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Professional Development for One-to-One Mobile Technology Programs

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This is to certify that the doctoral dissertation by

LeAnn Martin Morris

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Walden University
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Abstract

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MEd, Lesley University, 1995

BA, University of Wyoming, 1990

Dissertation Submitted in Partial Fulfillment

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Abstract

One-to-one mobile technology integration is the goal of increasing numbers of school districts each year, and many factors exist to consider when measuring success. The research problem for this qualitative study focused on one of the critical components for measuring success: the need for effective teacher professional development. The purpose of this study was to examine (a) principles and practices to facilitate the integration of one-to-one mobile technologies into professional learning experiences, and (b) the perceptions of technology instructional coaches regarding changes in teachers' practice and attitudes following professional development. The conceptual framework included Knowles's theory of andragogy and Koehler and Mishra's TPACK framework. In two rounds, 19 interviews were conducted with 13 technology instructional coaches. Thirteen coaches were interviewed in round one and from that data six high level coaches were identified for a second round of interviews. The data from both interview rounds were analyzed and coded to identify themes and categories. The key findings revealed that effective one-to-one mobile technology integration requires supportive leadership; building culture and relationships; instructional design with standards and frameworks; building collaborative, job-embedded teacher agency; and personalized learning with differentiated delivery. All stakeholders could use the key results to make informed decisions for planning and implementing professional learning opportunities. This study may affect positive social change by enhancing how technology is integrated into teaching and learning through increased teacher engagement in professional learning.

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Dedication

I dedicate this dissertation to my loving husband, Craig; my 14-year-old son, Andrew, who is the “son” shine of my life; my Mom; my brother, LeRoy; and my twin sister, Lynette, who have supported and encouraged me as I have pursued this monumental goal and dream. This dedication is also to the memory of my Dad, who I know would also be very proud of me for this incredible accomplishment.

Acknowledgments

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Chapter 1: Introduction to the Study

In the era of high-stakes accountability and college and career readiness in K–12 education, many school districts are implementing one-to-one mobile technology projects. This pedagogical approach is characterized by each student and teacher having access to their own Internet accessible device. The addition of this technology in the classroom has resulted in a need for changes in teaching practice (Gulamhussein, 2013; Killion, 2016; Sell, Cornelius-White, Chang, McLean, & Roworth, 2012) to adjust to

- computerized assessments (Consortium for School Networking, 2015);
- narrowing digital equity gaps between students of high and low socioeconomic status (Warschauer, Zheng, Niiya, Cotton, & Farkas, 2014);
- the promotion of digital and blended learning; and
- the need to support the continuous development of teachers (Robbins & Alvy, 2014) and improve the quality of teaching.

In order for teachers to transform the way they teach, they must be provided with effective professional development to help them understand the classroom management strategies and instructional design techniques needed to teach with one-to-one devices. Increasing numbers of schools and districts across the country and around the world have embraced the need for information and communication technology (ICT) integration to enhance quality education (Coklar & Yurdakul, 2017; Kim, Kim, Lee, Spector, & DeMeester, 2013; Phelps, Graham, & Watts, 2011; Polly & Hannafin, 2011). The impact of the digital revolution on student learning outside of school is also pushing schools to use the same tools for student learning in school (Clarke, 2012). While some educators

have voiced concerns about being replaced by technology, the single most important contributor to effective instruction is the teacher (Bozkus & Tastan, 2016; Darling-Hammond, 2010; Magana & Marzano, 2013). Regarding ineffective teachers who are viewed as warming a seat in the classroom, Thornburg stated, “Any teacher that can be replaced by a computer should be” (as cited in J. P. Costa, 2012, p. 85). If changes are to occur in teaching approaches, professional learning for teachers must be “ongoing, focused, and consistently connected to practice” (L. A. Wilson, Gielniak, & Greaves, 2017, p. 1) and provide for continuous improvement (Robbins & Alvy, 2014). This occurs in two different functional roles: “teacher as technician” with technical skill training and “teacher as intellectual” with innovative classroom strategies (Gulamhussein, 2013, p. 21).

To identify specific strategies to transform teacher practices with one-to-one technology, I explored professional development in one-to-one mobile technology program implementations in multiple K–12 school districts in this study. According to Brooks and Gibson (2012); Challoo, Green, and Maxwell (2011); and Chiyaka, Kibirige, Sithole, McCarthy, and Mupinga (2017), high-quality professional development includes in-service education, staff development, and professional learning—all of which have similar definitions. They include

- relevant hands-on training with a focus on content knowledge and pedagogical skills (Clarke, 2012; Sell et al., 2012);
- supporting and empowering teachers as reflective practitioners to improve their practice (Cifuentes, Maxwell, & Bulu, 2011);

- sustained effort over time (Learning Forward, 2011); and
- promoting teachers as collaborative lifelong learners (Sparks, 2002).

The results of this study add to the research regarding school district implementation of one-to-one mobile technology initiatives. It was my hope that the recommendations I provide in this study will support K–12 students in developing 21st century skills (Lowther, Inan, Ross, & Strahl, 2012). The findings include proven and effective technology teacher professional development principles and practices for blended learning environments (Siko & Hess, 2014).

In Chapter 1, I provide the main components of this qualitative, in-depth interview study. In the background for the research, problem statement, and purpose of the study sections, I introduce the challenges facing school districts that are implementing one-to-one mobile technology programs. The theory of andragogy and the technological, pedagogical, and content knowledge (TPACK) model provided the conceptual framework for this study. In this chapter, I also present the research questions, nature of the study, definitions of relevant terms, assumptions, limitations, and delimitations. The significance of the study is its practical contributions that may be significant for K–12 districts who are implementing one-to-one mobile technology programs.

Background

Technology professional development strategies and transforming instruction with one-to-one mobile technology initiatives are becoming a necessary skill set for K–12 teachers. Even though different forms of technology—including film, television, computers, and scientific calculators—have been used in classrooms as far back as the

1950s (Cuban, 1986, 2001; Halverson & Smith, 2009), one-to-one mobile technology use has continued to grow in classrooms around the world since the 2000–2001 school year (Bebell & O'Dwyer, 2010; Dorfman, 2016; Lindsay, 2016). Literature on technology professional development practices and strategies in one-to-one mobile technology programs primarily concentrates on the three general areas of societal, school-specific, and disciplinary (Fleischer, 2012), including

- planning for varying outcomes,
- implementation strategies, and
- operational characteristics (Sell et al., 2012).

Professional development is referred to in the literature as staff development, in-service education, professional learning (Joyce & Calhoun, 2010; Swanson, 2013), and teacher training. The focus of this study was on professional development to assist teachers in building their skills levels as one-to-one implementers. Shapley, Sheehan, Maloney, and Caranikas-Walker (2010a) focused their study on the need for a technology professional development model for education to assist in attracting and retaining talented teachers by providing a structure for them to use their skills and knowledge to create a ripple effect on the technology immersion in teaching throughout the country. In addition, the *Journal of Technology, Learning, and Assessment* published six articles in a special edition that presented empirical evidence on one-to-one computing models (Bebell & Kay, 2010; Bebell & O'Dwyer, 2010; Drayton, Falk, Stroud, Hobbs, & Hammerman, 2010; Shapley, Sheehan, Maloney, & Caranikas-Walker, 2010b; Suhr, Hernandez, Grimes, & Warschauer, 2010; Weston & Bain, 2010).

Three categories of 21st-century skills are critical components of technology professional development for teachers:

1. Learning and innovation skills: Creativity and innovation, critical thinking and problem solving, and communication and collaboration.
2. Digital literacy skills: Information literacy, media literacy, and ICT literacy.
3. Career and life skills: Flexibility and adaptability, initiative and self-direction, social and cross-cultural skills, productivity and accountability, and leadership and responsibility (Crockett, Jukes, & Churches, 2011).

According to An and Reigeluth (2012) and Kang, Hahn, and Chung (2015), teachers must focus on a learner- or student-centered model; this requires professional development with embedded technology use and not the presentation-only model of the past (sometimes called the “stand and deliver” model). Lowther et al. (2012) presented findings from an investigation of the overall effectiveness of Michigan’s 2005–2006 Freedom to Learn initiative, one of the first comprehensive statewide one-to-one programs in the United States. They found that teachers who participated in the Freedom to Learn initiative reported greater confidence in effective technology integration practices. Variables and outcomes in the school environment that affect technology implementation include a correlation between high-quality curriculum-based instructional technology professional development and a change in teacher perceptions and outcomes (Bebell & O’Dwyer, 2010; Cavanaugh, Dawson, & Ritzhaupt, 2011; Crompton, Olszewski, & Bielefeldt, 2016; Martin et al., 2010; Oliver, 2010).

School districts spend substantial amounts of money and a great deal of time each school year on professional development training for K–12 teachers. Their goal is that teachers learn integration strategies for one-to-one mobile technology devices (Ertmer & Ottenbreit-Leftwich, 2013; Sell et al., 2012; The New Teacher Project (TNTP), 2015). However, a research gap exists concerning proven and effective principles and practices for technology professional development specific to one-to-one programs and changes in teacher practice and attitude (Potter & Rockinson-Szapkiw, 2012; L. A. Wilson et al., 2017). In this qualitative, in-depth interview study, I examined the systems and structures that are in place for proven and effective principles and practices in one-to-one mobile technology professional development programs.

Problem Statement

The integration of one-to-one mobile technology continues to be a goal of more school districts each year, as a result of the need to ensure that students have a strong background in technology and digital literacy skills (Crockett et al., 2011; Crompton et al., 2016; Dorfman, 2016; Lindsay, 2016). In one-to-one programs, students are either issued their own school-owned devices or required to bring their own—known as “bring your own device” (BYOD) programs. Twenty-first-century skills, such as critical thinking and problem solving, communication, collaboration, digital citizenship, creativity and innovation, productivity, and risk-taking (Partnership for 21st Century Learning, 2015; Voogt, Erstad, Dede, & Mishra, 2013), are essential for students to become contributing members of society.

There are many variables to consider when measuring the success of one-to-one mobile technology programs; one of the critical elements is the effectiveness of professional development provided to the teachers (Beaver, Jessup, & Leslie, 2015; Storz & Hoffman, 2013; Topper & Lancaster, 2013). When professional development is personalized and job embedded and provides ongoing support, teachers are more willing to implement what they learn (Murray, 2014; Siko & Hess, 2014; TNTP, 2015). However, when professional development is provided as one size fits all with minimal offerings for specific instructional pedagogies, implementation of new skills is marginal (Creemers, Kyriakides, & Antoniou, 2013; Inserra & Short, 2013).

K–12 teachers face specific problems in the implementation and integration of 21st century skills into the core curriculum using technology. These issues correlate with inadequate time for continual and sustainable professional development that helps teachers learn the necessary skills to teach with technology and to plan activities that integrate technology (Coklar & Yardakul, 2017; Kopcha, 2012). In fact, there is a lack of systemic technology integration structure for proven and effective one-to-one mobile technology professional development programs for K–12 teachers (Grundmeyer, 2014; Richardson, McLeod, Flora, & Sauers, 2013; Spires, Wiebe, Young, Hollebrands, & Lee, 2012; Storz & Hoffman, 2013; Topper & Lancaster, 2013; Towndrow & Wan, 2012). There must be ongoing support to transform a teacher- or expert-centered instructional model into a teacher-as-learner-centered model (Clarke, 2012), where teachers learn from each other and promote teacher agency (Calvert, 2016). Models and plans that provide a framework for proven and effective technology professional development for one-to-one

mobile technology implementation were my focus in this qualitative, in-depth interview study.

Purpose of the Study

The purpose of this qualitative, in-depth interview study was to examine professional development principles and practices used by technology instructional coaches to facilitate the integration of one-to-one mobile technologies into K–12 student learning experiences. I also explored the perceptions of technology instructional coaches regarding changes in teacher practice and attitudes following professional development training in this study. Studying the integration and transformation of teaching practices necessary for the digital age of learning can expand the knowledge and understanding of the significant need for highly effective professional development to transform teaching and learning in K–12 education.

Research Questions

I designed this study to answer four primary research questions:

Research Question 1: What professional development principles do technology instructional coaches use in designing professional development for one-to-one mobile technology programs?

Research Question 2: What professional development practices do technology instructional coaches use in designing professional development for one-to-one mobile technology programs?

Research Question 3: What are the perceptions of technology instructional coaches regarding changes in teacher practice after professional development sessions?

Research Question 4: What are the perceptions of technology instructional coaches regarding changes in teacher attitudes after professional development sessions?

Conceptual Framework

The conceptual framework for this study was based on the theory of andragogy (Knowles, 1975) and the pedagogical framework of TPACK (Koehler & Mishra, 2009). Both are important in the field of educational technology, where teachers as adult learners should receive high-quality, sustainable professional development training. Andragogy, the art and science of teaching adults or helping adults learn (Knowles, Holton, & Swanson, 2015), provided the foundation for me to study how teachers learn best when acquiring knowledge for technology integration of one-to-one mobile technologies into their classrooms. The TPACK framework (Mishra & Koehler, 2006), built on Shulman's (1986) pedagogical content knowledge (PCK) framework, provided a lens for studying how teachers effectively use technology, pedagogy, and content knowledge as they integrate one-to-one mobile technologies into student learning. (I provide a more thorough explanation of the logical connections among the key elements of the theory of andragogy and the pedagogical framework of TPACK in the literature review.)

Andragogy has six core adult learning principles:

- learner's need to know,

- self-concept of the learner,
- prior experience of the learner,
- readiness to learn,
- orientation to learning, and
- motivation to learn (Knowles et al., 2015).

These six principles are significant to the needs of teachers who participate in technology professional development for one-to-one mobile technology programs for creating new knowledge (Brooks & Gibson, 2012; Clarke, 2012; Potter & Rockinson-Szapkiw, 2012).

In the TPACK model, Koehler and Mishra (2009) added technology to the original two components of the PCK framework. For the purpose of this study, I applied this approach to the integration of one-to-one mobile technologies. Koehler and Mishra defined content knowledge as knowing the subject matter and pedagogical knowledge as knowing about teaching practices and methods, while technological knowledge centers on knowing how to use technology to accomplish a variety of tasks. Koehler and Mishra also noted that "Equally important to the model are the interactions between and among these bodies of knowledge, represented as PCK (Pedagogical Content Knowledge), TCK (Technological Content Knowledge), TPK (Technological Pedagogical Knowledge), and TPACK" (p. 62). This conceptual framework provided me with a foundation for carrying out the qualitative, in-depth interview study approach. In addition, it was foundational in establishing the research questions by addressing how adult learners gain new knowledge and acquire an understanding of technology integration for one-to-one mobile technologies.

Nature of the Study

The qualitative, in-depth interview study approach best suited the research problem, purpose, and questions for this study by allowing me to explore the perceptions of technology instructional coaches and how they developed and/or delivered professional development programs for one-to-one technology programs and changes in teacher practice and attitudes following professional development training. I chose this design because it was most suitable for "studying the meaning of people's lives, as experienced under real-world conditions" (Yin, 2016, p. 9). In this study, I explored technology integration uses by instructional coaches who had developed and/or delivered technology professional development programs by focusing on the *what* and *how* of different one-to-one mobile technologies practices and strategies.

I collected qualitative data from technology instructional coaches in 12 different school districts that were in different phases of one-to-one mobile technology implementation. The districts' implementation of one-to-one mobile technology programs ranged from 1 year to more than 10 years. Due to geographical distance, I conducted the interviews electronically through GoToMeeting (https://www.gotomeeting.com). Data were drawn from two sets of interviews. The first set involved 13 technology instructional coaches from 12 different districts who had developed and/or delivered technology professional development in their districts for one-to-one mobile technology implementations. Once the initial interview data were analyzed, seven of the original 13 coaches who showed higher levels of expertise were interviewed again. No clarification was needed, so no follow-up interviews were

conducted. I used NVivo 11 Pro (QSR International, 2015) as the qualitative analysis software tool to transcribe and analyze the interview data.

Definition of Terms

Andragogy: The art and science of adult learning (Knowles et al., 2015).

Blended learning: A combination of traditional face-to-face instruction with supported digital resources (Siko & Hess, 2014).

Bring your own device (BYOD): A technology model where students bring a personally-owned device to school for the purpose of learning. A personally-owned device is any technology device brought into the school and owned by a student (or the student's family; Alberta Education, School Technology Branch, 2012).

Bring your own technology (BYOT): A policy that allows employees or students to use their own personal electronic devices at work or school (TechTarget, 2018).

Instructional technology: The use of computers or other technology devices to enhance and support instructional practices (Meltzer, 2012).

One-to-one computing, 1:*1 mobile technology, e-learning (electronic learning), m-learning (mobile learning),* and *ubiquitous computing*: All refer to each teacher and student having a separate Internet-connected wireless computing device, such as a laptop or tablet, with access to and support for classroom instructional materials and resources available to use at school or at home (Abell Foundation, 2008; Lindsay, 2016; Sell et al., 2012). School-issued devices may be all the same; student- and teacher-provided devices may be different.

Pedagogy: “The art and science of teaching children” (Knowles et al., 2015, p. 41) and the method and practice of teaching methods and skills acquired through training and experience (Creemers et al., 2013).

Practice: “The actual application or use of an idea, belief, or method, as opposed to theories relating to it” (Practice, n.d., para. 1).

Principle: “A fundamental truth or proposition that serves as the foundation for a system of belief or behavior or for a chain of reasoning” (Principle, n.d., para. 1).

Professional development, professional learning, staff development, teacher training, in-service, and *workshop*: All refer to professional educators working together with practitioners and experts currently using technology to learn resources and strategies to support the efforts of using technology as part of the regular curriculum (Meltzer, 2012; Ruggerio & Mong, 2015).

Professional learning communities (PLCs): “Communities of professionals caring for and working to improve student learning together by engaging in continuous collective learning of their own” (Challoo et al., 2011, p. 40).

Professional learning networks (PLNs): “Connect teachers to other individuals worldwide who can offer support, advice, feedback, and collaboration opportunities” (Trust, 2012, p. 133).

Teacher agency: “The capacity of teachers to act purposefully and constructively to direct their professional growth and contribute to the growth of their colleagues” (Calvert, 2016, p. 4).

Technological pedagogical content knowledge (TPACK): "The TPACK framework describes the kinds of knowledge that teachers need in order to teach with technology, and the complex ways in which these bodies of knowledge interact with one another" (Koehler, Mishra, Akcaoglu, & Rosenberg, 2014, p. 2).

Technology integration: Incorporating digital tools and resources into content and pedagogical instructional practices (Kim et al., 2013; Mouza, 2011; Potter & Rockinson-Szapkiw, 2012).

Twenty-first century skills: The knowledge, skills, and expertise students should master beyond the core content subjects to succeed in work and life in the 21st century. These skills include global awareness; financial, economic, business, and entrepreneurial literacy; civic literacy; health literacy; and environmental literacy (Partnership for 21st Century Learning, 2015).

Assumptions

The design process in qualitative interview research begins with a focus on "studying the meaning of people's lives, as experienced under real-world conditions" (Yin, 2016, p. 9). In taking on a qualitative, in-depth interview study using the "responsive interviewing model with main questions, probes and follow-up questions" (Rubin & Rubin, 2012, p. 6), I made the following assumptions:

1. All participants were K–12 technology instructional coaches. My recruiting procedures automatically excluded teachers who did not fit this parameter.

2. Due to the fact that the participants all agreed to be in this study, all participants answered the interview questions honestly, openly, and to the best of their ability and could opt out at any time (which no one did).

Scope and Delimitations

There is a lack of evidence on systemic technology integration principles and practices for effective one-to-one mobile technology professional development programs for K–12 teachers. This is important in the scope of the research about the perceptions of technology instructional coaches regarding changes in teacher practice and attitudes after professional development sessions. There are also many variables to consider when measuring the success of one-to-one mobile technology programs, the most critical being the effectiveness of the professional development provided to the teachers.

The delimitations of this study consisted of interviewing a manageable sample size of 12 to 15 participants who, as technology instructional coaches, provided professional development opportunities in K–12 school districts implementing one-to-one mobile technology projects. I selected a qualitative, in-depth interview study design to obtain in-depth, non-directed, open-ended information from the participants that would answer the research questions. I selected the participants purposively from school districts that I had researched and identified as having one-to-one mobile technology projects and a focus on teacher practices with no correlation to increased student achievement. The school districts represented in this qualitative, in-depth interview study did not consider this a factor in proven and effective methods.

I chose andragogy and the TPACK pedagogical framework to support this study in the field of educational technology, where teachers as adult learners should receive high-quality, sustainable, professional development training. I also considered Siemens's (2005) theory of connectivism due to the idea of a "learning theory for the digital age" with principles of learning focused on connections and current up to date technology (p. 3). However, connectivism does not promote effective practices and principles during professional learning opportunities with a one-size-fits-all approach with minimal offerings for specific instructional pedagogies, which made it inappropriate for this study and why I selected TPACK.

I identified the participants according to specific criteria, that will be further discussed in Chapter 3, in order to align them with the purpose of this qualitative, in-depth interview study, which was to examine professional development principles and practices used to facilitate the integration of one-to-one mobile technologies into K–12 student learning experiences and to explore changes in teacher practices and attitudes following professional development training. However, the experiences shared by the technology instructional coaches were unique due to a number of factors, including years of teaching experience, amount of time and training as an instructional coach, the length of time the district had been implementing one-to-one mobile technologies, and administration support. These distinct aspects may limit the transferability of a comparable experience to different participants and school district settings.

Limitations

The limitations of this research study were influences that I could not control, including the number of technology instructional coaches available for interviews, the time constraint of collecting data within three months, and the interview questions that I created as the researcher. Additional limitations consist of not having other stakeholders included such as teachers or administrators, and the focus of TPACK on the "what" of technology integration, such as what teachers are teaching and what technology tools students are using. The indicated limitations lead to findings that can be generalized to a more extensive population utilizing themes that were developed using manual coding techniques of the interviews.

Significance of the Study

In this study, I focused on technology instructional coaches from multiple school districts around the United States and world that were in different phases of one-to-one mobile technology initiatives implementation. The significance includes practical contributions that provided research data for school districts that are implementing one-to-one mobile technology initiatives. The results of this study are important for all stakeholders, including students, parents, teachers, administrators, and decision makers at the district, board, state, and national level. The findings may assist policy makers in understanding the importance of funding and implementing proven and effective practices and strategies for technology professional development for teachers to implement sound practices effectively as they integrate one-to-one programs.

Summary

The integration of one-to-one mobile technology programs in K–12 schools around the world is on the rise. The purpose of this study was to explore the principles and practices that technology instructional coaches used in designing professional development for one-to-one mobile technology programs. In addition, I looked at the perceptions of participating technology instructional coaches regarding their perceptions of changes in teacher practice and attitudes after professional development sessions. In Chapter 2, I provide a comprehensive description of the current literature that contributes to the understanding of effective methods and strategies in technology professional development for one-to-one mobile technology initiatives.

Chapter 2: Literature Review

Integrating one-to-one mobile technology is a goal of more school districts each year, due to the increased need to ensure that students have a strong background in technology literacy, 21st-century skills, and to narrow digital equity gaps (Crockett et al., 2011; Partnership for 21st Century Learning, 2015; Warschauer et al., 2014). According to Nicholas Negroponte, creator of One Laptop per Child, an important focus for all one-to-one projects is that "it's not a laptop project; it's an education project" (One Laptop per Child, n.d., para. 2). One of the critical variables and a problem for successful implementation of one-to-one mobile technology is the effectiveness of professional development provided to teachers and administrators (Afshari, Bakar, & Siraj, 2012; Drayton et al., 2010; Shapley et al., 2010b). Many "teachers feel like seafaring captains suddenly asked to pilot a jumbo jet, all while the unruly passengers are given free access to the controls" (Toyama, 2015, p. 6) when they are expected to integrate a class full of laptops or tablets but do not have the knowledge needed for successful implementation. Therefore, I examined current research focused on proven and effective professional development strategies that effected positive change in teachers' perceptions and behaviors in integrating one-to-one mobile technologies in this study.

Technology professional development (the term I use in this study) was also referred to in the literature as staff development, in-service education, professional learning (Joyce & Calhoun, 2010; Swanson, 2013), and teacher training. The focus of the study was on integration techniques for technology use in general; similarly, one-to-one mobile technology integration research focused on program implementation, including

infrastructure and leadership. Conversely, there is little research about effective professional development strategies and techniques specific to one-to-one mobile technology facilitating positive change in teachers' perceptions and behaviors. The purpose of this literature review was to serve as a foundation for this qualitative, in-depth interview study along with the conceptual framework of andragogy and TPACK by describing professional development principles and practices.

In this chapter, I discuss research findings centered on the integration and transformation of teaching practices needed for the digital age of learning that can expand understanding of the significant need for highly effective professional development. I also present literature regarding the transformation of teaching and learning in K–12 education in relation to the conceptual frameworks of andragogy and TPACK in this chapter. The chapter include three sections focusing on an in-depth analysis and synthesis of key concepts in the literature in different levels of professional development standards and strategies: general professional development, professional development for technology integration, and professional development for one-to-one mobile technology. In conclusion, I present a summary of the literature describing how the study fills a gap in the literature, extends knowledge in the discipline of educational technology specific to one-to-one mobile technology programs, and transitions to the research method in Chapter 3.

Literature Search Strategy

I used the three main education databases accessed through the Walden University Library to find current, germane, peer-reviewed scholarly literature to inform

this study: EbscoHost with ERIC, Education Research Complete, Education Research Starters, and Teacher Reference Center; SAGE Premier; and ED/IT Digital Library. Other useful databases included the ProQuest Multidisciplinary Database, ProQuest Dissertations and Theses, and Google Scholar. Search terms for my queries included various combinations of the following key words: *K–12 , technology, one-to-one, 1-to-1, 1*:*1 laptop initiative, one-to-one computing, ubiquitous computing, computer initiative, professional development, teacher training, professional learning, staff development, TPACK, SAMR technology, technology adoption,* and *technology integration.* I also received groundbreaking information from RSS feeds and blogs, along with LinkedIn and Twitter educational connections.

A plethora of research and dissertations about K–12 one-to-one mobile technology programs became the foundation for this literature review. However, minimal research and only a few dissertations focused on proven and effective practices and strategies in technology professional development for one-to-one mobile technology programs. The existence of only minimal research supported the need for further study into this topic.

Conceptual Framework

One-to-one mobile technology programs that provide either laptops or tablets with Internet access for students to use at school and at home continue to expand each year in K–12 classrooms around the globe (Penuel, 2006; Topper & Lancaster, 2013). With the increase of the technology in the hands of students comes the increase in the need for staff training and professional development for teachers (Inan & Lowther, 2010).

Andragogy, the art and science of teaching adults or helping adults learn (Knowles et al., 2015), provided the conceptual framework I needed to study how teachers learn best when acquiring knowledge for technology integration of one-to-one mobile technologies into their classrooms. The TPACK framework (Mishra & Koehler, 2006), which is built on Shulman's (1986) PCK framework, provided a connection to how teachers most effectively develop technological, pedagogical, and content knowledge when integrating one-to-one mobile technologies into their students' learning.

Andragogy

Knowles's humanistic adult learning theory, andragogy, has six core adult learning principles:

- learner's need to know;
- self-concept of the learner, including self-directed learning, cognitive development, and transformational learning;
- prior experience and developmental needs of the learner;
- affective readiness to learn;
- orientation to learning; and
- internal motivation to learn (Knowles et al., 2015; Merriam, Caffarella, & Baumgartner, 2007; Reischmann, 2004).

