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A Descriptive Mixed-Methods Study Examining Teachers' Needs and Preferences for Technology Integration Professional Development

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DEDICATION

To my parents Michael, and Nellie, my sisters, Patrice, and Constance thank you for always believing in me and helping me achieve my dreams. To my grandmothers, Ethel, and Gloria, and all my family members and friends, thank you for your inspiration. Your support means so much to me.

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ABSTRACT

The purpose of this study was to examine teachers' needs and preferences for technology integration professional development (PD). To guide the study, three research questions were developed: (1) What are teachers' needs and preferences for technology integration professional development in K-12 schools?, (2) How are teachers currently integrating technology for teaching and learning in their classroom?, and (3) How do teachers perceive technology benefits and usefulness of technology integration for teaching and learning?

This was a descriptive mixed methods study. The research study included 33 educators from six different U.S. states. Quantitative data was collected from the technology needs assessment survey and analyzed using descriptive statistics. Qualitative data was collected through one-on-one interviews and open-ended questions on the technology needs assessment survey. Qualitative data was analyzed using an inductive and thematic approach. Quantitative findings revealed that participants are using technology to improve instruction productivity and student learning. Qualitative findings showed that participants want technology integration PD that incorporates elements of hands-on, active learning activities that are beneficial for enhancing teaching and learning.

Findings from the study show teacher needs and preferences for technology integration PD align with elements of effective PD from previously publish literature such as active learning, collaboration, and expert support for integration.

Recommendations for technology integration PD, future research and limitations of the study are discussed.

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CHAPTER 1

INTRODUCTION

Twenty-first century students live in an increasingly interconnected world where technology is constantly changing. It is our responsibility to provide students with opportunities to gain the necessary skills needed to adjust to the continuous adaptation of technology needed for college and career readiness (which have been referred to as 21st century skills) and the ability to compete in a global society (Holter, 2018). To prepare students with the skills needed for future success, schools must provide opportunities to develop students' 21st century skills such as critical thinking and problem solving, communication, collaboration, and creativity (Haug & Mork, 2021; OCED, 2018; Weng et al., 2022).

To meet the demands of preparing students to compete on a global scale, U.S. leaders have authorized federal initiatives including National Education Technology and The Every Student Succeeds Act. A commonality between these federal initiatives is technology and teacher professional development (PD). To successfully prepare students for the rapidly evolving 21st century careers, teachers must be able to "teach critical thinking, collaboration, communication, and creativity skills" (National Education Association, 2014, p. 30). This can only be done by effectively preparing teachers to teach for tomorrow by improving their technology knowledge and skills, as well as their perception towards technology benefits (Adenegan, 2019).

As the use of technology expands, it is important that teachers continue learning about effective ways to use technology in the classroom (Kent & Giles, 2017). Unfortunately, barriers such as inadequate technology access (Ertmer et al., 2012; Li et al., 2015; Moldavan et al., 2022;), time (Bergdahl & Bond, 2022; Li et al., 2015; Goodwin et al., 2015), and lack of training to support technology integration (Ertmer et al., 2012; Francom, 2016; Hanny et al., 2021) interfere with technology integration. U.S. school districts have invested in increasing educational technology (e.g., hardware, software, and connectivity) access in classrooms, but teachers may receive ineffective training or no training at all to support successful technology integration (Davies & West, 2014; Tawfik et al., 202). Now that technology is a common tool in schools for teaching and learning, teachers must be able to effectively integrate technology. The National Assessment of Educational Progress (NAEP) administered a representative study of U.S. public school students' computer access and use. At the national level, almost 25% of fourth and eighth grade public school teachers reported using computers every day or almost every day in their mathematics and reading classroom learning for various activities like conducting research, extending learning, playing math games, and building vocabulary (NCES, 2016).

Research showed that in reading, 23% of fourth grade and 18% of eighth grade public school teachers reported that they used computers every day or almost every day to increase students reading fluency and comprehension (National Center for Education Statistics [NCES], 2016). When using computers to conduct research, 4% of fourth and eighth grade public school teachers reported using computers every day or almost every day. In math, 16% of fourth grade and 8% of eighth grade public school teachers reported

that they extended students' mathematics learning with enrichment activities on the computer every day or almost every day (NCES, 2016).

Purcell et al. (2013) reported that 92% of Advance Placement and National Writing Project teachers say the internet has a major impact on their ability to access content, resources, and materials for their teaching, but only 40% of middle school, 35.5% of high school teachers reported that they used collaborative web-based tools. Although teachers believe in the benefits of educational technology, there is still a lack of technology integration.

Despite the need for integration of technology for teaching and learning, teachers are facing potential barriers to integrate technology such as insufficient training. Yurtseven Avci at al. (2020) determined that teacher pedagogical implementation and teacher training around technology integration may be insufficient. The U.S. Department of Education's Office of Educational Technology (2017) noted that the presence of technology has greatly increased in school, but educators will need ongoing support in implementing technology integration into their classrooms and school (King & South, 2017). The National Center for Education Statistics (NCES) reported that technology (e.g., digital resources) is a factor in ensuring equity in K-12 student achievement (Adenegan, 2019). Professional development can help teachers learn how to use technology tools and how to effectively integrate them to support teaching and learning (Yurtseven Avci et al., 2020). When we effectively prepare teachers to integrate technology in a meaningful way, students will reap the benefits.

The necessity to prepare teachers to effectively use technology for teaching and learning entered the educational spotlight in February 2020. The coronavirus disease

2019 (COVID-19) pandemic forced school districts across the country and internationally to close and rapidly transition to full remote learning. By the end of March 2020, over 181 countries implemented nationwide school closures in response to COVID-19 (UNESCO, 2020), resulting in over 1.5 billion students being out of school (Lynch, 2020).

This led to the transition to distance/remote learning for billions of students. Although distance/remote learning is not new, it is a new method of teaching that many teachers were forced to adapt to without the proper guidance (Gardner, 2020; Kaden, 2020; Zimmerman, 2020). Instead of a smooth transition of teachers being able to use digital tools to assist in moving in-person learning to remote/distance learning, teachers were left scrambling to put together quick low fidelity strategies online due the lack of training needed to effectively integrate technology remotely (Gardner, 2020). Technology tools such as learning management systems and video conferencing software that were used to transition to distance/remote learning were readily available to schools and universities prior to school closures (Gardner, 2020; Zimmerman, 2020). However, these tools were not frequently used to manage assignments and course materials or administer lectures and discussions.

Teachers were tasked with quickly learning pedagogical practices associated with distanced and remote learning such as technological proficiency and engaging ways to assess learning (Nasr, 2020). The COVID-19 pandemic exposed deficits in the U.S. educational system's teacher preparation for using technology tools for teaching (Ferdig et al., 2020). Additionally, Dorn et al. (2020) foresaw that the chaotic transition to remote learning may worsen existing achievement gaps. Due to the rapidly evolving technology

and the shift in education to prepare students for college and career readiness educators must be aware of the influence technology has in evolving students' twenty-first century skills. Technology is an ever-present factor in our daily lives, and the COVID-19 pandemic has shown the importance in making sure educators are prepared to use technology for teaching and learning.

Statement of the Problem

Federal initiatives and district plans entail students to be able to utilize technology to use critical thinking skills to complete projects and assignments, have strong communication skills, problem solve and demonstrate creativity and innovation (Griffin & Care, 2015). However, students cannot successfully develop these skills if their teachers are not properly trained in how to integrate technology into their teaching practice. The Office of Educational Technology reported that almost half of U.S. teachers desire more training on how to effectively use technology (King & South, 2017), but they are not receiving effective technology PD (Combs & Silverman, 2017). Teachers want to use technology to innovate teaching and learning in their classrooms, and they need their district and school to provide the proper training for them to attain new technology integration skills (Carpenter & Linton, 2016; Ertmer & Ottenbreit-Leftwich, 2010; King & South, 2017).

In response to this problem, this descriptive mixed methods study focused on understanding teachers' needs and preferences for technology integration professional development. By determining teachers' needs and preferences recommendations can be made to help teachers broaden and deepen their knowledge, skills, and commitment to effective education technology.

Purpose Statement

The purpose of this descriptive mixed-methods research study was to examine teachers' current needs and preferences for technology integration PD. The goal of this research is to determine effective PD strategies to implement based on teachers needs and preferences.

Research Questions

Three research questions will guide this research study.

1. What are teachers' needs and preferences for technology integration professional development in k-12 schools?
2. How are teachers currently integrating technology for teaching and learning in their classroom?
3. How do teachers perceive technology benefits and usefulness of technology integration for teaching and learning?

Researcher Subjectivities and Positionality

I align my research to the pragmatic paradigm. This approach was selected due to developing my mixed methods study to understand my personal experience as an educator and instructional designer. Pragmatic inquiry allows me to focus on understanding teachers' needs and preferences to integrate technology through PD through the collection quantitative and qualitative methods.

Understanding teacher technology integration needs and preferences is the focus of this mixed methods study. As the researcher, it is important to be objective when conducting the study (Mertler, 2017). I value the use of effective technology integration for enhancing supporting educators in teaching and learning. My perspective may differ

from those of the participants. The mixed methods study allows me to determine teachers' needs and preferences for PD focused on technology integration.

When conducting a mixed methods study, researchers position themselves as insiders or outsiders. This positionality determines the researcher's methods and possible ethical challenges (Herr & Anderson, 2005). I position myself as an outsider for the research study since I do not work in the educational environment with the participants. I currently work in a military agency as an instructional designer. In this role I work to design and develop educational instructional materials. This work involves the knowledge of learning theories and the integration of technology in instruction to support educators and provide learning for students. This research study aligns with my current role because a major element in my production of educational content is understanding the needs of my prospective audience. In this role, I apply the skills I developed during my 8 years of classroom teaching experience with my niche for educational technology and PD to improve the educational outcome for instructors and students.

Definition of Terms

21st Century Skills

This term refers to "a broad set of knowledge, skills, work habits, and character traits that are believed—by educators, school reformers, college professors, employers, and others—to be critically important to success in today's world, particularly in collegiate programs and contemporary careers and workplaces" (Great Schools Partnership, 2016, para.1).

Educational Technology/Ed Tech

Davies, Sprague, and New (2008) defined educational technology as "any tool, piece of equipment, or device—electronic or mechanical—that can be used to help students accomplish specific learning goals" (as cited in Davies & West, 2014).

Perception

Perception is the process of selecting information and organizing it into our current patterns, and then interpreting information based on previous experiences (Jones, 2013). Jones (2013) determined "we respond differently to an object or person that we perceive favorably than we do to something we find unfavorable" (para. 1). My mixed methods study will look at the teachers' perceptions of technology integration.

Professional Development (PD)

The Elementary and Secondary Education Act in section 8102 (42), as amended by Every Student Succeeds Act, specifically noted that PD activities are "sustained (not stand-alone, 1-day, or short term workshops), intensive, collaborative, job-embedded, data-driven, and classroom-focused" (U.S. Department of Education, 2016, p. 11). The in study will focus on understanding teachers' needs and preferences for technology integration.

Technology

For this study, technology can be defined as learning for "engagement in learning goals, enhancement of learning goals, and extension of learning goals" (Kolb, 2017, p. 5). A part of technology is digital learning tools, which are "websites, apps, online tutorials, online games and videos or programs used to teach and support student learning and schoolwork" (Gallup Organization, 2019, p. 5). This study will examine how teachers

currently use technology, and what are their needs for technology professional development and their preferences for professional development sessions.

Technology Integration

Technology integration refers to "the effective implementation of educational technology to accomplish intended learning outcomes" (Davies & West, 2014, p. 6). In this study, I will focus on the participants' current use of technology integration into their classroom for teaching and learning.

CHAPTER 2

LITERATURE REVIEW

Introduction

The purpose of this descriptive mixed methods study was to determine teachers' current needs and preferences for technology integration. The goal of this literature review is to provide a comprehensive analysis of the following research questions: (1) What are teachers' needs and preferences for technology integration professional development in k-12 schools? (2) How are teachers currently integrating technology for teaching and learning in their classroom? and (3) How do teachers perceive technology benefits and usefulness of technology integration for teaching and learning? The key variables include (a) technology integration and (b) PD.

Methodology for the Literature Review

The literature review process began by searching through multiple electronic databases for articles relevant to the key variables including *Academic Search Complete, Education Source, ERIC, JSTOR,* and *ProQuest.* Additional information, such as statistical data reports and U.S. educational policies, was gathered from *Google Scholar*. To locate articles in the databases, a combination of key terms was used to find scholarly articles relevant to the research questions. A sample of the search terms include the following: technology professional development [or] technology staff development,

educational technology, technology integration, teacher technology barriers, technology benefits, and technology PD. Search modifiers were used to find the most relevant articles such as scholarly (peer reviewed) journals, full text, and published date after 2013. Additional journal articles were selected from the references of scholarly articles to augment the current literature review.

Organization of the Literature Review

The literature review is organized into three major sections: (a) technology in 21st century teaching and learning, (b) benefits and barriers of technology integration and PD, and (c) frameworks used to evaluate the effectiveness of technology integration in the classroom. These sections provide a description of how effective PD impacts technology integration.

Technology in the 21st Century

The role of technology as an important instructional tool has continued to shift based on societal, economic, and technological changes. This section will discuss changes being made across the United States to help prepare students to be globally competitive and prepared for college and career readiness by reviewing: (a) educational technology in the 21st century, (b) technology in schools' initiatives and (c) growth of educational technology in U.S. classrooms.

Educational Technology in the 21st Century

Since the turn of the millennium, the presence of educational technology has evolved from chalkboards to interactive whiteboards and from overhead projectors to document cameras (Firmin & Genesi, 2013). Nevertheless, it is important that we understand "what" educational technology is and "why" we use educational technology.

Davies et al. (2008) defines educational technology as “any tool, piece of equipment, or device—electronic or mechanical—that can be used to help students accomplish specific learning goals” (as cited in Davies & West, 2014). Technology integration goes beyond the simple use of a computer in a classroom. Emerging technologies today continue to advance and can include a wide variety of tools and digital resources to influence student learning, such as online learning (e.g., Web 2.0 tools), enabling technologies (e.g., automatic speech recognition), and learning technologies/information visualization (e.g., virtual reality and augmented reality) (Joosten et al., 2020; Yalcinalp Avci et al., 2019).

The U.S. Department of Education Office of Educational Technology developed the National Education Technology Plan (NETP) as the policy for the role of technology in education. The NETP policy explains that educational technology allows teachers to “accelerate, amplify, and expand the impact of effective teaching practices” (King & South, 2017, p. 5).

Educational technology allows us to motivate students to learn while preparing students with the 21st century skills needed for the future by using technology to apply and produce real-world knowledge (Firmin & Genesi, 2013; Lazar, 2015). As educational technology continues to evolve, it is important to understand that more technology does not improve teaching and learning, instead focusing on using technology appropriately and efficiently is essential to improve teaching and learning.

