest $M = 7.99$) who experienced an authentic mastery experience with the help of a coach in their classrooms whereas, pre and posttest findings show that there was a moderate increase in self-efficacy for treatment groups one, two, and three with no significant difference between the three groups. Interestingly, Tschannen-Moran & McMaster's (2009) findings also showed that some participants experienced a decline in self-efficacy because of learning about and integrating a new reading strategy. As such, it is likely that teachers re-evaluated their definition of effective instruction when they saw how successful this reading strategy was with struggling readers, which may have recalibrated their self-efficacy beliefs. Finally, although protected mastery experiences were identified as less influential, they may be a practical way to increase teachers' self-efficacy during a PL workshop or program.

Technology self-efficacy and professional learning. Learning that includes the five evidence-based components of PL (Desimone, 2009) and focuses on technology knowledge and skills can increase technology self-efficacy in both preservice (Anderson & Maninger, 2007; Holcomb & Brown, 2010) and in-service teachers (Albion, 2001; Tilton & Hartnett, 2016) which can positively affect student achievement (Mojavezi & Tamiz, 2012; Shazad & Naureen, 2017; Tschannen-Moran & Barr, 2004). A study of 76 pre-service teachers enrolled in a semester long educational technology course examined their level of perceived technology self-efficacy (Anderson & Maninger, 2007). Participants completed a course that integrated content-focus, adequate duration, active-learning, and coherent structure in its design, to help pre-service teachers learn to use educational technology for professional productivity and pedagogical purposes. Professional productivity includes using technology to write lesson plans and presentations, create and grade tests, and manage administrative tasks. Pre-service teachers

learned how to use various software programs including word processing, spread sheets, and graphic organizers to support their efficiency and productivity. In addition, they also learned about pedagogical practices to support technology integration such as constructivism, active-learning, and cooperative learning. A one-way analysis in variance (ANOVA) showed a significant change in pre-service teachers' technology self-efficacy after participation in the course ($F(1,41) = 54.27$, $p < .001$). The analysis of findings suggests that the content-focus, duration, active-learning, and coherent structure of the course contributed to higher levels of technology self-efficacy and increased intentions to use technology in the classroom.

The amount of time pre-service teachers spend learning about technology and using technology is positively related to their levels of technology self-efficacy (Albion, 2001; Anderson & Maninger, 2007). The experiences with technology act in part as mastery-experiences which may contribute to increases in technology self-efficacy. A study evaluated the technology self-efficacy levels of a sample of 114 pre-service teachers at a university in Australia (Albion, 2001). Participants completed a questionnaire assessing their technology self-efficacy at the beginning and end of the term and monitored the amount of time they spent using and learning about technology throughout the semester. Findings from this study indicate a positive correlation between amount of time learning about technology and using computers with pre-service teachers' levels of technology self-efficacy (Albion, 2001). Another study (Anderson & Maninger, 2007) examined the relationship between pre-service teachers' technology self-efficacy and participation in an education technology course. Participants included 76 pre-service teachers who completed a pre- and post-course questionnaire that measured their technology self-efficacy. Findings suggest the effectiveness of participating in an education technology course in increasing technology self-efficacy (Anderson & Maninger, 2007). Both studies

(Albion, 2001; Anderson & Maninger, 2007) suggest that when pre-service teachers receive education technology focused learning that resembles a protected mastery experience that includes active use of digital tools, practice over time, and feedback, their technology self-efficacy increases.

Content-focused and active learning experiences may also be important when providing learners with mastery experiences to increase their technology self-efficacy (Holcomb et al., 2010). A study used a technology-focused digital instructional tool as a mechanism for supporting pre-service and in-service teachers' (N =986) technology integration (Holcomb et al., 2010). Pre-service teacher participants were recruited from an accredited university in northeastern America and in-service teachers were recruited from public schools within the same state as the university. A digital performance-based assessment evaluated pre-service and in-service teachers' ability to use technology and effectively integrate it into their instructional practice. When participants were unable to complete an assessment task, the software provided them with instructions and opportunities to practice to successfully complete the task, thus enabling a mastery experience. Participants completed a technology self-efficacy survey before and after using the digital instructional tool over a two-day period. A paired sample t-test showed that both pre-service and in-service teachers' technology self-efficacy significantly increased ($t(985) = -26.76$, $p < .001$) after the technology-focused learning experiences that led to mastery experiences that occurred during the study (Holcomb et al., 2010).

In-service teachers' technology self-efficacy can increase when learning experiences embed technology content-focus, active learning, coherence, and adequate duration (DeSantis, 2013; Tilton & Hartnett, 2016). DeSantis (2013) investigated the effects of PL for interactive whiteboard use on teachers' technology self-efficacy. This mixed-methods study used a pre- and

post-test survey to evaluate 41 fifth through eighth grade teachers' technology self-efficacy before and after participating in a technology-content focused PL program. The program provided collaborative, scaffolded, and sustained learning about the technical and pedagogical uses of the interactive whiteboard. The PL program consisted of three elements: one eight-hour in-service seminar, monthly skills workshops on strategies for integrating interactive whiteboards during classroom instruction, and on-demand personalized assistance from mentor teachers. Findings from the qualitative and quantitative data were consistent and suggested that teachers' levels of technology self-efficacy increased after the PL program. Results from this investigation are consistent with existing literature that supports the importance of collaborative, coherent, and content-focused PL that occurs over an extended period (Desimone, 2009; Garet et al., 2001; Guskey & Yoon, 2009).

Another study conducted at an international school in Germany found that adequate duration of time, collaboration, content-focused learning, and mastery experiences contributed to teachers' technology self-efficacy (Tilton & Harnett, 2016). This qualitative year-long investigation examined the technology self-efficacy of five middle school teachers participating in a PL program to support the implementation of the iPad in classrooms. Participants participated in a variety of PL seminars during the first month of device integration, that included how to use the devices and how to use certain applications to support instruction. The participants were also given time to learn about specific applications through participating in content-focused workshops, classroom coaching, collaborative meetings, and independent experimentation. The teachers participated in semi-structured interviews three times during the year-long implementation. Analysis of the interviews indicated the year-long PL program that included collaboration with other teachers and content-focused learning and coaching, led to

mastery experiences which teachers reported as the most important element in increasing their technology self-efficacy. Findings from the studies mentioned above suggest that PL can increase technology self-efficacy when technology-focused content is embedded in the learning for an extended time and includes opportunities for teachers collaborate, experiment with, and undergo mastery experiences with digital tools.

Self-efficacy and teachers' sense of agency. Human agency refers to an individual being the driver of their own action and decision-making (Bandura, 1982). Furthermore, teacher agency is the ability of teachers to act on their ideas and future plans to modify their instructional practice (Damsa, Langford, Uehara, & Scherer, 2021; Kimber, Pillay, & Richards, 2022). Individuals who are doubtful about their capacity to control their own actions are inclined to undermine their efforts in tasks that challenge their abilities (Bandura, 1982). Bandura (2000) states that "efficacy beliefs are the foundation of human agency. Unless people believe that they can produce desired results by their actions, they have little incentive to act or to persevere in the face of difficulties (p.75)."

Substantial barriers have interfered with teachers' ability to effectively integrate technology into their classrooms, including self-efficacy (Ertmer, 1999; Holcomb & Brown, 2010). As such, teachers may feel a low sense of agency when teaching with digital tools. For example, the rapid integration of technology into classrooms has placed pressure on established teaching practices and professional competencies that may be considered inadequate and irrelevant due to the integration of technology (Albion & Tonduer, 2018; Damsa et al., 2021). It is likely that if teachers perceive their instructional practice to be incompatible for teaching with digital tools, their self-efficacy will be impeded as well as their sense of agency, and they may choose not to persevere in upskilling their instructional practices (Bandura, 2000; Damsa et al.,

2021). Not only do some teachers feel that their professional competencies are inadequate and irrelevant with the integration of technology (Albion & Tonduer, 2018; Damsa et al., 2021), some also feel that technology is replacing them and the teaching profession in general (Schulte, 2019; Trucano, 2015). Digital tools are used to support the progression of student learning and the collection of data about student progress (Cheung & Slavin, 2013; Escueta et al., 2017), and therefore teachers are often feeling removed from what is meant to be their primary role (Trucano, 2015). This loss of control and lack of frequent teacher engagement with students during the learning process is likely to negatively affect teachers' sense of agency.

Not only do some teachers feel that technology is replacing their primary roles (Schulte, 2019; Trucano, 2015), they are also excluded from important decision-making regarding technology policy and school reforms (Calvert, 2017; NETP, 2017). Schools and school districts are adopting education technology at an escalating pace over the years and teachers are often omitted from the procurement of these technology products (Morrison, Ross, & Cheung, 2019; NEPT, 2017). As such, teachers' sense of agency may be diminished because they are not afforded the opportunity to choose what digital tools to integrate into their instruction practice and they cannot elect how they engage in learning activities that require use of these tools (Damsa et al., 2021). Also, due to reform and mandates, teachers are often provided with digital tools and expected to use them effectively without receiving the high-quality professional learning they need to use them to successfully support teaching and learning (Kopcha 2012; Tondeur et al., 2017; Zinger et al., 2017). For teachers to feel a sense of agency when teaching with technology, they need to be included in the decision-making process about what technologies to purchase and use (Morrison et al., 2019) and they must be provided with high-

quality profession learning and time to learn how to use the technologies effectively (Calvert, 2017; Tondeur et al., 2017).

Teacher technology self-efficacy in the Arabian Gulf. Studies conducted in the context of the Arabian Gulf show that technology self-efficacy can increase when teachers participate in programs that embed content-focus, collaboration, and an adequate duration of time into the design of the PL program. A mixed methods study of 67 K-12 educators at a two-year leadership program at a university in Oman examined participants levels of technology self-efficacy before and after completing the program (Al-Harthi, 2017). Throughout the program, teachers were required to use an unfamiliar learning management software (LMS) over the duration of a semester. Quantitative and qualitative findings showed that participants' technology self-efficacy improved because of consistent use of the same LMS software over time and being able to collaborate with other participants about using the LMS during the program (Al-Harthi, 2017). Findings also suggest that participants who had previous experiences with similar digital tools reported higher technology self-efficacy than those who did not. This is consistent with Bandura (1986) who asserts that self-efficacy in a particular domain can increase self-efficacy in a similar domain. Results from this study also suggest that is likely technology self-efficacy can increase when educators are given time to use digital tools without receiving formal training.

Technology self-efficacy can increase when pre-service teachers participate in technology-focused coursework over time that includes collaboration with other pre-service teachers and active learning experiences (Al-Awidi & Alghazo, 2012). A mixed-methods investigation of students ($N = 62$) pursuing an education degree at the United Arab Emirates University in the emirate (political territory) of Abu Dhabi aimed to assess the difference between participants technology self-efficacy before and after a semester-long student teaching

experience that required them to develop and deliver lessons that used technology as the primary learning resource (Al-Awidi & Alghazo, 2012). Results from a pretest/posttest administration of the Computer Technology Integration Survey (CTIS) showed that participants' technology self-efficacy increased after they had successful student teaching experiences (mastery experience) that required them to teach with technology. Participants reported that education technology-focused coursework prior to the student teaching semester, collaborative small group work focusing on implementing technology into teaching, and time to actively and independently learn about technology contributed to having a successful mastery experience while student teaching. These mastery experiences positively influenced the technology self-efficacy of pre-service teachers (Al-Awidi & Alghazo, 2012).

The literature reviewed contribute to understanding the role of PL in increasing teachers' technology self-efficacy. The five essential features of effective technology-focused PL can increase teachers' technology self-efficacy (Anderson & Maninger, 2007; Kopcha, 2012; Miranda & Russel, 2012; Tilton and Hartnett, 2016). Also, providing teachers with high quality PL that facilitates a mastery experience while teaching with technology may also increase teachers' technology self-efficacy (Al-Awidi & Alghazo, 2012; Holcomb et al., 2010; Tilton & Harnett, 2016; Tschannen-Moran & McMaster, 2009). Next, the Community of Inquiry Framework will be discussed.

Community of Inquiry. The Community of Inquiry (CoI) framework resulted from the need to develop an instructional strategy to create deep and meaningful online learning experiences (Garrison et al., 2001). The CoI framework can provide teachers with a structure to support their ability to effectively integrate technology into their instructional practice (Garrison, et al., 2001). Also, the CoI framework is comprehensive enough to be applied to instructional

practices regardless of what digital tool a teacher is using (Anderson, 2017). Tschannen-Moran and McMaster (2009) suggest that training teachers to use an instructional framework and providing them with a mastery experience in using that instructional strategy can increase their self-efficacy. As such, training elementary teachers at private international schools in Dubai to implement the CoI Framework when teaching with technology may be an effective way to increase their technology self-efficacy.

The CoI Framework stems from the sociocultural theoretical perspective that knowledge is actively constructed through social interaction with peers and experts (Garrison et al., 2001; Zhou & Brown, 2017). Within the framework, three components interact to increase the effectiveness of the learning experience of participants in the community: social, cognitive, and teaching presence (Garrison et al., 2001). While social processes and interactions are critical components of building a community (Adams, 2006), attention to cognitive development and teaching methods is necessary to optimize student experiences in the online learning environment (Garrison et al., 2001). Because the CoI framework utilizes components of sociocultural theory to support learning including collective inquiry and social constructivism (Garrison et al.,2010), it may serve as an instructional framework that elementary school teachers can adopt to improve their ability to teach with technology. Figure 1 represents the CoI framework.

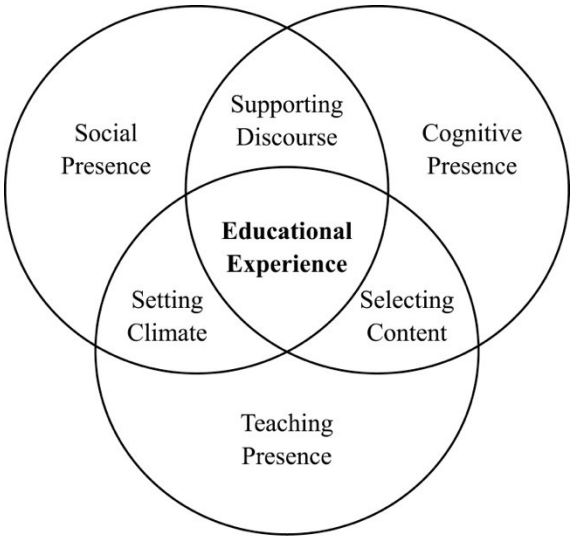

Figure 1. The Community of Inquiry Framework (Garrison et al., 2000)

The CoI framework can be applied to various types of technology-mediated instruction including distance learning, online learning, asynchronous and synchronous learning, and blended learning (Moore & Diehl, 2019; Szeto, 2015). Distance education can be characterized as contexts of learning and teaching in which the teacher and learner are in different locations (Moore & Diehl, 2019). Online learning is a kind of distance learning that occurs over the internet (Moore & Diehl, 2019). Through online learning, asynchronous learning can happen at any time when students learn independently, whereas synchronous learning occurs when both teacher and students come together in real-time (Lynch & Dembo, 2004; Moore & Diehl, 2019). Blended education uses both distance education as well as face-to-face modalities to provide instruction (Moore & Diehl, 2019).

Teaching presence. Teaching presence is defined as the interaction with students that teachers engage in when moderating the cognitive and social processes in the CoI (Garrison et al., 2001). Teaching presence is a critical factor in the CoI because it facilitates social presence, influences cognitive presence, and frames the learning experience for the participants in the community (Anderson, Rourke, Garrison, & Archer, 2001). The role of the teacher in a CoI is to

create, facilitate, and manage the education experience to engender meaningful learning outcomes. The construct of teaching presence is delineated by three categories – design and organization of the course, facilitating discourse both synchronously and through online discussions, and direct instruction during teaching (Anderson et al., 2001). Teaching presence can be improved when teachers implement practical inquiry techniques (discussed below) and engage in authentic and constructive feedback that guides student learning and increases student confidence (Miller, Hahs-Vaughn & Zygouris-Coe, 2014; Cleveland-Innes et al., 2019). If teachers aim to improve their teaching presence when integrating technology into instruction, more meaningful learning may occur (Anderson, 2017).

Teaching presence can increase learning and engender a more effective and meaningful overall learning experience (Garrison & Akyol, 2015; Garrison et al., 2010; Miller et al., 2014; Shea, Li, & Pickett, 2006). In an education context, mastery experiences refer to teachers' perceived successes in student learning and instructional practice and this source of efficacy has been correlated with increases in self-efficacy among teachers (Morris & Usher, 2011; Tschannen-Moran & Hoy, 2007). As such, if teachers are provided with an evidence-based PL program (Desimone, 2009) that increase their knowledge and skills about teaching presence during online or blended learning and enables a protected mastery experience, it is likely that their technology self-efficacy may improve.

Two studies illustrate the importance of teaching presence in the CoI Framework (Akyol & Garrison, 2008; Szeto, 2015). Graduate students ($N = 16$), from the University of Calgary reported teaching presence as the most important factor in their learning in a mixed-methods study of a synchronous and asynchronous course (Akyol & Garrison, 2008). Findings from this study also discovered that student satisfaction and perceived learning were positively correlated

with teaching presence. Similarly, a study of 28 first-year engineering students participating in an online and face-to-face synchronous course, found that teaching presence was a more important factor than cognitive presence in facilitating learning and achieving learning outcomes (Szeto, 2015). The researcher investigated the three kinds of presences in a course that used videoconferencing in a blended approach. Results from observations and focus group data indicated that the most effective components of teaching presence were the teacher's ability to manage the learning pace, provide direct instruction, and facilitate interactions between groups of students (Szeto, 2014).

Miller et al. (2014) and Shea et al. (2006) suggest that when teaching presence is high students report a greater sense of connectedness and course satisfaction than when teaching presence is low. Shea et al. (2006) measured the perceptions of learning, sense of community, and perceptions of degrees of teaching presence of 1,067 college students participating in online courses from 32 state universities in New York. Findings indicate that direct facilitation demonstrated by an active presence in which the teacher guides and directs the discussion, is associated with both the students' learning and the perception of connectedness to other students and the teacher (Shea et al., 2006, p. 185). Another study measured characteristics of teaching presence and found results consistent with Shea et al. (2006) where learners reported high levels of course satisfaction when they perceived teachers were providing direct instruction and facilitation throughout the course (Miller et al., 2014). Providing an evidence-based PL program (Desimone, 2009) to teachers that increases teachers' ability to successfully give direct instruction, engender student-connectedness, and enhance student achievement is likely to increase teachers' self-efficacy (Morris & Usher, 2011; Tschannen-Moran & Hoy, 2007), which suggests their technology self-efficacy may increase.

Social presence. The degree to which students feels both socially and emotionally connected to other participants, identify with the community, intentionally communicate, project their dispositions, and build relationships within the course is social presence (Garrison et al., 2001; Turner & Foss, 2018). Social presence consists of three components: open communication (indicated by risk-free expression of ideas), group cohesion (encouragement of collaboration), and affective expression (emotions and use of emoticons: Garrison & Arbaugh, 2007). For open communication to occur in a learning environment, a trusting environment is necessary (Rourke & Kanuka, 2009). Social presence highlights the importance of collaborative dialogue in learning environments - in this case online learning - where students work together to enhance understanding and application of knowledge. Collaborative dialogue involves conversation and academic discourse with peers and more knowledgeable others increase the understanding of learners (Garrison et al., 2010). Prior to education technology integration and distance learning, social presence was determined and limited by the logistical implications of face-to-face instruction (Garrison et al., 2001). Currently, digital tools such as mobile devices, email, wikis, applications, and videoconferencing can enhance and sustain students' social presence in an online learning environment where discourse, peer-review, and evaluation can occur both synchronously and asynchronously (Picciano, 2017).

Social presence has an important and positive correlation with perceived learning outcomes and course satisfaction (Akyol & Garrison, 2008; Arbaugh, 2013; Richardson, Maeda, Lv, & Caskurlu, 2017). Richardson et al., (2017) conducted a meta-analysis of 25 studies to identify the relationship between social presence and course satisfaction as well as social presence and perceived learning. Findings showed a positive average correlation between social presence and satisfaction and social presence and perceived learning. However, data indicated

that the relationship between social presence and course satisfaction and social presence and perceived learning was mediated by the length of the course. Courses longer in duration (six weeks or more) tended to have a stronger degree of correlation between social presence and duration, with 16-week courses having the strongest positive correlation. These findings suggests that time is needed to build relationships in online courses to strengthen students' perceptions of social presence. In the needs analysis of this study, time appears as a first-order barrier to technology integration. Teachers not only need more time learn about and plan with technology (Ertmer, 1999), they also need time to build relationships with their students and facilitate relationship building and social cohesion between students in the CoI (Richardson et al., 2017). An evidence-based PL program (Desimone, 2009) that provides teachers with time to build relationships with students during online or blended learning, (Richardson et al., 2017), may contribute to an increase in teachers' self-efficacy, which suggests that their technology self-efficacy may increase.