These six principles are significant to the needs of teachers who participate in technology professional development for one-to-one mobile technology programs for creating new knowledge (Brooks & Gibson, 2012; Cifuentes et al., 2011; Clarke, 2012; Potter & Rockinson-Szapkiw, 2012; Steinke, 2012). The application of andragogy principles in

technology professional development for teachers serves as a framework for technical and instructional essentials. These principles follow Knowles's (1984) prediction about the need for adult learning in a digital format in the 21st century. Teachers need to know why specific things are being taught—for example, how to manage a classroom full of laptops or tablets and strategies for content integration. Learning activities should be hands-on with a wide variety of task-oriented instruction focused on the process, not the content, because of the many different technology resources that are available for teachers to choose (DeMonte, 2013; TNTP, 2015). Instructional strategies should give teachers the ability to be flexible and self-directed and permit them to take responsibility for how they want to learn (Anyanwu, 2015; Slavit & McDuffie, 2013; Wake & Mills, 2014). Professional development also needs to allow for differing prior experience and aptitude because some teachers are avid users of technology in their classroom and others have not had the same opportunities.

The Adult Learner (first published in 1973 and now in its eighth edition; Knowles et al., 2015) and *Andragogy in Action*: *Applying Modern Principles of Adult Learning* (Knowles, 1984) are two primary sources on andragogy and how it relates to the way teachers learn. *The Adult Learner* (Knowles et al., 2015) has a new chapter on "Information Technology and Learning" with a focus on how technology affects the learner in control, promotes a facilitator-friendly environment, and provides access 24/7. All of this contributes to the need for teachers to receive training and enrich their own learning to assist with digital learning with their students.

The “andragogical process design” (Knowles, 1984, p. 14) provides a structure for professional development planning for K–12 teachers and adult learning and the use of the andragogical process design continues to increase as more teachers integrate one-to-one mobile technology. Learners are involved in mutual planning, diagnosing their own needs for learning; formulating their learning objectives; and designing, carrying out, and evaluating their learning plans (Farris, 2015; Terehoff, 2002). Andragogy has been applied and articulated in previous research by focusing on connections with self-directed learning. Self-directed learning encourages teachers to learn and think for themselves; gain professional self-awareness with a level of self-understanding (Brooks & Gibson, 2012; Brown & Mbati, 2015; Ghost Bear, 2012; Liu, Jehng, Chen, & Fang, 2014; Siko & Hess, 2014; Steinke, 2012); self-identify needs (Slavit & McDuffie, 2013); self-monitor, and actively reflect on the professional development opportunities presented to them. Professional development for K–12 teachers in any context or content area should be “life-centered” (Knowles et al., 2015, p. 91) and “performance-centered or problem-centered” (Terehoff, 2002, p. 69), unlike learning for children, which is typically subject centered. Professional development needs to respect teachers as adult learners and acknowledge their life experiences and teaching background.

In this qualitative, in-depth interview study, I benefited from the use of the andragogy theoretical framework by focusing on professional development for teachers “learning-how-to-learn” (Ghost Bear, 2012, p. 34) with one-to-one mobile technologies. The foundation of knowledge is different for all teachers and their learning, just as it is for students. Teachers need to empower themselves, embrace technology integration, and

have the opportunity to participate in professional development in a supportive organizational climate (Liu et al., 2014) as implemented in PLCs (Peppers, 2015). Flipping the professional learning for teachers to review materials and resources ahead of time makes the face-to-face training sessions more meaningful (Scott, 2014). The teacher is both a facilitator of learning and a content resource relating to the content knowledge focus in TPACK.

Technological Pedagogical and Content Knowledge

The TPACK framework (Mishra & Koehler, 2006) was built on Shulman's (1986) PCK framework with the importance of teachers having a "professional knowledge base of teaching" (Guskey & Huberman, 1995, p. 38), including general pedagogical knowledge, subject matter knowledge, and PCK. The TPACK framework provided me with a connection to how teachers as adult learners most effectively increased and developed their knowledge of how to teach with technology, and specific to this qualitative, in-depth interview study, how technology instructional coaches developed and provided professional learning opportunities for teachers in one-to-one mobile technology programs and identified proven and effective practices. In the TPACK model, Koehler and Mishra (2009) added technology as the third main teacher knowledge component in addition to the original two components of the PCK framework (Koehler, Mishra, & Cain, 2013). Content knowledge focuses on knowing the subject matter that is taught and learned (Koehler & Mishra, 2005b). Pedagogical knowledge focuses on knowing the teaching and learning methods, practices, procedures, processes, and strategies (Koehler & Mishra, 2005b). Technological knowledge focuses on knowing

how to use technology to accomplish a variety of tasks (Koehler & Mishra, 2005b). While the individual components of the TPACK model are significant in isolation, the interactions between the components are equally important (Koehler & Mishra, 2009, p. 62). Through the TPACK model teachers have the opportunity to understand the varying levels of technology integration that can occur between the seven distinct or overlapping knowledge levels. As teachers grow professionally and are prepared to adopt new strategies, their understanding of the integration process aligns with each of the TPACK components. They grow in their abilities to apply their pedagogical and technological contentment knowledge, as well as their technological pedagogical knowledge to their teaching. The focus is no longer solely on the device but on how pedagogy is supported by technology (Donovan, Green, & Hansen, 2012).

Koehler and Mishra's (2005b) work focused on "teacher knowledge around technology" (p.136) to understand and negotiate the "dynamic, transactional and mutually reinforcing relationship and rich connections between the three independent knowledge bases of content, pedagogy, and technology" (Koehler, Mishra, & Yahya, 2007, p. 741). The focus was not on how each independent component influences integration individually. Koehler and Mishra's (2005a) original work in the development of TPACK at Michigan State University was based on research conducted through seminars, faculty development, and online courses for teachers in a master's degree program. They used a process called "learning technology by design" (Koehler et al., 2007, p. 744) to focus on "the development of teachers' knowledge about technology, design, and learning" (Koehler & Mishra, 2005a, p. 99). The "significant implications for

teacher professional development" (Koehler et al., 2007, p. 758) also emphasized the value of self-directed learning, the same as andragogy.

In addition to Koehler and Mishra's many articles (Koehler & Mishra, 2005a, 2005b, 2009; Koehler et al., 2007, 2013; Koehler, Mishra, Kereluik, Shin, & Graham, 2014), there are two other primary sources that include their work and have dedicated chapters to TPACK. The *Handbook of Technological Pedagogical Content Knowledge (TPCK) for Educators* (American Association of Colleges for Teacher Education Committee on Innovation and Technology, 2008) is a primary source about TPACK that provided an extensive collection of technology-infused learning strategies to help teachers facilitate high-quality, effective instruction, with content integration suggestions useful for one-to-one mobile technology programs. Contributing authors included Koehler and Mishra (2008) and Harris (2008). Examples of how integrating technology into teaching and learning for K–12 teachers occurs through instructional planning methods are based on TPACK development in action "to personalize learning—for everyone" (Harris & Hofer, 2017, p. 12). A second primary source is the *Handbook of Research on Educational Communications and Technology* (Spector, Merrill, Elen, & Bishop, 2014). Chapter 9 (Koehler, Mishra, Kereluik et al., 2014) provided an update to previous research with a focus on how to measure TPACK from self-reporting to open-ended questionnaires, performance assessments, interviews and observations, and issues with reliability and validity.

Chai, Koh, and Tsai (2013) reviewed 74 journal articles investigating ICT integration and suggested possible revisions, including changing TPACK to technological

learning content knowledge to focus more on the student instead of the teacher. A second review of TPACK literature included 55 journal articles and one book chapter published between 2005 and 2011 and found that different understandings of TPACK influenced how it was measured (Voogt, Fisser, Roblin, Tondeur, & vanBraak, 2013). A third review of TPACK literature appeared in a special issue of *Journal of Educational Computing Research* (Angeli & Valanides, 2013) that focused on the advancement of TPACK research; six articles evaluated theoretical ideas and data from different research studies. This qualitative, in-depth interview study benefited from how the TPACK framework had been used as the conceptual framework in other research studies with professional development opportunities that enhanced technology integration and digital learning (Alsofyani, Aris, Eynon, & Majid, 2012; Ansyari, 2013; Debele & Plevyak, 2012; Hechter, Phyfe, & Vermette, 2012; Hechter & Vermette, 2014).

Angeli and Valanides (2015) provided the most recently published primary resource with a sole focus on TPACK. Of particular benefit to the current study was Hervey's (2015) chapter. Six teachers who had 8 or more years of teaching and participated in the study identified two generational struggles: "(1) Getting the help we need and want, and (2) us versus them" (Hervey, 2015, pp. 184–185). Both struggles focused on the professional learning opportunities to which the teachers had access, including informal help from younger teachers who had more technology experience and the veteran teachers who had more content and pedagogical knowledge. The knowledge and expertise of teachers with varying years of experience is something that school and districts should keep in mind as one-to-one programs are implemented. In fact, Hervey

adds that “the field may be better served to continue to research the added value of organized and informal collaboration with younger peers in transforming veteran teacher practice in 1:1 settings” (p. 186).

In addition, one study investigated the effects of technology-enhanced professional development in rural, high-poverty middle schools on teachers’ beliefs and practices (Blanchard, LePrevost, Tolin, & Gutierrez, 2016). Blanchard et al. (2016) used TPACK to specifically identify “changes in teachers’ attitudes related to technology use integration” (p. 213). Other beneficial research focused on the use of TPACK in science classrooms in Florida (Dawson, Ritzhaupt, Liu, Rodriquez, & Frey, 2013; Hakverdi-Can & Dana, 2012) and in Manitoba, Canada (Hechter & Vermette, 2013, 2014), where the science curriculum was enhanced by particular technologies. In social studies and geography, the research using TPACK (Debele & Plevyak, 2012; Doering, Koseoglu, Scharber, Henrickson, & Lanegran, 2014) has demonstrated the importance of, need for, and conditions for successful technology integration and innovation. The professional development included instructional scaffolding, collaborative efforts, and shared goals in alignment with simple, focused, and targeted learning outcomes and self-assessment surveys for teachers to demonstrate their own TPACK (Voogt, Fisser, et al. (2013). Additional research on the TPACK framework that benefited this qualitative, in-depth interview study has focused on a general level of technology integration and multiple perspectives of technology-enhanced learning (Dawson et al., 2013; Di Blas, Fiore, Mainetti, Vergallo, & Paolini, 2014; Di Blas, Paolini, Sawaya, & Mishra, 2014; Hechter & Vermette, 2013; Khine, 2015; Koh, Chai, & Tsai, 2014; Yurdakul et al., 2012).

As with any conceptual or theoretical framework, limitations and weaknesses in the TPACK framework are recommendations for future research studies. Currently, TPACK focuses on the *what* of technology integration, such as what is being taught and what technology tools are being used. On the other hand, Kimmons (2015, p. 74) argued that the approach should be on the *why* and *how*, asking such questions as "Why is this effective?" and "How is this impacting learning?" (p. 74). Other scholars recommended providing a better understanding of the knowledge base for specific subject areas, with the majority of the research on math, science, and social studies (Dawson et al., 2013; Debele & Plevyak, 2012; Doering et al., 2014; Hakverdi-Can & Dana, 2012; Hechter & Vermette, 2013, 2014). In particular, science teachers are known to be early adopters and leaders in the use of technology integration due to the experiments, labs, and data collection tools they already use (Purcell, Heaps, Buchanan, & Fredrich, 2013; Wang, Hsu, Campbell, Coster, & Longhurst, 2014).

Literature Review Related to Key Variables and Concepts

This literature review was an extensive examination of technology professional development for one-to-one laptop programs. It concentrated on three general areas: (a) planning for varying outcomes, (b) implementation strategies, and (c) operational characteristics (Sell et al., 2012) within "three contexts: societal, school-specific, and disciplinary" (Fleischer, 2012, p. 114). However, a research gap exists for proven and effective practices and strategies in technology professional development specific to one-to-one mobile technology programs to facilitate positive changes in teacher perceptions and behaviors.

This qualitative, in-depth interview study literature review addressed this research gap by examining professional development practices and strategies in systematic technology integration structures. The review is divided into three sections following the introduction. The first two sections build background knowledge for the reader about professional development. The first section includes professional development models, plans, practices, and strategies in general. The second section includes technology professional development models, plans, practices, and strategies. The third section consists of one-to-one mobile technology professional development principles and practices that encompass proven and effective strategies from the previous sections.

Introduction

Supporting teachers and helping them improve their teaching practice in formal structured opportunities has been a focus of K–12 education for decades (Creemers et al., 2013; Murray, 2014; Tyack & Cuban, 1995). Many schools and districts recognize that it is time "for schools to engage teachers in learning the way other professions do—continuously, collaboratively, and on the job" (Murray, 2014, p. xiii). Teachers should also be trusted to help make decisions about their own professional development (Mundy, Kupczynski, & Kee, 2012), following the recommendation that 80% of professional development be job embedded and 20% devoted to formal training (Learning Forward, 2011). There is also growing interest in how to recognize teachers for the skills and accomplishments they achieve and develop throughout their careers, beyond the traditional recertification and professional growth that many districts offer (Murray, 2014; Stewart, 2014). During the late 1960s and early 1970s, when the field of education

staff development was beginning, states gave school districts permission to apply district-offered professional development events toward recertification, which is how "the staff development unit was born to be used as college credits had been used before" (Joyce & Calhoun, 2010, p. 95).

There are formal and informal learning opportunities to improve skills and expertise through teachers' own personal and professional learning networks (Sie et al., 2013) and connect with others who will assist them (Trust, 2012). One study surveyed 800 K–12 teachers in public and private schools across the United States to find out what teachers know and think about micro-credentials (Grunwald Associates LLC & Digital Promise, 2015). The endorsements allow teachers to display evidence of their competency in a specific skill as a digital badge (Anyanwu, 2015; Diaz, Smith, & Petrillo, 2014) in any electronic correspondence or online platform. The majority of teachers (85%) had never heard of micro-credentials, yet 74% of the teachers were interested in learning more and wanted to earn a micro-credential as part of their professional development (Grunwald Associates LLC & Digital Promise, 2015).

The National Staff Development Council (NSDC) came into existence in 1976 to facilitate and promote excellence in teacher staff development (Learning Forward, n.d.). NSDC developed the first *Standards for Staff Development* in 1994 and changed the name of the organization to Learning Forward in 2010 to put the focus on learning (Learning Forward, n.d.). The latest revision of the standards (now called the *Standards for Professional Learning*; Learning Forward, 2011) focuses on teachers' professional learning as a process of continual improvement. The standards have clearly defined

learning goals and serve as a guide for “designing, managing, implementing, and evaluating professional learning” (Murray, 2014, p. xvii) for all educators in K–12 schools.

One of the standards is about different kinds of resources that promote effective professional learning, including “human, fiscal, material, technology, and time resources” (Learning Forward, 2011, p. 32). Technology is the resource focused on in this qualitative, in-depth interview study, with the emphasis on professional learning opportunities for teachers who teach in one-to-one mobile technology classrooms. Educators need to possess higher order teaching skills and deep content knowledge themselves to help students with the higher order thinking skills they need to succeed in the 21st century (Murray, 2014). Technology in schools increases every year, and the need for administrative- and mentor-supported professional development is one of the most critical factors influencing technology integration into the classroom (Lawless & Pellegrino, 2007; Lim, Zhao, Tondeur, Chai, & Tsai, 2013; Potter & Rockinson-Szapkiw, 2012).

In addition to strategies and content knowledge, successful teachers need a deep understanding of their subject and content area (DeMonte, 2013). As more work has been done to study professional development, research has emphasized the need to shift staff development from the typical one-time workshops and trainings that raise awareness, enthusiasm, and can impart knowledge (TNTP, 2015) to more intensive, ongoing, self-directed, and job-embedded professional learning (Slavit & McDuffie, 2013; Steinke, 2012). This allowed the professional learning to connect to practice, enhance teachers’

efficacy (Minshew, Caprino, Anderson, Justice, & Bolick, 2014; Skoretz & Childress, 2013), and bring about real instructional change within the context of specific academic content (Cordingley et al., 2015; Murray, 2014; Slavit & McDuffie, 2013; Stewart, 2014).

Professional Development for K–12 Teachers

School districts across the country spend as much as $20 billion each year in federal, state, local, and private funds on professional learning opportunities for K–12 teachers; most districts average about $18,000 per teacher per year on teacher learning efforts, including support staff and resources (DeMonte, 2013; TNTP, 2015). This follows the recommendation of Learning Forward (formerly the NSDC) "that at least 10% of a school district's budget be dedicated to professional learning for teachers and that 25% of an educator's workday be used for staff development" (Loucks-Horsley, Stiles, Mundry, Love, & Hewson, 2010, p. 106).

This investment continues to be a priority because teachers are the most important stakeholders and have a more significant influence in improving the quality of education than any other school factor (Archibald, Coggshall, Croft, & Goe, 2011; Bozkus & Tastan, 2016; Darling-Hammond & McLaughlin, 2011). Research also supports the notion that high-quality professional development of 30 or more contact hours each year transfers to higher quality teaching, which links to student achievement (Ghamrawi, 2013; Guskey & Yoon, 2009; Spires, Weibe et al., 2012). However, according to a 2005 Urban Institute report, "a minimum of 80 contact hours of training is needed to affect changes in teachers' instructional behaviors and a minimum of 160 contact hours is

needed to affect changes in the classroom environment" (as cited in Yasar, Maliekal, Little, & Veronesi, 2014, p. 358):

> Every teacher has different needs, so getting better at teaching is a lot like getting into better physical shape: a task that is difficult, highly individualized and resistant to shortcuts. Just as there is no single diet and exercise plan that will work for everyone, it is all but certain that there is no single development experience or activity that will get results for every teacher (TNTP, 2015, p. 34).

The focus on teachers having a strong PCK (Shulman, 1986) is one of the major reasons for professional development of K–12 teachers. This knowledge promotes the importance of what is being taught (content) and teaching how learners will learn it best (pedagogy; Buchanan, 2012), along with following the adult learning theory, andragogy (Meltzer, 2012). In addition, new programs influencing how professional development opportunities incorporate the use of technology must be offered to teachers:

1. Common Core State Standards (now adopted by 43 states) with Smarter Balanced Assessment Consortium and Partnership for Assessment of Readiness for College and Careers computerized assessments (Wake & Mills, 2014).
2. Narrowing equity gaps between students of high and low socioeconomic status (Warschauer et al., 2014).
3. Reauthorization of the No Child Left Behind Act, now known as the Every Student Succeeds Act (2015), which now includes Title IV, 21st Century Schools, §4109, "Activities to Support the Effective Use of Technology."

4. New teacher evaluation systems, with the need to support the continuous development of teachers (Robbins & Alvy, 2014) and to improve the quality of teaching, are all high priorities in K–12 education.

Professional development needs to be continuous and ongoing. It is not about attending a predetermined number of workshops or trainings, even though the majority of professional development models are implemented in this way through three major designs: “district-wide, site-based, and integrated” (Guskey, 2000, p. 31). These designs are commonly used because they are easier to schedule and interfere less with other responsibilities. According to many researchers (Brooks & Gibson, 2012; Creemers et al., 2013; Dikkers, 2012; Fleischer, 2012; Guskey, 2000; Guskey & Huberman, 1995; Kopcha, 2012; Loucks-Horsley et al., 2010; Murray, 2014; Trust, 2012), within these designs, the major models of formal and informal professional development are training sessions, staff meetings, observation/assessments, study groups, workshops, in-service experiences, critical friends, college courses, school rounds, inquiry/action research, individually guided activities, in-service days, involvement in a development/improvement process committee work, conferences, online communities of practice, online courses, personal and professional learning networks, video resources, peer-coaching/mentoring programs, published materials, and lesson study. In consideration of all these different professional development models, the effectiveness is about the specific activities that take place within each model (Kopcha, 2012).

Lesson study is one of the models of professional development highlighted in the research; originally from Japan, it is now becoming more popular in the United States.

Teachers work in teams in learning communities to collaborate and develop a lesson, observe colleagues, and reflect on the teaching and learning (Murray, 2014; Slavit & McDuffie, 2013). Providing time for teachers to observe other teachers teaching a lesson and to collaborate about the teaching and learning is a critical element in effective lesson study professional development (Lieberman, 2009).

Critics note that most of the major models are ineffective because they do not improve classroom instruction, teacher knowledge, and student learning outcomes, in addition to having little connection to teachers' day-to-day challenges and work responsibilities (Blank, de las Alas, & Smith, 2008; Murray, 2014).

There are five possible reasons why this is happening:

> (a) Approaches that rarely address specific teacher, student or school needs. (b) Teachers are often passive recipients of information in traditional professional learning rather than being engaged in the design and delivery of the activity. (c) Opportunities for follow-up on the ideas presented are rare and poorly organized. (d) Teachers have few opportunities to collaborate with colleagues on the skills and ideas presented. (e) Opportunities to develop and practice new lessons and approaches based on what is presented are rare, and opportunities to receive feedback on attempts to practice new methods are even more unusual (Murray, 2014, pp. 2-3).

The evaluation of professional development models needs to concentrate on change in teacher behavior and perceptions before proceeding to measure student learning (Joyce & Calhoun, 2010).

There is no one best way or right answer. However, “successful professional development programs are those that approach change in gradual and incremental fashion” (Guskey, 1995, p. 119) and allow “teacher-as-learner” (Buchanan, 2012, p. 345), “learner-centered professional development” (Darling-Hammond & McLaughlin, 2011, p. 81), “technology enhanced student-centered learning” (Kang et al., 2015, p. 253) or “learner-centered technology integration” (An & Reigeluth, 2012, p. 56). In addition, self-directed learning and adult learning theory combined with self-assessment, self-awareness, self-regulating, and self-understanding help teachers learn how they learn best and meet their own individual needs (Brooks & Gibson, 2012; Steinke, 2012). There are many ways to accommodate the complex, dynamic, and specific needs of teachers related to content. Professional development is successful when a particular context reflects the optimal mix of processes and technologies, specific to the time and setting (Guskey & Huberman, 1995).

A significant body of existing research has clearly identified that, in order to change teachers’ practice and facilitate positive change in teachers’ perceptions and behaviors, professional development must align with the following eight common principles, elements, and characteristics (Meltzer, 2012; Slavit & McDuffie, 2013; Thomas et al., 2012):

1. Align with and tailor to school goals, state and district standards, and assessments; monitor implementation of integrated programs through formative teacher evaluation by understanding the impact on student learning (DeMonte, 2013; Ghamrawi, 2013).

2. Focus on an academic core content area and model teaching strategies for the content with practices, skills, and techniques that are real and proven, along with being actively involved with instructional planning (Archibald et al., 2011; Creemers et al., 2014; DeMonte, 2013; Ghamrawi, 2013; Sheninger & Murray, 2017).
3. Focus on learning with opportunities for teachers to identify their own improvement needs and teacher beliefs (Kim et al., 2013; Sell et al., 2012), which facilitates new teaching and technology integration strategies. The focus then becomes the individual needs and beliefs within the context of critical thinking activities (Jonassen, 2000), not low-level skill practice (Ertmer & Ottenbreit-Leftwich, 2010).
4. Provide opportunities for collaboration among teachers during PLCs (Brooks & Gibson, 2012; Gormley & McDermott, 2014; Learning Forward, 2011; Sell et al., 2012; Stewart, 2014) to work in teams to maintain support and to develop skills related to teaching and successful, observable, and measurable learning outcomes in situated professional development (Kopcha, 2012).
5. Intentionally integrate and embed into the daily schedule a planned process with ongoing follow-up, support, and continuous systemic feedback (Guskey, 2000; Guskey & Huberman, 1995; O'Hara, Pritchard, Huang, & Pella, 2013).
6. Emphasize and recognize both individual and organizational change as a process (Spelman & Rohlwing, 2013; TNTP, 2015) in creating a sustainable

culture to support teachers in their practices and promote teacher beliefs (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012).

7. Encourage small changes that are guided by a grand vision; think big, but start small (Guskey & Huberman, 1995).
8. Use summative evaluations to identify factors and behaviors and their effect on professional learning opportunities (Kim et al., 2013). However, Owen, Farsaii, Knezek, and Christensen (as cited in Towndrow & Wan, 2012, p. 351), found that "it takes between three to five years for members of organizations to make and adapt to changes," such as new implementations and integrations of content, curriculum, tools, and resources.

Multiple research studies (Dawson et al., 2013; Francis & Jacobsen, 2013; Hakverdi-Can & Dana, 2012; Hechter & Vermette, 2013; Loucks-Horsley et al., 2010; Recker, Sellers, & Ye, 2012; Walker, Recker, Ye, Robertshaw, & Sellers, 2012) have provided content-specific professional learning opportunities in math, science, and social studies. These studies provide direct connections to teaching practices through teaching strategies that are coherent, collaborative, and rich in content. Math and science are the two most studied content areas, with and without technology.

> Teachers need opportunities to develop advanced knowledge in their content, an understanding of what they can learn by examining student work and thinking, a diverse array of assessment strategies, and a range of instructional strategies. All of these are key focus areas for effective professional development (Loucks-Horsley et al., 2010, pp. 61-62).

In one particular study with high school math, science, social studies, English, and foreign language teachers, professional development focused on specific instructional pedagogies: higher order thinking skills, collaborative learning, and differentiated instruction within one-to-one technology integration (Inserra & Short, 2013). The researchers found that math teachers tended to have lower capacity for implementation than English and social studies teachers (Inserra & Short, 2013, p. 166). These findings, which validated the need for content-specific professional development, are similar to those of a study conducted in New South Wales with secondary math teachers who believed that "real mathematics" was done with paper and pencil (Zuber & Anderson, 2013). As digital age learning along with the Common Core State Standards for specific content areas continue to promote the importance of preparing students for college and career, teachers must be ready to use technology.

Technology Professional Development for K–12 Teachers

The goal of technology professional development is to enable the integration of technology as a transparent tool to teach content and curriculum (Walling, 2012). The goal is not to become a distraction to the educational environment with students using the technology for non-school-related activities during class (Grundmeyer, 2014). Technology professional development can be using technology solely as a delivery medium, such as technology-mediated professional learning (Brooks & Gibson, 2012); online classes; or specific skills and integration strategies with a focus for teachers integrating technology in their instructional practices. Today's teachers have the responsibility to teach the "third generation, born in 2000 or after" (Wang et al., 2014, p.

640) or “digital native” (Prensky, 2001, p. 2) students who have grown up using mobile phones, tablets, cloud computing, and social networking sites. Therefore, the same processes, principles, elements, and characteristics of high-quality formal professional development that are promoted for general education purposes in the previous section of this literature review apply to this section on technology professional development. However, this study also focused on both generic and content-specific technology (Meltzer, 2012) skills and integration strategies designed specifically to enhance teaching and learning of specific subject matter (Kersaint, Ritzhaupt, & Liu, 2013). Generic technologies are computers and other hardware and software used to support productivity and enhance normal curriculum and instruction in the classroom.

According to Lim et al. (2013, p. 59), technology professional development and training for teachers and administrators on integrating different kinds of technology help address two significant gaps in educational use: the usage gap and the outcome gap. The usage gap contrasts students’ extensive use of technology outside school with the minimal use in school. The outcome gap contrasts the outcomes of technology investments outside schools with automated processes of using technology to increase productivity and decrease costs. The education system focuses much less on productivity and cost analysis measures, compared to business and industry.

The International Society for Technology in Education (ISTE; n.d.a), the Partnership for 21st Century Learning (2015), and the State Educational Technology Directors Association (2015) are three educational organizations that have developed standards and frameworks to help provide professional development tools and guidelines

for all educational staff. The five ISTE (2008) *Standards for Teachers*, which provide a model to foster technology integration for professional development programs (Anyanwu, 2015), were recently revised to seven standards and renamed the *Standards for Educators* (ISTE, 2017). The ISTE Conference and Expo held each summer provides a profusion of educational technology professional development ideas; many schools and districts sponsor teachers to attend for professional learning opportunities (Beaver et al., 2015). In addition, three theoretical support models provide guidelines for professional developers to understand better how teachers change and adopt technology into their classroom instruction practices:

1. The concerns-based adoption model includes stages of concern, level of use, and innovation configuration for technology integration (Borthwick & Pierson, 2008; Christensen & Williams, 2014; Hall & Hord, 2015; Kim et al., 2013).
2. The diffusion of innovations model (Rogers, 2003) is based on five adoption level categories of new technology innovations and the comfort levels at which teachers adopt the use of technology in their classrooms: innovator, early adopter, early majority, late majority, and laggard.
3. The technology acceptance model focuses on teachers' beliefs about technology integration and the perceived usefulness, perceived ease of use, attitude toward using technology, and behavioral intention of using the technology for teaching and learning (Aldunate & Nussbaum, 2013; Davis, 1989).