Technology in Schools Initiatives

Technology is a driving force that can help students develop skills needed for continued success after graduation (Chu et al., 2017). The use of federal legislation provides a framework for all educational stakeholders to have a shared understanding of

technology integration in 21st century classrooms (King & South, 2017; Roumell & Salajan, 2016). As technology's presence in our daily life has continued to grow rapidly, increasing access to technology for all students has been the main focus of federal legislation (J-PAL Evidence Review [J-PAL], 2019; White House Office of the Press Secretary [WH], 2016).

The No Child Left Behind Act of 2001 (NCLB) was the United States general law for K–12 public education from 2002–2015. The focus of NCLB was to provide all students equal opportunities for learning by raising educational standards. A component of NCLB was the Enhancing Education Through Technology Act of 2001 which allocated $1 billion for technology grants for fiscal year 2002 (U.S. Department of Education [DOE], 2002). The goals of this act included funding for technology and improving teachers' technology skills by integrating technology into teacher training and curriculum. This would help schools meet the NCLB expectation that by the end of eighth grade, all students should demonstrate proficiency in technological literacy (DOE, 2005). Nearing the end of NCLB, only 30% of U.S. public school districts were meeting the Federal Communications Commission's (FCC) minimum internet access goal of 100 kilobits per second (Kbps) per student (EducationSuperHighway (ESH), 2014; 2020).

NCLB was replaced by Every Student Succeeds Act (ESSA) in 2015. ESSA was developed to ensure success for students in schools by advancing equity and implementing high academic standards to prepare all students for college and career readiness literacy (ESSA, 2015; ISTE, 2016). Embedded in ESSA is Title IV, which authorizes school districts to provide students with a well-rounded education, support safe and healthy students, and support the effective use of technology (ISTE, 2016).

Congress approved $400 million of Title IV funds to meet the goals of the federal legislation (ISTE, 2016).

Under Title IV, improving the effective use of technology, local educational agencies cannot spend more than 15% of their funds on infrastructure including devices, equipment, software, and digital content. However, up to 60% of educational agency funding can go towards offering technology PD, hiring technology coaches and directors, and developing blended learning programs with a mandatory 2% for technical assistance and capacity building (ISTE, 2016; National Center on Safe Supportive Learning Environments, n.d.; DOE, 2016). This bill also developed official definitions of educational technology terms such as blended learning, technology, and digital learning. In 2018, the funding for Title IV of ESSA includes authorization for $1.1 billion, and $50 million designated for STEM education (Department of Education, 2019; Next Generation Science Standards, 2017).

With less than half of U.S. public schools receiving access to high-speed internet in 2013, President Obama established the ConnectED Initiative to connect, “99% of students to no less than 100 megabits per second (Mbps) per 1000 students or 1 Mbps per student” (Bakia, 2014, p.8). In comparison to technology during NCLB, 1 Mbps is 1000 times faster than 1 Kbps. The FCC in collaboration with other technology innovators (i.e., Adobe, Apple and ESH) responded to the ConnectED initiative by providing additional funding for expanding high-speed internet connectivity raising over $128 million in funding to support their mission (Bakia, 2014; ESH, 2019; NCES, 2018; WH, 2016). As of 2019, 99% of U.S. school districts have internet access at the FCC’s

minimum 100 kbps goal and 66% of schools have met the ConnectED goal of a minimum of 1 Mbps per student (Bakia, 2014; ESH, 2020).

Providing all public U.S. students access to computers and the internet is needed for them to compete in a global society (WH, 2016). However, simply increasing the amount of technology in schools without proper training can lead to adverse impacts on academic achievement (J-PAL, 2019). Using technology as a simple substitution for paper and pencil or recreational use does not allow students to use technology for more skilled activities that encourage critical thinking (J-PAL, 2019; Pew Research Center, 2020; Thieman, 2008). Teachers must be trained on how to integrate technology beyond substitution to ensure students are college and career ready.

Growth of Educational Technology in U.S. Classrooms

With strong bipartisan federal legislation and commitments from state and local educational agencies, access to technology in education has grown tremendously within the first twenty years of the 21st century. Roumell and Salajan (2016) studied the evolution of educational technology policy in the U.S. and found that the role of technology in education is to help prepare citizens for global competitiveness. Since the National Education Technology Plan (NETP) in 1996, the U.S. Department of Education has developed policies to justify increasing funding for federal technology programs in the U.S. from improving infrastructure, accessibility to high speed for high-speed internet, transforming teaching and learning with technology and providing equity of technology for all students (Roumell & Salajan, 2016). Accessibility to technology in K-12 education across the U.S. has help the country be a leader in educational technology on an international scale. In the U.S., 59% of classrooms have interactive whiteboards

compared to the 33% global average (Cambridge International, 2018). In a nationally representative study of education technology use in schools, 65% of teachers reported using digital learning tools to teach every day; 53% of students used digital learning tools for learning (Gallup Organization, 2019).

Online learning also known as distance learning has grown in popularity due flexibility in instruction, increased access to courses not offered in local schools and smaller class sizes (Gemin et al., 2015). In 2017-18, 39 states had blended and/or virtual schools. That included over 295,000 students enrolled in full time virtual schools and 132,960 students enrolled in blended schools (Molnar et., 2019). In higher education, the number of students taking courses online has also continued to increase. In the 2013-14 school year, 26.4% of postsecondary students (undergraduate and graduate) enrolled in any distance education course compared to an increase to 34.7% during the 2018-19 school year (DOE, 2014; 2019).

The cost of accessing broadband has decreased by 90% since 2013 and 90% of school districts have invested nearly $5 billion in new wireless networks for their schools since 2015 (ESH, 2020). The U.S. also leads in the use of smartphones and desktop computers in the classroom compared to the international counterparts (Cambridge International, 2018). This shows how educational technology has continued to evolve and provide opportunities for all students to have access to daily digital learning in their classrooms.

Benefits of Integrating Technology into the Classroom

It is important that learning is integrated with technology to help prepare students with the 21st century skills that are needed for college and career readiness. Research

from the U.S. Office of Educational Technology (NETP, 2017) indicates that the benefits of technology integration include: (a) differentiated instruction, (b) student engagement, (c) collaboration, and (d) being prepared for college and career readiness.

Differentiated Instruction

Differentiated instruction can be defined as "planned adaptations in process, learning time, content, product or learning environment for groups of students or individual students" (Smale-Jacobse et al., 2019, p. 6). The NETP (2017) recommends the use of technology to facilitate differentiation including providing enrichment for accelerated learners, and assistive tools such as automatic speech recognition. By using technology for differentiated instruction, students receive academic support for their individual academic needs (Davies & West, 2014; Eiland & Todd, 2019; Kurvinen et al., 2020; King & South, 2017; Pane et al., 2017). When instruction meets the specific needs of a student, the differentiated instruction can improve their attitude towards learning and increasing their intrinsic motivation and achievement (Smale-Jacobse et al., 2019).

Technology allows teachers to differentiate instruction through three methods: (1) content, (2) process and (3) product. (Karatza, 2019; Taylor, 2015). The use of technology provides opportunities for teachers to develop personalized learning for students through understanding the needs of the individual learner and how technology can provide additional remediation or enrichment support (Matuk et al., 2016; Roumell & Salajan, 2016).

When focusing on the *what* for technology based differentiated instruction, it can led to increased engagement and interest in reading, higher comprehension of text and reading level gains; for students with mixed reading deficits and led to significant gains

for students on the end of grade reading test (Baron et al., 2019; Haymon, 2019; Reis et al., 2011). Technology integration differentiates the process of how instruction will be taught. The use of technology allows organizing students to get their individual learning needs by implementing flexible grouping, learning centers, reading buddies, and peer teaching (Hapsari & Dahlan, 2018; Logan, 2011; Ismajli & Imami-Morina, 2018).

An important part of using technology in education is that students can produce evidence of what they learned (Tomlinson & Imbeau, 2013). Technology provides students with a variety of ways to demonstrate their understanding by offering ways to show creative and critical thinking (Ismajli & Imami-Morina, 2018), apply real-world relevance and application (Boelens et al., 2018) and offering clear and age-appropriate criteria for success (i.e., rubric) (Joseph et. al, 2013). This personalized learning experience makes learning meaningful and relevant to the learner which can increase student engagement (Boelens et al., 2018; Ismajli & Imami-Morina, 2018).

Ismajli and Imami-Morina (2018) determined teachers focus more on the product than on the content and process of differentiated instruction based on their lack of effective professional development for using technology for implementing differentiated instruction. When teachers receive proper training on technology integration, students can reap the full benefits of the use technology integration for differentiation instruction to make learning personal for their academic needs (Boelens et al., 2018; Ismajli & Imami-Morina, 2018).

Student Engagement

Technology improves student engagement by enhancing learning beyond a traditional lecture environment using real world opportunities for students to think

critically, collaborate and problem solve (Bester & Brand, 2013; King & South, 2017; Yang & Baldwin, 2020). Although there are multiple interpretations of student engagement it can be summarized as being a multidimensional construct beyond motivation that refers to being active in learning tasks and activities (Fredricks et al., 2016; Lei, Cui & Zhou, 2018). The definition includes three definite, yet interrelated, dimensions of student engagement: behavioral (i.e., active participant), emotional/affective (i.e., positive attitude about learning), and cognitive (i.e., critical thinking) (Bond & Bedenlier, 2019; Fredricks et al., 2016).

According to the U.S. Department of Education Office of Educational Technology, the use of technology helps engaging students in learning and allows them to make connections and retain what they learn engaging them behaviorally (King & South, 2017). Bond and Bedenlier (2019) discovered that student engagement that deliberately includes technology enhances student engagement by providing opportunities for collaboration, active participation, and support. In a meta-analysis of 69 independent studies, Lei et al. (2018) found a "moderately strong and positive correlation between overall student engagement and academic achievement" (p. 517). This correlates with the emotional/affective findings from Northey et al. (2018) that showed when students were engaged emotionally, it positively influenced their academic achievement and perceived engagement in learning. Technology can also engage students cognitively, by providing opportunities to think critically.

Critical thinking projects help students take ownership of their learning and collaborate with others to complete an extended task (Moore, 2011; Stozhko et al., 2015). This is commonly seen in project or problem-based learning (PBL) where teachers

facilitate students through an ongoing project where they are presented with a real-world question and they are tasked with answering the question and finding a solution (Stozhko et al., 2015). Technology enhances students' cognitive engagement in PBL projects because they can extend learning outside of the classroom by collaborating virtually with external experts such as council workers and medical practitioners to conduct interviews (Maher & Yoo, 2017) and develop a science toy, like an electric current avoider to show their understanding of science electricity concepts (Wang, 2020).

Eiland and Todd (2019) suggest that technology must allow opportunities for student participation, therefore engaging them in the learning process. To prepare students with the necessary skills they need to thrive in the 21st century after high school graduation, technology can be used to promote college and career readiness.

Collaboration

When discussing collaboration, it is important to understand that it is defined as "the ability to work effectively and respectfully with diverse teams," implements "flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal," and assumes "shared responsibility for collaborative work, and value the individual contributions made by each team member" (National Education Association, 2014, p. 20). Research has demonstrated the benefits of collaboration between peers working together in partners or groups through technology integration (Darling-Hammond et al., 2014; King & South, 2017). Nouri et al. (2020) studied K-9 teachers who taught some form of programming/coding to their students. When collaborating in programming activities, students are improving their "collaborative

problem-solving skills, pedagogic communication skills and sharing and building on others' work" (Nouri et al., 2020, p. 13).

Peer collaboration assisted with technology integration can promote simulate inquiry and critical thinking because students are using tools such as Google Docs, emails, and discussion boards to work on collaborative activities, both synchronously and/or asynchronously (King & South, 2017; Riegel & Kozen, 2016). Technology allows the use of collaboration tools to improve student collaboration because it encouraged students to give and receive help peers and helps students who typically do not normally speak in class to engage in group discussion, increasing their ability to demonstrate their understanding by actively participating in group discussions with peers (Chang, 2016; Leaman & Corcoran, 2018; Scalise, 2016).

Collaboration among students is important because it helps students learn to use their knowledge and skills to communicate clearly, and to work well with others and apply that skill set to their future college and career (Chang, 2016; Mishra & Mehta, 2017; OCED, 2013).

College and Career Readiness

The ESSA (2015) outlines the importance of preparing students for college and career readiness. But what exactly is college and career readiness? College readiness is defined as being academically prepared for postsecondary education, as measured through standardized test scores, course completion, and grade point average (ACT, 2012; An & Taylor, 2015) while career readiness means possessing skills presumed necessary for workforce success (Malin et al., 2017). The terms college and career are both used with the notion that students should not be required to choose between college

or career, instead all high school graduates should have the skills needed for success in college and a future career (An & Taylor, 2015; ESSA, 2015; Malin et al., 2017).

Multiple states across the U.S. have adopted and are using college and career readiness standards (National Governors Association Center for Best Practices, & Council of Chief State School Officers, 2010). These standards are in place to help ensure all high school graduates have the knowledge and skills needed to be successful after high school in the rapidly changing technological society. This includes the move towards online assessments in schools. The shift to digital testing has been done so students can demonstrate proficiency in literacy, math and problem-solving skills using technology enhanced testing items to elicit higher order skills and knowledge of students (OCED, 2013; Piliouras et al., 2014).

For students to be successful on the digital assessment, the use of digital learning can help students reach the higher level of critical thinking based on the college and career readiness standards and improve academic achievement (i.e., summative and formative assessment) (Darling-Hammond, et al., 2014; Escueta, et.al., 2017; Kurvinen et al., 2020; OECD 2015; Sabzian et al., S. 2013) needed to foster innovation needed to succeed in the 21st century.

Technology rich instruction can help increase achievement gain, particularly for underrepresented students by closing the achievement gap on standardized test through more teachers frequently integrating technology (Blanchard et al., 2016; Gerard et al., 2010; Lee et al., 2009; Liu et al., 2011; Turner 2020). Turner (2020) researched how to use literacy to improve the readiness of black K-8th grade students for college and career by encouraging teachers to use technology to show students how to read the world:

> Notably, "reading the world" helped [students] acquire a wide range of traditional literacy skills (e.g., reading fluency, comprehension strategies, vocabulary development, research skills, writing skills), multimodal tools (e.g., Glogster, Power Point, GarageBand), and digital literacy skills (e.g., composing digital six-word memoirs and memes, recording podcasts, making movies) (p.447).

Utilizing technology and digital media strategically helps teachers prepare underrepresented students to master CCSS literacy skills by thinking critically in reading and writing needed to achieve college and career readiness (Curry & Shillingford, 2015; Turner, 2020). The use of Web 2.0 technologies and technology devices (i.e., iPads) technology can have a positive impact on underrepresented and first generations college students as they transition to higher ed because faculty can use it to help scaffold concepts and augment learning (Martinez Aleman et al., 2018). Although there are many benefits for technology integration, there are obstacles impeding the success of technology integration for many schools.

Barriers of Technology Integration

Although technology is important and its presence has increased in the classroom, unfortunately, there are still barriers that prevent sufficient access to and successful integration of technology in teaching and learning. When discussing the factors impacting technology integration, Ertmer (1999) created a framework of challenges that teachers faced when integrating technology and found two barriers teachers face: first-order barriers (external to teachers) and second-order barriers (internal to teachers).