There is a positive relationship between social presence and cognitive presence in online discussions (Shea & Bidjerano, 2009), social presence and perceived learning, and social presence and satisfaction (Shea & Bidjerano, 2009; Swan & Shih, 2005). Swan & Shih (2005) conducted a mixed-methods study of 91 students enrolled in four online graduate classes at a large public university in Northeastern America and investigated the relationship between students' perceptions of social presence and students' degree of satisfaction with online discussions. Quantitative results showed a significant correlation between social presence and satisfaction with online discussions. Further, findings suggests that the social presence of teachers may be a more important factor in predicting satisfaction than the perceived social presence of peers, and course design can either promote or restrict the growth of social presence.

Qualitative data were consistent with quantitative findings and suggested that students who perceived high social presence participated more frequently in online discussions (Swan & Shih, 2005). Shea and Bidjerano (2009) also found that social presence positively correlated with cognitive presence in online discussions. More specifically, lower levels of comfort in participating in online discussions were strongly correlated with lower cognitive presence in students. As such, an evidence-based PL program (Desimone, 2009) that increases teachers' knowledge and skills to foster social presence and increase cognitive presence during a course (Shea & Bidjerano, 2009; Swan & Shih, 2005) may increase their self-efficacy.

Studies that examine the relationship between social presence and cognitive presence have inconsistent results (Akyol & Garrison, 2008; Garrison et al., 2010; Shea & Bidjerano, 2009; Wise, Chang, Duffy, & Del Valle, 2004). Garrison et al. (2010) conducted a study using structural equation modeling to explore causal relationships amid the three presences. A cohort of students ($N = 205$) completing a master's degree in Integrated Studies and a master's degree in Education completed a survey measuring their perceptions of teaching, cognitive, and social presences. Findings from this study show that the relationship between teaching presence and cognitive presence was mediated by social presence and that teaching presence influences social presence. Similarly, a study by Shea and Bidjerano (2009) measured the three presences in the CoI framework with a sample of undergraduate students ($N = 1{,}265$) participating in asynchronous online courses. Findings indicated that cognitive presence was significantly predicted by social presence.

Conversely, Akyol and Garrison (2008) suggest social presence as an important factor in satisfaction, but not a significant factor in cognitive presence or learning outcomes during a course. Wise et al. (2004) manipulated social presence in a study of a synchronous and

asynchronous online professional learning course for graduate education students. In the low social presence condition, teacher gave feedback and encouragement to students in a formal and efficient way and avoided personal, humorous, or friendly interactions. In the high social presence condition, teachers provided feedback and encouragement through friendly and personal interactions. Findings showed no causal effect between social presence and cognitive presence. Although data suggested that social presence increased the participants' positive perceptions of the teachers, it did not affect student learning. The findings about how social presence influences the cognitive presence of learners is inconsistent, however social presence is still an important factor in the CoI framework because it facilitates open-communication, group cohesion, and affective expression (Garrison & Arbaugh, 2007). Therefore, when providing teachers with a PL program that uses the CoI Framework to increase technology self-efficacy, social presence need be included as an area of focus (Garrison & Arbaugh, 2007).

Like teaching presence, social presence can engender a more effective and meaningful learning experience (Garrison et al., 2001; Lombard, Biocca, Freeman, Ijsselsteijn, & Schaevitz, 2015; Turner & Foss, 2018). When teachers perceive successes with their instructional practice and student learning an increase in their self-efficacy is likely to occur (Morris & Usher, 2011; Tschannen-Moran & Hoy, 2007). The needs assessment of this study showed that teachers at private international schools in Dubai report quality of professional learning, and technology self-efficacy as barriers to technology integration in their classrooms. An evidence-based professional learning program (Desimone, 2009) that increase teachers' knowledge and skills about social presence as part of the CoI Framework, is likely to increase teachers' self-efficacy.

Cognitive presence. The extent to which learners can construct and use evidence to verify their knowledge, participate in discourse, and engage in learning activities and reflection

defines cognitive presence (Garrison et al., 2001; Vaughan & Garrison, 2005). Enhancing cognitive presence during a course can increase learning and engender a more effective and meaningful learning experience (Garrison et al., 2000; Turner & Foss, 2018). Cognitive presence relies on social and teaching presence in that other learners must be present to engage in meaningful conversation that includes critical thinking and reflection (Garrison et al., 2001). Because teachers at private international schools in Dubai report low technology self-efficacy, they may need more training to adjust their levels of teaching presence to facilitate activities that engage students in the higher-order cognitive processes that play a role in meaningful learning with technology experiences (Celentin, 2007; Garrison & Arbaugh, 2007; Kanuka, Rourke, & Laflamme, 2007; Rourke & Kanuka, 2009).

Cognitive presence is grounded in the literature about critical thinking, and discourse and reflection are integral to facilitating cognitive presence (Garrison et al., 2001). The operationalization of cognitive presence derives from the practical inquiry model, which uses Dewey's (1933) four phases of reflective inquiry to guide practical inquiry: the triggering event, exploration, integration, and resolution. Although practical inquiry was not a component in the original description of the CoI framework, it furnishes teachers with one way to design and facilitate courses that enhance the degree of cognitive presence of students (Cleveland-Innes et al., 2019; Garrison et al., 2001).

The first phase of the practical inquiry model is the *triggering event* where a problem is conceptualized, and students' curiosity grows (Cleveland-Innes et al., 2019; Garrison et al., 2001). The teacher's role is to initiate and shape the triggering event by presenting an issue or problem and causing a state of dissonance in students. The next phase is *exploration*, which includes understanding the problem and iterative collaborative exchanges of information

between students to make sense of the issue. Statements that reflect divergent ideas related to the triggering event, unsupported conclusions, and brainstorming are indicators of exploration. *Integration,* the third phase, occurs when students focus more deeply on the problem and construct a framework or solution that fits the context of the problem. During this stage, students shift between group discussions and personal reflections by synthesizing ideas, building on previous ideas, and developing hypotheses. Teaching presence is important in the integration stage for direct facilitation, to model critical thinking, ask questions, identify misunderstandings, and offer accurate information. Finally, the *resolution* phase ensues when the solution to the problem is implemented. Indicators of the resolution phase include testing and application of solutions. Through practical inquiry, the teacher can facilitate critical discourse and directly influence the social presence and cognitive presence of the students within the course to support learning (Cleveland-Innes et al., 2019). Figure 2 is a representation of the practical inquiry model.

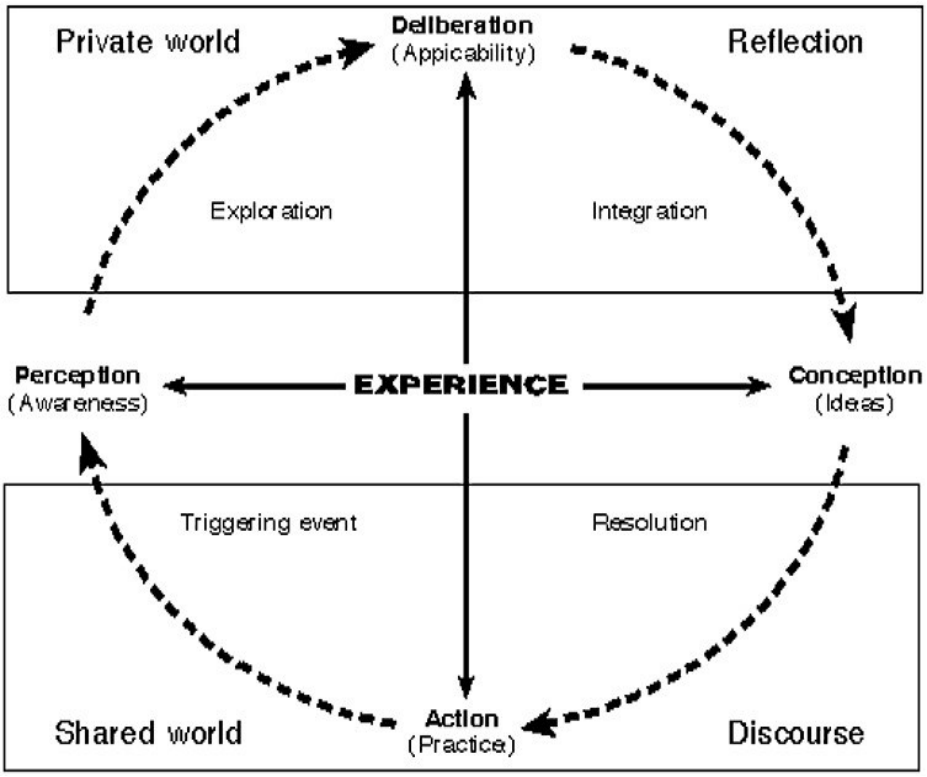

Figure 2. The Practical Inquiry Model (Garrison et al., 2001).

Cognitive presence is an integral component of the CoI Framework because critical thinking, discourse, and reflection assists learning (Garrison et al., 2001; Turner & Foss, 2018). However, some students are often unsuccessful in ascending to the higher cognitive stages of integration and resolution (Celentin, 2007; Garrison & Arbaugh, 2007; Kanuka et al., 2007; Rourke & Kanuka, 2009) and teachers may need more training to facilitate student engagement and learning through these stages. Celentin (2007) examined levels of cognitive presence through quantity of messages posted in discussion forums during a two-year blended learning course for foreign language teachers. Findings show that most messages (39.67%) transpired during the exploration stage indicating that cognitive presence was highest in this stage. During the integration phase 19.52% of discussions occurred whereas 5.83% of discussions occurred during the triggering event, and 2.6% of messages took place during the resolution stage. In a

similar study, Rourke and Kanuka (2009) found that most messages were posted in the discussion forum during the exploration phase and the fewest were in the resolution phase from an analysis of seven studies that examined transcripts of online discussions. Although number of messages can be an indication of cognitive presence (Celentin, 2007; Rourke & Kanuka, 2009), messages can also point to the degree of social presence during a course (Lowenthal & Dunlap, 2020; Turner & Foss, 2018). Regardless of recognizing messages as an indicator of cognitive or social presence, it is critical for teachers to develop the knowledge and skills to enhance students' messages in discussion posts throughout the practical inquiry phases to reflect their level of cognitive presence and learning (Celentin, 2007; Lowenthal & Dunlap, 2020; Rourke & Kanuka, 2009; Turner & Foss, 2018). As such, teachers at private international schools in Dubai may need more training to support students in reaching higher levels of cognitive presence as defined by the practical inquiry model in the CoI Framework. An evidence-based PL program (Desimone, 2009) that enables teachers to successfully implement the practical inquiry framework and therefore positively affect student learning may be likely to increase their self-efficacy.

The way in which teaching presence, social presence, and cognitive presence interact, during both synchronous and asynchronous instruction, can affect the learning of the student (Garrison et al., 2010). Studies reveal inadequacies about the level of cognitive presence reached by students who participated in courses, while other research shows the CoI as an effective framework to increase learning and for teachers to effectively integrate technology into their practice (Ak, 2016; Darabi, Arrastia, Nelson, Cornille, & Liang, 2011; Choy & Quek, 2016; Garrison et al., 2010; Gašević, Adesope, Joksimović, & Kovanović, 2015). Choy and Quek (2016) investigated the relationship between academic achievement and the CoI Framework

using a sample of 227 students at a polytechnic university in Singapore. Findings from this study suggest a positive relationship between student participation (an aspect of social presence) and academic achievement. Also, a strong association between teaching presence and cognitive presence was suggested which indicates the importance of the role of the teacher in the design and facilitation of learning during the course to increase learning. When teachers perceive successes in student learning their self-efficacy increases (Morris & Usher, 2011; Tschannen-Moran & Hoy, 2007. Darabi et al., (2011) found that the teaching presence technique of scaffolding led to higher levels of learning. Scaffolding is a tool used in sociocultural learning where teachers engage with students at their zone of proximal development and support them to increase their knowledge and skills (Vygotsky, 1978). These researchers investigated four online instructional practices in course 73 students and concluded that higher levels of cognitive presence occurred during scaffolded instruction when teachers were highly engaged, mediated discussions, and directed discussions towards the resolution phase (Darabi et al., 2011). A similar study showed that when teachers provided scaffolding in asynchronous discussions that included message labels and sentence openers, they elicited higher levels of cognitive presence than in asynchronous discussions that did not have scaffolded support (Ak, 2016). Gašević et al., (2015) showed that scaffolding practices that include creating opportunities to ask new questions, distributing information, and brainstorming solutions contributed to higher levels of cognitive presence in students. Therefore, training teachers to use scaffolding during an evidence-based PL program (Desimone, 2009) is likely to provide teachers with knowledge and skills to increase student learning. When teachers perceive that their instructional practice was successful and contributed to student learning, their self-efficacy was likely to increase (Perera,

2019; Tschannen-Moran & Hoy, 2007; Tschannen-Moran & McMaster, 2007), which suggests their technology self-efficacy will increase.

The Community of Inquiry (CoI) framework can help teachers define and construct an effective instructional strategy to enhance their ability to teach meaningfully with technology and increase student learning (Anderson, 2017; Garrison et al., 2001). Also, the CoI framework can be applied to instructional practices regardless of what digital tool a teacher is using (Anderson, 2017). Elementary school teachers at private international schools in Dubai reported needing more time to learn about and experiment with technology, technology-focused PL, and low levels of technology self-efficacy. Providing teachers with an evidence-based PL program (Desimone, 2009) that integrates an effective framework as the technology content-focus (Anderson, 2017; Desantis, 2013; Perera et al., 2019), acts as a mastery experience (Tschannen-Moran & McMaster, 2009; Tilton & Hartnett, 2016) and increases student learning (Perera, 2019; Tschannen-Moran & Hoy, 2007; Tschannen-Moran & McMaster, 2009) is likely to increase their technology self-efficacy.

Conclusion

Findings from the needs analysis suggested that technology self-efficacy, inadequate provisions of high-quality PL, and lack of time manifest as barriers to effective technology integration for teachers at private international schools in Dubai. The literature review examined research about evidence-based professional learning (PL), teacher self-efficacy, and the Community of Inquiry (CoI) framework to uncover intervention components that may be effective in addressing the barriers to technology integration found in the needs analysis.

To address the barrier of teachers' technology self-efficacy a PL program will be designed that embeds Desimone's (2009) five essential elements of PL to train participants to use an

effective teaching with technology framework. Self-efficacy is an important factor because there is a positive relationship between teacher self-efficacy and student achievement (Mojavezi & Tamiz, 2012; Shazad & Naureen, 2017; Tschannen-Moran & Barr, 2004). The CoI Framework can support teachers in constructing and defining an effective teaching model when using technology (Anderson, 2017; Garrison, et al., 2001). Evidence-based frameworks about teaching with technology are likely to increase teachers' self-efficacy (Desantis, 2013; Kopcha, 2010; Perera, 2019), which suggests their technology self-efficacy may increase.

Another way to address the barrier of technology self-efficacy, is to provide teachers with a high-quality PL program aims to facilitate the occurrence of mastery experiences (Bandura, 1982). Mastery experiences, a source of self-efficacy, are positively correlated with increases in teaching self-efficacy teachers (Morris & Usher, 2011; Tschannen-Moran & Hoy, 2007), which suggest a technology-focused mastery experience can increase teachers' technology self-efficacy. Teachers will be provided with adequate time to gain knowledge and skills to successfully engage in a protected mastery experience that integrates the CoI into online or blended learning. As a result of a mastery experience, teachers can increase their expectancies for future goal achievement (Bandura, 1982; Usher & Pajares, 2008) and are likely to be guarded from the loss of self-efficacy due to any upcoming failures (Usher & Pajares, 2008).

The barrier of high-quality professional learning will be addressed by embedding Desimone's (2009) evidence-based elements of effective PL when delivering a program to increase teachers' technology self-efficacy. These elements include content-focus, coherence, active-learning, collaboration, and duration. The content-focus of the PL will be the CoI Framework and techniques to increase teaching presence, social presence, and cognitive presence during online or blended learning. Coherence, the degree to which PL is aligned to

teachers' pedagogical beliefs and subject-knowledge (Desimone, 2009), other PL experiences they have participated in (Desimone, 2009; Garet et al., 2001), and the real-world context and policies of where teachers live and work (Desimone, 2009; Johnson, et al., 2013), will be embedded into the PL program to make the material more relevant to the participants. Active learning with digital tools will be part of the technology focused PL to help increase teachers' ability to have successful experiences using technology (Curwood, 2011; Desantis, 2013; Kopcha, 2012). Participants will be provided with opportunities to collaborate throughout the PL so that they may work together to discuss concepts and skills, solve problems, and share instructional materials and practices. The PL program will occur over an extended period to afford participants with sufficient time to learn, practice, implement, and reflect on the new knowledge and skills acquired throughout the intervention (Penuel et al., 2007).

Finally, the barrier of time will be addressed by embedding sustained duration into the PL program. Professional learning that occurs over a longer duration, 30 hours or more, is related to teacher learning and may also positively affect student achievement (Darling-Hammond et al., 2017; Garet et al., 2001; Guskey & Yoon, 2009). By combining a high-quality PL program that includes sustained learning about the CoI framework and how it can support instructional practice, teachers' technology self-efficacy may increase.

Chapter 4: Intervention Procedure and Program Evaluation Methodology

The integration of technology into classrooms is a challenging undertaking and many schools and teachers in Dubai have failed to effectively integrate technology to increase student learning (OECD, 2015; OECD, 2020). The debate regarding whether technology is making a positive impact on student achievement persists (Delgado et al., 2015; Escueta et al., 2017) and conflicting empirical evidence (Cheung & Slavin, 2013; Delgado et al., 2015; Zhao et al., 2015) highlights the complexity of effective technology integration into classrooms (Cuban et al., 2001; Ertmer, 1999; Mishra & Koehler, 2006). Many factors affect how technology is integrated into private international K-12 schools in Dubai (Almekhlafi & Almeqdadi, 2010; Buckner et al., 2016; Ibrahim et al., 2013) and these factors influence the relationship between technology integration and student achievement (OECD, 2015).

A needs analysis occurred in June 2019 at K-12 private international schools in Dubai and consisted of 245 elementary school teachers. The purpose of this study was to examine how certain factors affect classroom teachers' ability to integrate technology in the classroom. These factors include participants' perceptions about technology self-efficacy, pedagogical beliefs about the role of technology in the classroom, quality of technology-related professional learning (PL), and other supports, including planning time, provided to help teachers integrate technology. A convergent parallel mixed-method research design was implemented to collect data about teacher barriers to effective technology integration. Findings from this examination indicated that technology self-efficacy, professional learning, and time manifest as barriers to technology integration. Findings about teachers' technology self-efficacy were inconsistent. The quantitative data showed teachers generally have high levels of technology self-efficacy whereas the qualitative data suggested that teachers have low levels of technology self-efficacy

when it comes to using unfamiliar digital tools and evaluating technology. Lack of time appeared as the largest barrier to technology integration in both the quantitative and qualitative data. The quality, relevance, and collaborative potential of PL was the second largest barrier to technology integration suggested by both the quantitative and qualitative data.

A literature review explored research related to PL interventions that address the factors uncovered in the needs analysis of time, quality of PL, and teachers' technology self-efficacy. The literature review examined research about teacher self-efficacy evidence-based PL, and the Community of Inquiry (CoI; Garrison, Anderson, & Archer, 2001) framework to uncover intervention components that may be effective in addressing the barriers to technology integration found in the needs analysis. The literature suggested that a useful way to address the barrier of teachers' technological self-efficacy is to train teachers to use an effective instructional framework when teaching with technology. The CoI framework can support teachers in constructing and defining an effective teaching model when using technology (Anderson, 2017; Garrison et al., 2001). The barrier of high-quality PL will be addressed by embedding Desimone's (2009) evidence-based elements of effective PL into a program that trains teachers to use an effective teaching with technology framework, such as the CoI. The barrier of time can be addressed by embedding sustained duration into the PL program (Desimone, 2009) to give time to apply the knowledge and practice the skills they learn from the PL program. Professional learning that occurs over a longer duration, may also positively affect student achievement (Darling-Hammond, et al., 2017; Garet et al., 2001; Guskey & Yoon, 2009). By combining a high-quality PL program that includes sustained learning about the CoI framework and how it can support instructional practice, teachers' technology self-efficacy may increase.