Technology professional development plans have emphasized other elements (Meltzer, 2012) to facilitate positive change in teachers' perceptions and behaviors about technology integration:

1. Focus on specific learning goals and student outcomes.
2. Build a professional learning community that is collaborative, coherent, and continuous (U.S. Department of Education, Office of Educational Technology, 2016).
3. Be flexible and supportive of teachers learning new knowledge and skills (Wake & Mills, 2014).
4. Provide a long-term sustainable, participatory, teacher-directed structure for support, resources, and continued learning.

Additional research has focused on the need for professional development models to include support for technology operation, technology application, and technology integration with mentor and community support (Brooks & Gibson, 2012; Lawless & Pellegrino, 2007; Potter & Rockinson-Szapkiw, 2012). All three of these aspects support Knowles's (1984) theory of andragogy and the importance of professional development having flexibility, clear communication, and discussion; taking into account adults' prior knowledge of the technology; and providing authentic opportunities for application along with collaborative support from others and "intentional partnership building" (Burrows, 2015, p. 35).

Professional development that supports technology integration must overcome barriers to be effective in the classroom. Barriers have been studied for many years. "In

1999, Ertmer distinguished between first-order barriers, which are external to the teacher such as resources, professional development/training and support; and second-order barriers which are internal such as attitudes, beliefs, knowledge and skills" (Ertmer & Ottenbreit-Leftwich, 2013, p. 177). In 2012, Tsai and Chai (p. 1059) proposed a "third-order barrier": the lack of "design-thinking" by teachers, who need to be problem solvers through creative thinking to be able to change, improve, and create a desired situation. The concept of a third-order barrier addresses why, even when the first- and second-order barriers are removed, technology-enabled learning may not happen or succeed (Ertmer & Ottenbreit-Leftwich, 2013). There is a correlation between the emphasis on teacher training and support, how frequently teachers use technology, and whether it becomes a "seamless component of the curriculum" (Walling, 2012, p. 43). The importance of professional learning opportunities for teachers cannot be overstated as "professional development is the linchpin of any successful learning initiative, whether or not it involves technology. But when new technological tools are layered onto new learning initiatives, the need for training and support grows exponentially" (Consortium for School Networking, 2015, p. 8).

Many teachers feel they do not have the technology literacy skills they need because "across the board, teacher preparation and professional development programs fail to prepare teachers to use technology in effective ways" (U.S. Department of Education, Office of Educational Technology, 2016, p. 5). One recommendation is "giving teachers time for professional learning and collaboration at least once a month and training school leaders in how to facilitate second-order change are best practices of

successful education technology programs" (Intel Education, 2014, p. 43). Effective professional learning designed and led by teachers, mirrors individualized, learner-centered instruction for students and can occur face-to-face or online, through blended learning, mentoring, coaching, and PLCs and networks (U.S. Department of Education, Office of Educational Technology, 2016).

There are many different ways for teachers to participate in professional learning opportunities to enhance their integrating technology skills. The research and literature review for this study identified the following models: (a) action research/teacher inquiry; (b) peer coaching; (c) Edcamp; (d) content specific for math and science; (e) online communities and personal and professional learning networks; (f) online and blended learning courses; (g) the substitution, augmentation, modification, redefinition (SAMR) model; (h) technology-related teacher professional development; and (i) video and multimedia anchored instruction (Brooks & Gibson, 2012; Clarke, 2012; Dawson, 2012; Edcamp Foundation, 2012; Goldenberg, Culp, Clements, Pasquale, & Anderson, 2014; Thomas et al., 2012).

Action research (AR) or teacher inquiry. In one statewide technology integration initiative, 353 elementary, middle, and high school teachers participated in an AR experience (Dawson, 2012). AR is a way for teachers to study how "technology integration affects student learning" and "experience conceptual change regarding their beliefs about technology integration practices" (Dawson, 2012, p. 117). Many of the teachers reported improvements in their teaching practices and positive changes in their attitudes. In a second study, 200 teachers in 37 teams from 20 schools participated in a

yearlong teacher research-based professional development program on how the digital learning collaborative model impacted their use of technology in the classroom (Clarke, 2012). Findings were similar to the previously mentioned study, with five core themes specifically identified by the teacher participants:

1. Teachers felt empowered to discover and learn on their own with guidance available.
2. Teachers felt more comfortable as researchers to value observations, reporting, and analyzing their professional development experiences.
3. The use of technology and the skill level to apply technology applications increased considerably.
4. Workload was the major drawback, due to the extra time required for the study.
5. Increased engagement for teachers and students facilitated positive change, with teachers feeling "inspired, driven, and focused on integrating technology throughout their teaching" (Clarke, 2012, p. 74).

Peer coaching. Peer coaching is one model of professional development support that is successful in helping teachers build their confidence and overcome their fears when learning how to integrate technology into their instruction (Thomas et al., 2012). In one study, 36 teachers representing various subject areas and grade levels had the opportunity to work collaboratively over a semester for approximately 15 hours with a peer coach (D. Wilson & Alaniz, 2015). Participants unanimously agreed that coaching was more effective than other professional development because it was individualized,

supportive, and tailored to meet each teacher's specific technology integration needs (D. Wilson & Alaniz, 2015). The ISTE (2011) *Standards for Coaches* were developed to serve as a guide and coaching model for educational staff who serve as technology integration coaches, either in a face-to-face environment or as virtual technology coaches (Sugar & Slagter van Tryon, 2014).

Edcamp. The first Edcamp occurred in 2010 and is an increasingly popular model for professional development. Often referred to as an "unconference" because there is no preset agenda, Edcamp relies on the participants to create a focus for the day, which may include technology integration, pedagogy, and current issues (Edcamp Foundation, 2012). One study found that 57 participants who attended the first Edcamp in Arkansas came away from the day, as have other teachers who attended Edcamps, with a positive attitude about the Edcamp model that supports, validates, and empowers teachers to create and implement their own professional development (Wake & Mills, 2014).

Content specific for math and science. The literature review found that math and science studies were more prevalent, as mentioned in the previous section for general professional development and with the integration and use of technology. Two universities, one in New York and the other in Florida, teamed with local K–12 teachers to provide interdisciplinary professional development programs for teachers with a specific focus of integrating technology into math and science teaching (Kersaint et al., 2013; Yasar et al., 2014). Both studies used the TPACK framework (Koehler & Mishra, 2009), focusing specifically on the TCK component and how technology tools and resources enhance math and science instruction. Yasar et al. (2014) worked with more

than 180 secondary teachers in New York over a 5-year period. Kersaint et al. (2013) worked with 1,090 teachers and 189 administrators in Florida over the course of a year. The findings were similar: In order for teachers to increase the use of technology in math and science, the professional development needs to be content specific with technology integration, not just about generic technology use to support productivity. In addition, the findings support research that teachers need "ample time to learn, understand, and model sound pedagogical practices" (Keengwe, Schnellert, & Mills, 2012, p. 139) and need to increase their comfort level and efficacy with technology integration (Aldunate & Nussbaum, 2013; Potter & Rockinson-Szapkiw, 2012; Recker et al., 2012). Teachers who were able to participate in a three-tier summer institute advanced to the expert level in content-specific integration strategies, compared to many of the teachers who might not have had enough time to get past generic technology use (Aldunate & Nussbaum, 2013).

These findings support a research-based professional development program study that focused on a single technology integration tool: a wiki. Related findings show that providing adequate resources in a participatory, sustained, and student-centered professional learning environment has a significant impact on teacher learning and technology integration skills (Duran, Brunvard, Ellsworth, & Sendag, 2012). Anyanwu (2015) studied technology integration professional development workshops on district-supported Web 2.0 tools (e.g., Gaggle, Edmodo, Glogster, Prezi) and strategies for integration into teaching and learning. Significantly, Anyanwu found that two of the five participants who were high school teachers considered the Web 2.0 workshops irrelevant and too elementary for their needs, as the workshops focused mostly on elementary and

middle school curricula. Anyanwu recommended that future workshops address Web 2.0 tools with audio and video—which are usually restricted because of concerns with security, safety, and network bandwidth—and offer beginning and advanced modules for differing skill levels.

Online communities of practice and professional learning networks. Online communities of practice and PLNs, including online teacher professional development (Brooks & Gibson, 2012), allow for informal, personalized professional learning for teachers. These communities make possible additional choice, flexibility, and customization, giving teachers the ability to exchange ideas, experiences, resources, content, data, information, and expertise they could not otherwise access due to cost or physical location. A distinct advantage for online communities and networks is the cost factor, which can be much less than with formal, highly structured, school-district-organized professional development such as coaching or mentoring. However, online communities and networks will only endure if they establish a level of trust with the contributing teachers, knowing that participants have confidence and assurance in what they are sharing and are learning without the verbal and nonverbal cues found in a face-to-face environment (Booth, 2012; Kopcha, 2012; U.S. Department of Education, Office of Educational Technology, 2010).

One qualitative case study selected two successful online learning communities for K–12 educators out of 15 initially identified (Booth, 2012). In both communities, teachers' knowledge of the purpose of the community for increased trust led to greater participation in "structured conversations" (Booth, 2012, p. 19) by extending content-

focused professional learning and having a record of participation for future reference. In another study, a university-based intervention team provided support for "just-in-time online professional development activities" (Hamel, Allaire, & Turcotte, 2012, p. 5) using video conferencing for teachers in small, isolated, rural remote-networked schools in Quebec, Canada. Like Booth (2012), Hamel et al. (2012) noted the importance of enriching professional development for teachers with just-in-time support, assistance, and interventions.

Online and blended learning courses. Online courses, which bring together large groups of teachers who have similar teaching responsibilities for content- and grade-specific training, are becoming more common. In blended learning, the facilitator of the learning in the online environment is also available in a face-to-face environment. In one study, PBS TeacherLine delivered online professional development for high school biology teachers (Goldenberg et al., 2014). Like other researchers (e.g., Robbins & Alvy, 2014), they found that participation increased teacher content and pedagogical knowledge and beliefs, but Goldenberg et al. (2014) saw minimal changes in classroom instructional practices or improvement in student performance. In another study, the University of Canterbury in New Zealand developed an online blended learning course to share "best practices in online teaching and learning to enhance the quality of blended and distance learning" (Dabner, Davis, & Zaka, 2012, p. 73). The course included how to design an online course, how to embed authentic assessments, and how the organization of the course in the learning management system affects different learning styles. The

findings show the importance of providing professional development for teachers who find themselves teaching in an online or blended learning environment.

SAMR model. The SAMR model (Puentedura, 2013) classifies levels of education technology use and how technology is integrated into teaching and learning. At each level, Puentedura provides questions to explore how technology enhances the teaching process. At the substitution level, what is gained by replacing the assignment or lesson with technology? Most teachers begin at this level when using technology in their classrooms, and it is beneficial for increasing access to a variety of resources. At the augmentation level, does the technology add anything new that improves the assignment or lesson? The transformation comes at the higher levels, which support more student-centered learning. At the modification level, does the assignment or lesson significantly change with using technology? At the redefinition level, does the technology allow for a new assignment or lesson that would not be possible without technology? Not all assignments or lessons have to be at the higher levels, but the goal is to strive for modification and redefinition. A similar model to SAMR is Grappling's technology and learning spectrum (Education Technology Planners, 1995), with three levels of technology use: literacy, adapting, and transforming (Skoretz & Childress, 2013). The T3 framework (Magana, 2017) details three stages of educational technology use: translational, transformational, and transcendent.

Technology-related teacher professional development. In one multilevel quasi-comparative study design conducted with junior high science and math teachers, reported out by both Recker et al. (2012) and Walker et al. (2012), online activities were designed

using online learning resources, either with technology only or technology plus problem-based learning (PBL). This study was significant because of self-reported student outcome gains. Of the 36 teachers who participated, both designs showed large gains in self-reported knowledge, skills, and technology integration for teachers. However, students whose teachers used technology plus PBL showed significant increases in behavior, knowledge, and attitudes; students of the technology-only teachers showed improvement only in their attitudes. In another study using PBL, 65 teachers from elementary and middle schools showed significant differences in levels of efficacy with technology integration based on whether they taught in elementary or middle school and whether they taught a single subject or multiple subjects. This study demonstrated that teachers who have more time for mastery of content and experience show greater ability for technology integration (Skoretz & Childress, 2013) and supports PBL research when it comes to long-term knowledge retention and performance improvement that is significantly more effective than traditional instruction (An & Reigeluth, 2012; Strobel & van Barneveld, 2009).

Video and multimedia anchored instruction. Video-based technology instruction is not new; it has been around since the 1980s as a way to share resources and learn from other teachers who are modeling what and how to teach a particular concept, skill, or lesson (Vereb, Carlisle, & Mihocko-Bowling, 2015). The popularity of YouTube, SchoolTube, and TeacherTube and the ability to watch a video more than once, pause anytime for discussion, and use multiple kinds of lessons has increased the use of video instruction in classrooms (Sherin, & Lomax, 2014). It is only in the last few years that

multimedia and interactive videos have become anchors for extended learning experiences for teachers and students that would not be possible without them (Thomas et al., 2012, p. 447). One study of 70 elementary school teachers from 10 school districts in the Midwestern United States has significance to this research because it is the only study about the content area of reading. Teachers were guided with a systematic and analytic framework called "thinking questions" to evaluate effective features of reading instruction within eight of 17 case studies (Sherin, & Lomax, 2014). The teachers valued the resources that were presented with the videos within the case studies and the opportunity to work independently. Those who had the opportunity to participate in the discussion group meetings that took place with colleagues found them even more beneficial, compared to those who did not have the discussion opportunity (Sherin, & Lomax, 2014).

One-to-One Mobile Technology Professional Development for K–12 Teachers

The research literature on professional development and professional learning opportunities for teachers in general and technology integration support, reviewed in the previous two sections, is also critical to enhance ubiquitous computing in schools with one-to-one mobile technology, as shown in this section. According to Storz and Hoffman (2013), Topper and Lancaster (2013), and Towndrow and Wan (2012), teachers who are effective with technology integration in a one-to-one mobile technology environment must receive meaningful, sustained, job-embedded, and relevant professional development; opportunities for providing input and addressing concerns; and time for exploration, reflection, and collaboration. When teachers received too much information

to process at one time and the timing was inconvenient, they expressed frustration (Corn, Tagsold, & Patel, 2011).

Christensen and Williams (2014, p. 2745) recommended that measuring personality attributes and learning styles of teachers could enhance the usefulness of professional development through the ability to customize and personalize the new learning. In addition, instructional planning to locate content-rich resources, facilitation methods, technology integration strategies to work on realistic tasks, communication strategies, and curriculum projects can also embrace local, national, and global partnerships (Spires, Oliver, & Corn, 2012). Other research suggested continued just-in-time hardware, software, and technical support (Claro, Nussbaum, Lopez, & Diaz, 2013), along with informal assistance from colleagues and peers, ongoing access to coaches, lead teachers or trainers on site to help with integration, and proficient monitoring processes (Penuel, 2006; L. A. Wilson & Peterson, 2006). All of these recommendations would allow time and support for teachers to master both the content and the strategies they implement in their classrooms and make significant improvements to teaching practices in one-to-one technology-rich classrooms.

Schools and districts can learn from their successes and mistakes in the many one-to-one mobile technology projects in schools, districts, and state initiatives throughout the United States and around the world, with “most studies (67%) focusing on the first three years of implementation, between pre-implementation and the first two years of implementation” (Sauers & McLeod, 2012, p. 5). The research on these projects identifies professional development as an essential component for success (Drayton et al.,

2010; Sauers & McLeod, 2012; Shapley et al., 2010b). However, significant to this study is that the majority of the project studies include very little information about professional development principles and practices—hence the research gap addressed in this qualitative, in-depth interview study (Richardson et al., 2013). One statewide professional development forum specific to one-to-one mobile technology is the Iowa 1:1 Institute (n.d.), which is a full-day event of professional learning opportunities.

As previously mentioned in Chapter 1, an extensive review of one-to-one computing research was compiled in six special issues of the *Journal of Technology, Learning and Assessment* in 2010: "Educational Outcomes and Research from 1:1 Computing Settings" (Bebell & O'Dwyer, 2010); "One to One Computing: A Summary of the Quantitative Results from the Berkshire Wireless Learning Initiative" (Bebell & Kay, 2010); "After Installation: Ubiquitous Computing and High School Science in Three Experienced, High-Technology Schools" (Drayton et al., 2010); "Evaluating the Implementation Fidelity of Technology Immersion and its Relationship with Student Achievement" (Shapley et al., 2010b); "Laptops and Fourth-Grade Literacy: Assisting with the Jump over the Fourth-Grade Slump" (Suhr et al., 2010); "The End of Techno-Critique: The Naked Truth about 1:1 Laptop Initiatives and Educational Change" (Weston & Bain, 2010). The significance of this extensive review is the minimal amount of specific research findings about professional development that were reported, emphasizing the research gap for this research study. However, there were two findings significant to this study:

1. The level of implementation was statistically significant to the quality of professional development (Shapley et al., 2010b).
2. The lack of time for professional development was a hurdle for implementing technology (Drayton et al., 2010).

Several statewide programs from the last decade have laid the foundation for the new school and district projects that are beginning each year. Maine's Learning Technology Initiative (Maine Department of Education, n.d.) started in 2002 and is still active; it was the first statewide one-to-one project for all students in particular grades (seventh and eighth). Both a teacher leader and technology coordinator at each school were important support for teachers in finding ways to integrate laptops into the curriculum. Also of particular importance was the support of the building-level administration. The laptops helped teachers teach with greater depth in less time through their training in developing and providing curriculum and instruction after many years of the initial deployment and laptops. However, differentiating instruction and assessment are specific teacher skills to focus on in professional development training (Silvernail, Pinkham, Wintle, Walker, & Bartlett, 2011). Of particular interest to this qualitative, in-depth interview study is the only one-to-one technology project that indicated a correlation between the professional development implemented and improvement in student academic achievement. The "well-designed and executed professional development" (Silvernail et al., 2011, p. 1) improved student performance in one core content area: mathematics.

The Texas Technology Immersion Project was one of the largest studies of laptop programs in the United States. In 2003, 42 middle schools (Grades 6–8) carried out a technology immersion program with laptops over a 3-year period. The results are significant and have been recently studied (Argueta, Huff, Tingen, & Corn, 2011; Warschauer, 2011; Warschauer et al., 2014). One of the key findings was the significance of professional development in schools that gave it high priority by providing time and personalized training, maintaining close relationships with professional development instructors, and holding teachers accountable for what they learned. These were the schools that had higher implementation of using the one-to-one laptops with students.

North Carolina's 1:1 Learning Technology Initiative identified "a new learning ecology" for professional development in one-to-one learning environments (Spires, Weibe et al., 2012, p. 234). Five unique conditions of this learning ecology, which support other professional development research for technology integration, included engaging teachers in (a) TPACK, (b) project-based inquiry, (c) a global skill set, (d) performance-based assessment, and (e) PLCs and networks (Spires, Weibe et al., 2012).

Other state and provincial projects have been studied in the literature as well; however, there were minimal if any findings or results about professional development opportunities within each project, furthering the need for this qualitative, in-depth interview study. A few of these state projects were Florida's Laptops for Learning Project and Enhancing Education Through Technology (Argueta et al., 2011), Michigan's Freedom to Learn Program (Lowther et al., 2012; L. A. Wilson & Peterson, 2006), Pennsylvania's Classrooms for the Future program (Argueta et al., 2011), and the

Tennessee EdTech Launch (Lowther et al., 2012). One provincial project is the Emerge One-to-One Laptop Learning Project from Edmonton, Alberta, Canada (Alberta Education, School Technology Sector, 2010).

A few school districts have launched district-wide one-to-one mobile technology projects. The Los Angeles Unified School District (LAUSD) launched the largest district-wide initiative, called Common Core Technology Project, in August 2013 (Margolin et al., 2014). LAUSD is the second largest school district in the country, with over 640,000 students at over 900 schools (Los Angeles Unified School District, n.d.). The rollout of the iPads has been implemented in phases. The hardware vendor and the content vendor for alignment with the Common Core State Standards provided the initial professional development. In addition, LAUSD hired coaches/mentors to provide support to the staff with device use and digital resources to enhance instruction. The following findings from the first-year evaluation of this project with over 30,490 students and 1,360 teachers are significant to this literature review:

- Only 42% of staff who received devices attended professional development, so initial mandatory training is necessary.
- The coaches/mentors needed more time to work with teachers; most of their time was working with leadership teams.
- The professional development in the Common Core Technology Project did not relate to implementing the Common Core State Standards, as the teachers expected and the name of the project implies (Margolin et al., 2014, p. 72).

The remaining part of this section shares a number of pedagogical and one-to-one mobile

technology professional development resources:

- The Anytime, Anywhere Learning Foundation from Microsoft was developed in the mid-1990s (Zheng, Warschuer, & Farkas, 2013).
- Apple Classrooms of Tomorrow launched in 1986 as the first attempt in the United States to provide readily available computers in schools (Constant, 2011). Its survey instrument is still used by teachers to "estimate their current understanding and use of technology in the classrooms" (Christensen & Williams, 2014, p. 2739).
- The Center for the Advanced Study of Technology Leadership in Education at the University of Kentucky "sought to create an open access database of all large-scale 1:1 efforts around the world" (Richardson et al., 2013, p. 7).
- The Levels of Teaching Innovation (LoTi Framework) "focuses on the balance between instruction, assessment, and the use of digital resources to promote higher order thinking, engaged student learning, and authentic assessment practices, of which are all vital characteristics of digital age teaching and learning" (LoTi Connection, 2017, para. 1).
- In 2010, Project RED (Revolutionizing Education) conducted the first large-scale national study to identify and prioritize the factors that make some U.S. K–12 technology implementations perform dramatically better than others (One-to-One Institute, 2017, para. 1).

- The Speak Up National Research Project findings from K–12 students in 2014 was about “Digital Learning 24/7: Understanding Technology — Enhanced Learning in the Lives of Today’s Students” (Project Tomorrow, 2015, p. 1).
- The Technology Integration Planning Model shows teachers how technology can effectively enhance learning and how to incorporate the TPACK framework (Roblyer & Doering, 2013).
- The Technology Integration Matrix provides a framework and common language for technology integration to enhance learning (University of South Florida, Florida Center for Instructional Technology, 2017).

Awareness of these resources to support one-to-one mobile technology professional development can help different stakeholder groups in school districts formulate a comprehensive program for the professional learning for teachers. As the number of one-to-one mobile technology devices continues to increase each year, the research presented in this literature review provides a foundation for teachers to be ready to integrate technology that is in the hands of every student and provide the knowledge and skills important in a 21st-century learning environment.

Summary and Conclusions

Extensive examination of the current literature on effective principles and practices in technology professional development programs for one-to-one mobile technology revealed an understanding of how adults learn best. Opportunities for self-directed learning through andragogy and TPACK provide the conceptual framework for this study with the correlation of how teachers as adult learners develop knowledge of

how to teach with technology. Within the three major sections of the chapter, (a) general professional development, (b) professional development for technology integration, and (c) professional development for one-to-one mobile technology, and what is known from the literature, all professional development principles and practices for technology integration provide a foundational structure for implementation.

It is essential for teachers to attend professional development opportunities that address individual concerns and are personalized and learner centered if technology integration is to occur in the classroom (Farris, 2015; Warschauer et al., 2014). The biggest contributing factor is giving teachers time to engage in learning continuously and collaboratively within the school day. Content-specific professional development is also a critical factor; math and science are the most studied content areas, with or without technology (Dawson et al., 2013; Doering et al., 2014; Hechter & Vermette, 2013, 2014). Science teachers tend to be early adopters of technology integration, due to the lab equipment they are already using. Another consideration is to study a program or project longer than the norm of the first 3 years.

When planning professional development opportunities, it is important to consider that one size does not fit all for different strategies and practices that are known for general professional development and professional development for technology integration. AR or teacher inquiry, peer coaching, Edcamp, online communities of practice, PLCs, PLNs, online and blended learning courses, PBL, and video and multimedia anchored instruction emerged within professional development for technology integration, not specifically for one-to-one technology integration (Dawson,

2012; Edcamp Foundation, 2012; Goldenberg et al., 2014; Sugar & Slagter van Tryon, 2014; Wake & Mills, 2014; D. Wilson & Alaniz, 2015).

The present study fills at least one of the gaps in the literature by addressing the need to study principles and practices for effective one-to-one mobile technology integration in K–12 classrooms. The multitude of research on one-to-one mobile technology projects and programs is extensive, but there is little if any research on professional development in its entirety. This qualitative, in-depth interview study extends knowledge in the discipline by providing an awareness about principles, practices, resources, and tools to support one-to-one mobile technology professional development that could help different stakeholder groups in school districts formulate a comprehensive program for professional learning for teachers when there is a grand investment in technology for each student.

Chapter 3 includes justification and a discussion of the qualitative research methodology chosen to explore the research questions within the conceptual framework. A qualitative, in-depth interview study methodology allows for constructing a thorough explanation of the research design, an in-depth narrative of principles and practices in technology professional development for one-to-one mobile technology programs, the rationale for choosing it, and the role of the researcher. Chapter 3 concludes with a summary and leads into the data analysis and synthesis in Chapter 4.

Chapter 3: Research Method

The purpose of this qualitative, in-depth interview study was to examine professional development principles and practices that technology instructional coaches used to facilitate the integration of one-to-one mobile technologies in K–12 student learning experiences. I also explored the perceptions of technology instructional coaches regarding changes in teacher practice and attitudes because of professional development. Studying the integration and transformation of teaching practices necessary for the digital age of learning can expand the knowledge and understanding of the significant need for highly effective professional development to transform teaching and learning in K–12 education.

Chapter 3 provides a detailed description of the processes I employed to conduct the study, including the research design and rationale, the role of the researcher, participant selection, and instrumentation and data collection procedures. Next, specific methods for data analysis are described. Last, issues of trustworthiness, including credibility, transferability, dependability, confirmability, and ethical procedures. A summary of the research methodology concludes the chapter.

Research Design and Rationale

I developed the following research questions to guide this qualitative, in-depth interview study:

Research Question 1: What professional development principles do technology instructional coaches use in designing professional development for one-to-one mobile technology programs?

Research Question 2: What professional development practices do technology instructional coaches use in designing professional development for one-to-one mobile technology programs?

Research Question 3: What are the perceptions of technology instructional coaches regarding changes in teacher practice after the professional development sessions?

Research Question 4: What are the perceptions of technology instructional coaches regarding changes in teacher attitudes after the professional development sessions?

The qualitative, in-depth interview study approach best suited the research problem, purpose, and questions of this study by enabling my exploration of professional development programs developed and/or delivered by technology instructional coaches regarding changes in teacher practice and attitudes to integrate one-to-one mobile technologies into students' learning. In this study, I used the responsive interviewing model (Rubin & Rubin, 2012) to develop the main questions and probes and follow-up questions,. In addition to addressing the problem and purpose of the study, the qualitative research design approach was the most suitable for studying the real world experiences of developing and facilitating professional development. . I compared and contrasted technology integration use by technology instructional coaches who had developed and/or delivered technology professional development programs by focusing on the *what* and *how* of different one-to-one mobile technology principles and practices used in teacher professional development in this study.