First-Order Barriers

The first-order barriers include external factors that may hinder technology integration such as (a) lack of time, (b) poor access to resources, and (c) insufficient training and institutional support (Hur et al., 2016). The difficulties of first order barriers may be difficult to overcome since they are related to resources and institutions outside of the teacher's control. Without proper training for effective technology integration overcoming how teachers adapt to first order barriers may be difficult to be achieved.

Lack of time. Lack of time is a constraint for education technology use since teachers do not have the availability to learn how to use the technology and to plan technology-supported learning (Eiland & Todd, 2019; Lawrence et al., 2020). While conducting a three-year study on barriers to technology integration, Francom (2020) determined time as the most stable and persistent barrier. Teachers describe inflexible instructional schedules, high stakes benchmarks, and standardized testing are the reasons they are unable to have the time needed to become effective with educational technology (Makki et. al., 2018; Tondeur et al., 2017; Yu, 2013).

Poor access to resources. Hew and Brush (2007) described "access" as a barrier by explaining the devices and digital resources are not readily available for use and/or not reliable (e.g., disconnecting from the internet). Although the presence of technology has grown in school districts, access to resources is a major challenge teachers' face when integrating technology. Pittman and Gaines (2015) determined that the level of technology integration is impacted by the availability of technology devices teachers have in their classroom, rather than the overall availability of devices classrooms must share.

Based on a nationally representative sample about the 21st century classroom, Vega, and Robb (2019) reported that teachers described "insufficient access to equipment, old or outdated equipment, technology being hard or difficult to use, and/or technology being unreliable, breaking down, or otherwise not working" (p.13) as the challenges of access to resources for technology integration. Additionally, 35.9% of teachers believed access was the most significant barrier to technology integration (Francom, 2020). For teachers in schools with a majority of low-income and minority populations, the barrier of access to resources tends to be even more prominent (Makki et al., 2018). Purcell et al. (2013) reported that 56% of teachers of low-income students perceived access as a significant barrier to technology integration.

Although access to high-speed internet has grown since 2015, only 38% of school districts are meeting the minimum of high-speed internet recommend per student (Federal Communications Commission, 2020). This means that over 60% of school districts still lack the access to the fastest broadband internet that can be used for technology tools and resources needed for technology integration.

Insufficient training and institutional support. For technology integration to be successful teachers must receive support from school and district administrators (Blanchard et al., 2016; Puhala, 2020). Johnson et al. (2016) and Kafyulilo et al. (2016) described how teachers are not receiving continuous support from administrators to integrate technology and how the lack of teacher training in technology integration hinders their ability to effectively use technology for teaching and learning. An explanation for this lack of effective training is due to schools' institutional structure and lack of support from administrators. School and district administrators impact teachers'

use of technology by providing PD opportunities for technology integration and by modeling how they use technology professionally (Christensen, 2018; Machado & Chung, 2015).

This requires administrators to implement effective technology PD to show teachers higher levels of technology usage. Although teachers would prefer additional training on technology integration, across the country almost 60% of teachers are receiving 8 hours or less PD related to technology integration (National Center for Education Statistics, 2009; Rotermund et al., 2017).

Time, access to resources, and support from school and district administrators are needed for successful technology integrating. The external barriers hinder teachers from using technology to enhance teaching and learning. The lack of technology equipment and limited availability of resources and technical support can increase the perceived internal barriers teachers have (Makki et al., 2018). The reduction and removal of the first-order barrier can assist teachers using technology. Although first-order barriers impact technology integration in the classroom, this mixed methods study will focus on understanding second-order barriers. By addressing second-order barriers, teachers can improve their attitudinal, skill set, and pedagogical beliefs to overcome the obstacles of first and second order barriers to technology integration in classrooms across (Durff & Cater, 2019; Ertmer, 1999).

Second-Order Barriers

Second-order barriers included teachers' perceptions about their ability to integrate technology, which are aligned with (a) attitude, (b) knowledge and skills, and (c) pedagogical beliefs (Durff & Cater, 2019; Ertmer, 1999). Because these barriers are

internal, they are often unaddressed in formal school PD. To make a significant impact on technology integration in classrooms, second-order barriers must be addressed.

Attitude. If a teacher has negative thoughts about their ability to use technology, they will likely not use new methods unless they feel comfortable doing so (Alenezi, 2017; Carver, 2016; Hew & Brush, 2007; Engel & Randall, 2009; Francom, 2020; Makki et al., 2018; Yu, 2013). Despite technology use increasing in education, some teachers may find technology integration useful, but do not find value in learning how to integrate technology.

Mishra and Mehta (2017) administered a survey to teachers about their beliefs about 21st century learning. The results of the survey showed that teachers believed technology was their biggest challenge but also perceived digital/information and communication technology (ICT) literacy was the most important skill set needed for 21st century learning. If teachers are limiting their technology integration, but their students can perform well on standardized tests, this may influence technology resistors to continue to limit their technology usage in their classroom (Tondeur et al., 2017).

Teachers' attitude that technology is a challenge ultimately impacts their students' readiness for their future. Teachers whose attitude impacts their use of technology, prefer more traditional methods of teaching and learning that do not require advance preparation needed for technology integration (Harrell & Bynum, 2018). A negative attitude towards technology affects their willingness to change. To overcome the challenges of teachers' negative attitude towards technology, Mueller et al. (2008) recommends that technology PD should focus on exposing teachers to successful ways to integrate technology in a positive and real-world way (as cited in Pittman & Gaines, 2015).

Knowledge and skills. Teachers' self-perceived lack of technology skills is an internal barrier that impacts their ability to integrate technology. Although perceived technology skill is a barrier, Wang et al. (2014) determined that a teacher's age could not be identified as the cause of teachers' deficiency of technology skills for teaching and learning. According to a 2019 survey, six out of ten teachers who use technology less frequently than their peers, want to use technology more for teaching students (Gallup, 2019).

After conducting over 140,000 direct classroom observations across the U.S., AdvancED found that the increase in technology resources has not resulted in students regularly using digital tools and technology as part of their daily school experience. In more than 61% of classrooms, students showed no evidence of using technology to conduct research, solve problems, and/or work collaboratively for learning (Van Broekhuizen, 2016). Howard and Mozejko (2015) found that when teachers feel they are not knowledgeable about technology integration, it can lead to feelings of being ashamed that they are not confident resulting in compromising their professional competence.

The lack of technology PD can lead teachers to develop a feeling of being unprepared and limited in skills based on their lack of training (Hsu, 2016). Kafyulilo et al., (2016) stated that if teachers received additional opportunities for applying what they learned during PD, it could help them to deepen their knowledge and strengthen their skills before they create a technology integrated lesson. To improve teachers' self-perceived lack of technology skills, they must be given the opportunity to participate in effective PD to overcome the internal barrier.

Pedagogical beliefs. Tondeur et al. (2017) described pedagogical beliefs as the teachers' beliefs about teaching and learning. When a teacher's pedagogical belief is student centered (the needs, interests and abilities of the student is the focus), they are more willing to integrate technology, while teachers with teacher-centered pedagogical beliefs must have the technology aligned with their current teaching practices to want to integrate technology (Ertmer et al., 2012; Liu, 2011; Shin, 2014; Tondeur et al., 2017). Since time is so valuable to teachers, if they do not understand how the new technology aligns to their current learning goals, they may not dedicate the time needed to learn about the new technology, or plan how to use the digital tools for teaching (Howard & Mozejko, 2015).

According to Ottenbreit-Leftwich et al. (2010), teachers' beliefs is the greatest barrier hindering technology integration and for technology integration PD to be successful, it must address teachers' values and beliefs. Eliminating second-order barriers is the key for successful technology integration in classrooms by using a "combination of technological, PD, institutional and personal factors had influence on the continuous use of technology in teaching" (Kafyulilo, et al., 2016, p. 1550).

Professional development can be the key to supporting teachers in learning how to effectively integrate technology for teaching and learning (Kopcha, 2012; Wang et al. 2014). Liu (2013) studied if PD for technology integration would positively alter teaching practice. The results of the study concluded that technology PD can benefit teachers in classroom technology integration by evolving their pedagogical beliefs by using technology for student centered instruction (Liu, 2013).

Kopcha's (2012) two-year case study also determined that PD helped teachers overcome their perceived technology integration barriers. By participating in effective technology PD that used strategies (e.g., establish systems for accessing and using available technologies) to overcome barriers (e.g., access and time) teachers reported that the continuous PD activities improved the quality and increased the frequency of technology integration (Howard & Mozejko, 2015).

The Office of Educational Technology (2017) determined that for technology integration to improve, "school systems, state and local policymakers, and educators come together in the interest of designing pre- and in-service professional learning opportunities that are aligned specifically with technology expectations outlined within state standards and that are reflective of the increased connectivity of and access to devices in schools" (U.S. Department of Education, 2017, p.88). By developing a shared plan and engaging all stakeholders, effective PD can be used to overcome second order technology integration barriers and help teachers learn how to overcome first order barriers (Hew & Brush, 2007; Howard & Mozejko, 2015; Kopcha, 2012; Wang et al., 2014).

Professional Development and Technology Integration

The literature informs us that there are (a) benefits of technology integration focused PD yet there are still (b) challenges with implementing PD for technology integration.

Benefits of Professional Development

Professional development is a method for training teachers about a variety of subjects and skills. The use of technology-based PD helps teachers use technology to

innovate teaching and learning. Professional development based on technology integration can benefit teachers by providing (a) active learning experiences, (b) collaboration, and (c) improving teacher skills.

It is important that teachers are active participants in learning during PD. Matherson and Windle (2017) reported that teachers want to be "actively engaged in the practice of skills, strategies, and techniques" (p. 30). This helps improve teaching and learning with authentic experiences for planning and implementing instructional technologies that are practical and immediately applicable (Hargreaves, 2014; Liao et al., 2017; Whitworth & Chiu, 2015). Colvin (2018) researched the impact of technology integration on fifth and sixth grade educator's classrooms and determined that teachers integrated technology more frequently after participating in technology PD. Tyner (2018) reported similar findings when examining the effects of PD on middle school teachers' technology integration. Tyner (2018) findings correlated with Hew and Brush (2007) recommendations that developing PD that encourages technology use by providing participants with specific technology integration knowledge, skills and examples have led to an increase in technology integration.

Darling-Hammond, Hyler and Gardner (2017) described examples of active learning during professional life to include practicing teaching lessons and exploring science kits. PD can reduce the feeling of teacher isolation by creating authentic opportunities for collaboration. When teachers can collaborate, they can share their knowledge and ideas with peers, which leads to improving their impact on teaching and learning (Kim et al., 2013, King & South, 2017). Teachers are one of the greatest influences on students' learning. To ensure all students have knowledgeable teachers,

effective PD should be used to continually educate teachers learning practices (Akiba & Liang, 2016; King & South, 2017; Polly et al., 2015).

Challenges to Implementing Professional Development for Technology Integration

Traditional PD may not meet the expectation of providing effective technology integration training due to challenges such as (a) time and (b) lack of focus on teaching and learning. These challenges affect the implementation of an effective technology integration PD.

For PD to positively impact teachers, they need time devoted to practicing technology integration after PD and working with peers using information applicable to their classroom and school goals. It takes repeated practice to effectively integrate technology that can support student learning (Brinkerhoff, 2006; Yurtseven Avci et al., 2020). Unfortunately, PD programs continually fail to prepare teachers to integrate technology effectively (King & South, 2017).

Combs & Silverman (2017) reported that the average amount of technology PD teachers receive is 4.5 hours of PD and only 13% of the PD takes place over three individual meetings. The Frontline Research and Learning Institute using the recommendations from the ESSA (2015) discovered that "most PD offered and enrolled in today does not meet the federal definition of quality" because only 9% of PD sessions have collaboration and 8% are aligned to school/classroom data (Combs & Silverman, 2017, p. 5). This supports the findings from Pittman and Gaines (2015) when they studied high-level versus low-level technology integration in third, fourth and fifth grade classrooms in a Florida school district. They found that 70% of respondents received 3 hours or less of technology-related PD during the previous school year. If teachers are not

receiving the time needed for technology integration, they are not able to reap the full benefits of teaching with technology.

Multiple studies support that current PD is ineffective in supporting technology integration and what teachers learn is not being applied to the classroom teaching and learning practice (Hur et al., 2016; Yurtseven Avci et al., 2020). When Sancho-Gil et al., (2020) examined the failures of education technology, they found alternatives approaches in helping improve technology by focusing on small-scale implementations technology integration in the K-12 setting. An example of an alternative approach is developing technology integration PD by prioritizing pedagogical principles before digital devices. Teachers will face barriers when integrating technology, but by addressing the challenges head on they are able to think of strategies to overcome the barriers. This helps teachers understand how to use technology as a supportive tool to engage students and encourage active participation in teaching and learning processes (Sancho-Gil et al., 2020). Professional development can help teachers over the technology barriers and learn how to use educational technology to enhance teaching in learning in their classroom.

After analyzing two decades of research on educational technology Kopcha et al. (2020) found that there is a disconnect between "current perspectives about technology integration and the realities of using technology in today's classrooms" (p.730). They found the recurring phenomenon that the lack of technology integration is not about teachers failing to use technology, instead Kopcha et al. (2020) noted 'there is a lack of understanding about a teacher's decision-making process about technology" (p.730). For a technology integration PD to successfully teach teachers how to integrate technology, it

must be designed to build the teacher's repertoire (e.g., skills) for using technology for teaching and learning (Darling-Hammond, 2012; Kopcha et al., 2020).

Design Elements of Effective Professional Development

The Every Student Succeeds Act of 2015 established criteria for effective PD (ESSA, 2015) and the Frontline Research and Learning Institute created definitions and metrics that support the ESSA criteria (Combs & Silverman, 2017). The criteria establish that effective PD (a) is frequent and ongoing, (b) supports collaboration (c) is content focused, (d) provides feedback and opportunities for reflection, and (e) has an effective PD model.

Frequent and Ongoing

A recurring theme is technology integration research is that for it to be effectively implemented by teachers they must receive PD that is frequent and ongoing. The use of traditional one day PD does not allow teachers to have multiple opportunities to engage and build upon their learning leading to little impact on teacher growth or understanding (Desimone & Garet, 2015; Donohoo, 2016; Liao et al., 2017; Martin, 2019). Darling-Hammond et al., (2017) determined that one day single workshop format is unlikely to lead to significant changes in teachers' instructional practices. Research shows that for student achievement to be impacted, their teacher must receive training over time to help teachers sustain what they learn (Darling-Hammond et al., 2017; Whitworth & Chiu, 2015). Yet in a study by Combs and Silverman (2017) only 13% of teachers receive PD over an extended period (more than three meetings). Frequent PD is shown to be more effective and engaging, schools are counting to provide teachers with infrequent PD sessions.

Supports Collaboration

Collaboration in PD allows teachers to work together to problem solve, learn from each other and can contribute to an improve quality of teaching (Darling-Hammond et al., 2017). When developing an online asynchronous PD Yoon et al. (2020) found that providing reflective and interactive discussion prompts is a good way to giving teachers different ways to collaborate with each other. Similar results were reported by Plešec Gasparič and Pečar (2016) and Acar and Yildiz (2016), when they found that participants can share communicate their own learning and receive constructive feedback from peers, their level of learning was greater than participants who lack in communicating with other participants. Collaboration during PD weather its one on one, online postings or small group meetings, allows teachers to work together to transform their teaching to improve student learning and achievement (Bae, 2017; Darling-Hammond et al., 2017; Nasir et al., 2014).