COVID 19

Due to another surge in the COVID 19 pandemic, the intervention initially proposed in this chapter, and referred to above, required modification. The omicron variant forced most K-12 schools and universities in Dubai to close and shift to online learning. As a result, teachers were required to isolate as much as possible in anticipation of schools re-opening and have taken on an additional workload to support online instruction. In addition, because many teachers were sick, the teachers who were well have taken on the additional responsibility of covering other teachers' classes. As such, my ability to recruit a sample for the initial intervention was compromised. Teachers were not willing to volunteer their time as they have extra responsibility and were living through the uncertainty of a pandemic. Because of this, the proposed intervention had shifted from a seven-week professional learning program to a pilot study and pretest-posttest measurement of technology self-efficacy. The pilot study evaluated a sample of five teachers' perceptions about the adaption of the Community of Inquiry (CoI) framework into the elementary school classroom. Findings from this pilot study can inform the creation and delivery of a longer PL program to teach elementary school educators to integrate the three presences of the CoI framework into their instructional practice when using technology.

Proposed Pilot Study

Pilot studies investigate whether something can and should be done and how it should be done (In, 2017). These studies are conducted on a small scale than the full-scale study to help improve the quality and efficiency of the full-scale study. Pilot studies can also inform the development of learning programs and improve the creation of the program content and delivery (In, 2017).

The purpose of this pilot study is twofold. First, to gain a deeper understanding of the challenges elementary school teachers have faced when integrating technology into in-person, hybrid, and online instruction. Next, I will coach elementary school teachers on the CoI framework. Findings from the coaching sessions will inform the design and delivery of a PL program aimed at adapting the CoI framework into the elementary school environment. While the focus on this pilot study is not to instigate change, I will measure changes in teachers' technology self-efficacy because of participating in the CoI-based coaching sessions.

The CoI framework can provide teachers with a structure to support their ability to effectively integrate technology into their instructional practice (Garrison et al., 2001) and it is comprehensive enough to be applied to instructional practices regardless of what digital tool a teacher is using (Anderson, 2017). Teachers who are provided with evidence-based frameworks about teaching with technology are likely to increase their self-efficacy (Desantis, 2013; Kopcha, 2010; Perera, 2019), which suggests their technology self-efficacy may increase. The CoI framework has been widely integrated into higher education contexts that use online and blended learning as the primary form of instruction (Akyol & Garrison, 2011; Doo & Bonk, 2020; Garrison et al.,, 2010). However, because the CoI framework stems from sociocultural theory (Garrison et al., 2001) it has the potential to be adapted into a framework that can support elementary school teachers in planning and delivering online, in person, and hybrid.

Research Questions

The pilot study explored seven research questions. Appendix J is a matrix that depicts the instruments and analysis methods used to answer the research questions. The research questions included:

1. What are the challenges elementary school teachers experience when providing online and hybrid learning to students during the pandemic?

2. To what extent do teachers perceive they have provided high-quality online instruction?

3. To what extent do teachers' feel a sense of agency when providing online and hybrid instruction?

4. What are elementary school teachers' perceptions of the relevancy of the parts of the Community of Inquiry to their instructional practice?

5. To what extent does participation in a Community of Inquiry based coaching session change teachers' technology self-efficacy?

6. What are teachers' perceptions of the coaching process?

In addition to the research questions, one process of implementation was asked: What was the attendance rate for the online sessions?

Methodology

The following section describes the considerations of the pilot study conducted at private international schools in Dubai. The content is organized into sections that discuss the participants, measures, procedure, data collection, and data analysis.

Research design. To answer the research questions, a convergent parallel mixed method design (Creswell & Plano-Clark, 2018; Shadish, Cook, & Campbell, 2002) was incorporated. This kind of research design enabled the collection of both quantitative and qualitative data about teachers' lived experiences using technology both before and during the pandemic, their perceptions of the CoI framework, and changes in teachers' technology self-efficacy. However, because this is a pilot study that aims to describe elementary school teachers' experiences with online, hybrid, and face-to-face learning and understand teachers' needs to develop an effective

long term PL program about the CoI framework, the study mostly relies on qualitative data collection. Qualitative data analysis is exploratory and enables researchers to gain in-depth information about participants lived experiences, reasoning insights, and motivations (Miles et al., 2014).

Participants. Sampling occurred through a combination of convenience and purposive sampling methods (O'Leary, 2014). I used purposive sampling because the pilot study addressed the techno-pedagogical needs and technology self-efficacy of elementary school teachers at private international schools in Dubai. All Master of Education students (N = 153) at a university in Dubai who are also not enrolled in the researcher's classes and who are elementary school teachers at private international schools in Dubai were invited to participate in this research. These teachers were the convenience sample because I am a professor at this university. Each of the qualifying Maters of Education student received an email from the researcher asking them to participate in the study and to respond to the email within seven days if they agree. Four Masters of Education students responded positively to the email.

Classroom teachers are homeroom teachers that spend most of the school day with students; this excludes teacher aides, or specialist teachers such as music, art, or physical education. Classroom teachers of any age, gender, or race who were employed full-time met the criterion for the sample. Master of Education Students who agreed to participate in the study emailed me and I generated a participant list composed of the participants' names and emails.

The participants were four (N = 4) women between the ages of 25 - 50. Other demographic information collected included years of teaching experience and level of education. Table 4.1 describes key demographic information.

Table 4.1

Key Demographics of Participants

Attribute	Label	Count
Gender	Female	4
Age	26-30	1
	31 – 40	2
	41-50	1
Year of Teaching	0 – 3	1
Experience	4 - 6	2
	6 - 10	1
	Bachelor's Degree	4
Role of Teacher	Second Grade	1
	Third Grade	2
	Fourth Grade	1

Measures. The selection of appropriate data collection instruments is contingent upon the construct in the study and the research questions (Creswell & Plano-Clark, 2018). Because this is a mixed-methods convergent parallel design, both qualitative and quantitative data collection occurred.

Coaching session recordings. Questions about teachers experiences during the pandemic with online, hybrid, and in person learning were built into the online meetings. This qualitative approach to research can successfully bring depth to answers to questions and allow for the researcher to ask probing follow-up questions to further access participants' experiences

(Lochmiller & Lester, 2017). Questions such as "What are the challenges you experienced when providing online learning to students?" and "To what extent did you perceive students to be emotionally and socially connected during online learning?" were included. Appendix F represents the activities and discussion questions employed during each of the five online sessions of the pilot study.

Field journal. To describe and interpret experiences within a study, researchers can use a field journal (Krefting, 1991). Field journals are comprised of written observations recorded by researchers during or immediately after a study or part of a study and are essential to comprehending phenomena that occurred during a study. I used the field journal to write reflections about the content presented, participant experiences and participant attendance.

Exit tickets. Data was collected using exit tickets (Appendix I) to garner a deeper understanding of how satisfied participants were with each online coaching session. The first question on the exit ticket used a Likert scale to measure the extent to which participants felt satisfied by participating in the coaching session. The second question on the exit ticket used a Likert scale to determine the extent to which teachers perceived the coaching session provided information that can positively contribute to their instructional practice. Questions three, four, and five on the exit ticket were qualitative and open-ended. They asked: (1) What was the thing you benefited from the most from the coaching session? (2) What new technology-related instruction techniques will you integrate into your instruction practice as a result of this session? and (3) If this coaching session did not meet your expectations and needs, how could it be improved?

Technology integration confidence survey: Version 3. The first version of the Technology Integration Confidence Scale (TICS) was developed by Browne (2011) and used as a self-efficacy scale in alignment with the technology integration standards for teachers created by the International Society for Technology in Education (ISTE). ISTE is education technology organization that created technology integration standards for students, educators, coaches, administrators, and computer science teachers (ISTE, 2018). Browne's (2011) TICS version 2, more intently measured teachers' confidence in performing various technological skills. The TICS version 3 (Gomez, Trespalacios, Hsu, & Yang, 2021; Appendix H) evaluates teachers' self-efficacy in integrating technology in the classroom (i.e., teachers applying and using digital tools during instruction). The TICS version 3 (Gomez et al., 2021) is divided into four subscales: Technology usage (C1); technology application (C2); technology-infused learning (C3); technology literacy, and digital citizenship (C4); technology-supported assessment (C5). The scale includes 25 items that measure the level of confidence of participants about technology integration on a scale from 1 to 5, where 1 means not confident at all and 5 means completely confident. Combined item scores on the TICS indicate teachers' levels of perceived self-efficacy toward technology use for instructional practice, with higher scores suggesting higher levels of technology self-efficacy. The instrument's creators found Cronbach alpha coefficients of .977. For the subscales, reliability coefficients ranged from .916 to .933 for the C1 subscale, .905 to .921 for C2 subscale, .852 to .913 for the C3 subscale, .890 to .922 for the C4 subscale, and .846 to .882 for the C5 subscale. I chose three subscales from the TICS to measure the technology self-efficacy of the participants: Technology usage (C1); technology application (C2); technology-infused learning (C3). Table 4.2 shows the three subscales and the corresponding questions for each subscale.

Table 4.2

Subscales and Questions in the TICS (Browne 2011)

Technology Integration Confidence Subscale	Question
Technology Usage	How confident are you in using technology to stay current with research to support student learning outcomes?
	How confident are you in facilitating and supporting student learning opportunities with technology?
	How confident are you in modeling for colleagues the identification, exploration, evaluation, curation, and adoption of new digital resources and tools for learning?
	How confident are you in using collaborative tools to expand students' authentic, real-world learning experiences by engaging virtually with experts, teams, and students, locally and globally?
	How confident are you in collaborating and co-learning with students to discover and use new digital resources as well as diagnose and troubleshoot technology issues?
	How confident are you with actively participating in virtual and blended learning communities to support your CPD?
	How confident are you in designing authentic learning activities that align with content area standards and using digital tools and resources to maximize active, deep learning?
Technology Application	How confident are you in exploring and applying instructional design principles to create innovative digital learning environments that engage and support learning?
	How confident are you in using technology to create, adapt, and personalize learning experiences that foster independent learning and accommodate learner differences and needs?
	How confident are you in creating learning opportunities that challenge students to use a design process and computational thinking to innovate and solve problems?
	How confident are you in managing the use of technology and student learning strategies in digital platforms, virtual environments, hands-on makerspaces or in the field?
	How confident are you in providing alternative ways for students to demonstrate competency and reflect on their learning using technology?
Technology-infused Learning	How confident are you in learning about, testing or adding into regular practice a variety of proven, promising, and emerging learning strategies along with technology to support and enhance student learning?
	How confident are you in using technology to support student needs through increased personalization and differentiation?
	How confident are you in using technology to support student learning and enhance student engagement through virtual collaboration?
	How confident are you in using technology to support the demands of the student-centered pedagogy for project-based learning?
	How confident are you in using technology to support STEAM as an access point to guide student inquiry, dialogue, and critical thinking?

Procedure

This section explains the procedures by which the pilot study was conducted. First, I describe the online data collection and coaching sessions that the sample participated in. Next, I describe the data collection and data analysis processes used for both the qualitative and quantitative components of the study. The summary matrix that includes the data collection instruments and analysis is included as Appendix J.

Pilot study. The pilot study included five one-hour online coaching sessions and was designed to run for five weeks in May and June 2022 (Table 4.3). During the first meeting I included discussion activities to garner in-depth insight into elementary school teachers' experiences teaching with online, hybrid, and face-to-face lessons both before and during the pandemic. After the completion of the discussion, I introduced the participants to the CoI framework and asked them which presence/s (teaching, social, or cognitive) they would like to attend a coaching session on. Finally, during the last part of the first meeting, teachers completed a pretest questionnaire comprised of three sections of the Technology Integration Confidence Scale (TICS; Gomez, 2020) and demographic questions. The second online meeting consisted of a one-hour coaching session about teaching presence and the third and fourth coaching session pertained to social presence and cognitive presence respectively. Discussion questions were embedded into all the coaching sessions about the presences to gage teachers' perceptions about them. During the last session, the coaching focused on the dynamic interaction of the three presences and the embedded discussion questions addressed how the presences are relevant to participants' instructional practice. All coaching sessions provided participants with guidance on how to integrate what they were learning into their instructional practice. Examples of the activities and embedded discussion questions from each coaching session are in Appendix F. In

between each coaching session participants were asked to reflect on how they were implementing their learning from the sessions into their classroom via a WhatsApp chat group. This chat group did not serve as a form of data collection, but rather it aimed to keep participants accountable and reflective through the coaching process. Participants received an open-ended question on WhatsApp after session two, three, and four, asking them to reflect on how they are integrating their learning from the sessions into their classroom instruction. The WhatsApp Prompting messages were the same each time (see appendix F) and were sent two days after each session. At the end of the last session, I administered the posttest questionnaire to see if attending the coaching sessions influenced teachers' technology self-efficacy. The posttest questionnaire is comprised of the same items as the pretest questionnaire.

Proposed pilot study timeline. Table 4.3 represents the pilot study timeline, specific activities, and measurements that occurred each week.

Table 4.3

Proposed Intervention Timeline

Session	Activities	Measurement
One	Participants completes the technology self-efficacy pretest, partake in discussion about their online, hybrid, and face-to-face teaching experiences, and introduced to the CoI Framework	Pretest Survey, Discussion Activities, Exit Tickets, Field Journal
Two	Participants attend a coaching session about teaching presence, engage in partner work about strategies to integrate teaching presence, and partake in a follow-up discussion and reflection to share their learning	Discussion Activities, Exit Tickets. Field Journal, WhatsApp Chat
Three	Participants attend a coaching session about social presence, engage in partner work about strategies to integrate social	Discussion Activities, Exit Tickets, Field Journal, WhatsApp Chat

	presence, and partake in a follow-up discussion and reflection to share their learning	
Four	Participants attend a coaching session about cognitive presence, engage in partner work about strategies to integrate cognitive presence, and partake in a follow-up discussion and reflection to share their learning	Discussion Activities. Exit Tickets, Field Journal, WhatsApp Chat
Five	Participants complete the technology self-efficacy posttest, attend a coaching session about all three presences in the CoI, engage in partner work. and partake in discussion activities to collect data about their perceptions of the CoI framework	Posttest Survey, Discussion Activities, Field Journal, Exit Tickets

Data collection. Data collection for this study began with the administration of the pretest survey at the beginning of the first session. Both qualitative and quantitative data sets were collected throughout the pilot study and participants were assigned ID codes to pair different sources of data.

Coaching session recordings. With the exception of the partner work in break-out rooms, each of the five online coaching sessions was recorded using the Zoom application. As soon as all participants entered the Zoom room, I asked them for their permission to record. After all typed "yes" in the chat box, I began to record each session. All recordings were stored on my password protected Zoom account.

Field journal. I wrote reflections about the content presented and participant experience during and immediately after each online coaching session. Participants were referred to by their ID numbers in the field journal to protect their anonymity. I also took attendance in the field journal at the end of each online coaching session.

Exit tickets. Exit tickets (Appendix I) were administered using Google forms at the end of each online coaching session. However, only two of the exit tickets were completed after each of the four coaching sessions. If I had asked the participants to complete the exit tickets before leaving the call, I may have gotten a higher response rate. Therefore, the exit tickets were omitted from the data analysis.

Technology Integration Confidence Survey: Version 3. The survey was administered twice, once during the first online coaching session of the pilot study and once at the end of the last online coaching session. The survey is included as Appendix H and was used to measure teachers' technology self-efficacy. The survey took approximately ten minutes to complete and was distributed to the participants through the web-based tool Qualtrics. All respondents completed the same survey and did not receive an incentive to participate. Participants read and signed an electronic consent form on Qualtrics before taking the survey. Results from the survey remained in a password protected data file.

Data analysis. The following section describes the steps in the data analysis of this pilot study. The analysis started with quantitative data and was followed by qualitative data analysis. Finally, the results from qualitative data were analyzed to consider the creation and delivery of a long-term PL program that adapts the CoI framework to elementary school environments.

Database and audit trail. Qualitative data collected from the coaching sessions were accumulated in a database to organize and arrange the data. The database was created using Microsoft Excel on a private and password protected computer. First, I created the catalogue of data organized by the date of coaching session when the data was collected. Next, I entered data from the other data collection instruments used in the study each onto a separate spreadsheet in the database. After the catalogue of data was entered, data points were assigned a-priori and

emergent codes (see coding section below). Also, the database included the a-priori and emergent codebook as well as the audit trail.

The audit trail consists of a collection of researcher-generated data that is used by the researcher to track the evolving analyses of data, observe and examine the researchers' personal responses to the data, and to review the confirmability, dependability, and credibility of the data (Lincoln & Guba, 1985). For the audit trail, I recorded four kinds of documentation: 1) contextual, 2) methodological, 3) personal response, and 4) analytic (Rodgers & Cowles, 1993) depicted in Table 4.4. Audit trail documentation was recorded into the field journal during interactions with participants and into the study database after and in-between sessions with participants, and during data analysis (Rodgers & Cowles, 1993).

Table 4.4

Audit Trail Documentation

Type	Description	Instrument
Contextual	Descriptive accounts of events, observations, activities, emotions, and non-verbal behaviors of participants.	Field Journal Database
Methodological	A description of the rationale for all methodological decisions made during the study.	Field Journal Database
Analytic	A description of the researchers thinking when sorting, coding, and comparing data and when conceptualizing the themes and patterns that emerge through the process.	Field Journal Database
Personal Response	A description of the researchers emotional and psychological responses to the participants of the study, the data, and the analysis process.	Field Journal Database

Coding. Qualitative data analysis occurred using thematic coding process (Miles et al., 2014) through multiple phases. In the first phase of coding, the data were read to garner a general

understanding of teachers challenges and success while teaching online, hybrid, or face-to-face lessons and how the coaching sessions and how the CoI framework influenced their practice. During this phase of coding, data points were assigned a priori codes (listed in Table 4.5). The a priori codes were derived from the variables being measured and to support the analysis of the research questions (Lincoln & Guba, 1985; Miles et al., 2014). Emergent coding further refined the data analysis by creating codes for data that did not fit into the a priori categories (Miles et al., 2014). Throughout the process of coding, in vivo examples were aligned to the a priori and emergent codes. In vivo examples are a holistic procedure where direct quotations deriving from participant responses are turned into examples supporting the codes (Miles, Huberman, & Saldana, 2020). This coding strategy was used for qualitative data analysis as it allows the researcher to "prioritize and honor the participant's voice" (Miles et al., 2020, p. 65) because the study focused on developing a deeper understanding of teachers' experiences during the pandemic and their perceptions of the relevancy of the CoI framework to their instruction practice. The researcher's thought process about creating and assigning emergent codes was also recorded in the audit trail. Table 4.5 represents the a-priori and emergent codes.

Table 4.5

A priori and emergent categories

A Priori Codes	Emergent Codes
Quality of Instruction	Meaningful Online Interaction
Collaboration and Engagement	Feedback
Time	Access to Technology
Teacher Agency	Technical Skills
Technology Self-Efficacy	Tasks and Assessments
Teaching Presence	
Social Presence	
Cognitive Presence	
Community of Inquiry Framework	

I also identified infrequently occurring codes that could be combined with other codes. During the final phase of coding, I identified themes emerging from the data (Miles et al., 2014). Finally, I aligned the themes with each research question and confirmed the association of codes with that particular question.

Several biases may have influenced the data from this study (Lochmiller & Lester, 2017; Miles et al., 2014). Sampling bias was likely to occur given that the participants in the research intentionally chose to undertake an online program. Response bias may have occurred as the subjects may have given responses that they thought would impress the researcher. Finally, my prior experience with teaching and online learning both before and during the pandemic may skew the analysis in a way that aligns to my experiences.

Field journal. The analysis of the notes in the field journal occurred at the end of each training session. I used the same method described in the previous section pertaining to coding the data from the coaching session recordings, to code the field journal. All codes, themes, and transcriptions were added to the codebook and kept in a password protected excel sheet. Finally, the attendance was calculated by creating frequencies of the number of participants who attended each of the five online training sessions. Attendance was recorded into the codebook on a new Excel page.

Technology integration confidence survey: Version 3. After the last online meeting and survey administration, pretest, and posttest data from the sections of the TCIS (Gomez, 2020) were cleaned and imported into the Statistical Package for Social Sciences (SPSS) for data analysis. Basic descriptive statistics were employed to measure changes in teachers' technology self-efficacy and are exhibited and discussed in the final chapter of this dissertation. Descriptive statistics were conducted for the whole sample including frequencies, means, and standard

deviations of the entire scale, subscales, and individual items. Due to the small sample size, inferential statistics were not conducted.