I rejected other qualitative research designs for this study based on the following explanations and examples. Because the data collection for this study consisted solely of interviews, not observations or analysis of documents (see Yin, 2016), I did not select the case study approach. The phenomenological approach was not appropriate because I did not focus on the essence of a particular experience or phenomenon of a small group of participants in this study (see Moustakas, 1994). Last, I rejected quantitative survey research (see Babbie, 1990) because I wanted to tap into deeper levels of the experiences of the technology instructional coaches, and this could best be done through the interview methodology.

Role of the Researcher

My research roles during this qualitative, in-depth interview study included being a good, attentive listener; asking open-ended, inquisitive questions; knowing my topic of study; being sensitive to the participants' time; caring about my data and handling it carefully; and understanding the need to multitask while conducting the interviews (see Yin, 2016). I was the interviewer, acting as the sole collector of data and the analyst of the data. An online transcription service, TranscribeMe, converted the MP3 audio files of the recorded interviews into written transcripts. TranscribeMe provided me with a confidentiality agreement (see Appendix A) indicating that the confidentiality and security of the MP3 audio interview files shared with them would be handled with integrity.

As a technology instructional coach, I have developed and delivered a variety of professional development implementations. However, I did not interview anyone with

whom I had a working relationship in the school district where I am employed for this study. I was aware of potential biases, and I strove for the highest ethical standards while doing my research (see Yin, 2014). I was sensitive to participants providing differing information from my beliefs by having a keen awareness of my reactions to interview answers, along with not having any distractions during the interviews. My primary concern was to be as objective as possible in all aspects of the research study, including conducting and analyzing the online interviews (see Salmons, 2015). All interviews were recorded, transcribed, and analyzed using the qualitative analysis software NVivo 11 Pro (QSR International, 2015) and TranscribeMe, along with hand-written, color-coded sticky notes for quotes and detailed information. Extensive reading, reviewing, and sorting of all the data written on the sticky notes helped me determine the major themes that emerged to answer the four research questions. I collected, coded, and analyzed all interview data based on findings rather than any assumptions of my own.

Participant Selection

I used purposive sampling (see Yin, 2016) to identify technology instructional coaches who have developed and/or facilitated professional learning opportunities for teachers using one-to-one mobile technologies in classrooms. I identified possible participants through LinkedIn professional connections. Snowball sampling occurred when participants chose to share the details of my study with others who met the participant requirements.

I identified technology instructional coaches and contacted them through e-mail or private messaging on LinkedIn with a Letter of Invitation (Appendix B) to ask them if

they had developed or facilitated one-to-one mobile technologies integration professional learning opportunities in their school districts. If they answered in the affirmative, I sent a Consent Letter Invitation (Appendix C) and asked them if they would be willing to participate in my qualitative, in-depth interview study. Any potential participant who met the criterion of developing or facilitating one-to-one mobile technologies integration professional learning opportunities in school districts and responded with interest to my e-mail or private messaging was contacted again with a Consent Letter Invitation (Appendix C). All 13 participants were asked to "sign" the consent letter by replying to the e-mail or message with the words "I consent." In this way, the purposive sampling of 12 to 15 participants did "maximize variation and emphasize information-rich sources" (Yin, 2016, p. 94). This number of participants, as suggested for a homogeneous participant pool by Guest, Bunce, and Johnson (2006), is best structured to produce data saturation.

Instrumentation

I developed the interview protocol using the E-Interview Research Framework (see Salmons, 2015) to ensure consistency in conducting computer-mediated communication using GoToMeeting. During the semi structured interviews, I asked the technology instructional coach participants questions about their opinions, values, feelings, knowledge, and background focused on professional development principles and practices (see Salmons, 2015). According to Yin (2016), the most effective method for accessing participant experiences is through qualitative interviews in a conversational

mode to capture the words and ideas of the interviewees, along with the opportunity for the interviewee to ask questions of the researcher.

I began the first round of interviews with open-ended questions from the demographic questionnaire (Appendix D) and the first-round interview questions and probes (Appendix E). After I analyzed the data from the first round of interviews, I developed second-round interview questions and probes (Appendix F) that dug deeper into the experiences of the high-level technology coaches—participants who displayed an extremely high skill level (see Rubin & Rubin, 2012). These questions guided the second round of interviews. No additional interviews were needed for clarification of vague, unclear, or confusing information beyond the second round of interviews.

The participants' responses to the questions from the demographic questionnaire (Appendix D), the first-round interview questions and probes (Appendix E), and the second-round interview questions and probes (Appendix F) provided me with the most detail to answer the research questions. I obtained informative responses on each participant's experiences as a technology instructional coach working in or with a K–12 school system with one-to-one mobile devices. Following the suggestion of Toledo (2015), the probing questions I asked included the follow open-ended prompts:

- Tell me more about . . .
- Describe …
- What exactly did you do in that situation …
- What exactly did you mean by …
- Give an example …

- How did you feel …

Procedures for Recruitment, Participation, and Data Collection

After receiving Walden University Institutional Review Board (IRB) approval, I sent invitations to participate either via e-mail or private messaging in LinkedIn to the potential study participants stating the purpose of the study, the time required to participate in the study, that participation would be voluntary, and that there would be no compensation. Each potential participant replied to me via e-mail or through private messaging in LinkedIn, indicating his or her acceptance to participate with a reply of "I consent." I then used e-mail and private messaging in LinkedIn to determine the date and time of each interview. My technology choice was GoToMeeting, where all interviews were recorded, along with the use of a Sony IC Recorder for audio backup. I also used NVivo 11 Pro (QSR International, 2015) and TranscribeMe for transcription.

As the researcher, I interviewed 13 technology instructional coaches from 12 different districts or schools in different phases of one-to-one mobile technology implementation. The first set of interviews using GoToMeeting lasted approximately 60 min. The second round of 35- to 45-min interviews were conducted with a subset of seven technology instructional coaches who showed higher levels of expertise in one-to-one mobile technology implementation practices and principles. No follow-up interviews were needed for clarification.

Each of the research questions was addressed during the interview with the participants' responses to my open-ended probing questions. The technology coaches shared their opinions, values, feelings, knowledge, and background during their semi

structured interviews (see Salmons, 2015). After I analyzed the data from the first round of interviews, I developed the second round of interview questions and probes (Appendix F; see Rubin & Rubin, 2012) to dig deeper into the experiences of the high-level technology coaches. These questions were approved by the IRB and guided the second round of interviews. No additional interviews were needed for clarification of vague, unclear, or confusing information.

I expected to contact at least 25 technology instructional coaches that I identified from professional organizations and associations. However, when the recruitment resulted in too few participants, I recruited other instructional coaches by contacting a backup list of 15 additional technology instructional coaches via e-mail, in just the same manner as I had recruited the first possible participants. This provided a pool from which I was able to draw additional possible participants to reach the recommended sample size of 12 to 15 participants—a total of 13 participants with purposive sampling for probable data saturation (see Guest et al., 2006). The participants were selected on a first-come-first-served basis, and their reply to me via e-mail indicated their acceptance to participate by stating, “I consent.”

Data Analysis Plan

I used the “five analytic phases” (Yin, 2016, p. 185) of qualitative data analysis—compiling, disassembling, reassembling and arraying, interpreting, and concluding—to develop a comprehensive description of what the technology instructional coaches experienced during the development and facilitation of the one-to-one mobile technology professional development strategies. In addition, I analyzed how they implemented the

experience with teachers. Finally, I analyzed the data to determine a common understanding of the collective principles and practices.

The data collection process included transferring interview data from GoToMeeting and the Sony Voice Recorder which was locked in a secure safe in my home to MP4 files on my home password protected computer and transcribing these files after uploading them into NVivo 11 Pro (QSR, 2015) to convert to MP3 files to be transcribed into written transcripts using TranscribeMe. The themes and categories were not predetermined; the coding by hand looked for common themes and patterns among the participants' responses to the interview questions. NVivo 11 Pro provided additional analysis tools with word frequency, text searches, and coding queries. These tools helped manage the data by coding text for manipulating, searching, and reporting the coded text to help examine relationships in the data. I also developed a matrix to compare key points in professional development principles and practices mentioned by the technology instructional coaches who reported transformation in teaching with one-to-one mobile technologies in the in-depth individual interviews, providing data analysis triangulation (Maxwell, 2013; Stake, 2010; Yin, 2014). Discrepant data or "rival thinking" (Yin, 2016, p. 90) that did not follow the interview questions were reviewed for further understanding. Any discrepant data were addressed and analyzed in the discussion of the data results in Chapter 4.

Issues of Trustworthiness

Validity and reliability in qualitative studies are much different from those found in quantitative studies. Accuracy checking is the term most often used to describe these

measures in qualitative research. For the purposes of this study, four issues of trustworthiness will be addressed: credibility, transferability, dependability, and confirmability (Shenton, 2004). The section concludes with ethical procedures for the rights and treatment of the participants.

Credibility

I established credibility with internal validity by triangulating the in-depth interview data, which participants reviewed to confirm that the data correctly reflect their perceptions and experiences with professional development training materials. I identified the 13 participants by their geographic region. Seven of the technology instructional coaches participated in a second interview to gain a more in-depth knowledge to obtain a comprehensive narrative of the data collected.

Transferability

I addressed transferability by specifying how the findings of this study of technology instructional coaches who have developed and/or facilitated professional development in school districts with one-to-one mobile technology programs could be applied to a similar situation ensuring "sufficient, thick descriptions of contextual information is provided to enable transfer" (Shenton, 2004, p. 69). The contextual information includes the geographic locations of the participants in the study, length of time the technology instructional coach had been developing and/or facilitating professional development, and the number of years the school and/or district had been implementing a one-to-one mobile technology program. The purposive sampling helped support transferability of the research findings to future studies.

Dependability

I addressed dependability by documenting all the processes in the study in detail. This will enable future researchers to repeat the study within the same context, methods, and participants to obtain similar results (Shenton, 2004). Documentation includes the research design, research questions, interview questions, interview protocol, tools, and a reflective review.

Confirmability

Confirmability, comparable to objectivity, shows to the best of my ability that the study findings are the interview results from the participants and not my opinions or preferences. I also established confirmability with the documentation of procedures through an "audit trail, which allows any observer to trace the course of the research step-by-step via the decisions made and procedures described" (Shenton, 2004, p. 72). This shows the systematic research process to collect the data that led to the development of recommendations, triangulation of the in-depth individual interview data, and the disclosure of my biases.

Ethical Procedures

Every researcher must be mindful of ethical issues and procedures when conducting a research study. I have adhered to Walden University's IRB standardized processes and procedures to guard ethics. I did not have any contact with the participants and collected no data until I received IRB approval. Once I obtained IRB approval (# 09-06-16-0155432), I sent an invitation to participate to each potential participant.

After participants acknowledged and accepted the invitation to participate, all participants signed a consent form by replying to the e-mail or private message in LinkedIn with “I consent” as an electronic signature, agreeing to participate in the study, and giving their permission for me to use the research data in a confidential manner. All interviews were recorded and transcribed verbatim and will be kept for the recommended period of 5 years from the conclusion of the study. During the course of this study, I kept participant names confidential and used no personal information that could identify any participant. All participants were told they might withdraw from the study at any time with no consequences. No unforeseen ethical issues arose, but if they had, they would have been addressed with the highest ethical standards as well (Yin, 2014). All data are stored on my personal, password-protected computer, along with a portable external hard drive for backup and a Sony Voice Recorder in a secure safe in my home. All data will be destroyed following the recommended period of 5 years from the conclusion of the study.

Summary

Chapter 3 included a description and explanation of the qualitative, in-depth interview study methodology chosen to support the research questions that allowed me to create a comprehensive narrative describing the patterns and themes generated from interviews of technology instructional coaches. This chapter included the research design and rationale; role of the researcher; methodology, including participant selection procedures and criteria, instrumentation and data collection procedures, and data analysis plan; issues of trustworthiness, including credibility, transferability, dependability,

confirmability, and ethical procedures. Chapter 4 will include data collection, analysis, and the study findings to develop answers to the research questions.

Chapter 4: Results

The purpose of this qualitative, in-depth interview study was to examine professional development principles and practices used by technology instructional coaches to facilitate the integration of one-to-one mobile technologies in K–12 student learning experiences. I also explored the perceptions of technology instructional coaches regarding changes in teacher practice and attitudes because of professional development. Studying the integration and transformation of teaching practices necessary for the digital age of learning can expand the knowledge and understanding of the significant need for highly effective professional development to transform teaching and learning in K–12 education. Many instructional coaches rely on conceptual frameworks based on Knowles's (1975) theory of andragogy and Koehler and Mishra's (2009) TPACK model for one-to-one mobile technology integration.

Chapter 4 includes the following sections: setting, demographics, data collection, data analysis, evidence of trustworthiness, results organized by research questions, and summary of data. I asked open-ended interview questions to give the participants freedom for their own expressions. I analyzed, organized, and coded their responses to determine the themes used for meaningful purposes. The use of a data matrix allowed me to compare key professional development principles and practices reported by the 13 technology instructional coaches regarding transformations in teacher attitudes and practices with one-to-one mobile technologies. This information from the in-depth individual interviews provided data analysis triangulation (see Maxwell, 2013; Stake, 2010; Yin, 2014).

Research Questions

The following research questions guided this qualitative, in-depth interview study:

Research Question 1: What professional development principles do technology instructional coaches use in designing professional development for one-to-one mobile technology programs?

Research Question 2: What professional development practices do technology instructional coaches use in designing professional development for one-to-one mobile technology programs?

Research Question 3: What are the perceptions of technology instructional coaches regarding changes in teacher practice after the professional development sessions?

Research Question 4: What are the perceptions of technology instructional coaches regarding changes in teacher attitudes after the professional development sessions?

Setting

I interviewed the 13 participants individually from my home using GoToMeeting on my personal, password-protected, laptop computer. The average length of the GoToMeeting calls was 1 hour. I had no control over the participant settings during the interviews; each participant was in a different place (e.g., classroom, office, and home). No known personal or organizational conditions influenced participants or their experience at the time of the study that might have influenced the interpretation of the study results (e.g., changes in personnel, budget cuts, and other traumas).

Demographics

All participants were either K–12 technology instructional coaches who worked within K–12 systems at the district or school level or as outside contractors serving in the same role with schools and/or districts that were implementing one-to-one mobile technologies. There were 10 female and three male participants. Three countries were represented: 11 participants from the United States, one from South Korea, and one from India. Participant demographic information included their college degrees; all held bachelor's degrees; 11 of the 13 participants held master's degrees, and two held doctoral degrees. They also shared the number of years they worked in education, ranging from 11 to more than 30 years. The demographic information revealed the number of years they served as technology instructional coaches (or with a similar title for the same role), which ranged from 1 to 15 years. Last, I found that the years of experience with one-to-one mobile technology projects or programs ranged from 1 to 12 years. A synopsis of the participants demographics can be found in Appendix G.

In this study, I referred to participants as Participant 1 through Participant 13 to maintain confidentiality. Participants 12 and 13 were interviewed together, due to their close teamwork. I identified Participants 1, 2, 3, 4, 6, 8, and 11 with (HL) after their participant number signifying them as high level technology instructional coaches; a subset of the participant pool who participated in both interviews rounds. In the following list, I provide a brief description of each of the participants:

- Participant 1-HL was a female from the northeastern United States who participated in both rounds of interviews. She had a B.S. in Accounting, a

M.A. in Educational Technology, and had been working in education for 16 years, 10 of which were as a technology instructional coach (or similar title) and all 10 of those years were in one-to-one mobile technology projects and programs.

- Participant 2-HL was a female from India who participated in both rounds of interviews. She had a B.A.in English Language & Literature, a M.A.in Educational Technology, a M.A. in Educational Leadership, and had been working in education for 30+ years. For nine of those years, she worked as a technology instructional coach (or similar title) and 5 of those 9 years were in one-to-one mobile technology projects and programs.
- Participant 3-HL was a male from South Korea who participated in both rounds of interviews. He had a B.A.in English, an M.A.in International Education, a M.A. in Educational Leadership, and had been working in education for 18 years. Out of those 18 years, he worked 10 as a technology instructional coach (or similar title) and 9 of those 10 years were in one-to-one mobile technology projects and programs.
- Participant 4-HL was a female from the southwestern United States who participated in both rounds of interviews. She had a B.S.in Science, a M.A.in Education, and had been working in education for 25 years. She had worked as a technology instructional coach (or similar title) for 13 years and spent 9 of those 13 years working in one-to-one mobile technology projects and programs.

- Participant 5 was a female from the midwestern United States who participated in the first round of interviews. She had a B.S. in English, Language and Literature, a M.A. in Curriculum and Instruction, and had been working in education for 11 years. Five of those 11 years, she had worked as a technology instructional coach (or similar title) and all of which were in one-to-one mobile technology projects and programs.
- Participant 6-HL was a male from the midwestern United States who participated in both rounds of interviews. He had a B.S. in Social Studies and an M.Ed. in Curriculum and Development. Out of 24 years working in education, he had spent 7 years working as a technology instructional coach (or similar title) and 3 of those 7 years were in one-to-one mobile technology projects and programs.
- Participant 7 was a female from the southwestern United States who participated in the first round of interviews. She had a B.S. and M. S. in Computer Science, a Ph.D. in Educational Technology, and had been working in education for 12 years. Four of those years of she had worked as a technology instructional coach (or similar title) in one-to-one mobile technology projects and programs.
- Participant 8-HL was a female from the western United States who participated in both rounds of interviews. She had a B.A.in Education, a M.Ed. in Curriculum Development with Technology Integration, and had worked in education for 25 years with 3 years as a technology instructional

coach (or similar title). All 3 of those years she had worked in one-to-one mobile technology projects and programs.

- Participant 9 was a female from the southwestern United States who participated in the first round of interviews. She had a B.A and M.A. in Education and had been working in education for 28 years. She had worked as a technology instructional coach (or similar title) and in a one-to-one mobile technology project for 1 year.
- Participant 10 was a female from the southeastern United States who participated in the first round of interviews. She had a B.A and M. A. in Music Education and had been working in education for 28 years. She had spent 12 years as a technology instructional coach (or similar title) and all 12 of those years in one-to-one mobile technology projects and programs.
- Participant 11-HL was a male from the northeastern United States who participated in both rounds of interviews. He had a B.S.in Science Elementary Education, a M.A. in Liberal Studies, and an Ed.D. in Administrative Leadership and Technology. Of the 23 years she had worked in education: 9 years were as a technology instructional coach (or similar title) and all 9 of those years were in one-to-one mobile technology projects and programs.
- Participant 12 was a female from the western United States who participated in the first round of interviews. She had a B.A. in Education and had been working in education for 30+ years, 15 years of which were as a technology

instructional coach (or similar title). She had spent 4 of those 15 years in one-to-one mobile technology projects and programs.

- Participant 13 was a female from the western United States who participated in the first round of interviews. She had a B.A. in Education and had been working in education for 18 years. For 4 of those 18 years, she had worked as a technology instructional coach (or similar title), and all 4 of those years were in one-to-one mobile technology projects and programs.

Data Collection

Upon receiving IRB approval to conduct the qualitative, in-depth interview study, I sent a LinkedIn instant message to 20 possible participants with a letter of invitation (Appendix B). I purposefully identified the prospective participants from my LinkedIn professional contacts as persons who were technology instructional coaches or held similar titles. Within 1 week after the invitations were sent, I received responses from seven of them with their willingness to participate. One invitee declined due to her busy schedule, and I did not receive any response from the other 12 invitees. I sent each of the first seven respondents a second LinkedIn instant message with the consent invitation (Appendix C) attached and received their consent within 2 weeks.

Using the snowball approach, I sent out 20 additional invitation letters on October 1, 2016: 15 as LinkedIn instant messages and five to e-mail addresses of professional contacts referred by the original seven respondents. I received seven responses from this second attempt; two invitees declined due to their busy schedules, and the other 13 invitees did not respond. One of the additional five willing respondents worked closely

with another technology instructional coach, so I interviewed them together, making additional participants. Within 3 weeks, I received LinkedIn messages from the first seven respondents and the additional six respondents with “I consent” as their official acceptance for participation in the study. Data collection began on September 12, 2016, and was completed on October 27, 2016. I sent one e-mail on January 6, 2017 to Participants 12 and 13 to verify their demographic information.

I used e-mail and LinkedIn private messaging to schedule the day and time for each interview with the participants. All 13 participants who consented to participate were interviewed. This allowed me to reach the recommended sample size of 12 to 15 participants. The sample size was sufficient to facilitate thick, rich feedback and ensure that the research questions were answered to the point of saturation (see Guest et al., 2006).

This qualitative, in-depth interview study consisted of 19 interviews conducted in two rounds: 12 interviews in the first round with 13 participants involved, and seven interviews with seven participants in the second round. The second-round interviews delved deeper into the experiences of a subset of the study participants who had been identified as high-level technology instructional coaches due to their exceptional experience and knowledge as supporters of one-to-one mobile technology programs. Initially, I considered a third round of interviews to clarify vague, unclear, or confusing information from the first two rounds. However, all questions were answered and all unclear information was clarified in the first two rounds of interviews, so the third round was not needed.

The interviews took place virtually, using GoToMeeting from my home office, while the participants were in locations of their choosing. In order to avoid interruptions and maintain confidentiality, I closed the door of my home office and silenced my phones. In addition to GoToMeeting, I recorded the interviews using a Sony Voice Recorder which was locked in a secure safe in my home. This dual recording approach provided a backup to prevent the accidental loss of any interview data.

The interview recordings from GoToMeeting were recorded as MP4 video files and were saved to my password-protected laptop and to a portable external hard drive for backup that was locked in a secure safe. The participants' initials were used to save each interview file to protect identity and confidentiality. The MP4 files that were created using GoToMeeting would not load into NVivo 11 Pro (QSR International, 2015) because they were video files. I used an online real-time video conversion service, Online Video Converter, to convert the MP4 video files into MP3 audio files. To enhance the speed of transcribing the 19 interviews, all of the MP3 audio files were uploaded into NVivo 11 Pro (QSR International, 2015). An online transcription service, TranscribeMe, converted the MP3 audio files into written transcripts. TranscribeMe provided a confidentiality agreement (Appendix A) indicating that the confidentiality and security of the MP3 audio interview files shared with them would be handled with integrity.

After receiving the transcript for each file uploaded to TranscribeMe, I carefully reviewed each transcript while playing back the audio recording of each interview to validate the accuracy of each transcript, ensuring that the text was a verbatim record of the audio interview data. After verifying the transcript for accuracy with only a few

minor edits needed, I completed the analysis using open coding and identified initial themes. I looked at the initial themes and went back to the first round of interview questions to see if there was information missing and looked at responses to see if there were questions that would further answer the research questions. Appendix E provides a list of the first round interview and the associated research questions. This enabled me to identify areas for deeper discussion and clarification which produced the second round of interview questions. Appendix F provides a list of the second round interview and the associated research questions.

To determine the participants in the second round of interviews, I considered each individual and his or her number of years in education, years as a technology instructional coach, years working with one-to-one mobile technology projects, the depth and knowledge of their answers, and the length of the interview. In evaluating the first round interviews, it became obvious which of the instructional coaches had more information to share than others. All first round interview data were taken into careful consideration to determine who was selected for a second interview.

Data Analysis

Nine initial themes emerged from the first round of interviews to answer the four research questions. Of the nine initial themes, two were common to all of the participants: supportive leadership and building culture, relationships, and agency. Four themes showed commonality with all but one participant: instructional design; delivery of professional development; learning first, technology second; and classroom management. The themes identified as standards and frameworks and professional learning

opportunities for coaches were common to 11 of the 13 participants in their first round of interviews; and the last code, Technology certifications was only reflected in eight of the participant's first round of interviews. There were no discrepant cases.

After I analyzed the data from the first round of interviews using the In Vivo first cycle coding method (Saldana, 2016). I developed second-round interview questions (Appendix F) to add richness to the experience and as a way to add validity to my interpretations. These 13 questions guided the second round of interviews which help to add to the depth and breadth of the study data.

Part of my analysis of the first round of interviews involved carefully evaluating each individual for the number of years in education, years as a technology instructional coach, and years working with one-to-one mobile technology projects. Most importantly, I considered the depth and breadth of their answers and the experiences as technology coaches they shared. As a result, I identified nine participants for a second round of interviews – this subset of participants are referred to as HL coaches — participants who displayed an extremely high skill level (Rubin & Rubin, 2012). Using either e-mail or LinkedIn private messaging, I invited the nine HL coaches for a second interview and seven agreed to participate.

The second-round interviews took place virtually, using GoToMeeting from my home office, while the participants were in locations of their choosing. In order to avoid interruptions and maintain confidentiality, I closed the door of my home office and silenced my phones. In addition to GoToMeeting, I recorded the interviews using a Sony

Voice Recorder which was locked in a secure safe in my home. This dual recording approach provided a backup to prevent the accidental loss of any interview data.

The interview recordings from GoToMeeting were recorded as MP4 video files and were saved to my password-protected laptop and to a portable external hard drive for backup that was locked in a secure safe. The participants' initials plus the number 2 (indicating it was second interview) were used to save each interview file to protect identity and confidentiality. The MP4 files that were created using GoToMeeting would not load into NVivo 11 Pro (QSR International, 2015) because they were video files. I used an online real-time video conversion service, Online Video Converter, to convert the MP4 video files into MP3 audio files. To enhance the speed of transcribing the 19 interviews, all of the MP3 audio files were uploaded into NVivo 11 Pro (QSR International, 2015). An online transcription service, TranscribeMe, converted the MP3 audio files into written transcripts. TranscribeMe provided a confidentiality agreement (Appendix A) indicating that the confidentiality and security of the MP3 audio interview files shared with them would be handled with integrity. After receiving the transcript for each file uploaded to TranscribeMe, I carefully reviewed each transcript while playing back the audio recording of each interview to validate the accuracy of each transcript, ensuring that the text was a verbatim record of the audio interview data.

Once the second round interviews were completed and transcribed in the same manner as the first round, I began the final data analysis by using the five analytic phases of qualitative data analysis: compiling, disassembling, reassembling and arraying, interpreting, and concluding (Yin, 2016, p. 185). No variation in data collection occurred

from the plan defined in Chapter 3 and approved by the IRB. No uncommon situations occurred during the data collection.

In the compiling phase, I began exploring in NVivo 11 Pro (2015) and quickly realized that I needed to listen to the recording of each interview again. While listening, I naturally highlighted key information in the transcripts that answered the research questions. I then began to disaggregate the data and code the transcripts into influencing factors. I highlighted, underlined, and bolded the key phrases that addressed the four research questions. After reviewing each transcript again, I wrote quotes and detailed information on color-coded sticky notes and then began to reassemble and array the interview data. I placed each sticky note on one of four large poster boards representing the four research questions. On the basis of the second round of interviews, all of the nine initial themes were confirmed and six new themes were added.

The next step in the data analysis process was to interpret the color-coded sticky notes. Extensive reading, reviewing, and sorting of all the data written on the sticky notes helped determine the major themes that emerged to answer the four research questions. The following themes were identified for each research question and the data analysis is addressed more completely in the Results section.

Research Question 1: What professional development principles do technology instructional coaches use in designing professional development for one-to-one mobile technology programs? (a) Supportive advocacy leadership, (b) Building culture and trusting relationships, (c) Instructional design supported by standards and frameworks,

(d) Promoting classroom management with technology, and (e) Professional learning coaching opportunities for technology instructional coaches.

Research Question 2: What professional development practices do technology instructional coaches use in designing professional development for one-to-one mobile technology programs? (a) Supportive participatory leadership; (b) Building culture and mentoring relationships; (c) Instructional design modeled with standards and frameworks; (d) Learning first, technology second within curriculum and instruction; (e) Professional learning conferences and certifications for technology instructional coaches.

Research Question 3: What are the perceptions of technology instructional coaches regarding changes in teacher practice after the professional development sessions? (a) Supporting content-specific teaching strategies, (b) Augmented technology usage, (c) Increased confidence to showcase knowledge and expertise.