Content Focused

Another important factor in having a successful PD is the structure. The PD structure should focus on teaching strategies aligned to specific curriculum content. When teachers can use their classroom data and schools' goals during their PD it can increase their motivation and commitment to the learning process because they have a personal connection (Darling-Hammond et al., 2017; Donohoo, 2016; Hargreaves & Fullan, 2012; Hobbs & Tuzel, 2017; Liu et.al., 2018). When developing the structure of a PD, one must also consider the teachers as learners. This means differentiating the PD to accommodate varying teaching assignments, career stages and learning styles (Darling-

Hammond et al., 2017; Hargreaves & Fullan, 2015; Hobbs & Tuzel, 2017; Liu et al., 2018).

Provide Feedback and Opportunities for Reflection

Feedback and reflection are important parts of an effective PD design. Reflection allows teachers to focus on strengths and areas of improvements so that they can build new knowledge about content and learners (Akiba & Liang, 2016; Darling-Hammond & McLaughlin, 2011; Desimone & Stuckey, 2014; Noonan, 2019; Pattie et al., 2012; Yurtseven Avci et al., 2020). When teachers can reflect on what they learned and receive feedback to make improvements, they develop ownership over their learning (Cviko et al., 2014).

Effective Professional Development Models

The ESSA (2015) suggests the use of various formats or structures for administering PD based on the districts and school's needs. I will review (a) face-to-face, (b) online, (c) hybrid/blended modes of delivering PD and (d) coaching.

Face-to-face

Face-to-face is a traditional PD format and allows participants to communicate visually, verbally and through body language (Sankar & Sankar, 2010). This method of PD is what is traditionally done and can take on a "sit and get" approach were participants are passively receive information from the PD facilitator (Desimone, 2009; Nishimura, 2014) or a hands-on approach where participants are required to be hands on in their learning (Darling-Hammond et al., 2017; Terrazas-Arellanes et al., 2016). Face to face PD sessions is common practice in schools due to encouraging hands on learning and provide immediate feedback and assistance (Sankar & Sankar, 2010).

Online

When PD is held online it may be delivered through synchronous (i.e., live workshops) or asynchronous (i.e., online self-paced workshops, discussion board participation) sessions (Yoon et al., 2020). Online PD fits into the teachers' schedule by providing flexibility of when they engage in learning and increases accessibility to PD courses because their geographical location is not a barrier (Russell et al., 2009; Yoon et al., 2020). This delivery method is beneficial when teachers volunteer for online PD versus when online PD is mandatory (McConnell et al., 2013; Parsons, 2019).

Hybrid/Blended

Hybrid/blended PD offers teachers the benefits of face to face and online learning (Fishman et al., 2013; Yurtseven Avci et al., 2020). Hybrid PD provides an opportunity for ongoing professional learning by having in person and online learning creating flexibility for teachers and the possibility to work with participants from various geographic locations (Moore, 2016; Watkins et al., 2020). When developing a hybrid PD, it is important that when face to face with participants they should be engaged in hands on learning and use the online sessions to sustain what was done by reinforcing and extending learning (Clary et al., 2017; Paskevicius & Bortolin, 2016).

Face-to-face and online PD can generate similar results when they both use the same effective PD materials (Russell, 2009; Terrazas-Arellanes et al., 2016). The PD effectiveness should be measured by the characteristics of the activities (e.g., content focus, coherence, and duration) not by the type of PD (e.g., workshop or study group) (Darling-Hammond et al., 2017; Griffin et al., 2018; Hochberg & Desimone, 2010; Lindvall, & Ryve, 2019; Main & Pendergast, 2015). Deciding the best method of PD for

an individual school district may focus on cost, location, or content (Fishman et al., 2013) instead of teachers preferred method.

Coaching

A coaching professional development model can be defined as an experienced individual (coach) developing an ongoing relationship with a less experienced person (coachee) for the purpose of developing professional growth through support and guidance rather than evaluative (Mraz, 2016; Pearce et al., 2019). Coaching is used in professional development because it allows the participants to have an ongoing relationship with the facilitator, reducing the possibility of withdrawal because of the continuous support (Brody & Hadar, 2011; Brown et al., 1989; Desimone & Pak, 2017).

Instructional Design

The Morrison, Ross, and Kemp (MRK) model offers a nine-component framework for instructional design planning (Morrison et al., 2007, 2019) as shown in Figure 2.1. The MRK model is a framework that can supports a descriptive mixed methods study because it can help instructional designers understand the needs of the survey population before planning solution for instructional problems (Brown & Green, 2016; Creswell & Creswell, 2018). A descriptive study is designed to tell a story of the perspective of the participants (Leavy, 2017). A needs assessment can assist in the story telling of a descriptive study. To identify the instructional problems, instructional designers (i.e., PD developers) can implement a needs assessment. Implementing a needs assessment aligns with the "instructional problems" of the MRK model. During this initial phase of the MRK process, directional designers can administer a needs assessment to identify the needs of the population being survey and the potential

instructional solutions to address their needs (Morrison et al., 2019; Patten & Newhart, 2017; Seel et al., 2017).

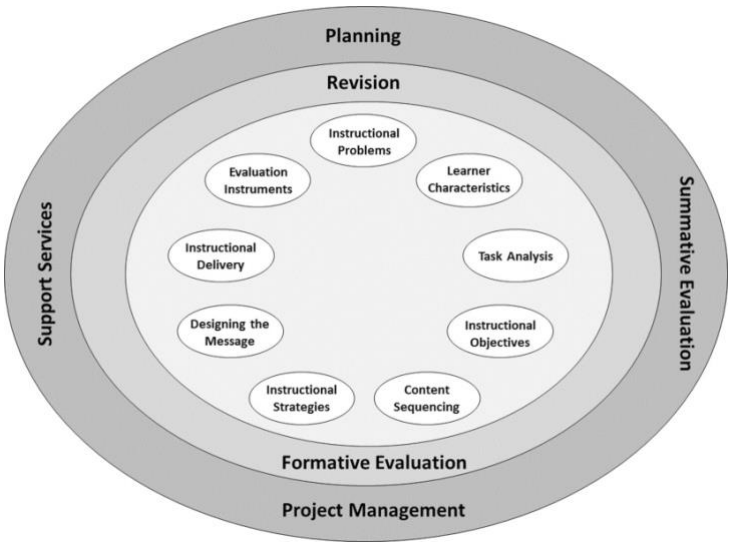
Researchers have looked at the use of needs assessments for procurement of educational technology and PD development. J. Morrison et al. (2019) researched school districts procurement of educational technology and found that in contrast to best practices, districts were rarely, administering needs assessments for acquiring and implementing technology. Using a needs assessment can help districts determine what needs are and the educational technology products to procure and how to design a PD to meet the needs of the respondents (J. Morrison et al., 2019; Penuel et al., 2016). Researchers have also examined the use of needs assessment to address instructional problems. Houston-Wilson & Lieberman (2020) developed a needs assessment to administer to physical education stakeholders (i.e., Physical education teachers, Physical therapists, occupational therapists etc.). The needs assessment was developed so school administrators could designed effective PD to support an inclusive physical education environment for students with disabilities.

Additionally, needs assessment have been developed and administered statewide to address the needs of a state. Researchers from the Assessment Resource Center at the University of Missouri conducted a statewide STEM PD needs assessment to determine the current PD needs of K-12 STEM educators throughout Missouri (McFarling et al., 2018). Researchers were able to take the results of the needs assessment to make recommendations for structure and content for PD based on educators reported needs (McFarling et al., 2018). Once school districts have administered a needs assessment to

identify the PD needs for technology integration, they can continue in the MRK process and design PD to address the instructional needs (Creswell & Plano Clark, 2018).

Figure 2.1

The Morrison, Ross, and Kemp (MRK) model



Source: Adapted from Morrison et al., (2011); reported in Seel et al., (2017).

Summary

Technology integration and PD both have many benefits in helping address the demand for preparing students with the skills needed for 21st century college and career readiness. The key for preparing students in ensuring that teachers are effectively prepared to integrate technology into their teaching and student learning. When integrating technology for teaching and learning, technology should be used as a tool to enhance learning and not the focus (Cauley et al., 2009; Thompson, 2013).

CHAPTER 3

METHODOLOGY

Introduction

The purpose of this descriptive mixed method study was to determine teachers' needs and preferences for a technology integration PD. Three research questions were explored by this mixed methods study: (1) What are teachers' needs and preferences for technology integration professional development in K-12 schools? (2) How are teachers currently integrating technology for teaching and learning in their classroom? and (3) How do teachers perceive technology benefits and usefulness of technology integration for teaching and learning?

Research Design

The purpose of this research was to identify and describe teachers' needs and preferences for educational technology-focused PD. The triangulation mixed-methods design was used for the mixed methods study. Quantitative and qualitative information was collected. This method was selected based on the greater credibility that comes with giving equal emphasis to quantitative and qualitative data collection (Mertler, 2017). The use of surveys and one-on-one interviews accomplished the triangulation of data by increasing trustworthiness and validity.

Participants

Participants

This descriptive mixed methods study took place with 33 participants across 6 U.S. states. Participants were selected using a combination of non-probability sampling (Patten & Newhart, 2017; Sharma, 2017) and voluntary sampling (Creswell & Plano Clark, 2018; Patten & Newhart, 2017). Participants from the study were recruited in phases. Initially, potential K-12 participants were recruited from two school districts. Due to low responses, recruitment continued through the University of South Carolina (UofSC) – Columbia EdTech social media pages. Additional recruitment was done through snowball sampling (referrals from study participants), and the researcher's personal and professional references for maximum dispersal. The personal and professional references did not participate in the study instead they shared the recruitment flyers with prospective K-12 teachers. Voluntary sampling (Creswell & Plano Clark, 2018; Patten & Newhart, 2017) was used to identify participants for the one-on-one interviews at the end of the survey.

Participants were asked if they would like to volunteer for an one-on-one interview and six participants elected to be interviewed. Demographic questions were used to determine general characteristics of the study participants (Creswell & Plano Clark, 2018; Mills & Gay, 2019). Of the 33 participants, 11 worked at the elementary level, 9 middle school and 11 high school. One participant elected not to share their current school level.

Data Sources

Data Collection

In this descriptive mixed methods study, quantitative and qualitative data was collected, allowing for a convergent parallel mixed methods approach to the research problems. This is an appropriate study design because quantitative and qualitative data collection provides a holistic understanding of the research study (Mertler, 2017). A descriptive study allows the researcher to describe participants' perspectives without modification or influence from an intervention (Mertler, 2017; Patten & Newhart, 2017). Table 3.1 shows the alignment between the research questions and the corresponding data collection methods.

Table 3.1

Research Questions and Data Collection Methods

Research Question	Data Collection Method
RQ1 What are teachers' needs and preferences for technology integration professional development in K-12 schools?	• Technology survey • One-on-one interview
RQ2 How are teachers currently integrating technology for teaching and learning in their classroom?	• Technology survey • One-on-one interview
RQ3 How do teachers perceive technology benefits and usefulness of technology integration for teaching and learning?	• Technology survey • One-on-one interview

Quantitative Data

Survey. The Likert type scale questions on the technology survey (Appendix A) was developed by modifying the School Technology Needs Assessment (STNA) (Friday Institute for Educational Innovation, 2016) to collect perception data on professional

development, and the impact of technology on teachers and students. The STNA was developed by the Friday Institute for Educational Innovation (The FI) at North Carolina State University. The FI allows the STNA to be modified if researcher credits the original source and completes a consent form on their website to receive the survey. Both requirements were competed for this study. The original STNA survey instrument collects data on digital teaching and learning using four constructs and ten sub constructs.

To develop the survey instrument, the STNA was adapted and modified to answer the three research questions of this study. Using an existing instrument based on theoretical basis; thoughtful and rigorous development; validity evidence; popularity of use; alignment with standards; and relevance to the current evaluation context (Maxfield, Huynh & Mueller, 2011) helped strength the modified survey instrument. Mertler's (2017) suggestions were used in selecting questions for creating a survey to increase its reliability. These include: (a) making sure the questions are focused, (b) using open and closed response items, (c) using consistent scaling, and (d) reviewing surveys before administration. To ensure that the survey items align to my study, simple modifications were made.

The original survey instrument was modified to remove the "supportive environment for technology use" construct. This construct consisted of 32 questions about vision, planning and budget, communication, infrastructure, and staff support and did not specifically reference professional development or technology use. It was removed so that the technology survey would focus on participants needs, preferences for PD, how participants and their students were using technology, and the benefits of technology use compared to the frequency of use.

The modified survey consists of two parts: Part I: demographic, teaching, and learning - technology use, technology benefits and frequency of use and PD needs and Part II: five open ended questions. Part I of the technology survey includes Likert scale questions. The first section is “Teaching and Learning - Technology Use”. Participants first answer questions about their technology use, more specifically participants digital instructional behaviors (e.g., using technology to communicate with families, analyze student data etc.). Then participants answered how students use technology for learning (e.g., productivity, collaboration etc.). Responses were reported on a Likert scale of (1) never to (5) always to determine the frequency. This was done to see what educational technology participants and their students were using.

The next section is “Technology Benefits and Frequency of Use”. In this section participants answer their level of agreement for each statement about how beneficial they believe technology is for teaching particular topics using the Likert scale of (1) strongly disagree to (5) strongly agree. Then participants answered how frequently they use technology, and their students use technology for in teacher instruction and student learning using the scale (1) never to (5) always. This was done to compare how beneficial teachers find something to be and how frequently it is being used. In the last section of Part I participants answer questions about their PD needs using a Likert scale of (1) strongly disagree to (5) strongly agree.

Each section in the technology survey aligns to a specific research question. Table 3.2 shows the alignment between the research questions and the surveys. The demographic section is not included in the alignment table. Demographic information will be collected for an aggregate picture of the research population.

Table 3.2

Research Questions Alignment to the Technology Survey

Research Question	Technology Survey Section Heading
RQ1 What are teachers' needs and preferences for technology integration professional development in k-12 schools?	Professional Development
RQ2 How are teachers currently integrating technology for teaching and learning in their classroom?	Teaching and Learning - Technology Use
RQ3 How do teachers perceive technology benefits and usefulness of technology integration for teaching and learning?	Technology Benefits and Frequency of Use

Qualitative Data

Survey. Part II of the survey consisted of five opened ended questions. I worked with Dr. Alison Moore and Dr. Erik Drasgow to develop open-ended questions that aligned to the three research questions. Open ended questions were included on the survey with Likert scale questions to provide additional insight into participants' thoughts and feelings (Fetters, 2019; Mertler, 2017). Since the one-on-one interviews were voluntary, the open-ended questions on the survey allowed all participants to express additional views about PD and technology integration. Table 3.3 display the research question and the survey question it is aligned to.