Data triangulation. Data were triangulated to enhance the validity of the findings and to garner a more in-depth understanding of the research questions. Data from coaching session recordings was compared to exit ticket data and the field journal to gain a deeper understanding of teachers' experiences with online, hybrid, and face-to-face learning, the coaching process, and teachers' perceptions of the CoI framework. This data was also compared to the data from the survey to create a more thorough understanding of the change in teachers' technology self-efficacy. Finally, field journal notes regarding attendance were compared to both qualitative and quantitative data about the change in teachers' technology self-efficacy and perceptions of the CoI framework. This comparison helped determine if the amount of coaching received by participants contributed to changes in teachers' technology self-efficacy and perceptions of the CoI framework (Dusenbery et al., 2003).

Researcher Subjectivity Statement

For data collection in qualitative research, the primary instrument used is the researcher (Golafshani, 2003). Accordingly, any biases and values embraced by the researcher may influence the findings of their study (Creswell & Plano-Clark, 2018). These biases and values must be accounted for and acknowledged in order to assure the trustworthiness of the study (Creswell & Plano-Clark, 2018). Accordingly, I will express my position and personal views comprehensively. The following section presents my background within the context of this research to lessen any inadvertent consequences stemming from any views and biases I espouse.

My educational background is in child development and elementary school education. I attended high school, college, and graduate school at American organizations and lived the first

35 years of my life in New York state. For the last 13 years, I have been living in Dubai and working in the field of education. During my first four years in Dubai, from 2009 – 2013, I taught both first and sixth grade at a private international school in Dubai that employed the American Virginia State Standards and then the Common Core standards. Throughout the next six years I worked as an education consultant engaging in teacher training projects at private American curriculum schools in the UAE and in other parts of the Gulf Cooperation Council (GCC). During this time, from 2013-209, I saw the rapid integration of technology into classrooms throughout the GCC and watched teachers and administrators experience both successes and failures in its integration. Additionally, as a consultant and teacher trainer, I had to improve my technopedagogical skills so that I could be more effective in my job. When COVID-19 shut down schools in the GCC in March 2019, I curtailed all my consulting engagements because I did not feel prepared to provide any expertise on this new paradigm of distance education during an international health crisis. I returned to work in the fall of 2020 as an adjunct professor of education at a British university in Dubai. My responsibilities increased greatly due to high amounts of staff turnover, and I am now head of the department of education and early childhood studies at this university.

My experiences as a classroom teacher, education consultant, professor, and head of department have driven my focus onto effective technology integration because of the struggle I have experienced with technology and because of first-hand observations and accounts of other teachers' struggles to integrate technology. The education policy mandates in the UAE, at all levels of the education system, have forced schools to integrate technology at rapid speed and without the digital tools, training, and knowledge needed to do so effectively. COVID-19 further quickened the rate of technology integration and diffused this integration into the homes of

teachers and students alike. Although I have been frustrated with the speed of technology integration, I am invested in making technology integration successful for teachers. First, I am deeply committed to improving the practice of the teachers I train as a consultant and educate at the university. Secondly, as a mother and educator, I want to see all the children who are attending both public and private schools in the UAE reach their fullest potential academically and emotionally.

As a researcher, I ensured that all participants in my intervention understand my work experience in the UAE. I conveyed to them my beliefs and attitudes about education technology and its integration into schools. I also considered my position of privilege as a white, US born, cisgender female head of department at the largest private university in Dubai as it related to the participants and focus of the research. My observations and conclusions were likely impacted by my positionality as a participant observer of this study (CITATION). In addition, although I felt that I developed a sense of trust with the participants, it is unlikely I was fully able to understand and clearly report their lived experiences because I do not know what it is like to teach elementary school children during a pandemic. Participants may have tried to please during coaching sessions as I am head of the department in which they are obtaining their master's degree. The participants sampled for the study were in my department of education, however they are not my students. To avoid coercion, I only invited students who were not enrolled in my classes to participate in this research. In addition, I included a section in the informed consent sheet guaranteeing that participation in this research will have no impact on their grades.

Chapter 5: Findings

The first objective of this study was to gain a deeper understanding of the challenges elementary school teachers faced when integrating technology into face-to-face, hybrid, and online instruction. Secondly, the study examined elementary school teachers' perceptions of the relevancy of the parts of the Community of Inquiry (CoI; Garrison, et al., 2001) to their instructional practice. Findings from the study can inform the design and delivery of a Professional Learning (PL) program aimed at adapting the CoI framework into the elementary school environment. While the focus on this study is not to instigate change, changes in teachers' technology self-efficacy were measured as a result of participating in the CoI-based coaching sessions.

This chapter begins with a description of the implementation and delivery of the five coaching sessions and is followed by the findings section and discussion, organized by research question. The discussion focuses on the challenges teachers experienced with online and hybrid learning, teachers' technology self-efficacy, and the relevancy of the parts of the CoI to elementary school teachers' instructional practice when teaching with technology. The chapter concludes with an exploration of the limitations and implications for future research.

Process of Implementation

The pilot study included five one-hour online coaching sessions that ran for five weeks in May and June 2022. Four elementary school teachers consistently participated in all five sessions of the study. Each participant completed the pre and posttest survey, exit tickets after three of the sessions, and contributed to the conversation during the coaching sessions and when the embedded discussion questions were presented. All components of the study were implemented as designed (Appendix F) and are represented in the logic model (Appendix G).

Each of the coaching sessions aimed to provide participants with an understanding of each of the presences of the CoI framework and strategies to facilitate these presences during instruction with digital tools. To support this, I used a dialogical approach to coaching where coaches and teacher-participants work together (Knight, 2021). The dialogical approach to coaching bridges the gap between facilitative and directive coaching. Facilitative coaching is grounded in the idea that teachers already know what to do but need a colleague to share ideas with and to help them transform their knowledge into effective practice (Knight 2021). Directive coaching is grounded in the idea that the teacher does not know what to do and would benefit from the coach directing the teachers practice (Knight, 2021). Because participants in this study were experienced teachers but new to the CoI framework, the dialogical approach to coaching facilitated what they already knew and directed them to embrace new knowledge and skills.

The content and format of each coaching session was designed to meet the needs of the participants with regard to their degree of knowledge about the CoI and how to integrate the CoI into their instructional practice. Data about participants experiences when teaching during the pandemic was gathered in the first coaching session and used to update the design and content of the coaching sessions to make them more relevant to the needs of the participants. In doing this, I attended to the critical components of content focus, coherence, active learning, and collective participation of professional learning (PL; Desimone, 2009). Also, I researched strategies to improve teaching, social, and cognitive presence and embedded the most useful strategies, based on participant needs, into the coaching sessions. During the first online session, held on the Zoom platform, I introduced participants to the CoI framework and led a discussion to garner in-depth insight into elementary school teachers' experiences teaching in both online and hybrid environments during the pandemic. Also, teachers completed a pretest questionnaire comprised

of three sections of the Technology Integration Confidence Scale (TICS; Gomez, 2020). For the remainder of the first session, I introduced the CoI to the participants and provided a brief definition and example of each of the presences. After this, participants reflected with partners in break-out rooms on the presences and determined to what degree, if any, they were using teaching, social, or cognitive presence as part of their practice during the pandemic. After the reflection participants and I returned to the main Zoom room and shared their reflections with the group.

The second online coaching session focused on providing participants with an understanding of what teaching presence is and with strategies to improve their teaching presence. Teaching presence refers to how the teacher creates, facilitates, and manages the education experience to facilitate learning outcomes (Anderson et al., 2001). During this session, participants were introduced to Triple E Framework (Kolb, 2015) to learn how to evaluate digital tools in order to support teaching presence. The Triple E Framework measures how effectively digital tools are integrated into instruction to help learners enhance, engage, and extend learning objectives. Because teachers drive student engagement, and can enhance and extend learning (Kolb, 2015), the Triple E Framework aligns to some of the components of teaching presence in that it can help teachers facilitate, manage, and create effective instruction using technology. After participants received coaching on understanding teaching presence, strategies to support teaching presence, and the Triple E Framework, they went into break-out rooms to reflect on strategies to enhance their teaching presence. As a coach, I visited each break-out room to both facilitate and direct the development of strategies to increase teaching presence. After the reflection, participants and I returned to the main Zoom room and shared their reflections with the group.

The third and fourth coaching session pertained to social presence and cognitive presence respectively. Social presence is the degree to which students feel socially and emotionally connected to other classmates, identify with the community, purposefully communicate, express their ideas, and build relationships with other students and the teacher (Garrison et al., 2001; Turner & Foss, 2018). Cognitive presence is the extent to which learners can construct and use evidence to confirm their learning, engage in discourse, and participate in learning activities (Garrison et al., 2001; Vaughan & Garrison, 2005). Each of these sessions were conducted online in a similar format to the second session; the specific CoI component was introduced, strategies to support the components were provided, partners reflected on and considered strategies to enhance the components in break-out rooms and then shared them with the group. After the second, third, and fourth session each participant was asked to fill out an exit ticket. During the last session, the coaching focused on the dynamic interaction of the three presences and the embedded discussion questions addressed how the presences are relevant to participants' instructional practice. Participants worked in pairs in break-out rooms to apply their learning by creating a Google Site to support a lesson in their curriculum, that embedded the characteristics of the teaching, social, and cognitive presence. As a coach, I visited each break-out room to both facilitate and direct the development of the Google Site that integrates the three presences of the CoI. After the Google Sites were created, participants shared them with the group and focused on how they integrated the three presences into the lesson that the site lesson as built to support. Finally, participants completed the posttest at the end of the last session.

Discussion questions were embedded into all the coaching sessions about each of the presences, to gage teachers' perceptions about them. These questions were asked after the presence was introduced and after participants shared their reflections and ideas from their

partner work in the break-out rooms. In between each of the five coaching sessions, participants were asked to reflect on how they implemented their learning from the coaching sessions into their classroom via a WhatsApp chat group and were able to ask questions and receive answers. Two days after each session, I created a prompt in the WhatsApp chat to see if and how participants were applying their learning. Participants actively engaged in the chat by sharing their successes and challenges and advised each other on strategies to use when integrating the components of the CoI into their instructional practice.

Findings

This study examined the challenges that elementary school teachers faced when engaging in online, hybrid, and face-to-face teaching during the Covid-19 pandemic. It also investigated the relevancy of the CoI framework to instructional practice in the elementary school classroom. Most of the data was qualitative and collected through embedded discussion questions during the coaching sessions. Only the data collected pertaining to self-efficacy was both quantitative and qualitative. The results are organized by each of the research questions.

Data analysis. Quantitative data analysis occurred through descriptive statistics. A thematic coding process (Miles et al., 2014), employed through multiple phases, was used to code the qualitative data (see chapter 4). Table 5.1 is a depiction of the timeline, qualitative data collection events and descriptions that occurred during the data collection and analysis process (Lochmiller & Lester, 2017). This audit trail is provided to facilitate transparency about the qualitative research and analysis processes.

Table 5.1

Audit Trail for Qualitative Data Collection Process and Analysis

Date	Entry
July 1, 2022	Downloaded all Zoom recording transcripts into word documents. Cleaned the data by playing back the Zoom video recordings. I cross referenced the recordings with the transcript on the word document and corrected any errors.
July 2, 2022	Continued to clean the data by playing back the Zoom video recordings. I cross referenced the recordings and corrected any errors.
July 3, 2022	Reviewed the cleaned transcripts and completed the first stage of coding for sessions one, two, and three. Sections of transcripts were assigned a-priori categories. Categories included quality of instruction, collaboration, time, assessment, teacher agency, classroom management, student engagement, and teacher confidence. Added the term 'engagement' to the 'collaboration' code because participants frequently mentioned these terms together.
July 5, 2022	Reviewed the cleaned transcripts and completed the first stage of coding for sessions four and five. Sections of transcripts were assigned a-priori codes (listed above).
July 7, 2022	Reviewed the initial coding work and created emergent codes for the data that did not fit into the a priori codes . Emergent codes included meaningful online interactions, feedback, access to technology, and technical skills. I also Confirmed that in vivo examples aligned to an emergent or a priori codes.
July 9, 2022	Reviewed all the coding processes. Collapsed the codes tasks and assessments into one category. Consolidated codes into themes: Online learning, blended learning, face-to-face learning, teaching presence, social presence, and cognitive presence. Replicated codes and in vivo examples under certain themes as they supported more than one theme.

Challenges when providing online and hybrid learning to students. The first research question asked, "What are the challenges elementary school teachers experience when providing online and hybrid learning to students during the pandemic?" Findings from analysis of qualitative data suggest that teachers face various challenges when administering both hybrid and online learning. These challenges are organized under the codes meaningful online interactions, collaboration and engagement, time, and tasks and assessments. Meaningful online interactions decrease students' feelings of isolation and increase students' connection to the teacher and classmates (Howland et al, 2104). This is important because online interactions can be dehumanizing which may contribute to decreases in student engagement and achievement (Rehn, Maor, & McConney, 2018). Collaboration and engagement refer to the degree to which students attend to, participate in, and work together during lessons (Shae & Bidjerano, 2012; Zinger, Warschauer, & Tate, 2017). The code time is divided into two sub-codes: Teacher time and student time. Teacher time refers to the amount of time it takes to plan and prepare lessons with technology and the loss of teaching time during online interactions when audio, video, or internet disconnects Student time refers to the amount of time it takes to get online or logged into learning applications, Tasks and assessments refer to the authenticity and degree of completion of student follow-up work. Table 5.2 and 5.3 show themes, codes, and in vivo examples that address challenges when providing online and hybrid learning to students respectively.

Table 5.2

Challenges During Online Learning: Theme, Codes, and Examples

Theme	Code	Example
Online Learning	Meaningful Online Interaction	"We weren't allowed to show them our home to connect with them. The school made us put a background. It would have been nice for the students to see that I am stuck at home like them and what my home looks like."

		"No. I don't feel connected to students, not at all."
	Collaboration and Engagement	"Sometimes when they were working in groups and I would call on a student, they wouldn't even respond. Their camera was off, and I didn't even know if they were there." "The problem with online was how to get them to collaborate." "It's easier to tell if students are collaborating with each other in a classroom situation because I can watch them. It's just easier to keep them on task." "They don't engage, not only in their studies, but also with the people around them online learning and that's serious and impacting them. It's something we need to focus on."
	Time: Teacher Time	"I would say the biggest challenge was how time-consuming it was to prepare lessons."
	Student Time	"It took a lot of time for students to learn how to use the apps. It was such a struggle."
	Learning Tasks and Assessments	"The grades of the assessments were really high when the classes were online compared to when the classes were in person. Someone must have been helping them, or they cheated" "I never know who did a task for a child or if the child did it themselves. It's really hard online. And, if I don't know if a child can do a task, I don't know if I am teaching them at their ability level." "I made a lot of online quizzes for assessment, and kids were just fooling around and answering questions randomly."

Table 5.3

Challenges During Hybrid Learning: Theme, Codes, and Examples

Theme	Codes	Example
Hybrid Learning	Collaboration and Engagement	"It is hard to connect the students who are online to the ones who are in the classroom. I become so stressed out about it. It is hard to get them to work together when one is at school, and one is online." "When I get a message that a student is going to be online for a week, my heart sinks. I'm like, 'Oh no, not again!' I know it's going to exert a lot of pressure on my part and in the classroom. You're divided between two things; you have to take charge of the classroom and handle the kids at home. And it's impossible to get the kids to collaborate with the kids at school.
	Time: Teacher Time	"When some kids are at home, live streaming takes a lot of time. You end up wasting the better part of your lesson. I have to waste time establishing the connection and making sure the students at home are online. Most of the time, they can't hear me, and I have to repeat myself or check the connection."

All teachers reported specific and common difficulties in their interactions with students. Furthermore, there were high degrees of uncertainty about the use of technology in the teaching process. In most cases, when teachers were asked to compare their experiences when teaching online and when teaching face-to-face with technology, they preferred face-to-face learning with technology. Participants reported numerous problems that they encountered during online teaching including unfavorable interactions between the teacher and the students, low collaboration levels, and poor classroom management during online and hybrid instruction, lack of time to plan and prepare lessons, and loss of teacher agency.

Meaningful online interactions. All the teachers felt that meaningful online interactions between the teacher and students were diminished due to school restrictions. Nina remarked, "We weren't allowed to show them our home to connect with them. The school made us put a background. It would have been nice for the students to see that I am stuck at home like them and what my home looks like." Two other participants reported having to use backgrounds provided by their schools. This data suggests that all of the teachers felt they could have interacted and connected with students more deeply if students could see into the home life of the teacher. This may have enabled the online interactions to be more personal and humanizing between teachers and students. In addition, all participants mentioned that students were allowed to keep their cameras off during online learning. This made teachers feel more disconnected from students as they were not able to see if students were engaged, comprehending the learning, or even attending the lesson. Felicia stated, "Sometimes when they were working in groups and I would call on a student, they wouldn't even respond. Their camera was off, and I didn't even know if they were there." Hence, these impediments o interacting with students render a challenge to online and hybrid teaching as perceived by the participants.

Collaboration and engagement. The data from the pilot study suggest that teachers could not implement effective or efficient collaboration strategies between the students and between the teacher and students when engaging in both online and hybrid learning. All the participants reported that students were not collaborating during online instruction. "The problem with online was how to get them to collaborate," said Danya. Felicia reported "It's easier to tell if students are collaborating with each other in a classroom situation because I can watch them. It's just easier to keep them on task." Nina agreed, saying "They don't engage, not only in their studies, but also with the people around them online learning and that's serious and impacting

them. It's something we need to focus on." Because students were allowed to keep their cameras off, this likely interfered with their ability to engage and collaborate with others, and students may not have been attending the online lesson at all. These responses indicate that the participants are surer about enabling student engagement and collaboration during face-to-face learning than online learning.

Furthermore, when teachers conducted hybrid learning they also experienced the same problems of low engagement and collaboration between the students and the teacher. Felicia remarked, "It is hard to connect the students who are online to the ones who are in the classroom. I become so stressed out about it. It is hard to get them to work together when one is at school, and one is online." Huda agreed,

> When I get a message that a student is going to be online for a week, my heart sinks. I'm like, 'Oh no, not again!' I know it's going to exert a lot of pressure on my part and in the classroom. You're divided between two things; you have to take charge of the classroom and handle the kids at home. And it's impossible to get the kids at home to collaborate with the kids at school.

These findings suggest that student engagement declined, and low levels of collaboration occurred between the students and between the students and the teachers during both online and hybrid learning. As such, low collaboration was a barrier to online and hybrid learning.

Time. All the participants identified time as a barrier to online and hybrid learning. The participants explained how much teacher time was consumed to plan and coordinate class activities using technology, to learn how to use new digital tools, and to get the technology working properly to stream lessons. Nina explained, "I would say the biggest challenge was how time-consuming it was to prepare lessons." Huda said:

> It took a lot of time, you know, preparing the PowerPoints and all of the lessons and stuff. And I am not very tech savvy, so it took a lot of time to learn how to use the new apps. It took a while, you know, to maneuver through the apps and feel confident in using them.

Teachers had trouble when planning and preparing lessons, and this required more time, especially when they were not conversant with the technology. It also took students time to get used to the technology before the online instruction began, and log into and learn how to use the provided applications. Huda mentioned, "It took a lot of time for students to learn how to use the apps. It was such a struggle." There was also inefficient time utilization during class hours for both online and hybrid learning.

> When kids are at home, live streaming takes a lot of time. You end up wasting the better part of your lesson. I have to waste time establishing the connection and making sure the students at home are online. Most of the time, they can't hear me, and I have to repeat myself or check the connection.

The needs analysis conducted before this pilot study (see chapter 2) identified time as one of the largest barriers to teacher technology integration. Data from the pilot study also emphasized time as a barrier to hybrid and online teaching. In both cases, teachers report needing more time to plan and prepare lessons that use technology and to learn and experiment with digital tools.

Tasks and assessments. Teachers reported the difficulty of conducting online assessments, as compared to face-to-face assessments. First, because students often did not have their cameras on, teachers were not able to see if the student was getting help by using the internet when answering assessment questions. One of the teachers pointed out that, most of the time, students scored higher in online assessments than in face-to-face assessments.

"The grades of the assessments were really high when the classes were online compared to when the classes were in person. Someone must have been helping them, or they cheated" remarked Nina. Danya added, "I am really surprised at the grades from the students who are taking the assessment at home. I think their parents are helping them. Either all of a sudden I did really well as a teacher or there is something else going on."

Not knowing if students were working without help also occurred during task completion. Felicia stated, "I never know who did a task for a child or if the child did it themselves. It's really hard online. And, if I don't know if a child can do a task, I don't know if I am teaching them at their ability level."