Research Question 4: What are the perceptions of technology instructional coaches regarding changes in teacher attitudes after the professional development sessions? (a) Building collaborative, job-embedded teacher agency with ongoing support; (b) Personalized learning with differentiated delivery of professional development.

Evidence of Trustworthiness

Credibility

Credibility with internal validity occurred by the triangulation of the in-depth individual interview data, as each was reviewed by the participants to confirm that the data correctly reflected their perceptions and experiences. In addition, the study participants were identified by their geographic region. The sample size of 13 technology

instructional coaches was a priority for obtaining a comprehensive narrative of the interview data; seven of the coaches had two interviews to gain in-depth knowledge.

Transferability

I addressed transferability by examining how the findings of this study could apply to a similar situation to "ensure sufficient, thick descriptions of contextual information is provided to enable transfer" (Shenton, 2004, p. 69). This includes the geographic locations, length of time the technology instructional coach had been developing and/or facilitating professional development, and the number of years the school and/or district had been implementing a one-to-one mobile technology program. The purposive sampling helped support transferability of the research findings to future studies.

Dependability

I addressed dependability by documenting all the processes in the study in detail to enable future researchers to repeat the study within the same context, methods, and participants to obtain similar results (Shenton, 2004). Documentation included the research design, research questions, interview questions, interview protocol, tools, and a reflective review. The four clearly defined research questions were reviewed throughout the study. In my role as the researcher, I explained the interview protocol and the use of GoToMeeting explicitly and shared the interview questions with all participants. Bias checks throughout the retrieval of all interview data were at the forefront of my mind; I deleted participant names and assigned them a number. Other elements that promoted dependability included referencing the theory of andragogy, use of the TPACK

framework, and a reflective review of the triangulated in-depth individual interview process.

Confirmability

I maintained confirmability, comparable to objectivity, during the data collection and analysis by making sure that the interview results were from the participants, not from my opinions or preferences, and were free from research bias. The documentation of procedures through an "audit trail, would allow any observer to trace the course of the research step-by-step via the decisions made and procedures described" (Shenton, 2004, p. 72). The systematic research process used to collect the data led to the development of recommendations, triangulation of the in-depth individual interview process, and the disclosure of my biases. I did not omit any pertinent data in the analysis and reporting of the study results and findings in this chapter or the following chapter.

Results by Research Question

This qualitative, in-depth interview study examined the systems and structures that are in place for proven and effective principles and practices in one-to-one mobile technology professional development programs for teachers. The data came from in-depth individual interviews with 13 technology instructional coaches. The seven coaches who were identified as high-level technology instructional coaches participated in a second interview to share more in-depth knowledge. The themes and influencing factors were determined by an analysis of the data and organized by research questions.

Research Question 1

Research Question 1 examined the professional development principles that technology instructional coaches used in designing professional development for one-to-one mobile technology programs. Data for Research Question 1 were taken from answers to the open-ended interview questions and five themes emerged with influencing factors: (a) Supportive advocacy leadership, (b) Building culture and trusting relationships, (c) Instructional design supported by standards and frameworks, (d) Promoting classroom management with technology, and (e) Professional learning coaching opportunities for technology instructional coaches. The analysis of the work of the technology instructional coaches was framed around professional development principles that have been implemented and facilitated in one-to-one mobile technology programs in K–12 schools and districts from around the world.

Supportive advocacy leadership. The first theme focused on the importance of district and building-level administrators who value the use of technology. This theme also brought out the importance of administrators who have helped establish a positive technology school culture. Participant 11-HL emphasized the importance of always having a collaborative environment that "promotes an understanding of people's frustrations, where people feel comfortable and are not being given something they are told to do, but are actually a part of the solution."

Participant 6-HL stated that school administrators who advocate the use of technology in the classrooms in their school want to know how to best support their teachers. At the same time, these administrators have difficulty knowing the best way to

support their teachers; many have never taught with technology. Participants 1-HL, 4-HL, and 8-HL shared similar sentiments. As a result, some technology instructional coaches provide modeling at the district level with principals and administrators in all meetings to encourage them to use technology. Participant 1-HL shared that the Lead & Transform Diagnostic Readiness Tool, which "takes a snapshot of school's alignment to the 14 Essential Conditions for learning and teaching with technology" (ISTE, n.d.b, para. 3), is a valuable resource. Participant 4-HL mentioned another resource that can promote visionary leadership: the ISTE Standards for Administrators (2009). From this participant's perspective, the use of these standards sets the leadership tone and establishes a culture of digital learning. As Participants 5 and 11-HL pointed out, if administrators find something valuable, they will buy into it and often make it a budget priority, thus making one-to-one technology integration more successful.

In the initial planning of a one-to-one mobile technology program, supportive leadership helped teachers embrace the integration of technology into their classrooms. A school usually reflects the leadership in the building, according to Participant 6-HL. Where "highflier" teachers are doing well with technology, chances are the principal is forward thinking and embraces technology. However, when schools are lagging behind in technology usage, usually it is not because the leaders are against technology; rather they may not have fully embraced the idea of integrating technology. Establishing a technology committee, as Participant 7 suggested, helps move the school and district forward with technology integration. This type of committee allows stakeholders such as parents, students, and school board members to have informal, candid discussions about

challenges and successes. In addition, Participant 8-HL discussed the importance of including community members as stakeholders on the committee:

> Professional learning needs to go beyond the teachers and students, and into the community, especially with the one-to-one. Parents, guardians, and community members need to understand technology, why every school district has an AUP [acceptable use policy], and how it affects home life. An example is showing the film *ScreenAgers*, which has to do with student screen time, while partnering with local libraries to present conversations about digital citizenship that need to happen in and out of school and in the community.

As this participant points out, buy-in from all stakeholders strengthens the appropriate use of technology in the one-to-one environment.

Participant 6-HL expressed a key role that leadership can play in the planning process of technology integration. One way to ensure that teachers begin to feel comfortable with technology is to provide adequate and meaningful professional development at least 6 months before a school or district begins the device rollout. In addition, once the devices are in the hands of students, school administrators must have a plan in place where teachers feel supported. If that support is there, administrators will lobby for technology instructional coach positions, because technology is not going away and the teachers need and want to have the support. In contrast, the statement by Participant 5 about one-to-one programs challenged the idea that technology cannot fade away:

> The first year schools or districts go one-to-one, their focus is all about the technology and trying to acclimate. Year 2 is where the golden stuff happens with integration, but there must be a vision and support. Years 3, 4, and 5 is where the 'super' support is needed, because other trends or focuses become a priority and technology takes a back seat. If the support does not continue, the one-to-one program will fall to the wayside; because, if there is no PD [professional development], there is no clear vision.

As this participant identified, continued support for professional development needs to be a priority with a clear vision to sustain the use of the one-to-one technology integration.

In summation, the data indicate that supportive leadership promotes a positive digital learning culture by using research-based resources and standards to understand how teachers are using technology; this in turn helps the leadership to discern how and when they should deliver professional development. District and school administrators who know the value of integrating technology encourage buy-in from all stakeholders, make it a budget priority from the beginning, and continue to support it for years. They also sustain the role of the technology instructional coach to provide immediate and ongoing support for teachers.

Building culture and trusting relationships. The title of the technology instructional coach position makes a difference in how other teachers perceive this position. Some variations that emerged from the interviews included teacher on special assignment, instructional technology resource teacher, teacher technology specialist, technology integration coach, leader in technology education, and education technology

specialist. Participants 2-HL, 3-HL, 8-HL, 10, and 11-HL collectively shared these position titles (titles are not identified individually, for confidentiality reasons). As one of the participants stated,

> When you have a title that belongs in the teacher realm, it is more acceptable by other teachers. There is a certain trust factor of speaking with another teacher as compared to the trust factor of speaking to an administrator. Team leader meetings run by teachers are also stressed by grade level at the elementary [school level] and by content area or department at middle and high school [level] to help build this mindset.

Another participant referred to the importance of having the word *teacher* in the title for instructional coach positions, to differentiate them from the onsite technician. The participant credited the onsite support from the coach and the technician at this school as a key reason for the sustainability of the school's one-to-one program.

Getting along well with colleagues and understanding their technology skills and strengths, as Participant 2-HL expressed, is a prerequisite for designing and facilitating professional learning opportunities between coaches and teachers. Technology instructional coaches must be able to build relationships, strengthen rapport, and have a good technology skill set. Participant 6-HL (supported by Participants 1-HL, 3-HL, 4-HL, 5, 12, and 13) noted that there is an advantage to being an extroverted "people person" whom others can rely on and trust. Participant 6-HL added,

> You must be a good listener, being the "eyes and ears" as the lead for educational technology to understand how everything fits together in a classroom, school, and

> district to help streamline processes and different initiatives and help eliminate archaic ways of doing things. Being a communicator who is nonjudgmental, accessible, has empathy, is inspirational, flexible, and pivots to teacher needs, allows teachers time to learn, even with a little struggle to be pushed outside of their comfort zones. Leveraging the power of having devices for every student and the accessibility to many resources helps teachers build a culture of technology integration with empowerment, encouragement, advice, documentation, and research.

As this participant indicated, technology instructional coaches must be good listeners and communicators to help teachers integrate the one-to-one technology and to understand the influence the devices can have on student learning.

Technology instructional coaches give recommendations to teachers, provide guidance, and collaborate to solve problems with teachers and administrators. Participants 5 and 8-HL emphasized that providing support on what works and is challenging gives "voice and choice," not pushing their own agendas. Participants 1-HL, 3-HL, 6-HL, and 10 noted the value of building technology integration into what teachers are already doing, as well as explaining and helping teachers understand why technology matters for their students.

Teachers feel empowered when they can choose what they want and need to learn. Professional development is not solely about technology, as Participant 8-HL noted, but also about pedagogy and the "Nine Essential Instructional Strategies" by Marzano et al. (2001) and how technology works with these strategies. Participants 1-HL,

3-HL, 5, 6-HL, and 8-HL shared the importance of building a culture for teachers to seek their own assistance. This culture could include things like booking appointments during prep time or before or after school using a tool such as a shared Google Calendar, hopping on a Google Hangout, or simply using the phone or e-mail. In addition, Participants 3-HL, 4-HL, 5, 6-HL, and 7 shared how they help build relationships and teacher agency by providing just-in-time support for risk-taking, modeling, brainstorming, hand-holding, coteaching and coplanning, hands-on practice, providing time to implement, acting in a liaison role between teachers and information technology (IT) staff, and taking teachers to conferences to be with like-minded people.

Participant 3-HL shared the need to understand professional blind spots: Some teachers are not early adopters and are afraid to experiment and invest time in learning new technology tools on their own. Therefore, the key to one-to-one programs, according to Participant 7, is teacher professional development:

> Schools and districts cannot adopt one-to-one mobile technology programs and have teachers intuitively adopt and integrate it. Just because you are comfortable using technology does not mean that you know the potential of that technology for your teaching or you know how to change your practice and use the new technology. The professional development must focus on what is happening within the live portals with real-time data for the teachers and to take ownership right away.

As this participant indicated, professional development must be provided for teachers using the tools and resources they will be using with their students to enhance the appropriate use of technology in a one-to-one environment.

Technology instructional coaches must meet teachers at point of need because it is different for every teacher in every district. Some strategies for point of need are personalizing and customizing workflow, streamlining processes to save time, eliminating archaic ways of doing things, and getting organized. Several participants (1-HL, 3-HL, 5, 7, 12, and 13) discussed the importance of enhancing the learning of students with tailored professional development that is short, practical, purposeful, and to the point. Participants 12 and 13 also shared that following up with teachers and checking in with them provides additional ongoing support. Likewise, Participant 6-HL described using a Google Form for teachers to request customized one-on-one support to be more customer service oriented, to meet teachers in their own environment, and to make it more palatable for teachers to become more technologically literate. Participant 4-HL emphasized that helping teachers help students with the life skills of digital file management and organization, archiving work, and bookmarks influences how technology integration happens in the most efficient and useful way in a one-to-one environment.

Participant 5 shared the model, “I do, we do, and you do.” This participant gradually releases the responsibility for helping teachers learn new technology integration techniques with their students, while remaining available as a constant collaborator to assist teachers if needed. Additionally, it is important that technology instructional

coaches are accessible all of the time to have a presence in classrooms, according to Participant 6-HL; “every day and every week teachers have the opportunity for professional learning, so we say there are 182 days or 36 weeks of opportunities.” Participant 3-HL supported teachers with professional development throughout the school day in 30-min chunks of time.

Coaches use many different measurements to assess the effectiveness of professional development, according to Participants 1-HL and 11-HL, including teacher comforts with the technology and readiness to use what they have learned. Several participants (1-HL, 3-HL, 4-HL, 5, 7, 8-HL, 12, and 13) discussed the importance of getting survey feedback as teachers exit the professional development to determine its effectiveness. Seeing teachers progress in their classrooms with their students is one measure of effective professional development, according to Participant 6-HL. Additionally, teachers who are not usually positive but share highly positive feedback can be a strong voice when they buy in.

In summation, the data show that even something that may seem as insignificant as the title of the position can make a difference with how other teachers perceive technology instructional coaches. It takes a special personality to build relationships, rapport, and trust, while having good technology skills to facilitate a culture providing just-in-time support. Modeling, hand-holding, coteaching, hands-on practice, providing time to implement, and acting as a liaison between teachers and IT staff are many of the supports technology instructional coaches provide to teachers. Teachers always want more time for processing what they learn, including integration techniques and

application of the devices. Personalizing and customizing professional learning opportunities that are short, practical, to the point, and have a genuine purpose must include supporting workflow, streamlining processes, eliminating archaic ways of doing things, and enhancing the learning of the students. Survey feedback and anecdotal evidence captured by technology instructional coaches could reflect the professional learning opportunities.

Instructional design supported by standards and frameworks. The data showed that technology instructional coaches need to know instruction and understand the design of a lesson. Participant 1-HL shared that the concepts of lesson preparation and instructional strategies include essential questions, objectives, multiple means of representation, and formative assessments. With the shift to one-to-one devices in busy, noisy, classrooms, teaching is no longer the dispensing of facts but facilitating learning at deeper levels. Having content-area model master teachers work with technology integration coaches using a peer-coaching model helped departments and grade levels move into deeper levels of integration, according to Participant 1-HL.

Participants 1-HL, 2-HL, 3-HL, 4-HL, and 11-HL emphasized helping teachers obtain the skills they need to use technology in specific content areas and know the research behind how to use this technology to influence student learning. In addition, having a continuum of technology integration connected to the district's vision and mission promotes the need for digital fluency for students, which is now a priority and necessity rather than a luxury for all students. Other resources shared were (a) "1:1 Handbook" for care of Chromebooks and recommendations for amount of screen time

(Participant 8-HL); (b) focusing on district-provided digital tools first, such as G-Suite (Participant 6-HL); and (c) Learning Forward's Professional Learning Standards and ISTE's Essential Conditions (multiple participants).

In summation, technology instructional coaches need to know instruction and understand the design of a lesson to help teachers identify how the one-to-one technology fits into the lesson. Model master teachers in specific content areas who work with technology integration coaches using a peer-coaching model help departments and grade levels move into deeper levels of integration. Additionally, a continuum of technology integration connected to district vision and mission emphasizes the need for digital fluency for students in lesson design. Digital fluency is now a priority and necessity, no longer a luxury.

Promoting classroom management with technology. The data showed that bringing one-to-one mobile devices into the classroom provides new challenges for teachers in classroom management, influencing the use of the devices and how often they are used. Whether the school provides the device or students bring their own devices or technology (BYOD or BYOT), the teacher must be sure the devices are compatible with all learning systems. Teachers need to know how to manage the use of one-to-one mobile technology in their classrooms—a process that occurs over time, according to Participant 10. In contrast, Participant 1-HL emphasized the need for teachers to be patient, flexible, and know enough about technical capabilities of all devices, whether school-issued or BYOD/BYOT, to help themselves and students if the technology is not working as expected.

Participant 6-HL, supported by Participant 11-HL, shared two reasons why many school choose to issue devices: (a) Instructional coaches do not waste time troubleshooting software and devices because they know what works and what does not. (b) This system provides a centralized platform for tracking, filtering, and controlling devices. According to Participants 1-HL, 6-HL, and 8-HL, the centralized platform also helps promote the importance of digital citizenship by creating an environment in which students use their one-to-one mobile devices safely, respectfully, and responsibly, and understand that the devices are there for educational purposes.

In one-to-one programs, much of the professional development focuses around applications specific to the device in the hands of the students. Whether a district is BYOD/BYOT or not, Participant 4-HL recommended the use of a learning management system (LMS) and web-based resources to simplify the workflow for students and teachers. Giving out and turning in assignments, along with providing instant feedback on formative assessments, are simpler when content can be shared across multiple devices and platforms. In contrast, if a district has not chosen an LMS that will work on all devices, sharing information with students can be problematic, according to Participant 3-HL. If school-issued devices do not go home with students, teachers have to be careful that students will be able to access content on the devices used at home.

When each student and teacher has a reliable device, they take more ownership and better care of the technology, according to Participants 5, 7, and 11-HL. Therefore, having a working device enhances the ability for students and teachers to engage in anytime/anywhere learning. In addition, Participants 4-HL and 7 stressed the importance

of teachers having a student device available to test how things will work for their students. Many schools use tablet devices at lower grade levels, moving to a device with a physical keyboard in Grades 3-12 because of high-stakes testing. Participant 6-HL shared that many teachers are reviewing how frequently and at what grade levels keyboarding should be taught. Teachers believe keyboarding is something that students need to practice every day, in Grade 3 or before, to increase the efficiency of using one-to-one mobile technology devices. Teachers who have never taught keyboarding need instructional support for teaching keyboarding basic principles.

Professional development about the importance of teaching about "digital footprints" creates a strong digital citizenship culture, according to Participants 1-HL, 2-HL, 6-HL, and 8-HL. A digital footprint is the information that exists on the Internet about a particular person because of his or her online activity. Some now refer to "digital tattoos" rather than digital footprints: Footprints can be washed away, but tattoos are permanent, just the same as Internet activity. The BrightBytes Technology & Learning module by Clarity is another resource to support the importance of digital citizenship with an emphasis on web literacy, Internet safety, and social media and digital literacy. Participant 2-HL suggested the Global Citizen Diploma as an additional way to promote a high school credential that includes digital citizenship.

In summation, the data indicate that one-to-one mobile technologies, whether school-issued or BYOD/BYOT, must be compatible with all learning systems, and schools must be able to track, filter, and control devices as needed. Teaching keyboarding to students and preparing teachers how to teach keyboarding is introduced in earlier

grades due to the spread of one-to-one devices. Additionally, schools should establish a strong digital citizenship culture along with an emphasis on other digital literacies to assist with classroom management of devices.

Professional learning coaching opportunities for technology instructional coaches. Participants 2-HL and 6-HL (supported by Participant 1-HL) shared two coaching models that are essential for technology instructional coaches: cognitive coaching (A. L. Costa, Garmston, Hayes, & Ellison, 2016) and instructional coaching (Knight, 2007). These models focus on communication, building relationships, and being a good listener, which are essential in building professional development principles to help teachers with a pedagogical shift in their teaching. In addition, teachers cannot feel that coaches are one-upping, them according to Participant 6-HL; coaches need to bring themselves down to a level of "Hey, I started just like you did, and I have been able to grow, just like we are going to get you to grow." Participant 6-HL also suggested that instructional coaching is also a time for coaches to learn how to coach teachers and allow for reflection.

Professional learning and coaching possibilities for technology instructional coaches include attending local, regional, national, and international technology conferences to learn, as well as present. Participants 1-HL, 6-HL, 8-HL, and 11-HL attended conferences sponsored by ISTE, the Florida Educational Technology Conference, Computer Using Educators, and the Texas Computer Education Association. Sometimes unique opportunities come along for technology instructional coaches. One of the participants (not identified for confidentiality reasons) was part of one of four early

adopter schools that worked with Google in 2011 to help build one-to-one programs with Chromebooks. Being a part of the Google Education Team has allowed this participant to network all over the world, especially since Chromebooks are the most popular devices in schools today.

Participating in the ISTE Standards refresh to redesign different sets of standards for students, teachers, and administrators is an opportunity that any educational technology coach or teacher would love to be a part of, according to Participant 3-HL. The ISTE Standards are used in many districts as guiding principles that help build professional development. Participants 1-HL, 3-HL, 6-HL, 8-HL, and 11-HL shared the following organizations that provide professional learning opportunities for coaches and teachers: ISTE, Computer Using Educators, Texas Computer Education Association, Illinois Computer Educators, Google Educator Groups, and California Educational Technology Professional Association. In addition, participants said coaches and teachers could grow their own PLNs through the National Council of Teachers of Mathematics, Apple, Google, Intel, Microsoft, Twitter, and YouTube Channels such as Lisa Highfill, friEdTechnology, LogicWing, blogs, journals, webinars, books, face-to-face and online classes, and observations.

In summation, the data showed that to help teachers with a pedagogical shift in their teaching coaching models must emphasize strong communication skills, relationship building, and good listening skills. Coaches need time to learn and reflect to build their own skills. Attending local, regional, national, and international technology conferences helps coaches learn new technology integration knowledge and skills but also gives them

the opportunity to present and share their skills with others. In addition, professional associations, organizations, and resources help coaches and teachers grow their own PLN. The data presented above provided answers to Research Question 1: What professional development principles do technology instructional coaches use in designing professional development for one-to-one mobile technology programs? Data addressing Research Questions 2, 3, and 4 will follow in a similar format.

Research Question 2

Research Question 2 asked what professional development practices technology instructional coaches use in designing professional development for one-to-one mobile technology programs. Data for Research Question 2 were taken from answers to the open-ended interview questions and five themes emerged from the data: (a) Supportive participatory leadership; (b) Building culture and mentoring relationships; (c) Instructional design modeled with standards and frameworks; (d) Learning first, technology second within curriculum and instruction; and (e) Professional learning conferences and certifications for technology instructional coaches. The findings were similar to the findings of the five themes determined for Research Question 1; however, there are different influencing factors in the following themes between principles and practices. The work of the technology instructional coaches in the context of the results of this study was framed around professional development practices that have been implemented and facilitated in one-to-one mobile technology programs in K–12 schools and districts around the world.

Supportive participatory leadership. The first theme that emerged from the data focused on the importance of school and district leadership who participate in, facilitate, and lead professional learning opportunities on an ongoing basis to promote a supportive culture. Administrators provide time for technology professional development during staff meetings (even if it is only for 5 min, as Participant 8-HL said). In addition, Participants 4-HL, 5, 9, and 10 pointed out that some staff meetings and PLCs are all about professional development specific to teacher needs. Other events scheduled to encourage technology integration include late start/early release days, scheduled professional development days, after-school sessions, and drop-ins with coaches that do not require an appointment.

Most schools and districts have four or five district-provided professional development days and a few half days for site-specific professional learning opportunities. While administrators realize that professional development needs to be ongoing and systemic, they want their teachers in the classrooms with students and do not want to interrupt instruction, as Participants 8-HL, 9, and 11-HL emphasized. Participant 11-HL also mentioned that professional learning must be scheduled during the school day because that is “when we own the teachers,” given the culture that has been established by the teacher unions. Even paying teachers will not get them to attend professional development before or after school hours. Participants 8-HL, 9, and 11-HL also pointed out that finding substitute teachers to fill in during professional development is a problem for many districts. However, Participants 12 and 13 (supported by Participants 2-HL, 7, and 10) noted that schools do use substitute teachers in creative ways. For example,

substitutes come in for morning classes, so the technology instructional coach may work with a few teachers; then the substitute teachers move to different classrooms in the afternoon for the coach to work with the other group of teachers. In contrast, Participant 1-HL expressed a need for fewer substitute teachers because of the increased professional learning opportunities in classrooms to model and coach teachers with their students. Real-time in-class coaching and coteaching helps teachers move from substitution to higher levels of technology integration use, letting go of some control and allowing for more choice and flexibility for students to demonstrate their learning with technology.

Supportive leadership advocates growing and supporting teachers, coaches, directors, and coordinators. Participant 2-HL reinforced how using a "technology audit process" of data visualizers and data scientists who are leaders in learning and data analytics can help technology instructional coaches collect and classify data artifacts to examine instructional strategies, student engagement, and teacher professional development, that were integrated into teaching and learning. Classification of data artifacts occur through using Bloom's taxonomy and the ISTE Standards for Students, Educators, and Coaches. This process has created a common language to promote higher order thinking skills and the sense of a common language around technology. In addition, Participant 2-HL shared how "professional development 3.0" was named for teacher agency and teacher-driven professional development guided by discussion and exploration between teachers, versus top-down professional development.

The leadership of the district IT department manages and maintains the infrastructure to support all devices when implementing one-to-one mobile technology. A

robust network and infrastructure allows professional learning to be portable, flexible, available anywhere, and invisible to teachers. If teachers cannot count on the devices and infrastructure to work, as Participants 6-HL, 12, and 13 said, they will not use it. District leadership must help promote collaboration with IT and instruction, as Participant 4-HL shared, and give technology instructional coaches with curriculum and instruction expertise the opportunity to work with the IT staff and have a good relationship. In addition, many times technology instructional coaches are the liaison between teachers and IT. Ideally, IT and instruction would share a common space for ongoing conversations to provide students and staff with the best learning opportunities, as Participant 1-HL experienced, and no longer work as separate entities. This is a big cultural change for most schools and districts. Additionally, more than one or two people should have authority to keep one-to-one programs moving forward, in case there is a change of leadership. Participants 6-HL, 8-HL, and 11-HL shared similar sentiments.

Administrators and IT staff should be encouraged to participate in professional development. In particular, as Participants 1-HL and 4-HL shared, IT staff should be present at leadership trainings to better understand the goals of curriculum and instruction and hear the questions teachers are asking. Participants 1-HL, 2-HL, 4-HL, 6-HL, 8-HL, and 11-HL placed great emphasis on basing decisions on instructional needs, not on IT wants (excluding laws, regulations, and policies). However, Participant 4-HL mentioned that in some districts, IT is not part of instructional professional development; IT people often see things as infrastructure and devices and have made decisions that were non-educational. However, at times IT staff do attend teacher professional development for a

specific tool; having the right open-minded people present to make certain decisions is a win–win situation.

From a different perspective, Participant 11-HL shared the experience where IT staff do not participate in instructional conversations with technology instructional coaches because IT people were making decisions that were non-educational such as not understanding why a teacher needs to show a particular YouTube video, and setting the filters to block the video because it is "the policy." Professional development does occur when IT and instructional staff are together, but not to discuss instructional content or have instructional conversations "because it's a level of professional background that separates the dialogues from where you want to go." In addition, Participant 2-HL shared that IT staff often present and provide support if needed, but "education is first, and technology is second. Technology does not guide what technology is, but education guides the technology, and network administrators do not dictate what happens."

In summation, the participants shared that supportive leadership provides time for continual professional learning opportunities in a variety of different ways for teachers, whether during the school day by providing substitute teachers or during other scheduled times. Many administrators also facilitate and lead sessions to model technology integration strategies in trainings and meetings. Leadership from the district and principals helps promote collaboration and provide the opportunity for technology instructional coaches with curriculum and instruction expertise to have a good relationship with the IT staff so the needs and wants of all stakeholders are met.

Building culture and mentoring relationships. One of the big questions when executing a one-to-one mobile technology program is how to get all teachers on board with implementation. According to Participant 3-HL, to build culture and mentor relationships the enthusiasm of the technology instructional coach is important. Participant 3-HL believed that when the coach is excited, other people will tend to be interested, even though they might not be excited. In addition, branding a professional learning space by name invites teachers to come and learn. Participant 3-HL shared a few examples, such as “the Fishbowl,” “the Den,” the Loft,” and “the Zone,” depending on where the space was physically located in the building.