Table 3.3

Research Questions Alignment to the Open-Ended Technology Survey Questions

Research Question	Open-Ended Questions
RQ1 What are teachers' needs and preferences for technology integration professional development in K-12 schools?	• What have been the most effective professional development (any subject) that you have experienced, and explain what made them effective? • What have been the least effective professional development (any subject) that you have experienced, and explain what made them ineffective?
RQ2 How are teachers currently integrating technology for teaching and learning in their classroom?	• How do you currently utilize technology in your classroom? • Describe your experience when integrating technology in your classroom. What are the difficulties or successes you faced when integrating technology into your classroom?
RQ3 How do teachers perceive technology benefits and usefulness of technology integration for teaching and learning?	• How would you rate the impact of technology on education on a scale of 1 to 5, in which 1 means having a low impact and 5 having a great impact? Explain your reason for this rating.

One-on-one interview. At the end of the technology survey, teachers were asked if they would like to volunteer for a one-on-one interview (Appendix B). Teachers who responded that they would like to participate in an interview then selected their availability and provided their contact information. I then sent a Microsoft Teams meeting invitation to set up their one-on-one interview. The one-on-one interviews were scheduled for 30 minutes and recorded using Microsoft Teams video conferencing. A semi-structured format, guided by 6 open-ended questions was used. Microsoft Teams video conferencing platform provided a record function and transcribed the recording after the video call ended. Each interview question aligns to a research question. Table

3.4 shows the alignment between the research questions and the focus group interview questions.

Table 3.4

Research Questions and One-on-One Interview Questions Alignment

Research Question	Interview Questions
RQ1 What are teachers' needs and preferences for technology integration professional development in k-12 schools?	• What is your ideal technology professional development session? What makes it ideal?
RQ2 How are teachers currently integrating technology for teaching and learning in their classroom?	• Describe your experience when integrating technology in your classroom? What are difficulties or successes you faced when integrating technology into your classroom? • What was your most successful technology-based lesson or activity you have used in your classroom? What made the lesson successful?
RQ3 How do teachers perceive technology benefits and usefulness of technology integration for teaching and learning?	• In your opinion, what are the benefits of integrating technology in instruction? • What are the most significant factors that help you decide what technology to integrating into your classroom?

Questions were developed using information from the literature review, collaborating with Dr. Alison Moore, and adopting and adapting questions from an existing instrument (Bradley, 2020). Questions were developed to be aligned with my research questions and research purpose. Referring to instruments from published studies led to similar previous studies and questions that were adopted and adapted the individual one-on-one interviews (Bolderston, 2012).

Data Analysis

The descriptive mixed methods study yield both quantitative and qualitative data. The quantitative data required descriptive statistics and the qualitative data was analyzed using inductive analysis. Table 3.5 shows the alignment between the research questions, data collection methods, and data analysis methods.

Table 3.5

Alignment of Research Questions, Data Collection Methods, and Data Analysis Methods

Research Questions	Data Collection Methods	Data Analysis Methods
RQ1 What are teachers' needs and preferences for technology integration professional development in K-12 schools?	• Technology survey • One-on-one interview	• Descriptive statistics • Inductive analysis
RQ2 How are teachers currently integrating technology for teaching and learning in their classroom?	• Technology survey • One-on-one interview	• Descriptive statistics • Inductive analysis
RQ3 How do teachers perceive technology benefits and usefulness of technology integration for teaching and learning?	• Technology survey • One-on-one interview	• Descriptive statistics • Inductive analysis

Quantitative Data Analysis

A descriptive statistical analysis (Creswell & Creswell (2018) was used to analyze Likert scale question responses. The technology survey will be analyzed using descriptive statistics measures of central tendency. Mertler (2017) defined the measure of central tendency as beneficial to determining the "collective level of performance, attitude, or opinion of a group of study participants" (p. 285). The specific statistical procedure of central tendency includes the mean, median, and mode. The results will be displayed in

tables showing the overall mean (average) of the teachers' responses about their needs and preferences of technology integration. The standard deviation was also reported to determine how responses varied from the mean (Mills & Gay, 2018; Patten & Newhart, 2017). The responses from the Likert scale questions on the technology survey was collected from the Qualtrics survey and input into JASP statistical software to analyze, export results, and create reports.

Qualitative Data Analysis

The transcriptions of the semi-structured one-on-one interviews, and the open-ended survey questions were analyzed individually using inductive analysis process of organization, description, and interpretation (Leavy, 2017; Mertler, 2017). Inductive analysis allows the researcher to identify themes to answer the research questions (Creswell & Plano Clark, 2018; Mertler, 2017; Mills & Gay, 2018). The qualitative data from the one-on-one interviews were transcribed using Microsoft Teams. The audio transcription was cleaned up by the researcher by reviewing the interview transcripts line by line (Bernard et al., 2017; Liu, 2016; Saldana, 2016) to make sure participants were accurate in the transcription. The open-ended questions and the on-on-one interviews were then uploaded individually into Delve. Delve is a qualitative data analysis software, was used to code the data into categories and themes. This inductive analysis process was used to develop categories, and themes.

Procedures and Timeline

The timeline for the procedures for this research will be implemented in three phases: (a) Phase 1: Participant Identification, (b) Phase 2: Data Collection, and (c) Phase 3: Data Analysis. Each phase is described in detail in Table 3.6.

Table 3.6

Timeline of Participant Identification, Data Collection, and Data Analysis

Phase	Expectation	Time Frame
Phase 1: Participant Identification	1. Identify participants 2. Contact participants 3. Obtain consent from participants	6 months
Phase 2: Data Collection	1. Administer the technology survey 2. Conduct the one-on-one interviews	15 weeks
Phase 3: Data Analysis	1. Analyze one-on-one interview transcription (coding and analysis) 2. Conduct technology survey analysis	6 weeks

Phase 1: Participant Identification

Phases 1 started with Institutional Review Board (IRB) approval from UofSC (Appendix C). After receiving IRB approval, Phase 1 began when permission to contact school principals was obtained from two school district in the Southeast of the U.S. School principals were contacted with recruitment flyers (Appendix D) for them to share with their staff. Due to significantly low responses, the participant identification process was expanded to invite K-12 teachers from across the U.S. by posting recruitment information to the UofSC EdTech social media pages, encouraging snowball sampling, and the researcher's personal and professional references. A consent form (Appendix E) was obtained by all individuals who volunteered to participate. Responses remained confidential through de-identification and the use of pseudonyms in reporting.

Phase 2: Data Collection

During phase 2 begins data was collected from participants who volunteered to complete the technology survey. The survey was distributed through Qualtrics.

Participants could access the survey from the link and QR code located on the recruitment flyer. One-on-one interview participants were identified from the survey based on their responses to the question asking if they would like to participate in an interview.

The one-on-one interviews were scheduled based on participants availability. Each interview was held virtually using Microsoft Teams video conferencing platform. Participants received an email containing the Microsoft Team meeting link and the date and time for the interview. The one-on-one interviews were scheduled for 30 minutes. Participants were notified that the one-on-one interview would be recorded (participant cameras on or off and their microphones on). If they did not consent to being recorded for the focus group, they were not required to participate.

Phase 3: Data Analysis

In Phase 3, the data from the one-on-one interviews and the survey was analyzed. Data analysis included exporting the quantitative data from Qualtrics as a Microsoft Excel document and uploading to JASP for descriptive statistics analysis. The qualitative data was exported from the five open-ended questions on Qualtrics and uploaded to Delve for inductive analysis. The Microsoft Teams transcripts one-on-one interview transcripts were cleaned and uploaded into Delve individually. All data was de-identified before uploading to JASP and Delve for analysis. The data from the interviews was triangulated with the technology survey data for a more comprehensive view of the research questions (Mertler, 2017).

Rigor & Trustworthiness

When conducting research, the study must be considered trustworthy by the readers. Pilot and Beck (2014), define trustworthiness or rigor as, "a study refers to the degree of confidence in data, interpretation, and methods used to ensure the quality of a study" (as cited in Connelly, 2016, p. 435). To combat bias, I established trustworthiness between myself, the participants, and anyone analyzing this study. To accomplish this, I ensured the trustworthiness of this mixed methods study by engaging in thick and rich description, peer debriefing, methodological triangulation, and an audit trail.

Trustworthiness

Table 3.7 outlines how credibility, transferability, dependability, and confirmability will be implemented to ensure trustworthiness for the qualitative data collected.

Table 3.7

Trustworthiness of the Findings of Qualitative Data in this Study

Criteria	Study Phase for Criteria	Action Taken in this Study
Credibility	Data Collection & Data Analysis	Data obtained from participants over the course of the study. Data collection methods include surveys and one on one interview.
Transferability	Findings & Conclusions	Although the small study is not focused on transferability, I will provide recommendations for improving technology integration PD.
Dependability	Literature Review	This study relies on scholarly literature, peer reviewed journals, well-known theorists, and subject matter experts.
Confirmability	Data Analysis & Summary of Findings	This study relies on scholarly literature, peer reviewed journals, published theorists and subject matter experts.

Credibility ensures that the results of the study are believable and credible (Forero et al., 2018; Lincoln & Guba, 1986). Transferability pertains to the findings of the study being applicable or transferred to another study (Forero et al., 2018; Lincoln & Guba, 1986). Dependability applies to the idea the study can be repeatable if conducted by a different researcher using the detailed information provided in the study (Kalu & Bwalya, 2017; Shenton, 2004). Confirmability requires the researcher to be objective and not influenced by biases or assumptions (Forero et al., 2018; Kalu & Bwalya, 2017; Lincoln & Guba, 1986).

Thick and Rich Description

Thick and rich descriptions describe the phenomenon in sufficient detail and are evaluated to explain what is occurring in the observed research setting (Creswell & Creswell, 2018; Lincoln & Guba, 1985). Notes will be used for the thick and rich description. The notes combined with the survey results will provide an overview of the teacher's perception about the effectiveness of the technology integration professional development. The use of notes will support the trustworthiness of my study by allowing the reader to see the participants' responses compared with the survey results (DeCuir-Gunby & Schutz, 2017).

Peer Debriefing

Peer debriefing enhances a study's rigor and trustworthiness by "enhancing the accuracy of the account" (Creswell & Creswell, 2018, p. 277). As the researcher, I leveraged my dissertation advisor as a peer debriefer. My dissertation advisor provided an external opinion of my interpretation of the research findings. Also, former and current members of my dissertation committee collaborated with me to develop open-

ended questions for the interviews and the survey, and to provide feedback about my study prior to implementation. This improved my research project's trustworthiness by checking for potential biases and providing new perspectives for improving the quality of my research (Anney, 2014; Creswell, 2014).

Methodological Triangulation

Methodological triangulation involved using multiple methods for a study through convergence in the research findings by providing an ample amount of data and increasing the trustworthiness of the study (Bekhet & Zauszniewski, 2012). The technology survey and interviews are developed to align with the research questions and referencing previously published research. This is done to ensure my research findings are valid and reliable for publishing and limits my research biases (Fallon, 2016; Shenton, 2004). The questions on the technology survey have internal reliability. That involves the individual scale questions measuring teachers' perception about the technology integration and PD (Biddix, 2018). Using a mixture of quantitative data from the technology survey and qualitative data from the one-on-one interview strengthened each other while producing reliable results (Zohrabi, 2013).

Audit Trail

In addition to developing my survey from previously published research, an audit trail was used to help the reader understand my steps and procedures used through the duration of my mixed methods study (Shenton, 2004). The audit trail was a record of changes made to the research and why the changes took place. This method of creating memos strengthened the audit trail by show what decisions I made when coding and how decisions were reached (Stuckey, 2017). The one-on-one interview questions and notes

provided insight to teacher perception and allowed me to interpret their responses to better understand the participants (Raufelder, Bukowski, Mohr, 2013). An example of this is, as I am coding, in the margins of the interview transcription, I wrote notes, detailing how I developed themes and its connection to my three research questions. This method triangulates the data sources by verifying the participants' views and experiences with one another (Shenton, 2004).

Plan for Sharing & Communicating Findings

A presentation will be created to show the results of each research question and the recommendation for teachers' needs and preferences for technology integration. This insight will support participants' efforts in sharing with their school and district how to develop effective PD for technology integration.

Beyond my research, I would like to present my research at the SC Association for Educational Technology (SCAET) and North Carolina Technology in Education Society (NCTIES) conferences. The SCAET and NCTIES conference sessions focus on learning and teaching through the effective use of technology. By presenting at the conferences, I will share the results of my study and recommendation for developing a technology integration PD. Through conference presentation, I would like to show educational stakeholders the value of listening to participants needs and building a PD to address their needs. To protect participants' identity, confidentiality will be ensured by removing all names and personal-identifying information from all published materials.

CHAPTER 4

ANALYSIS AND FINDINGS

Introduction

The purpose of this descriptive mixed methods research study was to determine teachers' needs and preferences for technology integration professional development. Quantitative data was collected through a survey, and qualitative data was collected through five open ended survey questions and one-on-one interviews. The quantitative findings are presented first then the qualitative findings. Data presented in this chapter was analyzed to answer the following research questions:

1. What are teachers' needs and preferences for technology integration professional development in K-12 schools?
2. How are teachers currently integrating technology for teaching and learning in their classroom?
3. How do teachers perceive technology benefits and usefulness of technology integration for teaching and learning?

Quantitative Findings

This section presents the findings for the quantitative survey data analyzed with descriptive statistics. The original School Technology Needs Assessment (STNA) included four constructs (supportive environment for technology use, professional development, teaching and learning, and impact of technology) and ten sub-constructs

(vision, planning and budget, communication, infrastructure and staff support, professional development needs, professional development quality, teacher technology use, student technology use, teacher impact, and student impact) (Friday Institute for Educational Innovation, 2016).

The STNA was modified for this study and included three constructs (professional development, teaching and learning, and technology benefits and frequency of use) and four sub-constructs (teacher technology use, student technology use, frequency of teacher technology use, and frequency of student technology use). The means and standard deviations for the constructs and subconstructs of the survey can be seen in Table 4.1. The low standard deviations indicated that the responses for survey constructs and subconstructs data were closely related to the average, therefore reliable (Patten & Newhart, 2017). Further in the chapter, the individual M and SD is shown for each survey item.

Table 4.1

Mean and Standard Deviation for Survey Constructs and Subconstructs

Survey Item	*M*	*SD*
Professional Development Needs	3.99	0.17
Teacher Technology Use	3.51	0.21
Student Technology Use	3.44	0.10
Benefits of Technology	4.51	0.13
Frequency of Teacher Technology Use	3.75	0.22
Frequency of Student Technology Use	3.38	0.18

Note. n = 33.

Using the open-source statistics program, JASP, the Cronbach's Alpha score was determined for each construct. A Cronbach's alpha score of at least .70 ensures the

reliability of a test instrument (DeVellis, 2017). Table 4.2 shows the Cronbach's Alphas for the survey constructs and subconstructs.