Students also did not seem attentive or engaged during online learning; they aimed to finish the class and the assessments and do other things. Nina reported, "I made a lot of online quizzes for assessment, and kids were just fooling around and answering questions randomly. They just wanted to get the task done so they would click on anything." These examples may indicate that one of the challenges to online instruction is the authenticity of student work and assessments. Barriers to meaningful interactions, effective collaboration between teachers and student and students themselves, lack of time, and tasks and assessments that do not truthfully reflect the knowledge and skills of the student were the challenges to online and hybrid learning reported by participants.

Quality of instruction. The second research question examined the extent to which teachers perceived they provided high-quality online instruction to students during the pandemic. Quality of instruction refers to the degree to which the delivery of a lesson facilitates student engagement and interest, critical thinking, and students' acquisition and understanding of knowledge (ASCD, 2022). Responses to the embedded discussion questions during the coaching

sessions indicate that teachers did not feel like they delivered high-quality instructions during online or hybrid learning. Table 5.4 and 5.5 shows the themes, codes, and in vivo examples pertaining to quality of instruction during online and hybrid learning, respectively.

Table 5.4

Quality of Instruction During Online Learning: Theme, Code, and examples

Theme	Code	Example
Online Learning	Quality of Instruction	"Everything is digital now. I believe kids need to feel things, move things, and touch things to learn"
		"Not all students seemed willing to learn online or engage so the quality of instruction was really affected by this"
		"I wouldn't call it high quality. I would say I managed the best I could to the best of my ability. But I didn't feel confident that the instruction quality was high."
		"When they are supposed to be solving their own problems, they always come to you. And they want you to just tell them what to do or tell them the answers"

Table 5.5

Quality of Instruction During Hybrid Learning: Theme, Code, and Examples

Theme	Code	Example
Hybrid Learning	Quality of Instruction	"There are so many times when I can't hear the child at home, so I can't answer the questions or help them. And then, half the time, the kids at home can't hear me. How are they supposed to learn anything?"
		"It's hard to attend to the kids at home and the kids in the classroom at the same time. I feel like I can't teach them both."

When asked about quality of instruction during online learning, one teacher indicated that students were missing out on high-quality instruction because they were unable to use their five senses for learning while learning on screen in a digital environment. All participants suggested that lack of engagement contributed to a lower-quality of instruction. Huda indicated, "I had such a hard time keeping students on-task. I don't think the quality of instruction was very good. Most of my time went to seeing if they were even paying attention." Nina agreed, "I wouldn't call it high quality. I would say I managed the best I could to the best of my ability. But I didn't feel confident that the instruction quality was high." Moreover, Felicia stated, "Not all students seemed willing to learn online or engage so the quality of instruction was really affected by this." This statement suggests that Felicia perceived high-quality instruction to resemble student-centered learning where student engagement and interest in learning are essential. Without students interacting, it was likely that instruction turned into a teacher-centered didactic method.

Another teacher explained that despite the dire efforts to ensure effective learning, she was not confident that her instructional process was high quality. When she asked questions, the students were not responsive, which indicated they may have not been paying attention to or comprehending the information.

The idea that students were not engaged or paying attention was repeated by all the participants. Danya said, "I kept asking questions again and again, waiting for a response from a student. It was a waste of time." Nina suggested that students were not paying attention because they continuously asked her for answers. "When they are supposed to be solving their own problems, they always come to you. And they want you to just tell them what to do or tell them the answers" she said. Teachers perceived that the quality of instruction during online learning was lower than during face-to-face learning. While teachers attributed this to lack of

engagement from students, it is also likely that the barriers to online and hybrid learning (identified in research question 1) contributed to the reported low quality of instruction.

It was also pointed out that students were not keen on doing their assignments. When given assignments to research, students would spend a lot of time surfing the web instead of getting answers to the research question. Therefore, students were not completing follow-up tasks to deepen their understanding and teachers may have interpreted this by assuming they were providing low-quality instruction.

Teachers who conducted both hybrid and online learning also disclosed that they did not offer quality instruction to students because of poor internet connection between the teacher and students at home. Huda said, "There are so many times when I can't hear the child at home, so I can't answer the questions or help them. And then, half the time, the kids at home can't hear me. How are they supposed to learn anything?"

The quality of instruction during online and hybrid learning was lower than face-to-face, as reported by participants. Teachers felt that the students were not attentive as they had spent time explaining the concepts but getting questions about the very concepts they explained from the students. Teachers' also felt that students were not willing to learn online and engage, which affected the quality of their instruction as collaborative dialogue was not occurring during instructional time. Also, poor internet connections made it difficult for teachers to communicate properly with students, thus interfering with the quality of instruction. Interestingly, none of the teachers' thoughts about the lowered quality of instruction were self-reflective. Teachers did not suggest that they lacked pedagogical strategies to effectively teach online.

Teacher agency. Next, the research investigated the extent to which teachers feel a sense of agency when providing online and hybrid instruction. Teacher agency is

the ability of teachers to act on their ideas and future plans to modify their instructional practice to meet the needs of their students (Damsa, Langford, Uehara, & Scherer, 2021; Kimber, Pillay, & Richards, 2022). As such, agency also refers to the degree to which teachers were able to control their actions and feel a sense of control over the actions of their students (Bandura, 1982).Table 5.6 and 5.7 represent the themes, codes , and in vivo examples for the research question about teacher agency.

Table 5.6

Teacher Agency During Online Learning: Theme, Code, and Examples

Theme	Code	Example
Online Learning	Teacher Agency	"When I gave them independent time for learning, I did not know if they were using my resources or watching something on YouTube instead for fun." "I felt like I lost a sense of control and kids were just free to do whatever they wanted online." "It was difficult to tell if the students were staying on task and doing what they were supposed to. We used break-out rooms for group work, but I couldn't move between rooms fast enough to help groups and to see if they were on task or working

Table 5.7

Teacher Agency During Hybrid Learning: Theme, Code, and Examples

Theme	Code	Examples
Hybrid Learning	Teacher Agency	"When I go to help the kids online, the kids in the class start to misbehave. I lose control. It would be better if I could use a device that I could move around the classroom with so I can attend to kids online from anywhere in the classroom."

> And the parents are watching from home. It's really stressful because I feel like they are judging me or the noise of the classroom. So, I start teaching to please them instead of the students. I am afraid the parents are criticizing me.

The responses from the pilot study suggested that teachers did not feel a sense of agency when conducting both online and hybrid teaching. This was likely attributed to a lack of coordination and collaboration between the teachers and the students in online and hybrid environments, student cameras being turned off, and teachers not being able to monitor students while they were engaged in learning activities. All of the teachers reported a feeling a low sense of agency because students were not attentive during instructional time but were only doing the required activities instead. Huda said, "I felt like I lost a sense of control and kids were just free to do whatever they wanted online." Nina reported, "It was difficult to tell if the students were staying on task and doing what they were supposed to. We used break-out rooms for group work, but I couldn't move between rooms fast enough to help groups and to see if they were on task or working."

Participants also reported a loss of agency when students were working independently. Teachers indicated that they created sequences and resources for learning but were unable to tell if the students were using them properly or at all. Felicia said, "When I gave them independent time for learning, I did not know if they were using my resources or watching something on YouTube instead for fun." Danya agreed, "I wasn't even sure if students were using the online resources I made."

The findings also indicated that the teachers felt they were generally not in control of online classes because students' cameras were turned off and because they were unfamiliar with the technology they were using. Huda stated, "Sometimes, when they were working in groups, and I would call on a student, they wouldn't even respond. Their camera was off, and I didn't even know if they were there." Nina said,

> I often didn't feel in control because so many students were not submitting their work. I couldn't give them feedback or plan lessons based on their progress because the work wasn't being submitted. I had no control and couldn't get them to submit their work. Also, so much of the online learning during the pandemic was a learning process for me. Because I was still learning how to use the technology, I didn't really feel like I was in control. I felt lost.

The first response suggests how difficult it was for the teachers during online instruction and how not being able to see the students may have resulted in a loss of agency. Furthermore, often the students were unresponsive to the teachers, which likely resulted in a loss of teacher agency, as they could not lead a discussion without student participation. Similarly, teachers reported a feeling of loss of control of the class activities. Many students did not submit their assignments and teachers reported that this hindered them from moving students through the curriculum and giving quality feedback to the students. Furthermore, teachers suggested feeling a loss of agency because some of the technology they were using was not familiar to them and therefore they may have been unable to act on their ideas when creating and delivering.

Similarly, teachers conducting hybrid learning indicated a decreased sense of agency during the instructional process because it was difficult to coordinate the students at home with the ones in the classroom to achieve a common goal. Felicia said,

> When I have some online, and the rest are in the classroom, I can't even tell if the kids at home are engaged. I have to stay in front of the camera for the kids at home, so I can see if they are engaged and get them back on track or help them. And I can't walk around the room to help the kids who are there.

Danya agreed, saying "When I go to help the kids online, the kids in the class start to misbehave. I lose control. It would be better if I could use a device that I could move around the classroom with so I can attend to kids online from anywhere in the classroom." Nina commented, "We are still offering online learning to home-sick children or in quarantine. The kids at home pretend that their apps are not working or can't click on something. They only pay attention or show up during assessments."

Furthermore, all of the participants indicated that they were uncomfortable teaching under the observance of the parents. Teachers concentrated on performing for the parents rather than providing the lessons they created for the students. Nina explained, "And the parents are watching from home. It is stressful because I feel like they are judging me or the classroom noise. So, I start teaching to please them instead of the students. I am afraid the parents are criticizing me."

Data suggests that teachers' sense of agency was lowered during online and hybrid learning. The factors that likely contributed to teachers feeling a loss of control were students' cameras being turned off, difficulty with classroom management, challenges with attending to face-to-face students and online students at the same time, unfamiliar technology, and having to perform for parents.

Relevancy of the Community of Inquiry framework. The next research question asked, "What are elementary school teachers' perceptions of the relevancy of the parts of the

Community of Inquiry (Anderson et al, 2002). to their instructional practice?" There are three facets of the CoI framework: teaching presence, social presence, and cognitive presence. The findings about the research question are organized by each presence.

Teaching presence. Teaching presence supports the interactions with students that teachers engage in during learning to enhance social and cognitive processes (Garrison et al., 2001). The coaching process aimed to teach the participants to enhance their teaching presence while integrating technology in classroom instructions. After the first session that introduced the teachers to various parts of the community of inquiry framework and explained strategies to ensure teaching presence, teachers were asked about their perceptions of the relevancy of teaching presence to teaching with technology in the elementary school environment. Findings from the research suggest that the teachers appreciated and embraced the idea of teaching presence and planned on integrating it into their instruction going forward. Table 5.8 depicts the theme, codes, and in vivo examples for teaching presence.

Table 5.8

Teaching Presence: Themes, Codes, and Examples

Theme	Codes	Example
Teaching Presence	Technical Skills	So, there are many times when I show them links and think that they will just get on with it. Now, I have to remember that after I show them the link, I have to model the steps and guide them through using the website or the particular link."
		"Opening up a website is for them like a new thing, and we must guide them through it at least. A couple of times, the first three or four times. Especially if you are going to use that site regularly so the kids can get used to it."

	Quality of Instruction	"When I am designing a lesson, I am going to think about using more student-centered instruction to help students construct meaning."

Teachers reported a lack in technical skills to support students in the logistical aspects of navigating through and using a digital tool. Huda said, "So, there are many times when I show them links and think that they will just get on with it. Now, I have to remember that after I show them the link, I have to model the steps and guide them through using the website or the particular link." Similarly, Nina said "Opening up a website is for them like a new thing, and we must guide them through it at least. A couple of times, the first three or four times. Especially if you are going to use that site regularly so the kids can get used to it."

These responses indicate that the teachers believe that teaching presence is relevant their instructional practice , and to enhance their teaching presence they will further explain how to navigate websites rather than giving students links and leaving them alone. Furthermore, it was clear to the teachers that narrowing instruction and creating student-centered instruction that promote interaction fosters teaching presence. Felicia noted that a way to narrow instruction and increase teaching presence is by "giving them a list of websites to choose from when they do their internet research seems like a good idea." Huda noted that she can increase her teaching presence to guide students and enhance the quality of instruction. "When I am designing a lesson, I am going to think about using more student-centered instruction for students to help them construct meaning." She also indicated that it's a good idea to enhance her teaching presence by giving students guiding questions to follow when they are researching online rather than just leaving them to research on their own.

Such guidance and illustrations can enhance teaching presence, which participants

perceived as relevant because it helps students to follow up and expand their learning. Teachers also pointed out the criticality of teaching presence to help guide the students through navigating websites to get them used to the process for future learning.

Social presence. Social presence is the degree to which students and teachers feel socially and emotionally connected during instruction (Garrison et al., 2001; Turner & Foss, 2018). In the third session, teachers were asked about the importance of social presence and the strategies they used to improve social presence in the instruction process. The findings suggest that teachers valued and integrated various strategies that may have increased student interactions and social presence. Table 5.9 depicts the codes and samples of in vivo examples for the theme of social presence.

Table 5.9

Social Presence: Themes, codes, and examples

Theme	Code	Example
Social Presence	Meaningful Online Interaction	"It is important for teachers to share personal information about themselves to help connect to students. Recently I shared about a coin collection I have. This one student who would never do anything in the classroom finally talked to me and told me he had a coin collection. I used this to get closer to the student; now, he is engaged in class. And he brings his coins to school to show me."
	Collaboration and Engagement	"It is important to give them a sense of belonging to feel like they belong within the group. To feel like their thoughts are being valued and to get their input into, you know, the learning process."
		"They don't engage, not only in their studies, but also with the people around them and that's serious and impacting them. It's something we need to focus on."

Teachers suggested the component of social presence was relevant to their instruction because it can act as a pathway to enhance student support, collaboration, and increase student expression. Nina explained,

> It is important for teachers to share personal information about themselves to help connect to students. Recently I shared about a coin collection I have. This one student who would never do anything in the classroom finally talked to me and told me he had a coin collection. I used this to get closer to the student; now, he is engaged in class. And he brings his coins to school to show me.

The teacher facilitated social presence by sharing a personal experience to bond with an unresponsive student. As a result, according to the teacher, the student began to feel connected to the teacher and started to engage with her and the lessons. In addition to experiences like this, teachers reported the importance of encouraging students to share ideas in groups which is essential for collaboration and expression. Danya said, "It is important to give them a sense of belonging to feel like they belong within the group. To feel like their thoughts are being valued and to get their input into, you know, the learning process." Nina agreed, "Social presence is important for creating safety so children can talk and share ideas without getting laughed at." Participants felt that encouraging students to engage with the community positively impacted their learning.

Prior to the study, teachers perceived that social presence was low when students were using digital tools during online, hybrid, and face-to-face learning. Felicia noted, "When they are using technology, they are all out of the picture as if they aren't present anymore. Yeah, mentally I don't know where they are. Physically they are sitting, but if you look at their eyes, they look empty." Huda mentioned, "They don't engage, not only in their studies, but also with the people

around them and that's serious and impacting them. It's something we need to focus on." These remarks indicated that, although participants did not know about the CoI or have a name for 'social presence' before they participated in the coaching sessions, they were aware of its importance in the learning process when using digital tools

Cognitive presence. Cognitive presence refers to the extent to which students are able to construct and verify learning through discourse and reflection (Garrison et al., 2001; Vaughan & Garrison, 2005). The process involves critical thinking and reflection of previous ideas (Garrison et al., 2001). The pilot study also aimed to learn if teachers valued and understood the role of cognitive presence in instruction, as learned during the coaching process. Table 5.10 shows the codes and samples of in vivo examples for the theme cognitive presence.

Table 5.10

Cognitive Presence: Theme, codes, and examples

Theme	Codes	Example
Cognitive Presence	Quality of Instruction	I like that cognitive presence has four stages. Now that I know this, I can design my lessons and integrate teaching and social presence to go from the triggering event through to the resolution stage."
		"Now that I know about the stages in cognitive presence, I am concerned that I haven't been doing this in the past. What if students were only getting through the exploration stage and not to the end?"
	Collaboration and Engagement	"When social and teaching presence have been established, cognitive presence increases because students are more engaged and can now retain more."

Findings suggest that teachers appreciated and embraced the strategies taught on

developing cognitive presence. Huda explained, “I like that cognitive presence has four stages. Now that I know this, I can design my lessons and integrate teaching and social presence to go from the triggering event through to the resolution stage.” Felicia noted, “Now that I know about the stages in cognitive presence, I am concerned that I haven’t been doing this in the past. What if students were only getting through the exploration stage and not to the end?” Felicia’s statement suggests the willingness of the teacher to adopt the four stages in developing cognitive presence and ensuring that students go through all stages for effective learning.

Data also suggests that teachers understood that social and teaching presence are essential in fostering cognitive presence. Danya said, “When social and teaching presence have been established, cognitive presence increases because students are more engaged and can now retain more.” Huda talked about how social presence and teaching presence can be used to support students to increase their cognitive presence. “I feel like we can motivate the kids who aren’t working when we are using technology face to face. We can engage with them and help them understand and learn.” Participants valued cognitive presence and the four stages of the practical inquiry model that can be used to achieve higher levels of cognitive presence. Participants also perceived teaching and social presence as important factors in increasing cognitive presence thus attending to dynamic nature of the framework.

The CoI framework. The research also collected the teachers’ views regarding the whole framework. Teachers showed interest in implementing the framework to ensure effective learning using the technology. The in vivo examples pertaining to the entire framework were organized under the code quality of instruction. Table 5.11 represents the theme, code , and samples of in vivo examples for the CoI framework.

Table 5.11

Community of Inquiry Framework: Theme, code, and examples

Theme	Code	Examples
Community of Inquiry Framework	Quality of Instruction	"I'm going to be putting this in my mind now when designing or preparing lesson plans to ensure that I attend to the teaching and social and cognitive presence." This is the target that I am setting for myself, to ensure that whenever I am integrating technology, I ne need to ensure that all of the aspects of the Community of Inquiry are covered so that it becomes more meaningful and effective for the students. And I think it will better support the learning outcomes.

All participants suggested that the CoI framework is relevant to their instruction practice when teaching with digital tools. Nina commented, "I'm going to be putting this in my mind now when designing or preparing lesson plans to ensure that I attend to the teaching and social and cognitive presence." Danya said, "This framework is what good teaching should be with technology intertwined into it." Huda agreed, "I always felt like something was missing, we didn't have a framework or anything to follow. We were just using technology for technology. I am glad I joined these coaching sessions because this framework will make my practice better."

Participants also commented about the well-rounded nature of the framework and how the framework encourages teachers to use technology as a tool to support instruction not as an end in itself. Huda said, "This framework is holistic. If you look at everything together, technology is just intertwined into it. This is what a typical teaching classroom should be like. Technology is the tool to help, but it is not the entire lesson." Felicia spoke about the frameworks focus on pedagogy,

> I like the framework because it is not just about technology. It's really about pedagogy. Like, pedagogy is more important, and technology can support teaching and learning. So now I feel like I have an idea of how to make it effective when I use the technology. It won't just be for games anymore.
>
> Nina explained,
>
> This is the target that I am setting for myself, to ensure that whenever I am integrating technology, I need to ensure that all of the aspects of the Community of Inquiry are covered so that it becomes more meaningful and effective for the students. And I think it will better support the learning outcomes.

The teachers' views indicated that they perceived the framework to be relevant to their practice as elementary school teachers. Participants reported valuing the dynamic nature of the framework and the frameworks focus on pedagogy rather than technology. Also, they shared their goals of integrating the framework into their practice going forward and using it as a tool to design their lessons.

Teachers' technology self-efficacy. The next research question in the study asked, "To what extent does participation in a Community of Inquiry based coaching session change teachers' technology self-efficacy?" Overall, data reveal consistent quantitative and qualitative findings indicating that the coaching sessions may have increased teachers' technology self-efficacy. Quantitative data results will be reported first to answer this research question. Data from the Technology Integration Confidence Survey (TICS; Gomez et al., 2021) suggests that teachers have gained confidence in their ability to use technology and to integrate technology into lessons to support instruction. Descriptive statistics determined the mean score for each of three TICS subscales (technology usage, technology application, and technology infused

learning) and the score for the three subscales combined (Table 5.9). The TICS used a 5-point Likert-type scale to rate participants technology self-efficacy where 1 means *not confident* at all and 5 means *completely confident*.