When a school or district embraces a one-to-one mobile technology program, there are many practices to consider regarding roll out of the devices. Participant 10 shared three practices to enhance the technology integration process. The first practice is to promote an experience, where all the teachers in the district come together to learn how wonderful the technology will be in their classrooms. The second practice is training on the essential programs and how to use a laptop. The third practice is ongoing, job-embedded professional development, where an instructional coach at each school works alongside teachers, helping them integrate technology skills into lessons. According to Participant 10, this practice has contributed to a successful one-to-one program for more than 15 years. Participant 3-HL shared similar practices; the first professional learning sessions were presentations based around institutional needs with student information systems and gradebooks. The next step moved into how the coach interacted with the

resource or tool, learning how the resource or tool can be applied in each classroom, and asking the question, “What would I want to be offered if I was a teacher?”

Other participants presented additional practices for roll out. Participant 9 added that allowing teachers time to explore devices before students received them was a big component in making teachers comfortable with the pedagogical shift of integrating technology. In addition, Participants 4-HL, 9, and 10 expressed how important a “train the trainer” model had been for teachers to learn and share with the rest of the staff members. Participant 1-HL shared the importance of focus groups for teachers to learn from other teachers. “One size does not fit all” for professional development, Participants 5 and 11-HL stressed, because every teacher is at a different technology skill level. Participant 2-HL shared that the focus should be on those who are keen to learn and empower themselves.

Participants discussed essential ways to enhance teaching and learning outcomes by supporting teachers with technology integration. Participants 7, 9, 12, and 13 shared the need to spend a lot of time in classrooms observing, sitting side by side and meeting with teachers, and having candid discussions about challenges and concerns. Participant 2-HL discussed creating a “play date” atmosphere. In this practice, coaches set up a “sandbox” for teachers to learn new skills. This provides a grassroots, teacher-driven atmosphere where teachers choose tools, approaches, and topics they want to discuss and have the opportunity to go in and out of the sandbox or go deep with their learning.

Participants 1-HL, 5, and 11-HL mentioned the importance of getting buy-in from a small group of teachers to build culture and use technology to bring people together. In

this practice, the small group of teachers has conversations to learn what is going on and talk about content and integrating technology. Participant 8-HL supported an experience where technology instructional coaches "come together once a month for 2 hours to cover 'nuts and bolts' with instructional troubleshooting and problem solving about what is happening in classrooms." In addition, Participant 8-HL shared that the ability to quickly adjust any professional development session by watching body language, listening carefully, and adjusting accordingly was a strength. Other ideas from Participant 8-HL included following up with newsletters on tips and tricks of technology in the classroom to spark teacher interests for professional development opportunities.

Three of the participants (not identified by number for anonymity purposes due to the concern that the participants could be identified by demographic data) explained how they used a prototype or cohort model that emerged from extensive research; one of the participants had led a research and development task force. The first participant started the one-to-one mobile technology project 5 years ago with a prototype for all eighth grade students and teachers, then moved to high school and sixth and seventh grades, before moving to a validation program. During the last school year, a group of fifth grade teachers continued the prototype model to see how one-to-one mobile technologies would work in self-contained classrooms. The teachers met on a regular basis to share technology integration tips or questions and answers.

The second participant shared about two cohorts of technology-focused teachers who volunteered to implement the Blackboard LMS. Both cohorts became the Blackboard champions and mentors for other teachers by doing extra work and learning

how to put their curriculum in an online form used every class, every day to deliver instruction and share resources. The champions met once a month, either face to face or virtually, with technology coaches and participated in more professional development than other teachers receive. Within their PLCs, they shared artifacts that are now in one centralized location in their school community for all teachers to use.

The third participant explained that she was the lead on a mobile learning prototype project that had been running for 4 years. Only teachers who were willing to prototype mobile learning in their classrooms with teacher interests, teacher recognition of affordances and teacher empowerment participated because it was not a top-down delivered project. Coaches continually ask each prototype teacher, “How can I help you? What do you need from me? What support can I give you?” In addition, the open platform empowered students to bring in their own devices. The project provided devices for those who could not bring in their own (only about 10%). After the third year, all teachers in a particular subject area were required to have a mobile device along with their students, who were required to bring their devices as they moved from prototype to program. In the fourth year, more teachers volunteered to participate.

Over the 4 years, teachers in core subject areas like English, social studies, science, and math felt that the mobile devices were useful but not necessary to their teaching tool kit. The only subjects in which mobile one-to-one technology was necessary were the middle school English as an Additional Language program, the academic support program for both middle and high school students, theater arts, and physical education. In all of these subject areas, the teachers saw the affordances that the

mobile technologies offered in their teaching areas to capture data, movement, and performances. The physical education department was one of the leaders in the school to go with the program rather than with the prototype of a mobile device in their teaching tool kit.

All of the participants agreed that facilitating discussions and providing professional learning opportunities for teachers in a face-to-face setting would never completely go away. This was due to the human emotions and reactions in helping teachers and providing individualized attention and feedback. However, Participant 2-HL stated that she did not go out of her way to provide on the spot or face-to-face professional development because the teachers were autonomous in exploration and highly intrinsically motivated to learn on their own. In contrast, Participant 4-HL said her greatest strength was experience working both face to face and virtually with one-to-one technologies from multiple perspectives as a parent, middle school teacher, and higher education faculty member. In parallel, all participants also agreed that the future of professional development will include more online tutorials, social media, LMSs, and more self-select options. Participants 12 and 13 both stated that they had recently been asked to develop online modules for teachers to access in a cohort model targeted at the beginner level for Google basics and Google Drive.

In summation, building a positive one-to-one culture and developing mentoring relationships is about focusing on the teachers who want to learn and empower themselves to integrate one-to-one mobile technology into their teaching. One proven method was using a prototype model before moving to a program level. The prototype

model established the early adopters by grade level and/or department to help establish a support system where teachers felt comfortable discussing what was happening in their classrooms with technology integration. In addition, three important categories were creating an experience to build excitement, providing training on how to use the technology, and having job-embedded professional development support with integration.

Instructional design modeled with standards and frameworks. An important method of instructional design in professional development is presenting, facilitating, and teaching teachers as they will teach their students. Working one on one after the professional development session helps teachers grow individually, according to Participants 4-HL and 10, by meeting their specific requests at the point of need. Additionally, anything that instructional coaches deliver to teachers is put online so it is accessible to anyone who wants to access the material within or outside of the school system. In support, Participant 6-HL developed a professional development web page for anytime access for teachers and encouraged teachers to join a Google+ Community. Participant 1-HL asks teachers with whom she works, “Are you differentiating as much as you want to be with the instructional strategies you are using?” The reason for asking the questions is to let technology come out itself as a means to improve instruction.

Using theoretical frameworks, models, and standards to create a common language acts as a guide to integrate technology efficiently and effectively, making it obtainable for all teachers. The participants shared theoretical frameworks, models, and standards they use in planning professional development in specific schools and/or districts that support the research mentioned in the literature review. The following

briefly explains the use of the frameworks, models, and standards that emerged in the interviews.

Participants 1-HL, 5, and 6-HL shared that andragogy/adult learning (Knowles, 1975) was an important framework, keeping in mind that adults learn different from children. Adults have different strengths and more distractions, so the professional learning opportunities need to be engaging. In addition, they need to focus on the skill levels needed, and relevant to the adult subjects and content areas.

Apple Professional Development was specific to Participants 9 and 11-HL and schools and districts who use Apple one-to-one devices. In planning professional learning opportunities for teachers, technology instructional coaches identify and recognize professional learning goals that are clear and understandable by the teachers. The goals are always created with the intent to help teachers increase student achievement using the SAMR framework.

Participants 1-HL, 5, 6-HL, and 8-HL all indicated they use the BrightBytes Technology & Learning module, a perception survey from Clarity, to develop customized, personalized educational technology professional learning plans for teachers. The perception data obtained from the surveys of the stakeholders—students, teachers, parents and administrators—provide an analysis of the results in a user-friendly dashboard. In addition, the technological needs identified align with standards that help schools and districts create their vision for technology.

Participants 1-HL, 2-HL, 3-HL, 4-HL, 6-HL, 8-HL, and 10 emphasized the ISTE Standards for Students (2016), Educators (2017), Administrators (2009), and Coaches

(2011), and the ISTE Essential Conditions (n.d.a.) as important to include in long-term professional development plans and learning outcomes. The major focus for professional learning around the standards was to provide a framework for getting all teachers on board with technology integration and using one-to-one mobile technology devices with their students. Participant 2-HL shared a successful design based on the "Amazing Race" concept to introduce the new ISTE Standards for Students (2016). The staff worked in cross-subject teams and divisions to guide their professional learning. In addition, Participant 6-HL referred to the Learning Forward Standards for Professional Learning (2011) as another important set of standards supporting technology instructional coaches who analyze data to improve student achievement; however, all coaches have to be careful to avoid "analysis paralysis."

The SAMR model (Puentedura, 2013) is a framework that can be used to evaluate how technology has transformed learning and helps teachers reinvent and modify lessons that get to redefinition and educational transformation, according to Participants 2-HL, 3-HL, 4-HL, 5, 6-HL, 8-HL, and 11-HL, not a ladder where they only need to move to the highest level. Professional development that is teacher driven and teacher involved based on SAMR empowers teachers to make sense of how they are planning and designing lessons, according to Participant 4-HL. It is also important, as Participant 1-HL shared, to know when technology resources and tools will enhance student learning and when technology is not the best option.

Participants 2-HL, 4-HL, 5, 6-HL, 8-HL, and 11-HL emphasized the TPACK (Koehler & Mishra, 2009) theoretical framework in planning professional learning

opportunities about naturally and organically working with colleagues. Areas of focus included content areas with knowledge of pedagogy, content knowledge, and technology integration. The instructional coaches may not be content knowledge experts as the teachers are, but they have the skills in pedagogy and technology integration to assist the teachers.

Participants 1-HL and 10 shared the Teaching Innovation Progression Chart, developed in a school district in the southeast United States, as an important tool. It summarizes more than 1,700 high-quality 21st-century lessons based on the question, "What do we want to see in our classrooms if we see good 21st century education?" This resource provides concrete examples of lessons that answer that question.

Participants 1-HL, 2-HL, 8-HL, and 10 shared other theoretical frameworks, standards, and models worthy of mentioning. However, for confidentiality purposes, the frameworks, standards, and models are listed together, not by the individual participant, to avoid identifiable information. The theoretical frameworks, standards, and models include Bloom's taxonomy; Partnership for 21st Century Skills; Levels of Teaching Innovation; Project RED; Intel Teach Program; the Technology Integration Matrices from Arizona, Florida, and Iowa; Texas STaR Chart; and the Technology Rich Unit Design and Classroom Observation Template.

In summation, an important method of instructional design for one-to-one trainings is demonstrating to teachers, as they will be presenting to students. Creating a sense of common language acts as a guide to integrate technology efficiently and effectively, making it obtainable for all teachers with different skill sets. Working

individually with teachers will help them grow as their specific requests at the point of need are addressed. In addition, by sharing professional learning opportunities online the materials are accessible to everyone, anytime, whether they are inside or outside the school system.

Learning first, technology second within curriculum and instruction. The focus of integrating one-to-one mobile technologies should be on the following questions, according to Participant 3-HL (supported by Participants 1-HL and 2-HL): What is the learning goal? What are we trying to achieve? What do we want students to learn and how can a technology tool enhance the learning? If the technology does not enhance the learning, stick with paper and pencil or a different tool.

A technology instructional coach must be a master teacher first, always speaking pedagogically and focusing on instructional purpose resources, according to Participants 5, 7, and 8-HL (supported by Participant 11-HL). Thinking beyond the digital tools and resources and achieving technical skills comes second; it is never about the device, but always about the instruction. This allows the technology to extend and enhance the students' thinking and learning, and to make lessons more engaging, hands on, and self-directed.

In contrast, Participants 1-HL, 4-HL, and 6-HL recommended that teachers should focus on the tools first to become comfortable with the devices and resources and then move into integration. Understanding pedagogy and modeling empowers teachers to understand when technology is or is not the best tool to use. However, with one-to-one technology programs, getting the devices in the hands of students and getting them

comfortable with using the devices is also important, according to Participant 9. Enhancing content areas with tools for online assessments comes next.

One district has had one-to-one technology for more than 15 years. In that district, the technology instructional coaches must work with three to six teachers who want to improve their technology usage, skills, and growth. According to Participant 10, coaches are to help teachers develop to the point where they can coach another person the next year. This aligns with the six core adult learning principles (Knowles et al., 2015): (a) learner's need to know, (b) self-concept of the learner, (c) prior experience of the learner, (d) readiness to learn, (e) orientation to learning, and (f) motivation to learn, enabling the building of skills that expand the digital learning community. It works best when the teachers want to do it themselves, so most principals ask for volunteers. One principal asked his technology instructional coach to work with a different department every year. The department test scores improved each year the coach worked with them. While it is difficult to tie the use of technology to student achievement, Participant 10 shared that a small research study conducted in her district found that the technology definitely helped students make gains, up to a point. Improvement plateaued when students got tired of the app or resource and wanted to move onto something else.

In summation, the participants reported that having one-to-one mobile technology in the hands of all students is about how technology enhances the teaching and learning process. Looking at the work of the technology instructional coaches and their impact on technology integration helps schools and districts understand the impact of the technology on student learning and expected outcomes. However, tying the use of

technology to student achievement is difficult because of the number of variables that influence achievement. However, the measurement can be the follow-up with the teachers and instructional coaches on the level of support provided after the professional development session.

Professional learning conferences and certifications for technology instructional coaches. Technology instructional coaches attend professional learning opportunities to keep their skills up to date as they work with teachers in schools and districts. Bringing training opportunities and professional knowledge experts in from outside the district, according to Participant 11-HL, especially if the experts have a specific skill set that the instructional coach does not have, allows the technology instructional coach to learn together with the teachers. One example is bringing in a Google Certified Innovator to help facilitate Google Educator Level 1 and Level 2 professional learning, not only for the teachers but also for the coaches. In addition, the importance of coaches knowing about the infrastructure side of implementing Chromebooks and having Google Admin Console training supports how the instructional and technical systems work together.

Participant 4-HL shared that other certifications such as Apple Distinguished Educator and Leading Edge were important in the weight they carry as to who the technology instructional coach is and how that person is contributing and extending his or her own learning. In contrast, Participant 1-HL shared that teachers prefer to have a coach who is well versed in instructional and questioning strategies and who understands technology tools, rather than someone with every certification who does not know how to

design a lesson. Participant 2-HL shared two other resources: using Flipboard to create a magazine for educational technology coaches to help keep everyone up to date, and Slack, a platform that provides a back channel for project management.

In summation, technology instructional coaches need professional learning opportunities just as teachers do. For instructional coaches, professional learning is important in order to continue to provide the support, training, and professional learning opportunities teachers need. Sometimes it is necessary to hire someone from the outside with a skill set from whom the instructional coaches and teachers can experience side-by-side learning. At other times, teachers and instructional coaches are one and the same. Earning industry standard certifications is another way for instructional coaches to build their own skills.

Research Question 3

Research Question 3 asked, "What are the perceptions of technology instructional coaches regarding changes in teacher practice after the professional development sessions?" Data for Research Question 3 were taken from answers to the open-ended interview questions and three themes emerged from the data: (a) Supporting content-specific teaching strategies, (b) Augmented technology usage, and (c) Increased confidence to showcase knowledge and expertise. Many key factors emerged from the themes as perceptions of technology instructional coaches regarding changes in teacher practice after professional development sessions.

Supporting content-specific teaching strategies. Embracing the integration of one-to-one mobile technology and professional learning looks different for different

grade levels and different content areas because of the tools needed. Crossover of tools enhances and transforms lessons for all teachers, according to Participant 8-HL, but there is also a need to differentiate the professional development intended for specific subject and grade levels, because generic professional development does not meet teacher needs. According to Participant 10, when grade levels or departments have programs, applications, or software that speak directly to what they do, professional development makes it easy for them to integrate; they no longer feel they must use textbooks, and they feel more comfortable in developing their own curriculum. In addition, Participant 2-HL emphasized the importance of technology integration coaches as full-time teachers who were given extra money to strengthen their own technology skills and were able to assist teachers with embedded professional learning from their own subject-area expertise.

The majority of the participants in the study shared that schools and districts that have one-to-one mobile technology introduce it primarily in middle and high school. The differentiation for different subjects is extremely important, according to Participant 5. Technology instructional coaches often reach out to their PLNs for subject-area experts to assist teachers in their content areas; middle school teachers tend to jump in first before high school teachers. In addition, secondary teachers take longer to get on board with anything that has worked with all grade levels of teachers because they are the "keeper of their keys and knowledge masters," rely more on LMSs, and the importance of workflow in preparation for college.

The content area that commonly embraces the use of technology first is English language arts, according to Participant 1-HL, because using a word processing

application for writing is simply a substitution for what they already do. In contrast, Participants 1-HL, 4-HL, 6-HL, 8-HL, and 11-HL shared that middle and high school math teachers are most resistant and struggle more with integrating technology, because they use paper and pencil most of the time. Technology instructional coaches are continually looking for practice resources and supplemental materials beyond collaborative tools for math teachers. Two of the most used collaborative tools for math are digital inking and graphing calculator applications on touch screens. Coaches also model the use of an LMS in a flipped classroom for setting up assignments and giving instant feedback.

In contrast to math, science teachers embrace the use of technology at all levels, according to Participants 11-HL, 12, and 13, because they have always had some form of technology for labs and experiments. Participants 2-HL, 6-HL, and 11-HL shared that other content areas with differentiated professional development needs were social studies; foreign languages; theater arts and drama, with apps to capture data and performance; and physical education, using drones to observe activities and Fitbits to monitor physical activity. In addition, Participant 6-HL suggested a custom app store at the secondary level was important so teachers and students can download education-only apps. Participant 4-HL suggested K–12 BluePrint (2017), which shows apps available on different platforms and offers alternatives if apps are not available.

The few schools and districts who do have one-to-one mobile technology in elementary classrooms, especially at the K-2 level, spend a lot of time teaching respect and care of the devices. This leaves little time for differentiation for student learning,

according to Participants 9, 12, and 13. Some teachers wish the technology would go away; other teachers enthusiastically use the technology on a daily basis. In contrast, writing is a major focus for Grades 3-5; teachers use the technology to find apps and resources for different publishing opportunities to engage struggling writers. In addition, professional development is grade level specific for elementary teachers with an emphasis on academic vocabulary and using digital resources such as speech to text to help all learners, especially English language learners.

Participant 10 shared another example where elementary schools have developed a professional development model with their technology instructional coaches called "tech take outs" two Fridays a month:

> The coaches look at the academic achievement data for students to see where they have struggled. They go in to the classrooms and provide six technology-enhanced activities with six different ways of learning the same concept. Two things happen: (a) Kids learn the concept. (b) Teachers have six new technology resources to use with kids that the kids know and so teachers do not have to feel they need to know everything about the technology resource because their students can be the experts.

As this participant indicated, technology instructional coaches enhance academic achievement by helping the students and teachers learn new concepts and providing an opportunity for students to become resources experts through the use of technology in the one-to-one environment.

In summation, one-to-one mobile technology programs primarily begin in middle and high school. One size professional development does not fit all, so providing differentiated learning opportunities for different grade levels and content areas can happen anytime/anywhere. The schools who do have technology at the elementary level have a focus on writing in concurrence with the secondary schools where the content area that embraces the use of technology first is English language arts. Math is the subject that tends to have the most resistance to and struggle with technology integration; in contrast, science that embraces technology at all levels due to the use of technology for labs and experiments.

Augmented technology usage. If there is going to be any change in teacher practice after professional development, technology instructional coaches have to establish a level of trust and rapport early on. However, trust and rapport are not built overnight, according to Participants 3-HL and 5, nor does change occur quickly. Participant 5 also shared that "how long it takes to adopt or integrate technology is a process, and it depends on the teacher, how comfortable they are using technology, and their personality type." However, Participant 3-HL shared that "if the device is provided and there's support, teachers will use it."

Influencing changes in teacher attitudes and practices is thinking about their role as the teacher, according to Participants 1-HL and 10, which is to facilitate student learning and to empower students to make decisions and choices about the appropriate technology tool for the job and how they want to show their knowledge. Therefore, professional development needs to model how to teach students to figure out what they

have learned and where to find any further information they need. Participant 6-HL said that most students like this way of learning, except A students—they want to know when it is due and how many pages, because that is what they are used to. In addition, Participant 5 shared how working with local business associations to train teachers in skills that employers want to see helps tie what is expected of students in the "real world" back to what teachers are preparing students for, in and out of school.

Professional development can happen anytime, anywhere, according to Participants 7 and 8-HL, when all teachers have laptops they carry everywhere. Therefore, technology strands can be woven into all curriculum development including face-to-face, short tutorials, and screencasts. Participants 1-HL, 2-HL, 3-HL, 4-HL, 5, and 6-HL discussed how technology is only a separate focus when it is a new tool, such as a new LMS or student information system; with one-to-one programs, the professional learning mostly focused on technology integration.

Teachers need 3 to 6 months to integrate technology regularly, according to Participant 1-HL, if at least three professional learning opportunities are provided with an instructional coach with a minimum of 6 days to work with teachers in their classrooms to build relationships, rapport, trust, and to learn teacher needs and wants. If teachers "don't know what they don't know, they don't know what they need," according to Participant 6-HL; "if you insist, they will resist." In addition, Participant 4-HL shared that it takes 5 to 6 years before teachers seamlessly integrate technology into daily classroom practices, including the extra time that is needed to learn and put something new into place. Yet once teachers make the transition with technology, it saves time in the long

run, so they get their time back. This will look different from classroom to classroom based on what other resources the school and/or district has available.

When coaches empower teachers to help students take ownership of their own learning, teachers are no longer the "sage on the stage" or "guide on the side." Participant 6-HL emphasized the change to being the "mentor in the center," where teachers facilitate student learning by being at the center point of the class. Teachers give the students a pathway to the learning targets, goals, and autonomy in how they learn; how the students get there is up to them. Teaching in a one-to-one environment changes the delivery of instruction, causing a major paradigm shift for most teachers. The change in teacher practice is not about the technology; it is about moving desks and chairs, getting students involved in the conversation, and becoming comfortable with demonstrating mastery in different ways. Sometimes you have to treat teachers as you would want your grandmother to be treated, according to Participant 3-HL, by being incredibly patient and knowing that you can move someone a very long way in a very short amount of time; even if they do not necessarily know what is going on, as long as they feel like they are supported and personally mentored.

Two other examples of helping teachers augment their technology usage emerged from the interviews. Participant 2-HL mentioned a student-led technology club that teaches specific computing lessons to influence learning outcomes and to assist teachers. According to Participants 12 and 13, professional development should help students and teachers be consumers and producers of information where they can collaborate and share with a more global audience using 21st century skills.

In summation, a level of trust and support has to be established early on with technology instructional coaches in order for teachers to change their technology integration practice. It can take 3 to 6 months for teachers to integrate technology regularly if they have attended at least three professional learning opportunities; it takes 5 to 6 years before teachers seamlessly integrate technology into their daily classroom practices. Emphasizing the "mentor in the center" attitude for teachers with changes in teaching and the delivery of instruction promotes a major paradigm shift for most teachers. The change in teacher practice is not about the technology, it is about becoming comfortable with demonstrating mastery in different ways by moving teachers a long way in a short amount of time if they feel like they are personally supported and mentored.

Increased confidence to showcase knowledge and expertise. As teachers increase the use and integration of one-to-one mobile technology in the daily routine of their students' learning, their level of confidence to share and highlight their knowledge and expertise with colleagues increases inside and outside of their school building. Participants 1-HL, 6-HL, 7, 12, and 13 shared that teachers needed support and modeling from technology instructional coaches that connected directly to targeted specific content areas and addressed individual teacher learning styles to gain confidence, feel comfortable and proud, and want to be more collaborative with peers. Learning from peers makes a difference, especially when one teacher says, "Oh my kids can't do that," and another teacher says, "Oh yes they can, and let me show you how I do it with my students."

Building capacity in teachers, even if the teacher is a “quiet leader,” highlights their great work, according to Participant 1-HL; their practice will change and help them become a model master teacher through self-assessment of their skills and observations from coaches and administrators. Additionally, Participants 7 and 10 shared about modeling, coteaching, and then letting teachers try the lesson on their own, always followed by a reflective period afterwards; it is very important to look at the lesson and talk about what went well and what did not go well. In particular, Participant 10 expressed how lessons and projects are highlighted with a big awards assembly every year for students and teachers. Currently over 1,400 lessons for teachers and over 1,500 student projects are on display for others to learn from and build their own knowledge and expertise.

Teachers begin to see themselves as facilitators of the learning; they give students choices and understand that they as teachers cannot possibly know how every program or piece of equipment works, so they rely heavily on the students to help each other. Participant 8-HL (supported by Participant 7) emphasized that instructional coaches help teachers to not be afraid when other teachers want to come in and see what great things they are doing in their class; coaches build relationships with a risk factor to trust each other. Participant 3-HL (supported by Participants 1-HL, 12, and 13) shared the importance of teachers teaching other teachers by building trust, relationships, and learning from each other, rather than bringing someone in from the outside. Technology instructional coaches must look at teacher confidence levels to gage the success of professional development; what teachers are doing and willing to try is where the

foundation is built with technology integration. The skill set becomes better, and practices change.

Professional development is not always just about technology, according to Participant 3-HL, but also includes cooperative learning strategies that will enhance technology. Moreover, understanding that every teacher is at a different spot on the continuum of technology integration knowledge and skills with the ISTE Standards and the SAMR model, Participant 3-HL used a train model to demonstrate the spectrum:

> In the front car of the train are all the early adopters and the people who are probably on the Ed Tech Team. It is fun to work with those people because they get it, but they are actually not the people you need to focus on. You need to focus on the people in the middle car, because they are the ones who are on the cusp and could use technology more. They are just not sure how, and so they need support. Most of the time, the people in the middle car move to the first car, and the people in the third car have a tendency to come up to the middle car, or they choose to leave.

As this participant shared, technology instructional coaches need to help and support teachers who are interested in increasing their level of technology use for students in a one-to-one environment, but are not sure what to they need to do.

The train model was parallel to the bell curve model that Participant 10 shared. At one end of the curve there is a small group of teachers who move ahead with technology integration and do not need help. The middle group of teachers is the majority; they will do anything if you help them. The third group does not want to implement technology, so

some teachers retire after the first year of one-to-one implementation. In contrast, other teachers seek out specific schools and districts because of the wealth of technology available.

One of the common ways to increase teacher confidence and to display knowledge and expertise is helping teachers grow their skills with educational technology certifications. A few of the more common certifications are Apple Distinguished Educator, Common Sense Certified Educator, Google Certified Educator, Leading Edge Certification, and Microsoft Certified Educator. Participants 2-HL, 4-HL, 6-HL, and 8-HL shared about the value of earning certifications, teachers as well as instructional coaches. Participant 2-HL noted that certifications show a developed set of skills, knowledge, and proficiencies that make teachers more employable on a curriculum vitae or resume, especially if teachers are transitional; they also give teachers a sense of pride by demonstrating to students and parents that they are ready for challenges in the classroom. However, Participants 1-HL, 4-HL, and 8-HL all shared that while it is important for teachers to know about certifications, certifications may not be right for everyone and can be a source of added stress.

There are many commonalities throughout classrooms in lower grade levels where the students talk at recess, according to Participant 5; if one teacher is doing something that might be a competitive edge, it trickles into other classrooms, because teachers rely on each other and want to provide similar lessons. In parallel, at the secondary level, Participant 11-HL shared that when his district's one-to-one mobile technology program started over 10 years ago, there was a lot of resistance by the

teachers. However, the students kept the technology alive inside and outside of school, using tools and resources like Google Hangouts and the school YouTube channel, because it is the world they live in; they helped the teachers see why it was important.