Table 4.2

Cronbach's Alphas for Survey Constructs and Subconstructs

	No. Items	Cronbach's α
Professional Development Needs	14	0.93
Teacher Technology Use	10	0.82
Student Technology Use	8	0.93
Benefits of Technology	11	0.85
Frequency of Teacher Technology Use	11	0.77
Frequency of Student Technology Use	11	0.90

The professional development construct determines participants' needs for technology integration professional development (PD). The PD construct has a Cronbach's Alpha score of .93, indicating excellent internal consistency (DeVellis, 2017; Sriram, 2017). In teaching and learning, participants identified how they are using technology for teaching and learning and with two sub constructs for teacher technology use and student technology use. The teacher technology use construct Cronbach's alpha score is .82, good internal consistency, and student technology use has a Cronbach's alpha score of .93, excellent internal consistency (DeVellis, 2017; Sriram, 2017).

In the benefits of technology and frequency of use construct, participants respond to how beneficial they believe technology is for teaching and learning certain concepts and skills. The technology benefits subconstruct has a Cronbach's alpha score of .85, good internal consistency. The frequency of use address how often teachers and their students use technology for teaching and learning. The Cronbach's alpha score for

frequency of teacher technology use, and frequency of student technology use were .77, and .90, respectively.

Research Question 1. Professional Development Needs

The PD needs section contained a total of fourteen items using a scale that ranged from "Strongly Disagree" (1) to "Strongly Agree" (5). Participants "agreed" to topics proposed for technology PD (Table 4.2). In five areas, participants showed a strong response of "agree" to the technology PD they could benefit from (Table 4.3). The highest needs area for technology integration PD was for differentiating instruction for students with special learning needs (M = 4.42, SD = .79) and research-based practices they can use in their teaching (M = *4.39*, SD = .79). Participants lowest area for PD needs was using technology to collaborate with other educators (M = *3*.73, SD = 1.18). Although collaboration with other educators was identified as the lowest area of needs, Figure 4.1 shows that participants responses were concreted between neutral (3) and strongly agree (5) that there is a need for PD in that area. Overall teachers' highest area of PD needs relates to using technology to improve their teaching and learning.

Table 4.3

Descriptive Statistics for Professional Development Needs

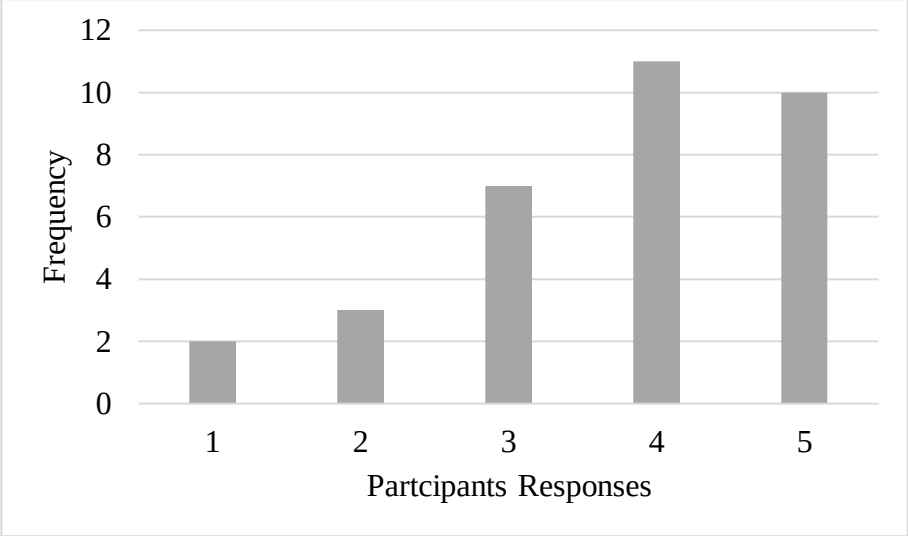
Survey Item	*M*	*SD*
Research-based practices I can use in my teaching	4.39	0.79
Identification, location, and evaluation of technology resources, e.g., websites that I can use with my students.	4.06	0.86
Performance-based student assessment of my students.	3.97	1.08
The use of technology to collect and analyze student assessment data.	3.79	1.14

Learner-centered teaching strategies that incorporate technology, e.g., project-based, or cooperative learning.	4.09	1.10
The use of technology for differentiating instruction for students with special learning needs.	4.42	0.79
Uses of technology to increase my professional productivity.	3.91	1.23
Ways to use technology to communicate and collaborate with families about school programs and student learning.	3.79	1.32
Ways to use technology to communicate and collaborate with other educators.	3.73	1.18
Alignment of lesson plans to content standards and student technology standards.	3.88	1.19
Use of research or action research projects to improve technology-enhanced classroom practices.	4.18	0.95
Use of data for reflecting on my professional practices.	3.85	1.00
Use of data to make decisions about the use of technology.	3.97	1.05
Use of technology to participate in professional development activities, e.g., online workshops, hands-on training in a computer lab.	3.79	1.24

Note. n = 33.

Figure 4.1

Responses for Technology to Communicate and Collaborate with Other Educators



Research Question 2. Technology Use

Participants answered ten questions about their digital instructional behaviors. Then they answered eight questions about student activities in their environment and how their students currently use technology. Using the scale, "Never = not at all" (1) to "Always = everyday/multiple times a day" (5), participants answered how their technology use takes places several times a week and is most used to communicate and collaborate with other educators (M = 4.33, SD = .78). Using technology to communicate with families about students and school events also takes place weekly (M = 4.09, SD = 1.04). Table 4.4 presents descriptive statistics for all items related to teacher technology use.

Table 4.4

Teacher Technology Use

Survey Item	*M*	*SD*
I consult publications, online journals, or other resources to identify research-based practices I can use in teaching with technology.	3.03	0.92
I identify, locate, and evaluate technology resources for use by my students, e.g., websites.	3.70	0.81
I apply performance-based student assessment to technology enhanced lessons, e.g., student portfolios, student presentations.	3.27	1.04
I use technology regularly to collect and analyze student assessment data.	4.03	0.85
My lessons include technology-enhanced, learner-centered teaching strategies, e.g., project-based learning.	3.58	0.90
I use technology to differentiate instruction for students with special learning needs.	3.70	0.92
I use technology to communicate and collaborate with families about school programs and student learning	4.09	1.04
I use technology to communicate and collaborate with other educators.	4.33	0.78

Note. n = 33.

Students "often" use technology to create new ideas and representations of information (*M* = 4.12, *SD* = .93). In six of the eight question areas, participants reported their students "sometime" (3) used technology in various ways (*M* = 3.48, *SD* = .08). The overall descriptive statistics for student technology use is in Table 4.5. In Table 4.5, it is shown that students are least likely to use technology to support higher-order thinking (*M* = 2.55, *SD* = 1.20). Figure 4.2 shows that participants answers were concentrated between "never" (1) and "sometime" (5) for how often students are using technology to support higher order thinking.

Table 4.5

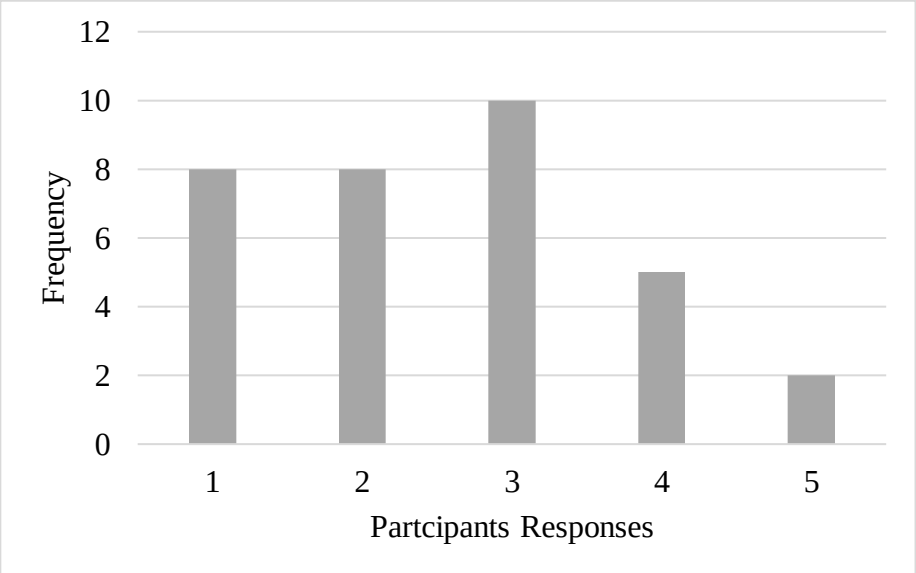
Student Technology Use

Survey Item	*M*	*SD*
Students use the same kinds of tools that professional researchers use, e.g., simulations, databases, satellite imagery.	3.97	0.95
Students work on technology-enhanced projects that approach real-world applications of technology.	3.52	1.18
Students use technology to create new ideas and representations of information.	4.12	0.93
Students use technology to support higher-order thinking, e.g., analysis, synthesis, and evaluation of ideas and information.	2.55	1.20
Students use technology during the school day to communicate and collaborate with others, beyond the classroom.	3.12	1.14
Students use technology to help solve problems.	3.61	1.06
Students use a variety of technologies, e.g., productivity, visualization, research, and communication tools.	3.36	1.14
Students use technology to access online resources and information as a part of classroom activities.	3.27	1.13

Note. n = 33.

Figure 4.2

Responses for Students' Use of Technology to Support Higher-Order Thinking



Research Question 3. Technology Benefits and Frequency of Technology Use

In this section, participants answered eleven questions about how beneficial technology is for teaching using the scale ranging from "strongly disagree" (1) to "strongly agree" (5) in Table 4.6. Frequency of teacher technology use, Table 4.7, and frequency of student technology use Table 4.8 used the scale ranging from "never = not at all" (1) to "always = everyday/multiple times a day" (5). It is noticeable that majority of participants "agreed" that technology is beneficial for teaching and learning multiple concepts (*M* = 4.51, *SD* = .13).

Participants reported that they sometimes use technology for teaching and learning (*M* = 3.75, *SD* = .22). Student digital technology use (*M* = 3.38, *SD* = .18) for learning was also reported as occurring "sometimes". Participants responded that technology is a beneficial using digital tools in project-based learning (*M* = 4.58, *SD* = .61). Additional information provided in Table 4.6.

Table 4.6

Benefits of Technology

Survey Item	*M*	*SD*
Practice or review topics (e.g., programs that teach specific subject matter)	4.58	0.61
Visually represent or investigate concepts (e.g., concept mapping, graphing, graphic organizers)	4.42	0.66
Use digital tools and resources to explore and solve real-world issues (e.g., project-based learning)	4.73	0.52
Work individually using technology	4.49	0.80
Work collaboratively using technology	4.58	0.90
Present multimedia projects to the class (e.g., Interactive Whiteboard, PowerPoint)	4.64	0.60
Simulations (e.g., frog dissections, science experiments)	4.27	0.88

Editing software (e.g., Photoshop, Audacity, Movie Maker)	4.42	0.83
Productivity applications (e.g., word processing, spreadsheet)	4.55	0.79
Conduct online research using databases (e.g., Britannica, Pebble Go Next)	4.52	0.83
Use the Internet to communicate and collaborate with experts or peers in or beyond your school	4.46	0.75

Note. n = 33.

Table 4.7 showed that participants "sometimes" (*M* = 3.64, *SD* = 1.03) used digital tools for project-based learning instruction. A large portion of participants responded that they frequently use technology to work independently (*M* = 4.55, *SD* = .56) and for presenting on the interactive display or presentations to their class (*M* = 4.36, *SD* = .74). However, participants "rarely" use simulations (*M* = 2.49, *SD* = 1.28) and editing software (*M* = 2.73, *SD* = 1.10).

Table 4.7

Frequency of Teacher Technology Use

Survey Item	*M*	*SD*
Practice or review topics (e.g., programs that teach specific subject matter)	3.82	0.95
Visually represent or investigate concepts (e.g., concept mapping, graphing, graphic organizers)	3.76	0.79
Use digital tools and resources to explore and solve real-world issues (e.g., project-based learning)	3.64	1.03
Work individually using technology	4.55	0.56
Work collaboratively using technology	4.00	0.79
Present multimedia projects to the class (e.g., Interactive Whiteboard, PowerPoint)	4.36	0.74
Simulations (e.g., frog dissections, science experiments)	2.49	1.28
Editing software (e.g., Photoshop, Audacity, Movie Maker)	2.73	1.10
Productivity applications (e.g., word processing, spreadsheet)	4.27	0.98

Conduct online research using databases (e.g., Britannica, Pebble Go Next)	3.49	1.30
Use the Internet to communicate and collaborate with experts or peers in or beyond your school	4.21	0.89

Note. n = 33.

Participants responded that their students use digital tools for project-based learning instruction "sometimes" (*M* = 3.39, *SD* = 1.00). When asked to reflect on the frequency of student technology use, participants noted that students frequently used technology individually (*M* = 4.27, *SD* = 0.72), to review topics (*M* = 3.76, *SD* = 0.97), and for collaborating (*M* = 3.76, *SD* = 0.97) as shown in Table 4.8.

Table 4.8

Frequency of Student Technology Use

Survey Item	*M*	*SD*
Practice or review topics (e.g., programs that teach specific subject matter)	3.76	0.97
Visually represent or investigate concepts (e.g., concept mapping, graphing, graphic organizers)	3.27	0.91
Use digital tools and resources to explore and solve real-world issues (e.g., project-based learning)	3.39	1.00
Work individually using technology	4.27	0.72
Work collaboratively using technology	3.76	0.97
Present multimedia projects to the class (e.g., Interactive Whiteboard, PowerPoint)	3.27	1.04
Simulations (e.g., frog dissections, science experiments)	2.55	1.25
Editing software (e.g., Photoshop, Audacity, Movie Maker)	2.58	1.12
Productivity applications (e.g., word processing, spreadsheet)	3.73	1.04
Conduct online research using databases (e.g., Britannica, Pebble Go Next)	3.27	1.15
Use the Internet to communicate and collaborate with experts or peers in or beyond your school	3.30	1.40

Note. n = 33.

Figure 4.3 compares teachers (*M* = 2.49, *SD* = 1.28) and students (*M* = 2.55, *SD* = 1.25) use of technology for simulations (e.g., frog dissections, science experiments). Most of the responses for teacher use of simulations was concentrated at "never" (1) or "sometime" (3), but not so much at rarely (2). Similarly, participants responses were concentrated at "never" (1) through "sometime" (3) for their students use of technology simulations in the classroom.