The first subscale of the TICS, technology-usage, measured teachers' confidence in their ability to use and model digital tools to support student learning in the classroom. Results from the technology-usage subscale indicate that prior to the coaching sessions, teachers' technology usage mean score was 3.75; whereas after the coaching sessions teachers' mean score increased to 4.68. The next subscale, technology-application, measured teachers' levels of self-efficacy to integrate digital tools into lessons and give students opportunities to apply these digital tools to support their learning. Results from the technology-application subscale indicate that prior to the intervention, teachers' technology application mean score was 3.25; whereas after the intervention teachers' mean score increased to 4.55. The subscale of technology-infused learning examined teachers' confidence in using student-centered learning pedagogy when employing digital tools to support their learning. Results from the technology infused-learning subscale indicate that prior to the intervention, teachers' technology application mean score was 3.15; whereas after the intervention teachers' mean score increased to 4.13. Table 5.12 represents the pre-test and post-test scores for the three TICS subscales (Browne, 2021).

Table 5.12

Mean Scores for the TICS and the Three TICS Subscales (Browne 2021)

Scale/Subscale	N	Pre-test *M*	Post-test *M*	Change
Technology Integration Confidence Scale	4	3.38	4.45	1.07
Technology Usage (subscale 1)	4	3.75	4.68	.93
Technology Application (Subscale 2)	4	3.25	4.55	1.3

Technology Infused-Learning (Subscale 3)	4	3.15	4.13	.98

Results indicate that participants' self-efficacy regarding technology application increased the most (pre-test $M = 3.25$ / post-test $M = 4.55$) after the coaching sessions whereas participants' technology usage increased the least (pre-test $M = 3.75$ / post-test $M = 4.68$) after the coaching sessions. This largest increase likely occurred because the coaching sessions focused on integrating digital tools into lessons and how to give students opportunities to apply these digital tools to support their learning. The low increase in technology usage could be attributed to that fact that participants had completed two years of online and hybrid learning and already felt confident in technology usage ($M = 3.75$) before the coaching sessions.

Areas where teachers reported the lowest technology confidence levels before the coaching sessions are indicated in Table 5.13 . The change in teachers' confidence levels in these areas after the intervention are also reported in the Table 5.14. The question "How confident are you in creating learning opportunities that challenge students to use a design process and computational thinking to innovate and solve problems?" had one of the lowest pre-test scores ($M = 3.00$) and yielded the smallest change ($M = 1.24$) after the coaching sessions. However, the post-test level of confidence for this question ($M = 4.25$) suggests that participants felt highly confident after the intervention about their self-efficacy for this item. Also, the question "How confident are you in using collaborative tools to expand students' authentic, real-world learning experiences by engaging virtually with experts, teams, and students, locally and globally?" had one of lowest pre-test scores ($M = 3.00$) and yielded the second smallest change ($M = 1.25$) after the coaching sessions. Interestingly, although these two questions had the smallest change in confidence, the post-test scores for these items indicate the participant feels confident ($M = 4.24$ and $M = 4.25$ respectively). It is likely that the coaching sessions successfully provided

participants with experiences to increase their technology self-efficacy for the items where they reported low technology self-efficacy including creating learning opportunities for students to engage in computational thinking, authentic learning experiences, digital platforms and virtual environments, and project-based learning, and student inquiry around STEAM content.

Table 5.13

Items Where Participants Reported Low Technology Self-Efficacy

Item	N	Pre-test *M*	Post-test *M*	Change
How confident are you in using collaborative tools to expand students' authentic, real-world learning experiences by engaging virtually with experts, teams, and students, locally and globally?	4	3.00	4.25	1.25
How confident are you in creating learning opportunities that challenge students to use a design process and computational thinking to innovate and solve problems?	4	3.00	4.24	1.24
How confident are you in managing the use of technology and student learning strategies in digital platforms, virtual environments, hands-on makerspaces or in the field?	4	2.75	4.74	1.99
How confident are you in using technology to support the demands of the student-centered pedagogy for project-based learning?	4	3.00	4.50	1.50
How confident are you in using technology to support STEAM as an access point to guide student inquiry, dialogue, and critical thinking?	4	2.75	4.25	1.50

Data from the embedded questions in the coaching sessions agrees with the survey data in that participants' overall technology self-efficacy increased. The in vivo codes for this research question were organized under the code self-efficacy. Table 5.14 depicts the theme, code, and in vivo examples for the self-efficacy variable.

Table 5.14

Self-Efficacy: Theme, code, and examples

Theme	Code	Examples
Self-efficacy	Online learning	"I always felt like something was missing. We didn't have a framework or anything to follow. We were just using technology for the technology. I am glad I joined these coaching sessions because this framework will improve my practice." "I feel like we can motivate the kids who aren't working when we use technology face to face. We can engage with them and help them understand and learn."

The teachers' responses on the survey and during the embedded discussions suggested an increase in technology self-efficacy after participating in the pilot study. Findings suggest that the CoI framework provided teachers with an effective strategy to follow rather than using technology without a framework. Huda noted, "I always felt like something was missing. We didn't have a framework or anything to follow. We were just using technology for the technology. I am glad I joined these coaching sessions because this framework will improve my practice."

Findings also suggest that teachers felt more confident after the coaching sessions because they learned strategies to foster student engagement through the three presences of the CoI. Danya said, "I feel like we can motivate the kids who aren't working when we use technology face to face. We can engage with them and help them understand and learn."

Participants reported that the Triple E Framework was vital in organizing their activities that relied on digital tools during the instructional process. They suggested that the framework made a valuable difference in supporting teaching and cognitive presence when using technology

and were eager to learn more about it. Felicia mentioned, “I felt it really made a positive difference in my teaching presence. The triple E framework helped me evaluate the apps, so now I can use them more meaningfully. I want to learn more about it and keep using it.” Such responses indicate that teachers' self-efficacy increased because of participating in the pilot study.

Perceptions of coaching. The following research question examined teachers’ perceptions of the coaching process. Analysis of the teacher’s responses at the end of the coaching sessions indicated that it was impactful. The in vivo examples for this research question were organized under the codes quality of instruction and self-efficacy. Table 5.15 depicts the theme, codes, and in vivo examples pertaining to participants’ perceptions of coaching.

Table 5.15

Perceptions of Coaching: Theme, codes, and examples

Theme	Codes	Examples
Perceptions of Coaching	Quality of Instruction	“What I learned from this is totally new to me. Now I feel like I can be more than just a technician. I can actually meaningfully integrate digital tools.”
	Self-efficacy	“I started these sessions thinking I had no idea about this before. Through the coaching sessions, I developed my understanding of how to use the CoI in my classroom and my teaching practice.”
		“Going through these coaching sessions helped me feel more empowered and confident. I am really excited now, you know, and I have the morale to implement this now.”

Positive perceptions about the coaching process were indicated by the high level of confidence teachers reported in integrating the community of inquiry framework using technology in the instruction process. Danya said, “I started these sessions thinking I had no idea

about this before. Through the coaching sessions, I developed my understanding of how to use the CoI in my classroom and my teaching practice." Huda explained, "Going through these coaching sessions helped me feel more empowered and confident. I am really excited now, you know, and I have the morale to implement this now."

Teachers described feeling connected to each other as the coaching sessions fostered engagement and collaboration. Teachers shared their ideas and experiences, making the coaching sessions interactive and effective. Felicia explained, "I feel very connected to the other members of our group, and I feel like I can go implement this." All the participants agreed and felt they were ready and equipped to implement the community of inquiry framework. Additionally, the coaching sessions facilitated teachers' reflections on their quality of instruction and experimentation with the different presences to improve their practice when teaching with technology. Danya indicated, "I feel like I have been able to reflect on my practice more. Now I can see where I was wrong and where I can improve my practice to get better student success." Nina mentioned, "What I learned from this is totally new to me. Now I feel like I can be more than just a technician. I can actually meaningfully integrate digital tools."

The coaching sessions likely contributed to changing teachers' perceptions toward using technology in the classroom. After participating in the coaching sessions, data suggests that teachers' technology self-efficacy increased, they perceived the CoI framework to be relevant to and useful for their teaching, and they viewed technology as a tool to enhance their teaching process.

Attendance rate. The last research question investigated the attendance rate for the online sessions. All four participants attended all five coaching sessions. . All participants also

engaged with the WhatsApp chat group between sessions which provided robust discussions about implementing the three presences in their classrooms.

Discussion

The purpose of this study was to gain a deep understanding of the challenges elementary school teachers faced when integrating technology into in-person, hybrid, and online instruction. Secondly, the study examined elementary school teachers' perceptions of the relevancy of the parts of the Community of Inquiry (CoI; Garrison et al., 2001) to their instructional practice and measured if participation in the study affected their technology self-efficacy. The following section discusses the results in relation to the purposes of the study.

Challenges Integrating Technology

All participants reported barriers to learning with technology whether entirely online, hybrid, or during face-to-face interactions. However, the participants in this study indicated that they experienced the largest teaching challenges when classes were completely online. These findings mirror the empirical research that indicates teachers considered lack of engagement (Kundu & Bej, 2021; OECD, 2022; Pressley, 2020; Rizvi, 2021; Rizvi, 2022; Trust & Whalen, 2020), low quality of instruction (Kundu & Bej, 2021; Marshall, Shannon & Love, 2020; OECD, 2022; Rizvi, 2022) and loss of agency as barriers to learning especially during online instruction (Kundu & Bej, 2021; Marshall et al., 2020; Rizvi, 2021; Rizvi, 2022).

Student engagement. All participants reported lack of student engagement as an obstacle when teaching in the online or hybrid format. Data indicated that lack of engagement may have also contributed to low levels of collaboration between students themselves and between the students and teacher. A study conducted during the pandemic used convenience sampling to gather a sample of 328 teachers employed in schools in the U.S (Marshall et al., 2020). A survey

was distributed to participants to measure their experiences when teaching during the pandemic. Many participants reporting having difficulty keeping students motivated, especially younger students, when teaching online. In addition, teachers indicated that their ability to communicate and collaborate with students was hampered (Marshall et al., 2020). Another study used a purposive sample of 141 elementary school teachers from four different continents to examine their experiences with online teaching during the pandemic (Kundu & Bej, 2021). Elementary teachers indicated that it was much more difficult to interact with students online than face-to-face, students lacked motivation and were not engaged, and that it was "particularly challenging to deliver concepts and engage young students" (Kundu & Bej, 2021, p. 13). Similarly, in the context of the UAE, teachers reported having trouble trying to keep students motivated and engaged during online learning (Rizvi, 2021).

Quality of instruction. In addition to lack of engagement and collaboration, participants from this pilot study indicated that the quality of instruction they provided decreased during online learning. Studies conducted during the pandemic indicated similar findings and suggested that quality of instruction was affected because few teachers had received training to teach in online environments (Kundu & Bej, 2021; Marshall et al., 2020; OECD, 2020; Trust & Whalen, 2020). Marshall et al. (2020) reported from their study of 328 participants that "teachers responded that they had difficulty providing quality instruction with an appropriate amount of rigor during the pandemic (p. 48)." Studies also suggest that teachers felt overwhelmed and unprepared to employ digital tools and appropriate pedagogies for online learning (Kundu & Bej, 2021; Marshall et al., 2020; Trust & Whalen, 2020).

Time was also a factor affecting quality of instruction in this pilot study as well as in the literature (Kundu & Bej, 2021; Marshall et al., 2020; Rizvi, 2022). Like teachers in this pilot

study, the empirical literature indicates that teachers expressed not having enough time to plan and prepare high quality lessons using digital tools for online learning (Kundu & Bej, 2021; Rizvi, 2022). Also, teachers conveyed that not having enough time to connect individually or in small groups with students to provide targeted support and instruction during online learning, which negatively affected the quality of their instruction (Kundu & Bej, 2021).

According to teachers in this pilot study, another factor that likely affected their quality of instruction was accountability and feedback. First, teachers felt challenged giving appropriate and timely feedback to students because students' cameras were turned off, students were not engaged, and students did not collaborate. Also, teachers indicated that they were not able to verify the veracity of assignments and exams that students submitted and questioned if they received help from family members or the internet. Findings from the empirical research conducted during the pandemic also suggest that teachers felt unable to provide adequate feedback to support students during online learning (Kundu & Bej, 2021; Rizvi, 2022). One such study (Kundu & Bej, 2021) noted that teachers reported not being able to provide adequate feedback to students, but also that teachers expressed having to "figure out new ways to provide feedback and how to do that without taking more hours than I was actually teaching" (p. 16). As such, quality of instruction was likely affected by low levels of student collaboration and engagement, lack of time and accountability, and teachers' challenges with providing adequate and timely feedback. While quality of instruction is a difficult construct to measure because of the dynamic nature of classroom settings (Junker et al., 2005; Boston & Candela, 2018) it likely has a positive relationship with student achievement both during face-to-face (Boston & Candela, 2018) and online learning (Voogt & Knezek, 2008).

Teacher agency. Teacher agency is the ability of teachers to act on their ideas and future plans to modify their instructional practice (Damsa et al., 2021; Kimber, Pillay, & Richards, 2022). Agency also refers to the degree to which teachers were able to control their actions and feel a sense of control over the actions of their students (Bandura, 1982). Several factors were reported that contributed to teachers' feeling a loss of agency during online and hybrid instruction including students' cameras being turned off, challenges with classroom management and student engagement, unfamiliar technology, and having limited time to plan and prepare lessons. The empirical research that evaluated teachers' sense of agency during the pandemic show findings that are like the ones in this study (Damsa et al.,2021; Gudmundsdottir & Hathaway, 2020; Heikkila & Mankki, 2021; Kundu & Bej, 2021).

In one study, twenty elementary school teachers in Finland participated in semi-structured interviews designed to evaluate their sense of agency during online teaching (Heikkila & Mankki, 2021). Findings from this study indicate that teachers' sense of agency decreased due to lack of experience with online teaching, the use of unfamiliar digital tools, and low levels of engagement from the students. Similarly, Gudmundsdottir and Hathaway (2020) found that teachers reported loss of agency due to inexperience with teaching online and challenges with assessing student learning. Teachers felt ill-equipped to modify their instructional practices because they were unable to engage students and assess their level of understanding as successfully as if they were in a face-to-face classroom. In another study (Damsa et al., 2021), teachers reported a general feeling of obstruction in their ability to employ the pedagogy they use in face-to-face classrooms due to the restrictions of the online environment. Findings indicated that teachers noted that they did not have time to switch their pedagogical practices to online learning strategies thus lowering their sense of agency.

While participants in this pilot study and from the literature show a loss of their sense of teaching agency, a new sense of agency was also reported. On the one hand, the shift to online learning likely restricted and obstructed teachers' instructional practice (Damsa et al., 2021; Gudmundsdottir & Hathaway, 2020; Heikkila & Mankki, 2021; Kundu & Bej, 2021); on the other hand, this shift may have provoked teachers to be innovative in their instruction approaches and adaptive in this scenario (Gudmundsdottir & Hathaway, 2020; Heikkila & Mankki, 2021; Rizvi 2021). Participants from this pilot study reported that even though their sense of agency decreased during online instruction, they were able to adapt to the online environment and get students through the remainder of the school year by trying different digital tools and pedagogical practices. However, it may be likely that teachers were surviving rather than thriving during the pandemic.

Self-Efficacy

Teachers' self-efficacy plays a central part in their decisions to integrate and adopt technology into their instructional practices (Ertmer, 1999; Overbaugh et al., 2015; Shifflet & Weilbacher, 2015). The fifth research question examined to what extent participation in the coaching sessions contributed to teachers' technology self-efficacy. The Technology Integration Confidence Survey (TICS; Gomez et al., 2021) was the pre- and posttest measure, which was triangulated with qualitative data from the embedded discussion questions and exit tickets.

Although the study was conducted over a five-week period, data shows that the expectation that positive changes in technology self-efficacy would occur was met. Teachers did report a positive change in their technology self-efficacy which likely occurred due to participating in the coaching sessions. However, research on effective professional learning (PL) suggests that the duration of PL be a minimum of 25 hours and occur over time (Desimone &

Garet, 2015; Desimone, 2009). As such, if this pilot study had been more robust and occurred over a longer period of time, teachers may have reported a greater positive change in their technology self-efficacy. The support of colleagues was easily accessible during and in-between the coaching sessions and may have positively impacted teachers who did not feel confident in their knowledge and skills of technology integration (Cifuentes, 2011; Kopcha, 2012). Interactions between participants from different schools and backgrounds may have provided varying perspectives and novel insights that could have positively influenced their technology self-efficacy. In addition, learning based in sociocultural theory may have positively contributed to the technology self-efficacy of elementary school teachers due to the scaffolded interactions between experts and novices and the exchange of ideas and knowledge (Vygotsky, 1978).

The Relevancy of the CoI to Elementary School Classrooms

The qualitative data collected in this pilot study shows that the participants strongly agreed that the Community of Inquiry framework is relevant to elementary school classrooms. The embedded discussion questions in the coaching sessions asked teachers to comment on each presence separately. The discussion of the findings is divided into teaching presence, social presence, and cognitive presence. However, for the purposes of this discussion it is important to note that most of the research about the CoI framework evaluated university students' perceptions of the framework. There is a paucity of research that examines university professors' perceptions of the framework (Samuel, 2016) and this study identified a gap in the literature about K-12 teachers' perceptions or use of the framework. As such, the discussion will focus on how the strengths of the framework underscored by the research conducted in university contexts, were reported as strengths by the elementary school teachers who participated in this study.

Teaching presence. By establishing teaching presence, teachers guide students through learning content and activities, reinforce important ideas, and raise student engagement (Anderson, Rourke, Garrison, & Archer, 2001). Teaching presence promotes the design and organization of lessons, facilitation of discourse, and delivery of direct instruction for the purpose of creating meaningful and worthy learning outcomes (Anderson et al., 2001). Both the research about teaching presence conducted in university contexts (Anderson 2017; Cleveland-Innes et al., 2019; Anderson et al., 2001) and the participants in this study agree that course design and organization of lessons is important to keep students engaged and on track. Participants mentioned that providing elementary students with clear goals and explicit and repetitive instructions are necessary to keep students on task when using digital tools. In addition to course design and organization, both participants and the research (Anderson 2017; Cleveland-Innes et al., 2019; Anderson et al., 2001; Szeto, 2015) emphasized the importance of building student understanding through the facilitation of discussions during online learning. Participants expressed the need to increase their teaching presence to keep students on task, engaged, clarify their thinking, and obtain formative feedback to check for understanding. Also, participants addressed the importance of delivering direct instruction to explain concepts to students as a whole class, small group, or individually. Research shows that direct instruction in university settings is also critical to fostering the cognitive presence of students so that they can construct and confirm knowledge (Anderson 2017; Cleveland-Innes et al., 2019; Anderson et al., 2001; Szeto, 2015).

Participants in this study emphasized the importance of teaching presence because their sense of agency declined and that they had difficulty maintaining student engagement, conveying information to students, and assessing their understanding. Therefore, the design and

organization of lessons, facilitation of discourse, and delivery of direct instruction are important components of teaching presence that are relevant for online learning in elementary school classrooms.

Social presence. Social presence refers to the ability of the students to project themselves both emotionally and socially into the online learning environment (Garrison et al., 2010). Social presence promotes open communication, group cohesion, and positive affective states of the students within the learning environment so that they can communicate purposefully and engage in discourse about the learning content (Swan & Shih, 2005). Both participants in this study and the research carried out in university settings (Doo & Bonk, 2020; Garrison et al., 2010) agree that social presence is an important part of online learning as it promotes critical thinking, discourse, and feelings of belonging. Research also suggests that social presence promotes student engagement (Doo & Bonk, 2020; Garrison et al., 2010). Participants in this study consistently reported that student engagement was low during online and hybrid learning. Elementary school teachers reported that increasing the social presence of the students will likely improve student engagement which can increase the quality of their instruction because there will be more interactions and collaborations with and between students.

Participants and the research conducted in universities also suggests that teaching presence influences social presence (Akyol & Garrison, 2008; Garrison et al., 2010; Shea et al., 2006). Participants remarked that going forward, they will use their teaching presence to increase the social presence of the students during online, hybrid, and face-to-face learning. They will focus their teaching presence on designing collaborative learning activities that increase social presence by providing explicit and redundant instructions, opportunities for discussion, and tasks to ensure accountability (Swan & Shih, 2005).