Participant 8-HL shared a technology teacher certification within her the district: a checklist of basic technology literacy skills for teachers to know, called the teacher validation levels:

> It is an optional professional learning opportunity where at the end of the year, the director of technology and the principal go in and award a certificate for the four levels: yellow, red, green, and blue. About 40% of teachers completed the yellow level (first level) with no compensation, simply wanting to increase their skill level, and were also rewarded at the end of the year. It is important to note that the director of technology provides professional development to secondary teachers and administrators in addition to the teacher technology specialists.

As this participant shared, many teachers want to increase their technology skill level and being rewarded is a bonus and it is not always technology instructional coaches who provide professional learning opportunities for teachers.

In summation, as teachers increase the use of technology and integration in their teaching practices, they increase their level of confidence to share their knowledge with colleagues. By building trust and relationships, learning from peers, instead of bringing an expert in from the outside, makes a difference in what teachers think they can and cannot do. Understanding that every teacher is at a different place on the continuum of technology skills and integration provides starting point for technology instructional

coaches to begin to help teachers where they are, with the goal of supporting all teachers from their starting place. This is a model of differentiation for teachers that gives them a sound approach for differentiating for their students. As teachers progress in their knowledge and skills, technology certifications encourage them to display their expertise.

Research Question 4

Research Question 4 asked, "What are the perceptions of technology instructional coaches regarding changes in teacher attitudes after the professional development sessions?" Data for Research Question 4 were taken from answers to the open-ended interview questions and two themes emerged from the data: (a) Building collaborative, job-embedded teacher agency with ongoing support; (b) Personalized learning with differentiated delivery of professional development.

Building collaborative, job-embedded teacher agency with ongoing support. When teachers feel supported and know it is safe to fail, they are willing to try new things in their classrooms. This is especially true when they understand how technology can enhance their workflow and efficiency and move toward more integration and innovation. Participants 1-HL, 2-HL, 3-HL, 4-HL, 5, 6-HL, and 7 shared that facilitating teacher interests, giving choice and flexibility, providing recognition, and empowering teachers to take an active role in their professional learning were significant factors in changing teacher attitudes.

Attitudes change and improve over time, according to Participants 12 and 13. Teachers first say, "I am terrible with technology," but when they go through a friendly, collegial, supportive series of professional development sessions, they become more open

to trying technology and doing things they never dreamed they could do. Attitudes improve with good professional development that demonstrates solid, academically rigorous modeling of how technology can be used. Some teachers who are negative will be negative forever—their attitude is entrenched—but that is a small percentage. Most teachers become more interested when they see the wide variety of tools that are available to them and examples of how to use them, and then they can advance their own skills. Once teachers who are on the fence start seeing more of what the technology can do and how they and their students can use it, they become excited and confident.

Job-embedded professional development in small groups with differentiated instruction by grade level or content area helps teachers build their agency and capacity. As Participant 1-HL stated, “The person doing the work is who is doing the learning, so give more control to the teachers in the training and they will learn more.” Several of the participants (1-HL, 4-HL, 6-HL, 8-HL, 11-HL, 12, and 13) indicated that they seek ways to help teachers connect with what they and their students need and provide time with a coach to mentor and implement ideas. Participant 1-HL shared that students and teachers attend professional development together. Participant 2-HL shared that student mentors help when needed, and Participant 8-HL explained the “nerd herd,” where middle school student help with basic skills for teachers and students. Participant 3-HL shared that teachers usually have a tool belt of three to five things that they like to use; having coaches or other colleagues introduce bigger and better tools is empowering for teachers. In contrast, some teachers find only one tool at a time that they feel comfortable using with their students, and then coaches can convince them to learn more. At the K-5 level,

it is more about skill development, with a focus on specific tools; at the middle school level, it is more about having students create and collaborate.

In one district, Participant 9 shared, the use of technology is a daily expectation; when attending professional development, teachers use a self-selection process to rate themselves by their comfort level on their use of technology. This idea failed at first when the teachers who were not comfortable with using technology were partnered with people who were comfortable, because some teachers felt like failures. One teacher sought out classes to learn on her own so that she would feel better about the process; another teacher gave up and retired. The level of enthusiasm and engagement in how deep the teachers and students take the learning with the technology has greatly increased, as noted through observation walkthroughs.

According to Participants 1-HL and 6-HL, giving teachers support with setting goals or creating a plan to use technology in their classrooms helps teachers understand that they do not have to learn everything at once; they are never going to keep up with the technology, but that is okay. The technology instructional coaches are there to provide support and resources, make sure teachers get answers to their questions, and enhance the student learning experience. In addition, teacher confidence levels will rise and their attitudes will positively change when they feel supported by coaches, administrators, and other teachers, and see things succeed in their classrooms with students. Opening doors with tools and resources that teachers ask for, helping them grow professionally, and watching them become the expert by putting light on teachers that are using specific tools

to share with other teachers provides more meaning, because learning is different when it comes from peers.

Participant 4-HL shared that prior to one-to-one mobile technology, each teacher would complete a training and receive a laptop, complete another training and receive a projector, and so on; they were learning to walk before they ran with technology. Now that teachers can become overwhelmed by the many choices of digital tools and resources to use with one-to-one programs, technology instructional coaches recommend setting yearly goals. For example: This year, everyone will use the LMS, and each teacher will choose to learn five apps targeted to a particular subject, content area, or grade level.

Participant 6-HL (supported by Participants 4-HL and 7) shared a different approach, called an individualized tech plan. It is based on each staff member's technology skill set to bring teachers along at their own pace with a personal, individualized timeline. The teachers like the pedagogical shift of taking the technology, enhancing the learning, and allowing students to take ownership of their own learning, as opposed to canned professional development. Having time to try things out, come back, and ask meaningful questions for support translates into changing and improving teacher practices. The individualized tech plan helps the technology instructional coaches build rapport with staff by letting them know that using technology is sending their students on a learning journey, making learning fun, and then building confidence together. Teachers are more involved in the ownership of their professional learning and choose to develop as a professional outside their regular school day. Teachers want change and are tired of the same old schooling that has been going on for 100 years. They are starting a

movement as trendsetters and trailblazers to deviate from the status quo, which is hard to do because schools are so institutionalized.

Participants 1-HL and 5 emphasized the need to build a culture of trust and breaking down idea that technology is only used one way or must be perfect. Teacher attitudes toward integrating technology can be fear, frustration, or apprehension in the beginning; according to Participants 1-HL, 5, 7, 8-HL, and 11-HL, they think of it as one more thing to do that they must figure out on their own. However, there is also a certain level of comfort in knowing support is available. Participant 5 also shared that having all the technology in the classroom provides countless opportunities for new learning and teaching strategies; however, the biggest barrier to integrating one-to-one mobile technology is not teacher attitudes about professional development but teacher doubts whether the technology actually works.

Using standards in professional development can help teachers show a positive attitude, according to Participant 8-HL, and help teachers understand why training covers some of the things they are learning. One of the professional learning standards from Learning Forward is that teachers need to know why they are doing something. However, Participant 10 shared the following (with agreement from Participants 6-HL and 8-HL):

> I do not think any teacher's attitude is going to change by going to a PD session. I think it is a coaching one-to-one relationship that changes teacher abilities to integrate the technology. It is not a matter of them having a bad attitude or a good attitude, it is being willing to try something new. Some teachers do not want to use technology, and a lot of time was spent trying to make sure that they did. This

> was not working, and now we focus our attention on the people that want to change. The group of teachers that are able to function without us has gotten bigger each year, and we still have the group in the middle that need help, but the people that are not willing to try is teeny-tiny, if at all.

As this participant indicated, coaching teachers who want to learn something new and change their practice of integrating technology in a one-to-one environment is where the attention and focus should be for technology instructional coaches.

In summation, when teachers feel supported and know it is safe to fail, they are willing to try new things in their classrooms, especially if they understand how technology can enhance their workflow, make them more efficient, and move toward more integration and innovation. Changing teacher attitudes to fully embrace technology integration requires facilitating teacher interests, giving them choice and flexibility, providing recognition, empowering them to take an active role, opening doors with tools and resources that teachers ask for, helping them grow professionally, and watching them be the expert. Job-embedded professional development in small groups, with differentiated instruction by grade level or content area, helps teachers build agency and capacity. However, if the network and infrastructure cannot handle the load, teachers become frustrated and their attitude negatively changes.

Personalized learning with differentiated delivery of professional development. Providing differentiated professional development opportunities by department and grade level encourages more teachers to use technology. Participant 4-HL emphasized the convergence between technology and content-specific curriculum

resources promotes connected learning for teachers; teachers also want to know how many credit hours and recertification credits they will earn. Schools, departments, and grade levels develop their own character, according to Participant 3-HL; one person can have a major impact on the way the department or grade level runs. Teachers' willingness to try new things rubs off on each other and positively impacts teacher attitudes, according to Participant 7; providing access to experts outside of school so teachers can integrate technology in meaningful ways is an important investment by school leadership.

Participant 6-HL emphasized the importance of helping teachers build their PLN and become both well-rounded professionals and lifelong learners. Teachers are able to build their PLN by leveraging the power of Twitter, Google+, Facebook, Google Educator Communities, webinars, Ed Camps, Ignite presentations, Ted Talks, Ed Chats, and attending conferences (Participant 4-HL). Teaching teachers how to do build their PLN is of utmost importance to increase their confidence, because otherwise they live in a silo.

Finding financial resources to help teachers present at conferences is important, according to Participants 2-HL and 11-HL; teachers want to present at conferences, and this is a great way to celebrate the teacher knowledge and learn about a school and district's one-to-one mobile technology identity, attitude, and culture. After teachers attend conferences, they have an epiphany, stated Participant 6-HL:

> Wow, it is not just us! This is a movement happening all over with technology and we have to be a part of it or we were going to be left behind. When you get a bunch of people in a room, the smartest person in the room is the room, because

> everyone has something to share. This is why Ed Camps are so much fun to attend, because teachers build and direct the professional learning and everyone shares.

As this participant shared, providing opportunities for teachers to learn from others who have the same focus around technology integration increases the excitement around the use of technology in the one-to-one environment through sharing similar experiences.

In contrast, schools that have attended and presented at multiple ISTE Conferences, as Participant 2-HL shared, found that they were giving more than they were getting. As a result, they do more Edcamps and Google Summits. Additionally, more schools are moving to the "unconference" type of professional learning, according to Participant 1-HL, where teachers ask what they want to learn and then schools find internal support to make it happen.

According to Participants 8-HL and 11-HL, professional development allows teachers to express where they are and what they are thinking, promote their membership in a team or professional learning group, and be treated like professionals to empower their learning. Collaboration occurs when teachers can get together face to face or online, come together to connect, and share best practices with the goal to increase student engagement with extending thinking and differentiating learning. The feedback from the different stakeholders in the school community determines the effectiveness of the professional development.

In some schools, the expectation is that everybody is using technology and this provides a plan for effective integration. Participant 7 shared that technology integration

is a part of teacher evaluation, so teachers understand that and view observations as helpful. In support, Participant 10 shared how the technology instructional coaches helped facilitate a peer-to-peer observation protocol. Teachers used a stop light to signal whether it was a good time for observation: Red = “I am testing, do not come in.” Yellow = “You can come in, but it is not a good time.” Green = “Come in anytime, open door policy.” Teachers understand that using technology to replace what they did without technology is not real integration. It takes a while to use technology to do the things only technology can do.

In contrast, Participant 11-HL shared that when you tell everyone they have to do something, the ones who do not want to do it are not going to do it. They do not pay attention during the professional development; then they do not really know what they are doing, and what they try to do in their classroom fails. Yet, when you tell them they cannot be a part of the group, they want to be part of the group.

Participant 6-HL shared an example of personalized learning: District trainers and digital coaches go to buildings after school and host food and professional development sessions as a social event to have fun and learn, called “Google and Grub.” The relaxed environment has gained popularity, and teachers at schools that are not hosting these events have put pressure on their administrators to request them. Participants 3-HL, 12 and 13 emphasized connecting with each teacher personally to find out what they need; spending whole days at schools for teachers to ask their specific questions and teach side by side and model strategies for teachers to use with their students changes teachers attitudes.

Teachers who want professional development will ask for it because they know when they are ready and committed to learning, usually when it is working successfully, according to Participant 11-HL; this is how the desire to learn spreads to other teachers. Teachers mentor and share with other teachers, but teachers want to be the ones to decide when and how they are learning. Additionally, Participant 11-HL shared that having face-to-face professional development from vendors became too expensive; most of the time was not about instruction but about how to run their program. Professional learning now occurs remotely for one hour at a time with great success during department and grade level planning meetings; these sessions occur more frequently rather than just a few times a year. Teachers are on task and engaged for one hour and they know what questions to bring; since it is during the school day, there is more commitment from teachers.

Certifications improve the credibility of being a technology instructional coach, but it is important that teachers do not feel that the coach is gaining an advantage over them. Participant 3-HL said that he encourages teachers to obtain certifications and earn badges and micro-credentials as well, to increase their credibility with students, parents, and other teachers; there was more enthusiasm for all teachers to become Google Level One Certified when it was a goal for accreditation for their school. In addition, Participant 6-HL pushes coaches and teachers to go outside of their comfort zone to earn certifications because it will open up more doors for them and is inspirational for people to see. People look at it and say, “Wow, you are ascending and I want to continue on a path like you have paved for yourself.”

In summation, providing differentiated professional development opportunities by department and grade level promotes positive teacher attitudes. More teachers agree to use technology when they are part of a team or professional learning group or attend after-school sessions with food and 1 hour planning meetings. Helping teachers build their PLN and attend conferences helps build teacher confidence so they do not feel like they are living in a silo.

Summary

In Chapter 4 I presented findings based on the data analysis that answered the four research questions. Data were coded, and multiple themes emerged from the data for each research question. Research Question 1 asked: "What professional development principles do technology instructional coaches use in designing professional development for one-to-one mobile technology programs?" Themes that emerged for Research Question 1 were (a) Supportive advocacy leadership, (b) Building culture and trusting relationships, (c) Instructional design supported by standards and frameworks, (d) Promoting classroom management with technology, and (e) Professional learning coaching opportunities for technology instructional coaches.

The findings were rich, and the data showed the high-level technology instructional coaches not only added more information but took the themes to a deeper level including sharing how administrators who advocate the use of technology have difficulty knowing the best way to support their teachers because many have never taught with one-to-one technology. The coaches emphasized the need for understanding and helping teachers obtain the skills they need to use technology within specific content

areas and knowing the research behind how to use one-to-one technology influences student learning. Providing professional development on the importance of teaching about “digital footprints” creates a strong digital citizenship culture. They also shared how cognitive coaching (A. L. Costa, Ellison, Garmston, & Hayes, 2016) and instructional coaching (Knight, 2007) support technology instructional coaches as they build relationships, develop as good listeners, and focus on communication to help teachers with pedagogical shifts in their teaching.

Research Question 2 asked: “What professional development practices do technology instructional coaches use in designing professional development for one-to-one mobile technology programs?” Themes that emerged for Research Question 2 were (a) Supportive participatory leadership; (b) Building culture and mentoring relationships; (c) Instructional design modeled by standards and frameworks; (d) Learning first, technology second within curriculum and instruction; and (e) Professional learning conferences and certifications for technology instructional coaches.

Emphasis is placed on basing decisions on instructional needs, not on IT wants (excluding laws, regulations, and policies) where learning is first and technology is second. The enthusiasm of the technology instructional coach builds culture and mentoring relationships and the importance of branding a professional learning space by name invites teachers to come and learn. Using a prototype or cohort model that emerged from extensive research creates a foundation for building a one-to-one technology program. Additionally, integrating theoretical frameworks, models and standards such as BrightBytes Technology & Learning module, ISTE Standards for Students (2016),

SAMR (Puentedura, 2013), and TPACK (Koehler & Mishra, 2009) to create a common language acts as a guide to integrate technology efficiently and effectively, making integrating technology obtainable for all teachers.

Research Question 3 asked: "What are the perceptions of technology instructional coaches regarding changes in teacher practice after professional development sessions?" Themes that emerged for Research Question 3 were: (a) Supporting content-specific teaching strategies, (b) Augmented technology usage, and (c) Increased confidence to showcase knowledge and expertise.

Middle and high school math teachers are found to be most resistant and struggle more with integrating technology because they use paper and pencil most of the time. With one-to-one programs, professional learning is mostly focused on technology integration and is only a separate focus when it is a new tool, such as a new LMS or student information system. Recognizing that teachers need 3 to 6 months to integrate technology regularly if at least three professional learning opportunities are provided with a technology instructional coach with a minimum of 6 days with teachers in their classrooms, and it takes 5 to 6 years before teachers seamlessly integrate technology into daily classroom practices. Teaching in a one-to-one environment changes the delivery of the instruction causes a substantial paradigm shift for most teachers by moving from the "sage on the stage" and the "guide on the side" to the "mentor in the center." Teachers facilitate learning by giving students a pathway to learning targets, goals, and autonomy in how they learn. Earning educational technology certifications such as Apple Distinguished Educator, Common Sense Certified Educator, Google Certified Educator,

Leading Edge Certification, and Microsoft Certified Educator is one of the common ways for teachers to increase their confidence, display knowledge and expertise and grow their technology integration skills.

Research Question 4 asked: “What are the perceptions of technology instructional coaches regarding changes in teacher attitudes after professional development sessions?” Themes that emerged for Research Question 4 were: (a) Building collaborative, job-embedded teacher agency with ongoing support and (b) Personalized learning with differentiated delivery of professional development.

Facilitating teacher interests, giving choice and flexibility, providing recognition, and empowering teachers to take an active role in their professional learning were significant factors in changing teacher attitudes. Seeking ways to help teachers connect with what they and their students need and provide time with a coach to mentor and implement ideas is central. Also, giving teachers support with setting goals or creating an individualized tech plan helps them work through their fear, frustration or apprehension of integrating technology. The pedagogical shift that occurs allows students to take ownership of their learning. Recognizing that teachers need help in building their PLN and attending conferences helps increase teachers’ confidence, so they do not feel like they are living in a silo.

The results of this study show that principles and practices in technology professional development for one-to-one mobile technology programs impact how technology is integrated into classrooms based on many different levels of support provided; technology instructional coaches perceived positive changes in teacher

attitudes and practices. In Chapter 5, I discuss the purpose of the study, the interpretation of the findings of this study, the limitations of the study, my recommendations, and the implications for positive social change.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this qualitative, in-depth interview study was twofold. The first purpose was to examine professional development principles and practices used by technology instructional coaches to facilitate the integration of one-to-one mobile technologies into K–12 student learning experiences. The other purpose was to explore the perceptions of technology instructional coaches regarding changes in teacher practice and attitudes following professional development trainings. I combined Knowles' (1975) theory of andragogy and Koehler and Mishra's (2009) pedagogical framework, TPACK, to create the conceptual framework that undergirded this study.

The qualitative, in-depth interview study design best suited the research problem, purpose, and questions of this study because it allowed me to explore the perceptions of technology instructional coaches and how they developed and delivered professional development programs for one-to-one technology programs and the changes in teacher practice and attitudes following professional development training. I chose this design because it was most suitable for "studying the meaning of people's lives, as experienced under real-world conditions" (Yin, 2016, p. 9). I explored technology integration uses by instructional coaches who had developed and delivered technology professional development programs by focusing on the *what* and *how* of different one-to-one mobile technologies practices and strategies.

The participants perceived that professional development principles used in designing professional development for one-to-one mobile technology programs focused on the need for advocative, supportive, and participatory leadership who promote a

positive digital learning culture and know the vital role of the technology instructional coach to provide immediate and ongoing support for teachers. They felt that district and building administrators must understand the value of integrating technology to encourage buy-in from all stakeholders and the importance of ensuring the budget is a priority from the beginning of the rollout process and throughout implementation. The participants stated that for technology instructional coaches to build a culture of trusting relationships with teachers, personalized professional learning must be timely, short and to the point, practical, targeted, meaningful, cost-effective, self-directed, and sustained. They thought it best to avoid brief, sporadic, episodic, top-down, and fragmented support. Another priority the participants shared was the promotion of instructional design that is supported by technology standards and frameworks. They also thought it imperative that instructional design includes elements that meet the need for student digital fluency. Classroom management strategies are vital to promoting learning first and technology second with curriculum and instruction, and providing professional learning opportunities for technology instructional coaches are essential to supporting and assisting teachers. To better support and assist teachers, technology instructional coaches recommended that they attend professional learning conferences and that the earning of certifications should be promoted, supported, and funded by leadership.

My analysis of the perceptions of the participants regarding positive changes in teacher practice and attitude after professional development sessions found that supporting content-specific teaching strategies increased teaching agency. Ongoing personalized learning and augmented technology usage with students increased

confidence to display knowledge and expertise with others, and following up with collaborative, job-embedded support was also emphasized. In Chapter 5, I present the interpretation of the findings, limitations of the study, recommendations for further research, implications of the study including social change and recommendations for practice, and the conclusion.

Interpretation of the Findings

The findings addressing the four research questions showed evidence that there was an integration of overarching similarities juxtaposing the themes of the research question themselves. The technology instructional coaches revealed that the principles they used in designing professional development for one-to-one mobile technology programs promoted teacher agency. In many cases, practices that were integrated into teaching became principles. Andragogy-focused (Knowles et al., 2015) professional development enriched teacher attitudes and agency positively while increasing technology use in their pedagogical practices. All of the integrated themes encircle the TPACK (Mishra & Koehler, 2006) framework as the foundation of professional learning opportunities for K–12 teachers, as shown in Figure 1.

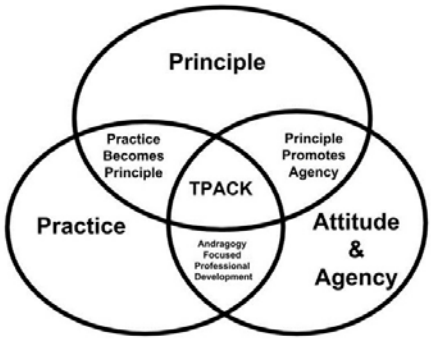

Figure 1. Interpretation of research findings.

I have divided this section according to the three major areas found: principle promotes agency, practice becomes principle, and andragogy-focused professional development. The sub-themes are explained in each of the following sections.

Principle Promotes Agency

The five themes that emerged from the principles that technology instructional coaches use in designing professional development for one-to-one mobile technology programs that answered Research Question 1 shared a direct correlation in determining the five themes that emerged from the practices that answered Research Question 2. The findings showed that the standards, philosophies, ideals, and guidelines that are followed when developing strategies and techniques to be delivered in professional development promote teacher agency (see Calvert, 2016) and attitude. In the following five subsections, I will discuss the themes that emerged from Research Question 1 to further explain how each theme connected or supported TPACK (see Koehler & Mishra, 2009) and how it confirmed or disconfirmed the literature review.

Supportive advocacy leadership. The findings showed that one way to ensure teachers feel comfortable with technology is to provide adequate and meaningful (Storz & Hoffman, 2013; Topper & Lancaster, 2013) professional development at least 6 months before a school or district begins the device roll out. During the first year or two of implementation, the focus needs to be all about the technology with a vision, buy-in from all stakeholders, and a budget priority; tremendous support of pedagogical practices must continue for the next few years because other trends or focuses become a priority, and technology can take a back seat (Richardson et al., 2013). School administrators must

promote a positive digital learning culture and play a vital role as the leaders (Lim et al., 2013) in their schools with one-to-one technology integration and sustain a technology instructional coach to provide immediate and ongoing help. In many cases, administrators have challenges because they may never have taught with one-to-one technology themselves.

Building culture and trusting relationships. The findings showed that to build culture, relationships, and teacher agency, even something that may seem as insignificant as the title of the position makes a difference in how other teachers perceive technology instructional coaches. Teachers want personalized and customized professional learning opportunities (Murray, 2014; Siko & Hess, 2014; TNTP, 2015) that are short, practical, to the point, and have a genuine purpose, with more time to process what they have learned. It takes a special personality to build relationships, establish rapport and trust, have a good technology skill set, and facilitate a culture to provide the just-in-time support (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012). Risk-taking, modeling, hand-holding, coteaching, hands-on practice, providing time to implement, and acting in a liaison role between teachers and IT are the support technology instructional coaches provide to teachers that make a difference for teachers of all content areas in integrating one-to-one mobile technology.

Instructional design supported by standards and frameworks. Technology instructional coaches need to know instruction and understand the design of a lesson (Dabner, Davis, & Zaka, 2012) and how the one-to-one technology fits into the lesson in particular content areas. In addition, the need for digital fluency for students in lesson

design is now a priority and necessity, no longer a luxury. It is also necessary to know Learning Forward's (2011) professional learning standards and ISTE's Essential Conditions (n.d.a) because the technology creates a significant shift in teaching practices.

Promoting classroom management with technology. The focus of integrating one-to-one mobile technologies, whether school-issued or BYOD/BYOT, must be compatible with all learning systems, and the devices must be tracked, filtered, and controlled as needed. Depending on the devices used at each grade level, teaching keyboarding to students and preparing teachers how to teach keyboarding is beginning in earlier grades. Additionally, a strong digital citizenship culture (Partnership for 21st Century Learning, 2015) should be established along with an emphasis on other digital literacies to assist with classroom management of devices.

Professional learning coaching opportunities for technology instructional coaches. Coaching models (A.L. Costa et al., 2016; ISTE, 2011; Knight, 2007; Sugar & Slagter van Tryon, 2014) are essential for communication, building relationships, and being a good listener to help teachers make a pedagogical shift. Coaches (D. Wilson & Alaniz, 2015) need time to learn and reflect to help develop their own skills; attending local, regional, national, and international technology conferences help them learn not only new things but also present and share their skills with others. In addition, professional associations, organizations, and resources help coaches and teachers grow their own PLN (Brooks & Gibson, 2012).

Practice Becomes Principle

The five themes that emerged from the practices that technology instructional coaches use in designing professional development for one-to-one mobile technology programs that answered Research Question 2 shared a direct correlation with the five themes that emerged from the principles that answered Research Question 1. The findings showed the practices that coaches implement and follow when developing strategies and techniques to deliver in professional development tend to become principles that others want to model. In the following five subsections on the themes derived from Research Question 2, I further explain the findings for each theme, how it is connected or supported by TPACK (Koehler & Mishra, 2009), and how it compares/contrasts with or is supported in the literature review.

Supportive participatory leadership. Supportive leadership provides time (Aldunate & Nussbaum, 2013; Coklar & Yardakul, 2017; Intel Education, 2014; Keengwe et al., 2012; Kopcha, 2012; Learning Forward, 2011; Skoretz & Childress, 2013) for professional learning opportunities on an ongoing basis in many different ways for teachers, whether during the school day by providing substitute teachers or during other scheduled times. Many administrators also facilitate and lead sessions themselves to model technology integration strategies in trainings and meetings. Leadership helps promote collaboration (Gormley & McDermott, 2014; Intel Education, 2014; Partnership for 21st Century Skills, 2015; Stewart, 2014; Voogt, Erstad, et al., 2013) and provides the opportunity for technology instructional coaches with curriculum and instruction expertise (Sheninger & Murray, 2017); content knowledge (Cordingley, et al., 2015,

DeMonte, 2013; Murray, 2014); and pedagogical skills (Clarke, 2012; Knowles et al., 2015; Sell et al., 2012) to come together with the IT staff and have a good relationship so that the needs and wants of all stakeholders are met.

Building culture and mentoring relationships. Building culture and mentoring relationships are about focusing on the teachers who want to learn how to integrate one-to-one mobile technology into their teaching (U.S. Department of Education, Office of Educational Technology, 2016). One proven method was using a prototype model before the expectation to move to a program level. The prototype model established the early adopters by grade level and department to help develop a support system where teachers felt comfortable discussing what was happening in their classrooms with technology integration. Similarly, three essential emphases were creating an experience to build excitement, providing training on how to use the technology, and having job-embedded professional development support with integration (Slavit & McDuffie, 2013; Stienke, 2012; Topper & Lancaster, 2013).