Figure 4.3

Comparing Teacher and Student Use of Simulations

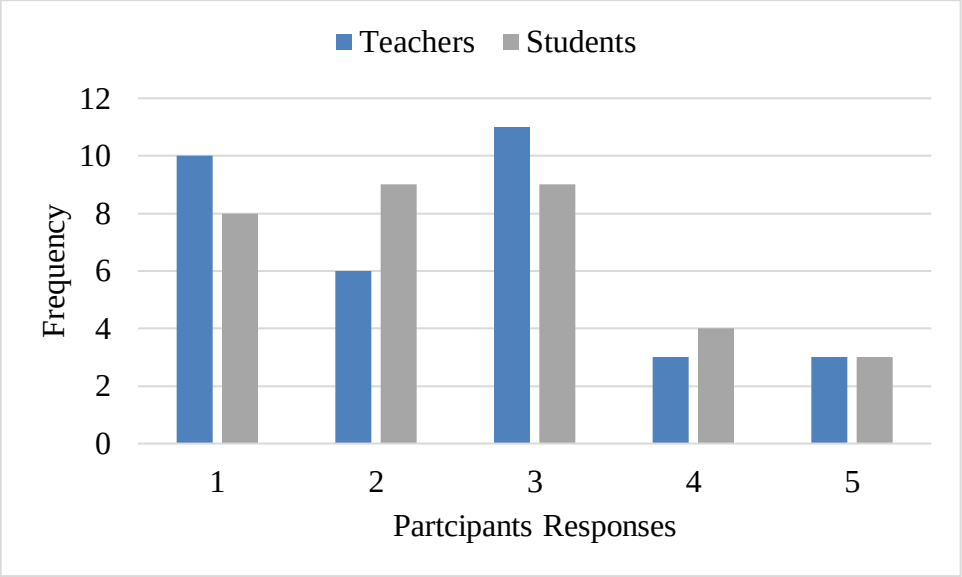


Table 4.9 shows the concepts participants consistently "agree" benefit from technology integration compared to how frequently it is used by teachers and students. Majority of responses demonstrated that participants "agree" that using digital tools for engaging in real world projects is beneficial (*M* = 4.73, *SD* = .52), yet its frequency of use for teachers (*M* = 3.64, *SD* = 1.03) and students (*M* = 3.39, *SD* = 1.00) is "sometime". Based on responses, participants "agree" multimedia presentations, set from the use of

technology integration and are "often" (*M* = 3.39, *SD* = 1.00) used by participants while students use is "sometime" (*M* = 3.39, *SD* = 1.00).

Table 4.9

Beneficial from Technology Integration Compared to Frequency of Use

	Beneficial		Teachers		Students	
	M	*SD*	*M*	*SD*	*M*	*SD*
Practice or review topics (e.g., programs that teach specific subject matter)	4.58	0.61	3.82	0.95	3.76	0.97
Work collaboratively using technology	4.58	0.90	4.00	0.79	3.76	0.97
Present multimedia projects to the class (e.g., Interactive Whiteboard, PowerPoint)	4.64	0.60	4.36	0.74	3.27	1.04
Use digital tools and resources to explore and solve real-world issues (e.g., project-based learning)	4.73	0.52	3.64	1.03	3.39	1.00

Note. n = 33.

Qualitative Data

The qualitative data sources include five open ended questions within the survey and six one-on-one interviews. Out of 33 participants, 30 completed the five open ended questions. Their responses were downloaded from Qualtrics, de-identified, and assigned pseudonyms. The data was then placed into separate .txt files and uploaded to Delve, a qualitative data analysis software program for coding.

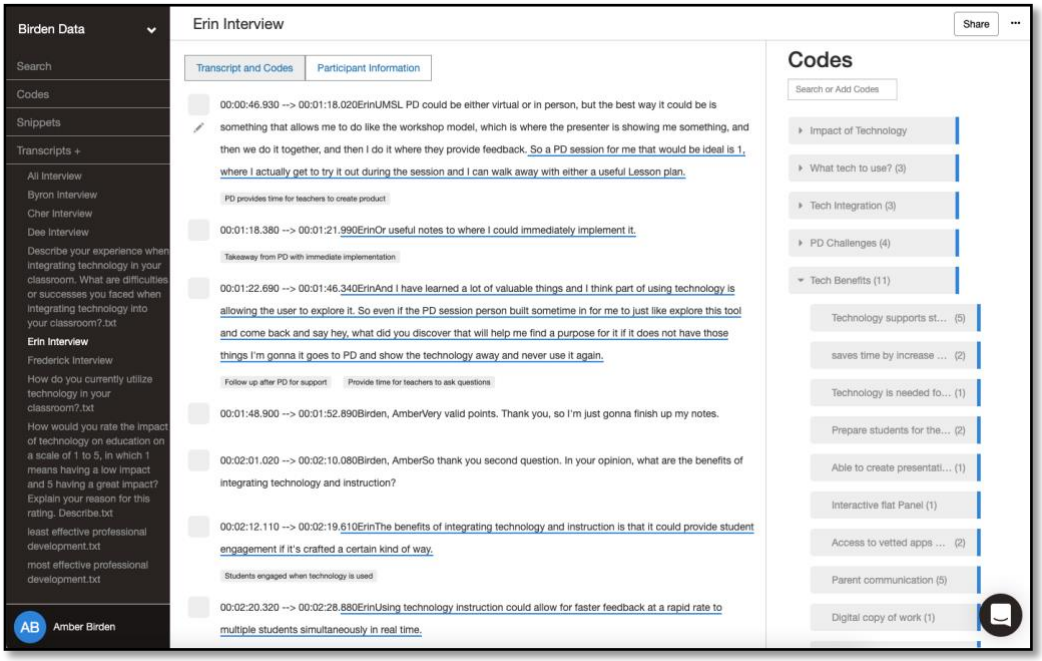
Out of the 33 research participants, six volunteered to participate in a one-on-one interview. The interviews were recorded and transcribed using Microsoft Teams. I de-identified the interviews by replacing participants' names with a pseudonym in a .doc file

produced by the Microsoft Teams recording. I reviewed each interview transcript with the video recording, line by line, for accuracy and validity of the transcriptions. Edits were made, as needed, to correct any transcription errors that occurred during the automated process.

The five open-ended questions and the six one-on-one interviews were uploaded individually to Delve. Figure 4.4 provides an image of the qualitative data in Delve, showing the six interviews and 5 open ended questions' transcripts individually uploaded on the left side of the screen, a one-on-one interview transcript in the center, and codes and categories generated on the right side of the screen.

Figure 4.4

Dissertation Data in Delve



Qualitative analysis in Delve resulted in a total of 430 codes from all the qualitative data sources (Table 4.10). There is a total of 249 unique codes, which were duplicated throughout the coding of open-ended questions and one on one interview

responses. Once all data was coded, analysis of the codes were performed for each individual research question. The following sections provide an overview of the qualitative coding cycles.

Table 4.10

Summary of Qualitative Data Sources

Qualitative Data Sources	Number	Total Codes Applied
Open-ended questions	30	205
One-on-one interviews	6	225
Total	36	430

Note. Of the 430 applied codes, several codes were used for multiple sources. Total of unduplicated codes generated was 249.

First Cycle Coding

Three coding strategies were selected for the first cycle: Structural, Initial, and In Vivo because these three methods capture participants' realities and build a foundation for future coding cycles (Saldana, 2016). Structural coding initially categorizes data with codes correlated to the research questions, while initial coding also known as “open coding” looks closely at data to form codes as an initial step (Creswell & Poth, 2016; Saldana, 2016). Initial coding was used in the beginning of the analysis process by examining the data, line by line, to create codes and review the codes for similarities and differences based on initial interpretations (Saldana, 2016). In vivo coding process allows me to identify the terminology verbatim used by my participants, helping me determine their perspective about technology integration PD (Creswell & Poth, 2016; Leavy, 2017; Miles, et al., 2018).

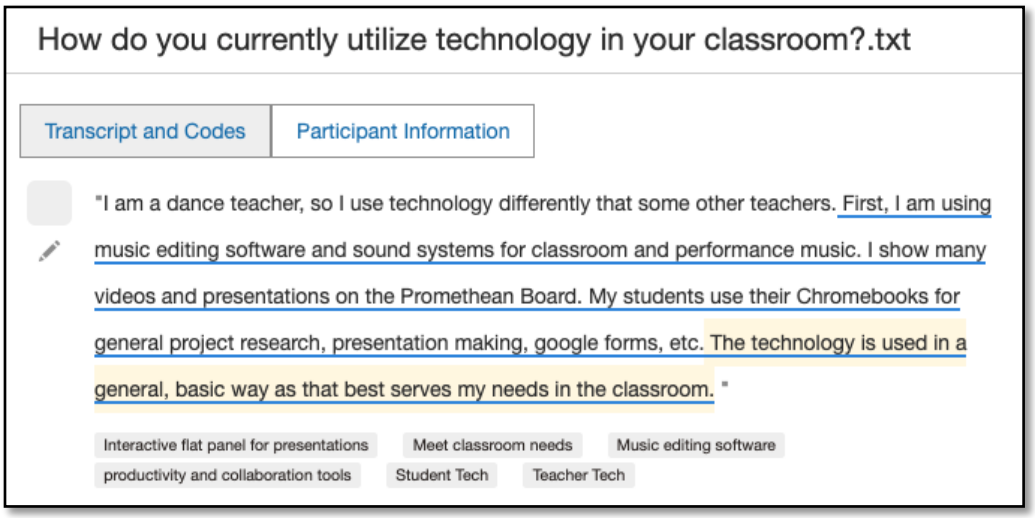
Structural and initial coding were performed simultaneously during the first cycle of coding. Using both methods simultaneously helped me become familiar with the data

by developing an understanding of how the data related to each research question. Structural coding was used to align specific codes with each of the research questions (Adu, 2019; Saldana, 2016). The initial structural codes for RQ1 were *PD needs* and *PD preferences*, for RQ2 the codes were *teacher tech* and *student tech*, and RQ3 structural codes were *tech benefits* and *tech challenges*.

Initial codes included broad terms such as *meet classroom needs* and *productivity and collaboration tools* to describe technology use in a participant's classroom. Initial coding or open coding allows researchers to find similarities in concepts from the original data to use as a framework for continued coding cycles (Adu, 2019; Saldana, 2016). As I coded through the data, codes were merged or delated to answer the research questions. Figure 4.5 shows an example of structural (e.g., teacher tech and student tech) and initial coding (e.g., meet classroom needs) in Delve for an open-ended question for RQ2.

Figure 4.5

Simultaneous Structural and Initial Coding in Delve

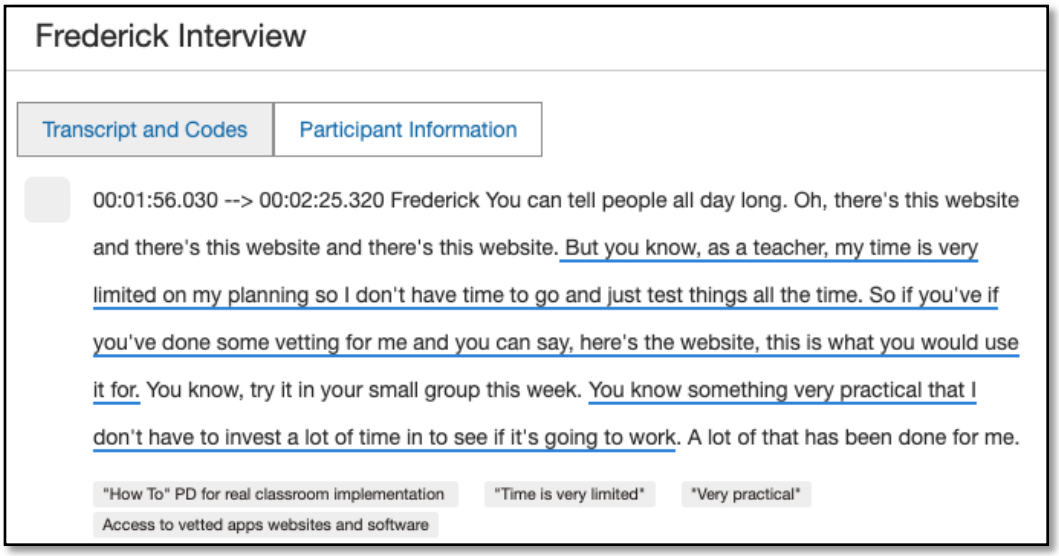


After completing the structural and initial coding for an individual data source, in vivo coding was used. In vivo coding involves creating codes using participant's words

and phrases verbatim (Creswell & Plano Clark, 2017; Saldana, 2016). The use of in vivo coding was selected as the next step because it strengths the validity of the data by emphasizing the actual words spoken by the participants to answer the research questions (Adu, 2019; Saldana, 2016). For instance, when asked about an ideal PD technology integration session, Fredrick described "time as very limited" and that technology PD needed to be "very practical" for implementation in the classroom. Figure 4.6 shows in vivo coding from an interview transcript.

Figure 4.6

In Vivo Coding in Delve

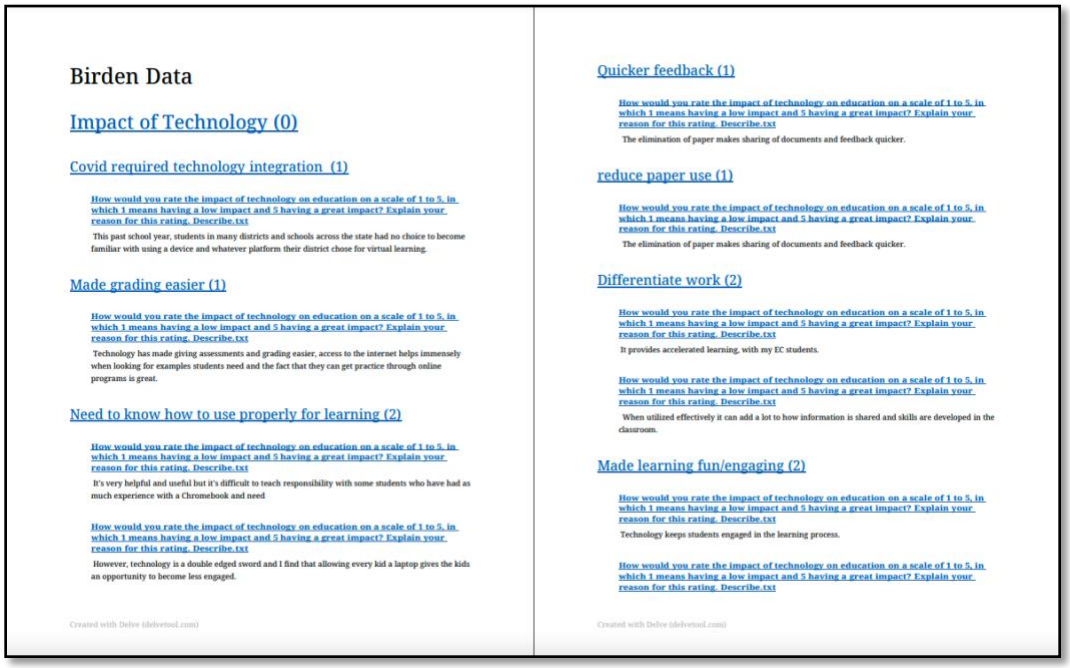


A total of 430 codes were extracted from Delve into a Microsoft Excel spreadsheet and Microsoft Word document after completing the first cycle of coding. The Microsoft Excel spreadsheet was used as the codebook for second cycle coding. The Microsoft Word document was used as a reference for completing the codebook because it provided a clickable URL for the code snippets for direct access to the data in Delve. Figure 4.7 displays a few of the 430 codes extracted from Delve into a word document

and Figure 4.8 shows an excel spreadsheet of codes that emerged during the first cycle of coding.