Cognitive presence. Cognitive presence refers to the extent to which students can construct and verify meaning (Garrison et al., 2001). The consideration of how students' progress through the learning process, approach novel ideas and problems, cultivate understanding, and convey their knowledge to the community are indicators of cognitive presence. The research conducted in university contexts (Garrison et al., 2010; Sadaf, Wu, & Martin 2021) and the participants in this study indicated that cognitive presence is the most important presence in the CoI because it has more influence on learning than the other presences, and because it is facilitated by teaching presence and social presence. Cognitive presence can be identified and measured through the four phases of practical inquiry (Dewey, 1933): the triggering event, exploration, integration, and resolution. Both the research conducted in university settings (Celentin, 2007; Rourke & Kanuka, 2009; Sadaf et al., 2021) and the participants in this study agreed that most of the students in their classes did not complete the four phases of inquiry. As such, participants in this study suggested that providing students with multiple and diverse representations of knowledge, multiple activities, and increased scaffolding can increase cognitive presence. These suggestions occurred when participants worked together in session five to apply the elements of the CoI into creating a lesson that uses Google sites as a digital tool to support instruction. These ideas are also supported in the empirical research about cognitive presence conducted in university contexts (Garrison & Arbaugh, 2007; Sadaf et al., 2021). In addition, both participants and research suggest that focusing on critical thinking through posing open-ended questions, facilitating brainstorming, and encourage collaborative discussions can enhance cognitive presence (Garrison et al., 2001; Sadaf et al., 2021)

Limitations

The limitations to this pilot study included the small sample size, researcher bias, duration, and history. Limitations exist in any research study, and it is important to identify how they might affect the findings of the study (Shadish et al., 2002). Some of these limitations are the result of the study design during the Covid-19 pandemic in the context of private international schools in Dubai.

The first limitation of this study is any claim that can be made using either the qualitative or quantitative data. There is a threat to the external validity of this research because the sample size ($N = 4$) is too small to compute a reliable effect size from the quantitative data and make generalizations from the qualitative data (Shadish et al., 2002). As such the reliability of the mixed-methods data is limited.

Researcher bias refers to the researcher's tendency to incorrectly interpret data due to their own conscious or unconscious assumptions (Lochmiller & Lester, 2017; Shadish et al., 2002) As a practitioner-researcher studying her own professional context, researcher bias can be considered a limitation as I have witnessed elementary school teachers shift their practice to online learning throughout the Covid-19 pandemic. The many interactions I had with teachers, who are like the ones in my sample, are likely to have affected my work with them during this pilot study. My pre-conceived notion was that teachers are struggling during the pandemic and do not feel efficacious in their online or blended practice when teaching with technology. To address this limitation, I kept an audit-trail in my journal when making the important decisions about coding the data.

Another limitation of the study was the short duration of the coaching sessions. The coaching sessions occurred once a week for five weeks, with a total of six contact hours. Only

one session was spent coaching participants about each presence and only the last coaching session looked at the dynamic interplay between the three presences in the CoI. One of the most pertinent research questions of this study was "What are elementary school teachers' perceptions of the relevancy of the parts of the Community of Inquiry to their instructional practice?" Because participants had a limited time to deeply engage with each presence during the coaching sessions and throughout the five-week study in general, it is likely that they are still learning about the presences and are not yet able to provide robust comments about the relevancy of the CoI to their practice. Professional learning that occurs over 30 hours or more, is positively related to increases in teacher learning (Darling-Hammond et al., 2017; Garet et al., 2001; Guskey & Yoon, 2009). Coaching, as a form of effective professional learning, can afford educators with sufficient time to learn, practice, implement, and reflect on the new knowledge and skills (Desimone & Pak, 2017; Penuel, et al., 2007). However, given the short duration of this study, it is likely that teachers did not have sufficient time to learn, practice, and experiment with the COI in a way that could support deep reflection on its relevancy to their pedagogical practice when teaching with digital tools.

History and maturation are two other limitations of this study. History refers to events that occur outside of the study that could cause an observed effect (Shadish et al., 2002). Maturation is defined as changes that occur naturally over time that could cause an observed effect. Because this pilot study was conducted in May and June of 2022, history and maturation played a role in validity of the findings because participants had already been employing online and blended learning for more than two years. Had this study been conducted at the beginning of the pandemic, results are likely to have varied because teachers and students were still adapting to online learning environments. Results pertaining to technology self-efficacy and teachers' sense

of agency would likely have been lower given their reports about the difficulty of the transition to online learning. Had this study occurred midway through the pandemic, again results are likely to be different because teachers may have acquired a certain amount of efficacy and agency when teaching in online and blended environments and may have unknowingly been applying one or more of the three presences in the CoI. As such, the interplay between history and maturation are likely to have provided different results based on at what point in time the study had been conducted. Moreover, had the pandemic not occurred, it is unlikely that teachers would consider the relevancy of the CoI framework in their instructional practice as they had not yet experienced online and blended learning.

While this study evaluated barriers to teacher technology integration before and during the pandemic, an investigation of student and teacher well-being was not included, given the scope of this study. However, the importance of student and teacher well-being and what we can learn about this topic in relation to the pandemic is crucial going forward. First, children need in person interaction with other children to cultivate compassion and emotional intelligence, the ability to listen deeply to others' ideas and perspectives, and the ability to communicate appropriately (CASEL, 2020). The vital aspects of social emotional learning are self-awareness, self-management, relationship skills, social-awareness, and responsible decision making (CASEL, 2020). Children need to learn these skills, regardless of the mode of delivery of instruction that they are partaking in, as they correlate to their well-being and ability to function in society. Again, for elementary school age children, the balance of face-to-face and online learning must favor the former so that students are provided with opportunities to build social-emotional skills and support their well-being. Frameworks must be developed that facilitate these skills in various learning environments, so children do not feel isolated or lonely.

In this study and in evidence gathered in many countries by the OECD (2022), teacher well-being was a large issue during the pandemic. In fact, OECD (2022) data suggests that teachers were paying attention to their own well-being last. The participants in this study reported feeling stressed, exhausted, anxious, and isolated. Teachers who are unwell and overstressed are less likely to connect with students and provide meaningful learning activities regardless of the online or face-to-face context. In addition, unwell and unhappy teachers negatively affect the operation of the school as an organization. It is essential for school administrators to continuously check in with their staff to provide a strong sense of connection and support, especially during the pandemic. Time and resources need to be provided to teachers to support their well-being before anything else is added to their already full plates.

Implications for Future Research

Teacher learning and development are complex processes that are affected by many factors including the integration of technology (Ertmer, 1999; Tondeur et al., 2017; Zinger et al., 2017). Although the design of this study was thoughtful and based on both a needs assessment and two literature reviews, what may have helped participants in this study cannot be generalized to other contexts, nor was this study long enough in duration to determine the relationship between the coaching sessions and teachers reported perceptions and behaviors about teaching with technology and the Community of Inquiry (COI) framework.

When it comes to professional learning, teachers are often not given the time to learn, explore, plan, and apply new knowledge and skills (Desimone, 2009; Ertmer & Ottenbreit-Leftwich, 2013). Because this study only occurred over five weeks, future studies should be conducted over a longer duration so that teachers can apply their knowledge and skills and continue to receive follow-up support. Attending professional learning on a regular basis over a

long period of time that is aligned to the policies of the participants school and classroom context and is based in collaborative and active learning is likely to enhance teacher learning (Desimone, 2009). Further, because the data in pilot study was self-reported, conducting classroom observations as another method of data collection may give additional insight into the value of coaching as a PL framework to increase teachers' technology self-efficacy and understanding of the CoI framework.

Another area for further research is to evaluate the relationship between teacher technology self-efficacy and the adaption of the CoI framework into elementary school classrooms under the conditions of online learning, blended learning, and face-to-face learning with digital tools. For this kind of study to occur, elementary school teachers would require longer term training about and practice with the CoI framework in a variety of learning environments. Participants in this pilot study indicated that learning about the CoI helped to increase their technology self-efficacy and that the CoI was relevant to their instructional practice. These findings necessitate a larger study to investigate how the adaption of the CoI framework into elementary school teaching affects teachers' technology self-efficacy and student achievement. If findings from such a study suggest that the CoI positively effects teacher technology self-efficacy and student achievement, these studies can be replicated in other contexts to contribute to the body of research about frameworks that support teacher technology self-efficacy and student achievement. Also, pre-service and in-service teacher training programs can be created and scaled to support technology integration in elementary school classrooms.

Conclusion

The use of digital tools is a norm in education is and the Covid-19 pandemic accelerated its integration in classrooms all over the world (OECD, 2022). Teachers, administrators, and

schools have displayed tremendous resilience in attempting to counteract the crisis, and while they require better preparation for comparable challenges, they have exhibited adaptability , and a spirit of innovation that we have a duty to learn from. The application of such learning can be applied not only to future problems, but to the current instructional practice of teachers who continue to use digital tools and work under ambiguous conditions.

A modified community of inquiry framework for elementary school. This study investigated the barriers to online, hybrid, and face-to-face learning both before and immediately after the Covid-19 pandemic. In addition, this study examined the relevancy of the Community of Inquiry (CoI) framework if applied into the elementary school classroom. Many of the barriers to technology integration appeared in both the finding of the needs analysis and the pilot study. These barriers include first-order barriers to technology integration such as access, time, professional learning, and quality of digital tools and the second-order barriers of technical knowledge and skills, technology self-efficacy and technology related pedagogical beliefs. Because of these barriers, elementary school teachers reported that their sense of agency, confidence in teaching, and the quality of their instruction when teaching with digital tools was compromised. After participating in the pilot-study, elementary school teachers reported that the CoI framework is relevant to their instructional practice and contributed to the improvement in their technology self-efficacy. The findings about the various parts of the CoI framework from this study have implications for elementary school pedagogical practice when teaching online and in hybrid contexts. These findings are applicable to the three presences embedded within the CoI framework.

One of the barriers to participants' ability to build teaching presence, social presence, and cognitive presence during online and hybrid teaching was the fact that students were allowed to

keep their cameras off for privacy reasons. Learners were not able to see each other and visually interact with each other. The theory of telepresence refers to the sensation of being immersed in a virtual environment (Lombard et al., 2015). When students are not able to see each other onscreen, they are less likely to build rapport and trust or foster a sense of belonging with the other students (Terada, 2021). This likely impeded their ability to engage in collaborative activities and discourse with other students; often students and teachers wondered if they were talking to themselves among the sea of blank screens (Terada, 2021). To counteract this, the Knowledge and Human Development Authority (KHDA) of Dubai might consider requesting a 'cameras-on' policy for elementary school students by asking Muslim caretakers in the home to wear their hijab when their child's camera is on. This would be a culturally sensitive initiative if the request is sent from the Director of the KHDA, who is Muslim, and includes the caveat that this request is optional but encouraged.

Another barrier to online and hybrid learning was the reported lower levels of engagement of elementary school students. This was likely due to teachers' digital pedagogical skills, loss of agency, and the developmental stages of elementary school students. The pandemic shone a spotlight on the critical need for comprehensive digital pedagogical skills to be developed in teachers. Some private international schools in Dubai tried to replicate the in-person learning environment by using the same pedagogical approaches to classes, resulting in excessive screen time for elementary school aged children.

By applying the principles of the CoI framework into elementary school digital pedagogical practice, teachers may be able to increase student engagement and their own sense of agency during online and hybrid learning. Elementary school students, especially early elementary school students, are developing the skills to self-regulate and become independent

learners (Flavell, 1971; Zimmerman, 2002). Online learning necessitates more self-discipline and grit from students; for example, the skills to autonomously separate tasks into manageable parts, endure prolonged ambiguity, evaluate the features and value of resources, and ask appropriate and specific questions that will enable teachers to provide solutions (OECD, 2022). However, lower elementary school students are less likely to be developmentally ready to regulate their ability to attend, participate, or learn independently in comparison to upper elementary school students (Zimmerman, 2002). Therefore, teaching presence is of critical importance in online and hybrid learning environments for elementary school students, especially those in the lower elementary grade levels because these students need support to help them self-regulate and guide them during learning.

Educators can increase teaching presence by providing elementary schools students with clear learning goals and redundant and chunked instructions to guide them through independent learning activities. For example, teachers might construct 'we are learning to' statements or allow student to co-construct these statements with them and record them in writing or drawing a picture. Next, lesson instructions can be step-by-step, help students navigate websites, and provide an appropriate number of resources to support learning. By providing an appropriate number of links to specific websites students can take ownership of their learning by choosing which of the websites they visit. This might disable students from getting lost in or feeling frustrated by the internet, wondering if the websites they are using as resources are applicable. In addition to offering choices of specific websites for students to use, teachers can offer choices about learning tasks. Giving students a choice of age-appropriate learning activities and requiring them to do a set number may not only give them a sense of ownership and motivation but may also help teachers sense of agency.

To further direct elementary school students during online and hybrid learning through teaching presence, teachers can provide scaffolding and questioning. These techniques can enable teachers to engage students more deeply, guide them to be more independent learners, provide individualized support and feedback, and design further learning activities based on student needs and interests. Educators can also increase their teaching presence by creating a sheet, blog, or vlog for the learners to record their completed tasks. This puts into effect accountability measures for the students (something that participants reported as lacking during online learning) and may encourage students to think about the choices they made in their learning and how well they finished a task or activity. Teachers can also use break-out rooms or discussion and sharing apps (like Flipgrid) to provide feedback to students and help them set next steps and goals for their learning. Because participants mentioned that they don't have enough time to provide individual feedback to students, discussion and sharing apps can enable virtual conversations to occur between teachers and students in real time and outside the hours of the school day.

Finally, to help increase student engagement and independent learning, teachers can use their teaching presence to create engagement rubrics for online and hybrid classes. These rubrics (OECD, 2022) can be filled out by both students and teachers. For an elementary student rubric, children can monitor their own learning and engagement by recording how many times they made contact with the teacher and other students, actively engaged in a learning activity, completed tasks, felt stuck, and what their attitudes were (positivity, negativity, excitement, frustration, etc.) about the lesson. Teachers' rubrics can assess the engagement of students by recording their attendance, how many times they contacted the teacher, how many times they participated in collaborative activities, how often they generated evidence of work, and how often

they completed tasks. These rubrics can help teachers build agency during online learning because they will have a written record to inform subsequent instruction about how each individual student is engaging and accountable during learning.

In addition to increasing teaching presence, elementary school teachers can increase social presence during learning in online and hybrid contexts. First, a camera-on policy can be implemented for elementary school students to increase telepresence which might contribute to their sense of trust and belonging to their class (Lombard et al., 2015). Learning and social interactions that occur amongst a sea of black screens hinders social presence (Terada, 2021). Many young children need visual and non-verbal cues, which can be conveyed by students and teachers when cameras are on, to support their learning. "The social context of living classrooms- the often-invisible human connection that reinforces learning - was missing for students, who insisted that being able to hear and see each other in real time helped construct a more complete picture of their peers" (Terada, 2021, ¶ 4). Also, educators might benefit from receiving non-verbal and visual cues from students, such as looks of confusion or boredom, so that they can adjust their teaching.

Regardless of what a teacher does to improve social presence, in online or hybrid elementary school classrooms, social presence is likely to be most successful when it is guided by teaching presence. Young children, especially lower elementary school students, are likely to need guidance when collaborating in online, hybrid, or face-to-face environments (Zimmerman, 2002). They likely need to be supported in staying on task, following instructions, gaining understanding, and producing work. If teaching presence is taken away, collaboration may be more difficult for young children to achieve by themselves, especially lower elementary school students, as they are still gaining the social, emotional, and learning skills to become independent

learners (Zimmerman, 2002). As such, an important aspect of social presence for elementary school students is the extent to which they feel safe to express themselves and the extent to which they feel they belong to the community. If students feel part of a community where they can safely project their voice, teaching presence can be a mechanism to guide age-appropriate social learning activities.

For older elementary school children who have developed social, emotional, and independent learning skills, collaboration is an aspect of social presence that can be employed in the online or hybrid classroom and facilitated by teaching presence. Collaborative work often leads students to improved knowledge building and it can positively contribute to the development of social and emotional skills (Howland et al., 2014). Student-collaboration digital tools can enhance the social element of an activity, increase student productivity, enable sharing of resources and work, and increase creativity. In addition to specific student-collaboration tools, teachers can employ other strategies to build social presence. Creating an off-topic forum where students can post pictures, videos, and links about their lives can increase social presence. This might enable students to build rapport by interacting in an informal virtual environment and learn about their classmates' interests and lives outside of the classroom forum. Teachers can also increase social presence by creating and assigning group roles that allow students to direct their learning, contribute to teamwork, and experiment with different roles within a group. Also, teachers can help students develop collaboration contracts to divide learning tasks into parts so that each student can make an equitable contribution.

Like social presence, teaching presence can be the catalyst to increase cognitive presence in online or hybrid elementary school classrooms. Young children likely need guided and scaffolded instruction when they are acquiring, understanding, and encoding information.

Therefore, teaching presence can be used to design age-appropriate learner-driven activities that accommodate different students' abilities and needs. To increase cognitive presence teachers can leverage technology to personalize learning for elementary school students by using adaptive software, integrating scaled quizzes and tasks, and aligning learning to students' interests. Cognitive presence can also be facilitated when teaching presence focuses on creating intentional, active, and authentic learning activities. Intentional learning occurs when the learner is following planned-out steps to achieve a goal. Teaching presence can guide students through an activity and provide clear instructions about how to complete a learning task. Active learning is defined as learning events that foster interaction with the environment, manipulation of objects and tools, and observations of these manipulations. Teachers can capitalize on digital tools that enable students to manipulate and control variables in an online learning environment. Technology can also facilitate reflection and feedback when learners are working with tangible tools and objects that are found in their environments, not just digital tools and objects. Authentic learning can be guided by teaching presence when learning tasks are embedded in real-world situations and useful contexts for students to practice skills. As such, teachers actively guide students through problem-solving and critical thinking activities that require achievable and relevant solutions. Finally, using teaching presence to teach digital learning skills to students, instead of assuming students are digitally competent learners because they are digital natives, can increase cognitive presence.

New realities of education. The need for schools to create continuity plans is evident and continuous, and these efforts can account not only for what we learned from the pandemic, but what works for what students in various contexts while considering the varied nature of the digital divide. Many private international schools in Dubai serve students from high socio-

economic classes and were easily able to provide multiple digital resources to students to support their learning. Other schools that cater to students from lower socio-economic classes could not afford to purchase digital resources and many students attending these schools did not have access to devices to attend classes. Therefore, there is a great need to provide free devices and high-quality digital resources to supply equitable educational opportunities to disadvantaged children.

The pandemic exacerbated the need for schools to develop robust hybrid frameworks for learning that leverage the benefits of face-to-face and online learning. The balance of face-to-face and online learning needs to be studied for various age groups and contexts. Findings from this study suggest that elementary students are more engaged, and teachers have a greater sense of self-efficacy and agency when integrating digital tools in a face-to-face environment. Going forward, for elementary school students, the balance of face-to-face and online instruction should favor face-to-face learning.

In addition, the importance of high-quality professional learning for teachers was brought into the spotlight because of considerably increased use of digital tools for learning online. Elementary school teachers need to develop sound techno-pedagogical skills to be successful in both face-to-face and online learning environments. One of the obstacles for teachers to develop technopedagogical skills is the unlearning of pedagogical practices that work well in face-to-face environments but do not transfer well to online environments. Scaling this kind of professional learning will likely be a challenge and, it must be broken down by the ability levels of teachers, content of instruction, and age of the student.

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Appendix A

Demographic Questionnaire

This Survey is anonymous. Please do not write your name. All information will be summarized, and no individual responses will be used.