Instructional design modeled by standards and frameworks. An important method of instructional design is demonstrating to teachers, including the use of theoretical frameworks (Knowles, 1975; Koehler & Mishra, 2009); models (Partnership for 21st Century Learning, 2015; State Educational Technology Directors Association 2015); and standards (ISTE, n.d.a.) because they will be presenting to students. Creating a sense of common language acts as a guide to integrating technology efficiently and effectively, making it obtainable for all teachers with different skill sets. Working one-on-one will help teachers grow individually by addressing their specific requests at the

point of need and sharing professional learning opportunities online, so the material is accessible to anyone, anytime, anywhere (see Zheng, Warschuer, & Farkas, 2013), inside or outside the school system.

My analysis and interpretation of the findings in the context of self-directed learning and adult learning theory (andragogy) supported the contention of Brooks and Gibson (2012) and Steinke (2012). First, professional learning opportunities for teachers should model what teachers do to extend and enhance student thinking and learning. Additionally, it is imperative that teachers use these principles to make lessons more engaging.

Learning first, technology second within curriculum and instruction. The thinking behind having one-to-one mobile technology in the hands of all students is about the student learning and expected outcomes and how the technology enhances the teaching and learning process. Looking at the work of the technology instructional coaches and their impact on technology integration based on professional learning opportunities that teachers attend will help schools and districts know the effect of the technology. However, tying the use of technology to student achievement is difficult because there are too many variables, even though teacher contact hours in professional development opportunities are considered (Ghamrawi, 2013; Yasar et al., 2014). The measurement can be the follow-up with the teachers and instructional coaches on the level of support provided after the professional development sessions achievement (Ghamrawi, 2013; Guskey & Yoon, 2009; Spires, Weibe, et al., 2012).

Professional learning conferences and certifications for technology instructional coaches. Technology instructional coaches need professional learning opportunities just as the teachers do if they are to provide support, training, and professional learning opportunities to teachers. Sometimes it is necessary to hire someone from the outside who has a skill set that the instructional coaches can learn from a side by side with the teachers; other times teachers and instructional coaches are the same. Earning industry standard certifications is another way for instructional coaches to build their skills (Murray, 2014; Stewart, 2014).

Andragogy-Focused Professional Development

Andragogy-focused professional development emphasized the six core adult learning principles (Knowles et al., 2015): (a) learner's need to know, (b) self-concept of the learner, (c) prior experience of the learner, (d) readiness to learn, (e) orientation to learning, and (f) motivation to learn. The following five themes emerged from the perceptions of technology instructional coaches regarding changes in teacher practice, attitude, and agency after attending technology professional development sessions and answered Research Questions 3 and 4. The findings are further explained for each theme, how it is connected or supported by TPACK (Koehler & Mishra, 2009), and how it compares/contrasts with or is supported by the literature review.

Supporting content-specific teaching strategies. Providing professional development for different grade levels and content areas promotes differentiated learning where one size does not fit all and happens anytime, anywhere, with one-to-one mobile technology beginning primarily in middle and high school. The schools who have

technology at the elementary level focus on writing; similarly, the content area that embraces the use of technology first in secondary schools is English language arts, confirming the findings of Inserra and Short (2013). Math is the subject that tends to have the most resistance and struggle with technology integration, aligning with the findings of Zuber and Anderson (2013), where secondary math teachers believed that "real mathematics" was done with paper and pencil. In contrast, science embraces technology at all levels due to already using some form of technology for labs and experiments, aligning with the findings of Purcell et al. (2013) and Wang et al. (2014).

Augmented technology usage. A level of trust and support has to be established early on with technology instructional coaches in order for teachers to change their practice with technology integration. The findings about change in teacher practice after professional development sessions extend the knowledge in the discipline about how long it takes to adopt or integrate technology by adding to the research of Ghamrawi (2013); Guskey & Yoon (2009); Spires, Weibe, et al. (2012); and Yasar et al. (2014). It takes 3 to 6 months for teachers to integrate technology regularly if they have at least three professional learning opportunities with an instructional coach; it takes 5 to 6 years before teachers seamlessly integrate technology into daily classroom practices. Emphasizing the "mentor in the center" attitude for teachers with changes in teaching and the delivery of instruction promotes a major paradigm shift for most teachers. The change in teacher practice is not about the technology; it is about becoming comfortable with demonstrating mastery in different ways by moving teachers a long way in a short amount of time if they feel like they are personally supported and mentored.

Increased confidence to showcase knowledge and expertise. As teachers increase the use of technology and integration in their students' learning, their level of confidence increases to share their knowledge with colleagues. Learning from peers makes a difference in what teachers think they can and cannot do. Building trust and relationships to help and support colleagues within a school aligns with D. Wilson and Alaniz (2015), rather than bringing an expert in from the outside. Understanding that every teacher is at a different place on the continuum of technology integration and skills guides technology instructional coaches to help teachers where they are, with the goal to support all teachers from their starting place. As teachers progress in their knowledge and skills, technology certifications encourage them to display their expertise.

Building collaborative, job-embedded teacher agency with ongoing support. When teachers feel supported and know it is safe to fail, they are willing to try new things in their classrooms, enhance their efficacy (Aldunate & Nussbaum, 2013; Minshew, Caprino, et al., 2014; Skoretz & Childress, 2013) especially when they understand how technology can enhance their workflow, efficiency, and move toward more integration and innovation. Facilitating teacher interests, giving choice and flexibility, providing recognition, empowering them to take an active role, opening doors with tools and resources that teachers ask for, helping them grow professionally, and watching them be the expert is a significant part of changing teacher attitudes to embrace technology integration fully. Teachers who have the opportunity to attend job-embedded professional development in small groups with differentiated instruction by grade level or content area helps them build their agency (Calvert, 2016) and capacity. However, if the network and

infrastructure cannot handle the load, teachers become frustrated and their attitude changes negatively.

Personalized learning with differentiated delivery of professional development. Providing differentiated professional development opportunities by department and grade level promotes positive teacher attitudes. In addition, more teachers agree to use technology when they are part of a team, professional learning group, or when they attend after-school sessions with food and 1 hour planning meetings. Helping teachers build their PLN (Brooks & Gibson, 2012) and attend conferences provides the power of many technology resources and helps build teachers' confidence, so they do not feel like they are living in a silo.

The findings about professional development supported the research by Guskey (2000) that professional development for K–12 teachers needed to be continuous and ongoing. The findings also supported the importance of learning communities brought out by Murray (2014) and Slavit and McDuffie's (2013). One-to-one mobile technology professional development for K–12 teachers includes AR or teacher inquiry, peer coaching, Edcamp, content specific for math and science, online communities of practice and personal and PLNs, online and blended learning courses, SAMR model, technology-related teacher professional development, and video and multimedia anchored instruction.

Limitations of the Study

The limitations of this research study are influences that I could not control. This included the number of technology instructional coaches available for interviews, the

time constraint of collecting data within 3 months, and the interview questions that I created as a researcher. The indicated limitations lead to findings that can be generalized to a larger population utilizing themes that were developed using manual coding techniques of the interviews.

Due to the nature of the data (interviews with technology instructional coaches), a limitation of the study was not having other stakeholders included. Interviews with teachers and administrators might have provided clarification about their roles in establishing principles and practices with their one-to-one technology programs. Without access to such perceptions, it is unclear how teacher and administrator data could have provided additional insight to making the study results more transferable to a wider audience.

As with any conceptual or theoretical framework, limitations and weaknesses in the TPACK framework are recommendations for future research studies. Currently, TPACK focuses on the *what* of technology integration, such as what is being taught and what technology tools are being used. On the other hand, Kimmons (2015, p. 74) argues the approach should be on the *why* and *how*, asking such questions as “why is this effective?” and “how is this impacting learning?”

Recommendations for Further Research

The following recommendations for further research, grounded in the strengths and limitations of the current study as well as the literature reviewed in Chapter 2, are based on the participants’ perceptions of professional development principles and

practices for one-to-one mobile technology programs regarding changes in teacher practices and attitudes:

1. Qualitative research is needed to explore teacher perceptions about professional development principles and practices for one-to-one mobile technology programs. Further study could show any similarities to and differences from the perceptions of technology instructional coaches.
2. Additional qualitative research is needed around specific instructional coaching models used in designing professional development for one-to-one mobile technology programs. The data showed that cognitive coaching (A. L. Costa et al., 2016) and instructional coaching (Knight, 2007) were the two primary approaches that technology instructional coaches used. Study of these models could provide further insight into designing professional development.
3. Further qualitative research is needed to study the limitations and weaknesses of the TPACK framework. Currently, TPACK focuses on the *what* of technology integration, such as "what is being taught" and "what technology tools are being used." On the other hand, Kimmons (2015, p. 74) argued the focus should be on the *why* and *how*, asking such questions as "why is this effective?" and "how is this impacting learning?"
4. Quantitative research is needed to explore the scale of integration of the one-to-one mobile technology and the impact of technology instructional coaches on learning outcomes using standardized test scores or grade point averages. This research could also provide data related to return on investment for

schools and districts, including the one-to-one devices, infrastructure, and human resources.

Implications

The exploration of the perceptions of technology instructional coach regarding the professional development principles and practices they used in designing professional development for one-to-one mobile technology programs revealed a useful information that could help a variety of educational stakeholder. Data about changes in teacher practice and attitudes after their participation in professional development may provide schools and districts with insight about how, when, where, and why professional development impacts technology integration in classrooms. What follows is a discussion of the implications associated with positive social change and recommendations for practice.

Social Change

The perceptions and shared experiences of the technology instructional coaches provide different stakeholders insight into how embedding particular professional development principles and practices in the culture of schools and districts enhances and supports teachers' practices and attitudes with one-to-one mobile technology integration. The implications for positive social change from this study could extend into teacher retainment and recruitment. When teachers feel supported and have access to the tools and resources, they need to promote communication, collaboration, critical thinking, and creativity in student learning they are more likely to stay where the technology

integration with pedagogical practices are emphasized or transfer to a school or district with that priority.

Having mobile technology devices in the hands of every student promotes anytime/anywhere learning and helps close the digital equity gap for students. Where every student no matter their street address has the opportunity to learn from skilled, proficient teachers who feel supported with the integration of technology and have positive attitudes toward implementing the technology resulting in a positive change of practice to benefit their students. The findings of this study also indicate that supportive leadership in advocacy and mentoring roles is critical to ensure there are resources including time and human capacity to help teachers learn how to implement one-to-one mobile technology in their classrooms for sustainability purposes.

Differentiating the professional development by grade level and content level increases teachers' engagement level to embrace the integration of technology. The teachers' ability to enhance the learning opportunities for students in all classrooms that would not be possible without the technology opens the world to every student through virtual learning experiences. Teachers are no longer limited to the resources that are only available to them within the walls of their classrooms or schools.

Technology professional development gives teachers a lens through which to view the technology-rich world and broadens their perspective on the world to be more global and open-minded of how to facilitate the learning for all their students. Participants also reported that building relationships and understanding instructional design with standards and frameworks can provide a positive social change with teacher

morale and increased confidence to showcase their knowledge and expertise and build teacher leadership capacity.

Recommendations for Practice

In the era of high-stakes accountability and college and career readiness in K–12 education, many school districts are implementing one-to-one mobile technology projects with one computer device per student and teacher. This additional technology has resulted in a need for changes in teaching practice. For teachers to develop and transform the way they teach, effective professional development must help them understand the classroom management strategies and instructional design techniques needed to teach with one-to-one devices. Recommendations for practice are to share the results of this qualitative, in-depth interview study with all stakeholders, including students, teachers, administrators, parents, and policymakers at all levels, from local authority school boards to state and national legislators. Specific recommendations include:

1. Encourage administrators to participate in all professional learning opportunities for teachers to grow their knowledge and skills of how to best support and learn from teachers and technology instructional coaches.
2. If a dedicated position is not already in place, create a site technology instructional coach position to be available for daily support of teachers' instructional technology needs making sure instructional is in the title to differentiate from an onsite technician.
3. Provide adequate professional learning opportunities and resources for the technology instructional coach to stay abreast of the latest research including

standards, frameworks, and best practices to assist and support teachers as adult learners.

4. Brand a professional learning space by name with consistent hours of support that is inviting for teachers to come and learn.
5. Always put learning first and ask the question: What do we want students to learn and how can a technology tool or resource enhance the learning? If the technology does not enhance the learning, use a different tool.
6. Understand that change in teacher practice after attending professional learning opportunities is not about the technology, it is about becoming comfortable with demonstrating mastery in different ways and helping teachers build their skills from their own starting place.
7. Establish a culture of digital learning by promoting teacher agency.

All stakeholders could use the results of this research study to make informed decisions about how to plan, organize, and implement professional learning opportunities for teachers who have one-to-one mobile technology devices in the hands of their students. The results of this research study also have the potential to be transferred to higher education and could be used to guide technology instructional coaches on future curriculum enhancements, educational policy reform, and additional research focused on adult learning and TPACK.

Conclusion

Implementing one-to-one mobile technology projects with one computer device for each student and teacher has resulted in a need for changes in teaching practice

(Gulamhussein, 2013; Killion, 2016; Sell et al., 2012). For teachers to develop and transform the way they teach, effective professional development must help them understand the classroom management strategies and instructional design techniques needed to teach with one-to-one devices. If changes are to occur in teaching approaches, professional learning for teachers must focus on their needs as adult learners and provide the support needed to transform their practice.

The findings of this study demonstrated that specific professional development principles and practices implemented by technology instructional coaches transform teacher practices and attitudes in one-to-one mobile technology program implementations in K–12 school districts. Supportive leadership at the building and district level must advocate for technology instructional coaches who facilitate professional learning opportunities for teachers by providing time and resources and learning along with the teachers. A significant role of the technology instructional coaches is to build culture with teachers through trusting and mentoring relationships. All participants agreed that facilitating discussions and providing professional learning opportunities for teachers in a face-to-face setting is something that will never completely go away, due to the human emotions and reactions in helping teachers and providing individualized attention and feedback. In addition, all participants agreed that the future of professional development will include more online tutorials, social media, the use of LMSs, and the opportunity for more choice and self-select options.

Another vital role of technology instructional coaches is the need to know instruction, understand the design of a lesson, and be a master teacher first. The concepts

of lesson preparation and instructional strategies include essential questions; objectives; multiple means of representation; formative assessments; and the use of theoretical frameworks, models, and standards. Understanding pedagogy and modeling empowers teachers to know and understand when technology is and is not the best tool to use; they must think beyond digital tools and resources, for it is never about the device but always about the instruction. Having a continuum of technology integration connected to the school district's vision and mission helps teachers move into deeper levels of integration and promotes the need for digital fluency for students to be college and career ready, which is now a priority and necessity, no longer a luxury. Additionally, in order for technology instructional coaches to help teachers make pedagogical shifts in their teaching with one-to-one mobile technology, it is essential they understand and use models like cognitive and instructional coaching. Attending technology conferences to network with other like-minded professionals and earning technology certifications also give technology instructional coaches the skills and resources to further enhance teacher skills.

The perceptions of technology instructional coaches in regard to changes in teacher practice and attitude are positive after professional development sessions when several things happen:

1. The professional learning experiences are differentiated by grade level and department with a focus on applications and resources that speak directly to the teachers' needs.

2. Teachers are empowered to help students take ownership of their own learning when teachers are no longer the “sage on the stage” or “guide on the side.” Participant 6-HL emphasized the change to the “mentor in the center” model, where teachers give their students a pathway to learning targets and goals and autonomy in how they learn.
3. Building teacher agency by addressing individual teacher learning styles is the encouragement they need for success to increase confidence and showcase their knowledge and expertise with colleagues.
4. When teachers feel supported and know it is safe to fail, they are willing to try new things in their classrooms, especially when they understand how technology can enhance their workflow and efficiency to move toward more integration and innovation with their students.

To realize the potential of integrating one-to-one mobile technology devices into K–12 classrooms around the world, technology instructional coaches with the support of the administration can create a professional learning foundation where practice becomes principle, principle promotes agency, and andragogy-focused professional development encircles the TPACK framework. The potential benefits span all levels of education, from single classrooms of one grade level or content area to entire school districts with one-to-one mobile technology in every classroom. The need for effective professional development principles and practices for teachers to deeply integrate one-to-one mobile technology into their lessons is a global need, and the results of this study indicate that the need exists in three countries. I challenge policy makers, school boards, and

administrators to provide the necessary resources to promote professional learning opportunities for teachers to integrate one-to-one mobile technology in their classrooms at a deeper level. In doing so, teachers will use the one-to-one mobile technology devices to promote 21st-century learning for the greatest impact on student learning.

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Appendix A: Confidentiality Agreement

What is TranscribeMe's Confidentiality Policy?

TranscribeMe provides best-in-class security and confidentiality. Our process of segmenting audio ensures confidentiality by preventing any one transcriptionist from having full access to your recordings. The full recording is only available to our Quality Assurance team, all of whom have signed NDAs.

Moreover, TranscribeMe's platform is built on Microsoft's Windows Azure cloud solution—which is best-in-class in regards to data security.

Any materials or data that you provide to TranscribeMe for the purpose of providing the TranscribeMe Service will be your "Confidential Information," except to the extent such documents (a) are known to TranscribeMe prior to receipt from you from a source other than one having an obligation of confidentiality to you; (b) become known (independently of disclosure by you) to TranscribeMe directly or indirectly from a source other than one having an obligation of confidentiality to you; or (c) become publicly known or otherwise cease to be secret or confidential, except through a breach of this Section by TranscribeMe. TranscribeMe will use the Confidential Information solely for the purpose of providing the TranscribeMe Service to you (the "Permitted Purpose").

TranscribeMe will not, without your prior consent, disclose to any third party your Confidential Information, other than furnishing such Confidential Information to our directors, officers, employees, agents, consultants, contractors, representatives or affiliated entities (collectively, "Associated Persons") who need to have access to such

Confidential Information in connection with the Permitted Purpose. TranscribeMe will use at least reasonable care to protect the confidentiality of your Confidential Information.

In the event that TranscribeMe is required by law to make any disclosure of any of your Confidential Information, by subpoena, judicial or administrative order or otherwise, TranscribeMe will use commercially reasonable efforts to give you notice of such requirement (to the extent legally permissible) and will permit you to intervene in any relevant proceedings to protect your interests in your Confidential Information.

Appendix B: Letter of Invitation

Dear (Instructional Technology Coach),

My name is LeAnn Morris. I am a Ph. D. Candidate in Educational Technology at Walden University. I am conducting a qualitative in-depth interview study on principles and practices in technology professional development for one-to-one mobile technology programs. As a technology instructional coach in a school district with one-to-one mobile technology, I would love to have your insights regarding your work in this area for the study.

If you choose to participate, I will ask for at least one hour of your time to conduct an in-depth interview. You may also be selected for a second interview for more details which could be up to an hour of your time, as well; and there is a possibility of a third interview if any clarification is needed which would be no longer than 15 minutes.

The interview(s) may occur at a convenient time and place for you since the interview(s) will be conducted and recorded using GoToMeeting allowing me to give my full attention to our conversation. Recording the interview(s) will allow me to transcribe your thoughts accurately, and I will send you a copy of the transcript to review and verify for accuracy.

Your identity and interview will remain confidential and you will not be identified in the study. This study has been approved by Walden University's IRB ethics board.

If you are interested in participating in this study, please reply with YES, so I may send you the “Consent Form.”

Sincerely,

LeAnn Morris

Doctor of Philosophy Student in Educational Technology

Walden University

100 Washington Street South, Suite 900

Minneapolis, MN 55401

Appendix C: Consent Letter Invitation

Hello (Technology Instructional Coach),

Thank you for your interest in participating in my study!

Please review the attached Consent Form and if you feel you understand the study well enough to make a decision about it, please indicate your consent and willingness to participate in this research study by replying to this e-mail with the words, “I consent.” I will then be in contact with you about setting up an interview time.

Thank you again!

Sincerely,

LeAnn Morris

Appendix D: Demographic Questionnaire

1. What is your education experience and background?
2. How does your school district define “technology instructional coach” or a similar title?
3. As a “technology instructional coach” how and when are you collaborating with teachers to learn about their needs and wants?
4. What is your experience with developing professional learning opportunities for teachers for one-to-one mobile technology integration?
5. What is your experience with facilitating professional learning opportunities for teachers for one-to-one mobile technology integration?
6. When do you typically provide professional learning opportunities for teachers, and what does it look like?
7. How many professional learning opportunities did your faculty attend in the 2015-2016 school year, and do you anticipate the same number during the 2016-2017 school year?
8. What was the delivery style of the professional development sessions, such as face to face, online, or in some other way?
9. Where did the teachers attend the professional learning, such as in their own classrooms, the library, computer lab, or in some other place?

10. What was the nature of the professional development, such as content specific, technology integration focused, learning management system, or others?

Appendix E: First Round Interview Questions and Probes

1. What technology integration strategies and skills (including software, curriculum, and other educational resources) have you **developed** in professional development sessions that have positively impacted teaching practices? (RQ1) (RQ3)
2. What technology integration strategies and skills (including software, curriculum, and other educational resources) have you **facilitated** in professional development sessions that have positively impacted teaching practices? (RQ1) (RQ3)
3. In your experience, what type of professional learning opportunities influence how teachers use one-to-one technology in their classroom? (RQ2)
4. Thinking about technology integration strategies and skills, what essential elements of the professional development were most effective for the majority of teachers' learning styles? (RQ1) (RQ2)
5. How long did it take teachers to adapt to integrating technology after attending professional learning opportunities and did you see any commonalities with grade levels or departments? (RQ3) (RQ4)
6. How do you feel the professional development influences technology integration specific to a subject area or grade level? (RQ1) (RQ2)
7. In what ways should the professional development be differentiated for various subject areas and/or grade levels? (RQ1) (RQ2)

8. What professional development practices do you use to assist teachers in integrating one-to-one mobile technology programs? (RQ2)
9. What strategies have you developed to facilitate professional development for teachers integrating one-to-one mobile technology programs? (RQ1) (RQ2)
10. How do you determine if your professional development is effective? (RQ1) (RQ2) (RQ3) (RQ4)
11. What have you seen happen with teachers' **attitudes** toward technology integration after their professional development sessions? (RQ3)
12. What have you seen happen with teachers' **practices** toward technology integration after their professional development sessions? (RQ4)

Probe Questions

The probing questions include the follow open-ended prompts (Toledo, 2015):

- Tell me more about . . .
- Describe …
- What exactly did you do in that situation …
- What exactly did you mean by …
- Give an example …
- How did you feel in that situation …
- Is there additional evidence …

Appendix F: Second Round Interview Questions and Probes

1. What are issues you may experience as a technology instructional coach with BYOD vs. school-issued devices for one-to-one mobile technology programs? (RQ2)
2. How does this influence you designing and facilitating professional development? (RQ1) (RQ2)
3. As a technology instructional coach expert, what are your greatest strengths when designing and facilitating professional development? (RQ1) (RQ2)
4. How do you see your strengths influencing changes in teacher attitudes and practices after the professional development sessions you create and present? (RQ3) (RQ4)
5. What professional development principles are essential to a technology instructional coach for one-to-one mobile technology programs? (RQ1)
    a. Are you familiar with TPACK, SAMR, Technology Integration Matrix, or any other framework? (RQ1) (RQ2)
    b. Do you use any of these or other frameworks when you are creating professional development? (RQ1) (RQ2)
    c. Are you familiar with the “Standards for Professional Learning” from Learning Forward? (RQ1) (RQ2)
    d. If answer is yes: Do you use them when you create professional development? (RQ1) (RQ2)

e. If answer is yes: How have you seen these standards influence teachers' attitudes and practices for integrating the technology into their teaching? (RQ1) (RQ2) (RQ3) (RQ4)

f. How have you seen principles for adult learning (andragogy) influence teachers' attitudes and practices in technology integration? (RQ1) (RQ2) (RQ3) (RQ4)

6. As a technology instructional coach expert, what types of professional development opportunities do you attend to increase your knowledge about professional development principles and practices for one-to-one mobile technology programs? (RQ1) (RQ2)

7. How important do you think industry standard certifications such as Google Educator/Trainer/Innovator, Apple Distinguished Educator, Leading Edge or others are to you as a technology instructional coach expert? (RQ1) (RQ2)

   a. What impact have you seen these certifications have on teachers' attitudes and practices in the classroom with one-to-one mobile technology programs? (RQ3) (RQ4)

   b. Do you offer any certification opportunities in your professional development program/plan? (RQ1) (RQ2)

8. What educational technology organizations do you belong to, follow or participate in? (RQ1) (RQ2)

   a. How do they help you develop and facilitate professional development for your teachers who are implementing a one-to-one program? (RQ1) (RQ2)

b. Why are they important? (RQ1) (RQ2)

9. How much focus do you place on the ISTE Standards for Students, Teachers and Administrators in your professional development? (RQ1) (RQ2)
    a. What is the impact of these standards on teachers' attitudes and practices in your one-to-one program? (RQ3) (RQ4)
10. Do IT Department staff attend professional development opportunities with teachers and administrators? (RQ1) (RQ2)
    a. If yes: Have you noticed any impact or change in teachers' attitudes and practices in the classroom with one-to-one mobile technology programs as a result of having them attend? (RQ3) (RQ4)
11. Do students assist in professional development opportunities for teachers? (RQ1) (RQ2)
    a. If so, have you noticed any change in teacher attitudes and/or practices after the professional development sessions? (RQ3) (RQ4)
12. As a technology instructional coach designing and/or facilitating professional development for one-to-one mobile technology programs, what do you see as the future for professional development? (RQ1) (RQ2)
13. Is there anything else you would like to share with me about your 1:1 PD? (RQ1) (RQ2) (RQ3) (RQ4)

Probe Questions

The probing questions include the follow open-ended prompts (Toledo, 2015):

- Tell me more about . . .

- Describe …
- What exactly did you do in that situation …
- What exactly did you mean by …
- Give an example …
- How did you feel in that situation …
- Is there additional evidence …

Appendix G: Participants Demographics

Participant	Sex	No. of interviews	Highest Level of Education	Years working in education	Years as a technology instructional coach	Years working with one-to-one
1-HL	F	2	MA	16	10	10
2-HL	F	2	MA	30+	9	5
3-HL	M	2	MA	18	10	9
4-HL	F	2	MA	25	13	9
5	F	1	MA	11	5	5
6-HL	M	2	MEd	24	7	3
7	F	1	PhD	12	4	4
8-HL	F	2	MEd	25	3	3
9	F	1	MA	28	1	1
10	F	1	MA	28	12	12
11-HL	M	2	EdD	23	9	9
12	F	1	BA	30+	15	4
13	F	1	BA	18	4	4

Appendix H: First Round Interview Initial Themes

1. Supportive leadership
2. Building culture, relationships, and agency
3. Instructional design
4. Delivery of professional development
5. Learning first, technology second
6. Classroom management
7. Standards and frameworks
8. Technology certifications
9. Professional learning opportunities for coaches

Appendix I: Second Round Interview Initial Themes

1. Adult learning challenges
2. BYOD/BYOT needs
3. Technology instructional coaches greatest strengths
4. Principles, practices, standards, and frameworks
5. Change in teacher attitudes
6. Advocacy leadership

Appendix J: Themes from First and Second Round Interview Categories

Research Question 1

1. Supportive advocacy leadership
2. Building culture and trusting relationships
3. Instructional design supported by standards and frameworks
4. Promoting classroom management with technology
5. Professional learning coaching opportunities for technology instructional coaches

Research Question 2

1. Supportive participatory leadership
2. Building culture and mentoring relationships
3. Instructional design modeled with standards and frameworks
4. Learning first, technology second within curriculum and instruction
5. Professional learning conferences and certifications for technology instructional coaches

Research Question 3

1. Supporting content-specific teaching strategies
2. Augmented technology usage
3. Increased confidence to showcase knowledge and expertise

Research Question 4

1. Building collaborative, job-embedded teacher agency with ongoing support

2. Personalized learning with differentiated delivery of professional development