1. What is your gender? ____ Female _____ Male

2. What is your country of citizenship? _____

3. What is your Age: ___ 18-25 ___ 26-30 ___ 30-40 ___ 40-50 ___ 50-60 ___ 60+

4. What is your highest level of education completed?

   ___ High School __ Bachelor's Degree ___ Master's Degree ___ Doctorate

5. What grade do you teach? __K __1 __2 __3 __4 __5 __6

6. How many years have you been teaching? __ 0-1__ 2-3__ 3-4 __ 5-6 __ 6-10 __10-20 __20+

7. How long have you been teaching at this school? _____ years

8. How many years do you plan to continue teaching at this school?

   __ this is my last year ___ 1 ___ 2 ___3 ___ 4 ___ 5 years ___5 +

9. Currently I use technology approximately _____ hours per week in the classroom.

10. At the beginning of this year, I used the technology approximately _____ hours per week.

11. Currently, my students use technology approximately _____ hours per week.

12. What type of technology training have you received? (Check all that apply).

    _____ No training
    _____ Basic Computer Literacy (on/off operations, how to run programs)
    _____ Computer applications (word processing, spreadsheets)
    _____ Computer integration (how to use in classroom curriculum)
    Total days of integration training: _____

13. Where did you receive your training? (Rank order all that apply).

_____ Self-taught
_____ School sponsored professional development
_____ University or teacher licensing program
_____ Other (please specify _____

14. How many years of experience do you have teaching with technology?

____ 1 ____ 2 ____ 3 ____ 4 ____ 5 ____ 6 ____ 7-10 ____ 10-15 ____ 15+

Appendix B

Computer Technology Integration Questionnaire (Wang et al., 2004)

Please circle one response for each of the statements in the table: SD = Strongly Disagree, D = Disagree, NA/ND = Neither Agree nor Disagree, A = Agree, SA = Strongly Agree

1. I feel confident that I understand computer capabilities well enough to maximize them in my classroom.	SD	D	NA/ND	A	SA
2. I feel confident that I have the skills necessary to use the computer for instruction.	SD	D	NA/ND	A	SA
3. I feel confident that I can successfully teach relevant subject content with appropriate use of technology.	SD	D	NA/ND	A	SA
4. I feel confident in my ability to evaluate software for teaching and learning.	SD	D	NA/ND	A	SA
5. I feel confident that I can use correct computer terminology when directing students' computer use.	SD	D	NA/ND	A	SA
6. I feel confident I can help students when they have difficulty with the computer.	SD	D	NA/ND	A	SA
7. I feel confident that I can effectively monitor students' computer use for project development in my classroom.	SD	D	NA/ND	A	SA
8. I feel confident that I can motivate my students to participate in technology-based projects.	SD	D	NA/ND	A	SA
9. I feel confident that I can mentor students in appropriate uses of technology.	SD	D	NA/ND	A	SA
10. I feel confident that I can consistently use education technology in effective ways.	SD	D	NA/ND	A	SA
11. I feel confident I can provide individual feedback to students during technology use.	SD	D	NA/ND	A	SA
12. I feel confident I can regularly incorporate technology into my lessons, when appropriate to student learning.	SD	D	NA/ND	A	SA
13. I feel confident about selecting appropriate technology for instruction based on curriculum standards.	SD	D	NA/ND	A	SA
14. I feel confident about assigning and grading technology-based projects.	SD	D	NA/ND	A	SA
15. I feel confident about keeping curricular goals and technology uses in mind when selecting an ideal way to assess student learning.	SD	D	NA/ND	A	SA
16. I feel confident about using technology resources (such as spreadsheets, electronic portfolios, etc.) to collect and analyze data from student tests and products to improve instructional practice.	SD	D	NA/ND	A	SA

17. I feel confident that I will be comfortable using technology in my teaching.	SD	D	NA/ND	A	SA
18. I feel confident I can be responsive to students' needs during computer use.	SD	D	NA/ND	A	SA
19. I feel confident that, as time goes by, my ability to address my students' technology needs will continue to improve.	SD	D	NA/ND	A	SA
20. I feel confident that I can develop creative ways to cope with system constraints (such as budget cuts on technology facilities) and continue to teach effectively with technology.	SD	D	NA/ND	A	SA
21. I feel confident that I can carry out technology-based projects even when I am opposed by skeptical colleagues.	SD	D	NA/ND	A	SA

Appendix C

The Technology Integration Survey (Kopcha, 2008)

Please circle one response for each of the statements in the table: SD = Strongly Disagree, D = Disagree, NA/ND = Neither Agree nor Disagree, A = Agree, SA = Strongly Agree

1.	I am expected to use technology to support content objectives.	SD	D	NA/ND	A	SA
2.	There is strong administrative backing for using technology.	SD	D	NA/ND	A	SA
3.	The demands/goals placed on me for using technology are reasonable.	SD	D	NA/ND	A	SA
4.	The technology available is, for the most part, useful for teaching.	SD	D	NA/ND	A	SA
5.	I receive help fixing technology problems in a timely manner.	SD	D	NA/ND	A	SA
6.	The technology available is, for the most part, reliable.	SD	D	NA/ND	A	SA
7.	I believe using computers with students increases their learning.	SD	D	NA/ND	A	SA
8.	It is easy to design learning activities that incorporate computers.	SD	D	NA/ND	A	SA
9.	I believe that technology makes my job as a teacher easier	SD	D	NA/ND	A	SA
10.	The training I received could be easily applied in my classroom.	SD	D	NA/ND	A	SA
11.	I feel adequately trained on the skills needed to use technology.	SD	D	NA/ND	A	SA
12.	I have enough opportunity to share technology lessons with other teachers.	SD	D	NA/ND	A	SA
13.	Integrating technology takes less time than I thought it would.	SD	D	NA/ND	A	SA
14.	I was given time to learn to integrate technology into my lesson.	SD	D	NA/ND	A	SA
15.	I have enough time to plan and prepare lessons that use technology.	SD	D	NA/ND	A	SA

Appendix D

Teacher Interview Questions

1.What technology do you use in the classroom including devices, software, and apps?

2. How confident are you using technology in your classroom to support teaching and learning?

3. What are the benefits of technology integration to you and to student learning?

4. What are or were the challenges to using technology in your classroom?

5. How much time did you have, or do you have to learn and implement technology in your classroom?

6. Have you received professional development that supports the use of technology integration in the classroom?

7. How often does this kind of professional development occur?

8. Is the professional development you receive regarding technology integration relevant to your teaching?

9. What kind of professional development do you need to support your use of technology in the classroom?

10. What other supports can the educational leadership provide to help you integrate technology?

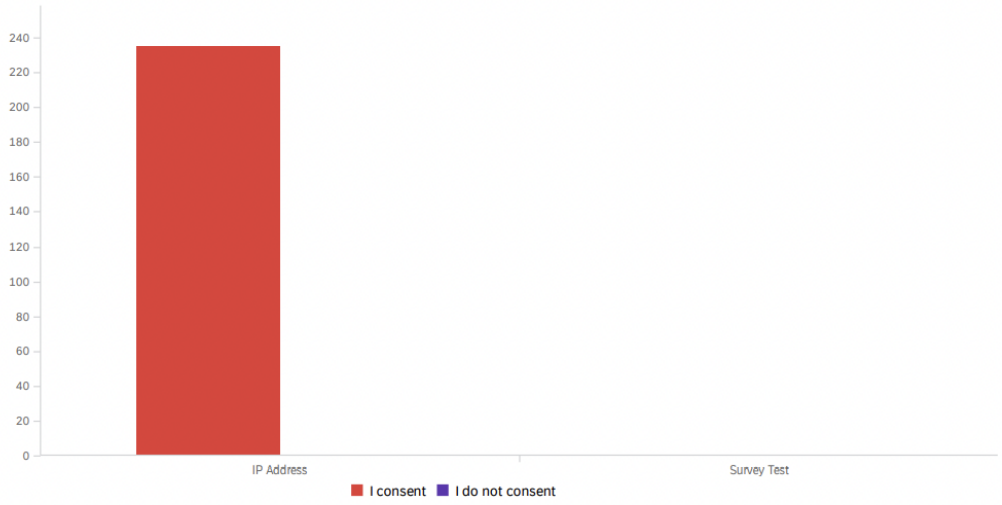
Appendix E

Electronic Consent Form

Q0 - By completing this survey or questionnaire, you are consenting to be in this research study. Your participation is voluntary and you can stop at any time. All information collected is strictly confidential and you will not be identifiable through this application. All information gathered will be summarized and no individual response will be used.

#	Field	IP Address	Survey Preview	Survey Test	Imported	Spam	Survey Preview Spam	Imported Spam	Offi
1	I consent	100.00% 235	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00
2	I do not consent	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00
		235	0	0	0	0	0	0	

Showing rows 1 - 3 of 3



End of Report

Appendix F

Coaching Session Activities and Embedded Discussion Questions

Session 1

Activities

- Introduction to pilot study
- Statement of confidentiality
- Administration of the survey
- Think Pair Share 1: Participants will go to a break-out room with a partner to discuss their successes and challenges when teaching with digital tools in a face-to-face environment. Participants will come back and present their discussion to the other participants.
- Think Pair Share 2: Participants will go to a break-out room with a partner to discuss their successes and challenges when teaching online during the pandemic. Participants will come back and present their discussion to the other participants.
- Introduction to the Community of Inquiry Framework: General overview of the framework including an introduction to the three presences
- Exit Tickets

Embedded Discussion Questions

1. What are the challenges you encountered when integrating technology into your classroom?
2. What were the challenges you experienced when providing online learning during the pandemic?
3. What are the challenges you experience when providing hybrid learning (some students are online, and some are in the classroom)?
4. What are the challenges teachers experience when students return to face-to-face learning after a period of online learning?
5. Do you feel you provided high quality online instruction during the pandemic?
6. Do you feel you provide high quality instruction when teaching with digital tools during face-to-face instruction?
7. What do you know about the Community of Inquiry Framework?

Session 2

Activities

- Introduction to teaching presence
- Definition of teaching presence including the three main categories: 1) Instructional design and management, 2) building understanding, 3) direct instruction.
- Partner Work: Partners go into a break-out room and consider how they approach instructional design and management, build understanding, and provide instruction when teaching online and face-to-face using digital tools. Partners return and share their findings with the group.
- Participants set professional goals for increasing their teaching presence

- Participants create and share two take-aways from the coaching session
- Exit ticket

Embedded Discussion Questions

1. Why is teaching presence important?
2. How do you facilitate teaching presence in face-to-face instruction when using digital tools?
3. How do you facilitate teaching presence during online instruction?
4. What are the barriers that you have experienced when creating teaching presence when teaching:
    a. Online?
    b. Hybrid?
    c. Face-to-face?
5. Do you feel that increasing your teaching presence could have a positive effect on the delivery of your instruction?
    a. If so, why?
6. What digital tools, including applications, can you use to increase teaching presence?
7. What additional training do you need to learn how to increase your teaching presence?

WhatsApp Reflective Prompt:

- How are you integrating your learning from the previous session into your classroom instruction? Please share your successes, challenges, and questions.

Session 3

Activities

- Introduction to social presence
- Definition of social presence including the three main categories: 1) Learning climate, 2) group identity/cohesion 3) self-projection/ emotional expression.
- Partner Work: Partners go into a break-out room and consider how they approach building a positive learning climate, group identity, and a safe place for emotional expression when teaching online and face-to-face using digital tools. Partners return and share their findings with the group.
- Participants set professional goals for increasing their social presence
- Participants create and share two take-aways from the coaching session
- Exit ticket

Embedded Discussion Questions

1. Why is social presence important?
2. How do you facilitate social presence in face-to-face instruction when using digital tools?
3. How do you facilitate social presence during online instruction?
4. What are the barriers that you have experiences when creating social presence when teaching:
    a. Online?
    b. Hybrid?
    c. Face-to-face?

5. Do you feel that increasing social presence could have a positive effect on the delivery of your instruction?
    a. If so, why?
6. What digital tools, including applications, can you use to increase social presence?
7. What additional training do you need to learn how to increase social presence?

WhatsApp Reflective Prompt:

- How are you integrating your learning from the previous session into your classroom instruction? Please share your successes, challenges, and questions.

Session 4

Activities

- Introduction to cognitive presence
- Definition of cognitive presence including the four main categories: 1) The triggering event, 2) exploration, 3) integration, 4) resolution.
- Partner Work: Partners go into a break-out room and consider how they approach setting goals, creating a sense of puzzlement, information exchange, connecting ideas, and applying new ideas, and checking for understanding. Partners return and share their findings with the group.
- Participants set professional goals for increasing their cognitive presence
- Participants create and share two take-aways from the coaching session
- Exit ticket

Embedded Discussion Questions

1. Why is cognitive presence important?
2. How do you facilitate cognitive presence in face-to-face instruction when using digital tools?
3. How do you facilitate cognitive presence during online instruction?
4. What are the barriers that you have experiences when creating cognitive presence when teaching:
    a. Online?
    b. Hybrid?
    c. Face-to-face?
5. Do you feel that increasing cognitive presence could have a positive effect on the delivery of your instruction?
    a. If so, why?

What additional training do you need to learn how to increase cognitive presence?

WhatsApp Reflective Prompt:

- How are you integrating your learning from the previous session into your classroom instruction? Please share your successes, challenges, and questions.

Session 5

Activities

- Review of the three presences
- Discussion of the dynamic relationship between the three presences

- Co-creation of a Google Site as digital tool to create a lesson involving the three presences of the CoI framework
- Partner Work: Partners go and set goals for integrating the CoI framework into their instructional practice. Participants will consider pedagogical techniques, instructional design, appropriate and supportive applications, student needs, and what additional training they need. Participants return and share their findings with the group.
- Participants create and share two take-aways from the coaching session
- Exit ticket
- Survey administration

Embedded Discussion Questions

1. How has your knowledge of the CoI changed as a result of participating in this pilot study?
2. What are your perceptions of the relevancy of the parts of the CoI to your instructional practice?
    - 2a. To what extent do you perceive teaching presence as important to your instructional practice?
    - 2b. To what extent do you perceive social presence as important to your instructional practice?
    - 2c. To what extent do elementary school teachers perceive cognitive presence as important to your instructional practice?
3. Do you feel the CoI framework can help you deliver high-quality instruction:
    - 3a. Online
    - 3b. Hybrid
    - 3c. Face-to face
4. Did participating in this pilot study influence your technology self-efficacy?
5. What are your perceptions of the coaching process?

Appendix G

Logic Model of Coaching Sessions

Inputs	*Activities*	Outputs	Outcomes -- Impact: Short	Outcomes -- Impact: Medium	Outcomes -- Impact: Long
Personnel: • Elementary school teachers ($N = 4$) to participate in intervention **Resources** • Online video conference software • Presentation software • Reliable infrastructure to support online workshops • Laptops or desktops • Participants' unit plans and lesson plans • Participant's classrooms **Time** • Five one-hour workshops • Participants integrate learning from the previous workshop into lessons during the week. **Permissions** Permission form the research committee at the University.	**Researcher will:** • Researcher will Provide five online coaching sessions to elementary school teachers (N=4) on integrating the CoI framework into instructional practice with technology. The five sessions will occur over five weeks. Topics will include an introduction to CoI, teaching presence, social presence, cognitive presence, and strategies to integrate the presences into instructional practice.. • Teachers will be expected to integrate a CoI framework element skill learned during the week • In the sessions teachers will reflect on an element of the CoI framework that they integrated into their classroom the previous week. The coach will use a dialogical approach to helping participants integrate each element.	• Coaching sessions will occur online. The coach will start each session by introducing one of the presences in the CoI. • Participants will discuss this component and give examples of how to integrate it into practice. • Participants will break into partner work sessions for 20-30 minutes and collaborate on integrating the component into their upcoming lessons. • At the end of each session, the coach will ask participants to share their learning. • During sessions two-five, participants will share their successes and challenges with what they integrated into their practice. • Throughout the entire five weeks, participants will use WhatsApp to report on their practice, share challenges and successes, and ask questions.	• Teachers increase their knowledge of the CoI framework and how it can be integrated into their instructional practice. • Teachers increase their technology integration confidence.	• Teachers engage in more formal and informal discourse about technology use in the classroom • Increased perception of the usefulness of the CoI framework • Increased instances of the integration of the CoI framework into instructional practice. • Instructional practice will reflect meaningful learning with technology for students	• Increased student engagement during instructional time. • Increased student achievement

Assumptions
- Teachers want to increase their technology self-efficacy and have the time to participate in the pilot study
- Teachers' administrators are flexible regarding instructional and curricular changes involving digital tools
- The intervention will provide enough support to increase teachers' technology self-efficacy

External Factors
- Changes in school leadership and staff
- First-order barriers to technology integration
- Second-order barriers to technology integration
- Lack of subject participation or attrition of subjects
- Other PL sessions or other events contribute to realized effects of the intervention

Appendix H

The Technology Integration Confidence Scale (Version 3)

C1: Technology Usage

How confident are you...?

1. In using technology to stay current with research to support student learning outcomes?
2. In facilitating and supporting student learning opportunities with technology?
3. In modeling, for colleagues, the identification, exploration, evaluation, curation, and adoption of new digital resources and tools for learning?
4. In using collaborative tools to expand students' authentic, real-world learning experiences by engaging virtually with experts, teams, and students, locally and globally?
5. In collaborating and co-learning with students to discover and use new digital resources as well as diagnose and troubleshoot technology issues?
6. With actively participating in virtual and blended learning communities to support your CPD?
7. In designing authentic learning activities that align with content area standards and using digital tools and resources to maximize active, deep learning?

C2: Technology Application

How confident are you in...?

8. Exploring and applying instructional design principles to create innovative digital learning environments that engage and support learning?
9. Using technology to create, adapt, and personalize learning experiences that foster independent learning and accommodate learner differences and needs?

10. Creating learning opportunities that challenge students to use a design process and computational thinking to innovate and solve problems?

11. Managing the use of technology and student learning strategies in digital platforms, virtual environments, hands-on makerspaces or in the field?

12. Providing alternative ways for students to demonstrate competency and reflect on their learning using technology?

C3: Technology-infused Learning

How confident are you in…?

13. Learning about, testing or adding into regular practice a variety of proven, promising, and emerging learning strategies along with technology to support and enhance student learning?

14. Using technology to support student needs through increased personalization and differentiation?

15. Using technology to support student learning and enhance student engagement through virtual collaboration?

16. Using technology to support the demands of the student-centered pedagogy for project-based learning?

17. Using technology to support STEAM as an access point to guide student inquiry, dialogue, and critical thinking?

C4: Technology Literacy and Digital Citizenship

How confident are you in…?

18. Teaching students to think critically, be safe, and responsible in the digital world?

19. Establishing a learning culture that promotes curiosity, critical examination of online resources, digital literacy, and media fluency for learners?

20. Mentoring students to use digital tools in safe, legal, and ethical ways including the protection of intellectual rights and property?

21. Modeling and promoting management of personal data and digital identity as well as protect student data privacy?

C5: Technology-supported Assessment

How confident are you in...

22. Facilitating data-driven instruction and guiding learning based on competency- based assessment and new data analysis tools?

23. Using digital tools to provide immediate feedback to students?

24. Dedicating planning time to collaborate with colleagues to create authentic learning experiences that leverage technology?

25. Using technology to design and implement a variety of formative and summative assessments that accommodate learner needs, provide timely feedback to students, and inform instruction?

Appendix I

Exit Tickets

Please answer the following two questions on a scale of 1-5 with 1 representing *not at all* and 5 representing *a great deal:*

1. To what extent are you satisfied with today's coaching session?
2. To what extent do you perceive the coaching session provided information that can positively contribute to your instructional practice?

Please write your answer in the space under the question:

3. What was the thing you benefitted from the most from the coaching session?
4. What new technology-related instruction techniques will you integrate into your instruction practice because of this session?
5. If this coaching session did not meet your expectations and needs, how could it be improved?

Appendix J
Summary Matrix

Evaluation Question	Construct	Data Source(s)	Data Collection Tool	Frequency	Analysis
What are the challenges elementary school teachers experience when providing online and hybrid learning to students during the pandemic?	Barriers to effective technology integration	Elementary school teachers	Embedded discussion questions	Discussion questions will occur during every coaching session "What are the challenges you encountered when integrating technology into your classroom?"	Transcription and thematic analysis
To what extent do teachers perceive they have provided high quality online instruction?	Quality of instruction	Elementary school teachers	Embedded discussion question	Discussion question will occur during the first coaching session "Do you feel you provided high quality online instruction during the pandemic?"	Transcription and thematic analysis
What are elementary school teachers' perceptions of the relevancy of the parts of the Community of Inquiry to their instructional practice?	Relevancy of teaching presence, social presence, and cognitive presence	Elementary school teachers	Embedded discussion questions Exit tickets	Discussion question will occur during the second through and fifth coaching session "To what extent do you perceive	Transcription and thematic analysis

				teaching presence as important to your instructional practice?" Exit tickets will be given to participants after each session using an online survey tool	
To what extent does participation in a Community of Inquiry based coaching session influence teachers' technology self-efficacy?	Teachers' technology integration confidence	Elementary school teachers	Technology Integration Confidence Scale (Gomez, 2020)	Once during the first session and once during the last session Field journal	Descriptive Statistics describing pre and post-test means Comparison of attendance frequencies to self-efficacy
Process Evaluation Question	**Construct**	**Data Source(s)**	**Data Collection Tool**	**Frequency**	**Analysis**
What are teachers' perceptions of the coaching process?	Quality of delivery (Dusenbury et al., 2003): Teachers' perceptions of the quality of the coaching process	Researcher	Exit tickets Embedded discussion questions	Exit tickets will be given to participants after each session using an online survey tool Discussion questions will be asked at the end of each coaching session "What are your perceptions of	Transcription and thematic analysis of data Transcription and thematic analysis of data

				the coaching process?”	
To what extent did participants attend the coaching sessions?	Dose (Dusenbury et al., 2003): Did all participants attend at least three of the five sessions over the three weeks?	Researcher	Field notes included attendance	Attendance was taken in field notes after each session	Frequencies: A bar graph showing the number of participants who attended 1-6 sessions