Figure 4.7

Codes That Emerged During the First Cycle of Coding in a Word Document



Birden Data

Impact of Technology (0)

Covid required technology integration (1)

How would you rate the impact of technology on education on a scale of 1 to 5, in which 1 means having a low impact and 5 having a great impact? Explain your reason for this rating. Describe.txt

This past school year, students in many districts and schools across the state had no choice to become familiar with using a device and whatever platform their district chose for virtual learning.

Made grading easier (1)

How would you rate the impact of technology on education on a scale of 1 to 5, in which 1 means having a low impact and 5 having a great impact? Explain your reason for this rating. Describe.txt

Technology has made giving assessments and grading easier, access to the internet helps immensely when looking for examples students need and the fact that they can get practice through online programs is great.

Need to know how to use properly for learning (2)

How would you rate the impact of technology on education on a scale of 1 to 5, in which 1 means having a low impact and 5 having a great impact? Explain your reason for this rating. Describe.txt

It's very helpful and useful but it's difficult to teach responsibility with some students who have had as much experience with a Chromebook and need

How would you rate the impact of technology on education on a scale of 1 to 5, in which 1 means having a low impact and 5 having a great impact? Explain your reason for this rating. Describe.txt

However, technology is a double edged sword and I find that allowing every kid a laptop gives the kids an opportunity to become less engaged.

Created with Delve (delvetool.com)

Quicker feedback (1)

How would you rate the impact of technology on education on a scale of 1 to 5, in which 1 means having a low impact and 5 having a great impact? Explain your reason for this rating. Describe.txt

The elimination of paper makes sharing of documents and feedback quicker.

reduce paper use (1)

How would you rate the impact of technology on education on a scale of 1 to 5, in which 1 means having a low impact and 5 having a great impact? Explain your reason for this rating. Describe.txt

The elimination of paper makes sharing of documents and feedback quicker.

Differentiate work (2)

How would you rate the impact of technology on education on a scale of 1 to 5, in which 1 means having a low impact and 5 having a great impact? Explain your reason for this rating. Describe.txt

It provides accelerated learning, with my EC students.

How would you rate the impact of technology on education on a scale of 1 to 5, in which 1 means having a low impact and 5 having a great impact? Explain your reason for this rating. Describe.txt

When utilized effectively it can add a lot to how information is shared and skills are developed in the classroom.

Made learning fun/engaging (2)

How would you rate the impact of technology on education on a scale of 1 to 5, in which 1 means having a low impact and 5 having a great impact? Explain your reason for this rating. Describe.txt

Technology keeps students engaged in the learning process.

How would you rate the impact of technology on education on a scale of 1 to 5, in which 1 means having a low impact and 5 having a great impact? Explain your reason for this rating. Describe.txt

Created with Delve (delvetool.com)

Figure 4.8

Microsoft Excel Spreadsheet of Codes That Emerged During the First Cycle of Coding

	A	B	C	D	E	F	G
1	Order of Code in List	Nested Level	Code Name	Number of Snippets	Code Description	Code URL	
2	1	>	Impact of Technology	0		https://app.delvetool.com/projects/5823/codes/203931	
3	2	>>	Covid required technology integration	1		https://app.delvetool.com/projects/5823/codes/203965	
4	3	>>	Made grading easier	1		https://app.delvetool.com/projects/5823/codes/203963	
5	4	>>	Need to know how to use properly for learning	2		https://app.delvetool.com/projects/5823/codes/203964	
6	5	>>	Quicker feedback	1		https://app.delvetool.com/projects/5823/codes/203961	
7	6	>>	reduce paper use	1		https://app.delvetool.com/projects/5823/codes/203960	
8	7	>>	Differentiate work	2		https://app.delvetool.com/projects/5823/codes/203954	
9	8	>>	Made learning fun/engaging	2		https://app.delvetool.com/projects/5823/codes/203953	
10	9	>>	Increase communication and organization	4		https://app.delvetool.com/projects/5823/codes/203952	
11	10	>>	Helps communicate with ELL/ESL students and parents	1		https://app.delvetool.com/projects/5823/codes/203951	
12	11	>>	Important for communicating with parents	1		https://app.delvetool.com/projects/5823/codes/203950	
13	12	>>	Shapes every aspect of the school day	1		https://app.delvetool.com/projects/5823/codes/203949	
14	13	>>	Technology outage would set back a district.	1		https://app.delvetool.com/projects/5823/codes/203948	
15	14	>>	Increased student collaboration	1		https://app.delvetool.com/projects/5823/codes/203944	

Second Cycle Coding

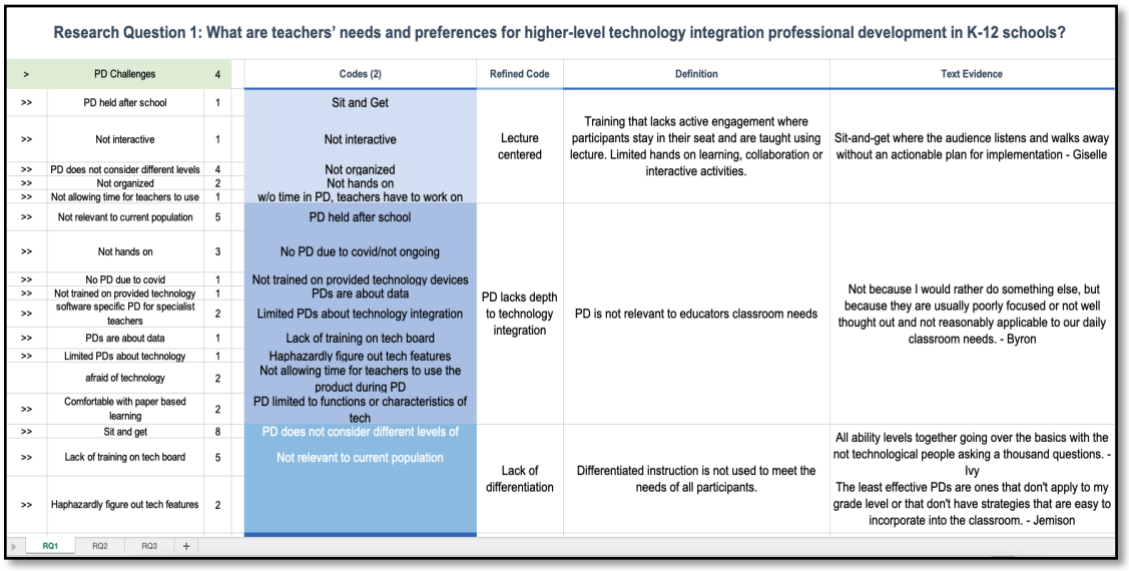
After completing Structural, Initial, and In Vivo coding during the first cycle, two rounds of pattern coding were done as the second cycle of strategies. This was done to group similarly coded excerpts under one overarching code to describe patterns in the data (Miles et al., 2018; Saldana, 2016). The Microsoft Excel spreadsheet (Figure 4.8) codes were organized onto individual spreadsheets based on the research questions. After placing the codes into the respective research question spreadsheet, the codes were grouped together into categories based on similarities. For RQ1, *PD challenges* was a common category for codes to answer RQ1 about teachers' needs and preferences for professional development. The codes for *PD challenges* were then grouped together based on the challenges teachers reported. Codes were further analyzed for similarities. For the first round of pattern coding, codes such as *sit and get, not interactive, not organized, not hands on,* and *w/o time in PD, teachers have to work on their own,* were grouped together because the described challenges of professional development instruction for participants.

The second round of pattern coding group together codes, for further similarities. The codes *sit and get, not interactive, not organized, not hands on,* and *w/o time in PD, teachers have to work on their own,* were given the refined code of *lectured centered*. The refined code was selected because a common challenge for professional development were sessions that were lectured centered. The refined code was then defined as "Training that lacks active engagement where participants stay in their seat and are taught using lecture. Limited hands-on learning, collaboration, or interactive activities." Text evidence from the qualitative data was included to support the pattern code. Figure 4.9

provides an example of the codebook for two rounds of pattern coding for RQ1, *PD challenges* codes.

Figure 4.9

RQ1 Codebook for Pattern Coding Cycle 1 and 2



Research Question 1: What are teachers' needs and preferences for higher-level technology integration professional development in K-12 schools?

>	PD Challenges	4	Codes (2)	Refined Code	Definition	Text Evidence
>>	PD held after school	1	Sit and Get	Lecture centered	Training that lacks active engagement where participants stay in their seat and are taught using lecture. Limited hands on learning, collaboration or interactive activities.	Sit-and-get where the audience listens and walks away without an actionable plan for implementation - Giselle
>>	Not interactive	1	Not interactive			
>>	PD does not consider different levels	4	Not organized			
>>	Not organized	2	Not hands on			
>>	Not allowing time for teachers to use	1	w/o time in PD, teachers have to work on			
>>	Not relevant to current population	5	PD held after school	PD lacks depth to technology integration	PD is not relevant to educators classroom needs	Not because I would rather do something else, but because they are usually poorly focused or not well thought out and not reasonably applicable to our daily classroom needs. - Byron
>>	Not hands on	3	No PD due to covid/not ongoing			
>>	No PD due to covid	1	Not trained on provided technology devices			
>>	Not trained on provided technology	1	PDs are about data			
>>	software specific PD for specialist teachers	2	Limited PDs about technology integration			
>>	PDs are about data	1	Lack of training on tech board			
>>	Limited PDs about technology	1	Haphazardly figure out tech features			
	afraid of technology	2	Not allowing time for teachers to use the product during PD			
>>	Comfortable with paper based learning	2	PD limited to functions or characteristics of tech			
>>	Sit and get	8	PD does not consider different levels of	Lack of differentiation	Differentiated instruction is not used to meet the needs of all participants.	All ability levels together going over the basics with the not technological people asking a thousand questions. - Ivy The least effective PDs are ones that don't apply to my grade level or that don't have strategies that are easy to incorporate into the classroom. - Jemison
>>	Lack of training on tech board	5	Not relevant to current population			
>>	Haphazardly figure out tech features	2				

RQ1 RQ2 RQ3 +

Peer Debriefing

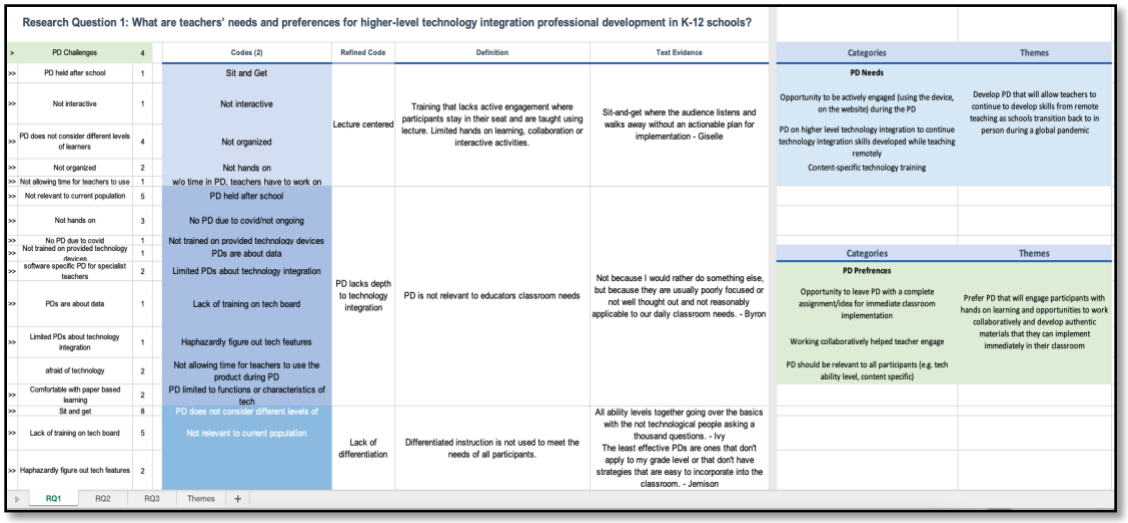
Throughout the first- and second-round coding cycles, peer debriefing meetings (Creswell & Creswell, 2018; Mertler, 2018) were held with my dissertation chair. We reviewed the data in Delve and the codes in the codebook to understand "why" codes were grouped together, how they were refined, defined and what evidence could be used to support the refined codes. The peer debriefing meetings allowed my dissertation chair, who is independent from the study, to review and assess the coding process to align the themes with the research question (Creswell & Poth, 2016).

Categories began to emerge from the refined codes created during the first and second cycles of coding. For example, in RQ1 the category "Student Tech Integration" was developed from the following refined codes: Students need additional support for

using technology academically, Students are familiar with technology devices for personal use, and Student technology use includes meeting individual instructional needs and peer feedback. The categories were then developed into themes. Each research question produced 1- 2 themes. For example, figure 4.9 shows a theme and categories created based on *PD challenges* for RQ1. Table 4.10 shows a summary of the five themes that emerged from the data and the categories and sample quotes to support the theme development. The findings for the themes are explored further in the next section and themes are organized by research question.

Figure 4.10

RQ1 "PD Challenges" from Codes to Theme Codebook Excerpt



Research Question 1: What are teachers' needs and preferences for higher-level technology integration professional development in K-12 schools?

PD Challenges	4	Codes (2)	Refined Code	Definition	Text Evidence	Categories	Themes
PD held after school	1	Sit and Get	Lecture centered	Training that lacks active engagement where participants stay in their seat and are taught using lecture. Limited hands on learning, collaboration or interactive activities.	Sit-and-get where the audience listens and walks away without an actionable plan for implementation - Giselle	**PD Needs** Opportunity to be actively engaged (using the device, on the website) during the PD PD on higher level technology integration to continue technology integration skills developed while teaching remotely Content-specific technology training	Develop PD that will allow teachers to continue to develop skills from remote teaching as schools transition back to in person during a global pandemic
Not interactive	1	Not interactive					
PD does not consider different levels of learners	4	Not organized					
Not organized	2	Not hands on					
Not allowing time for teachers to use	1	w/o time in PD, teachers have to work on					
Not relevant to current population	5	PD held after school	PD lacks depth to technology integration	PD is not relevant to educators classroom needs	Not because I would rather do something else, but because they are usually poorly focused or not well thought out and not reasonably applicable to our daily classroom needs. - Byron		
Not hands on	3	No PD due to covid/not ongoing					
No PD due to covid	1	Not trained on provided technology devices					
Not trained on provided technology devices	1	PDs are about data					
software specific PD for specialist teachers	2	Limited PDs about technology integration					
PDs are about data	1	Lack of training on tech board					
Limited PDs about technology integration	1	Haphazardly figure out tech features					
afraid of technology	2	Not allowing time for teachers to use the product during PD					
Comfortable with paper based learning	2	PD limited to functions or characteristics of tech					
Sit and get	8	PD does not consider different levels of	Lack of differentiation	Differentiated instruction is not used to meet the needs of all participants.	All ability levels together going over the basics with the not technological people asking a thousand questions. - Ivy The least effective PDs are ones that don't apply to my grade level or that don't have strategies that are easy to incorporate into the classroom. - Jemison		
Lack of training on tech board	5	Not relevant to current population					
Haphazardly figure out tech features	2						

Categories	Themes
PD Prefrences Opportunity to leave PD with a complete assignment/idea for immediate classroom implementation Working collaboratively helped teacher engage PD should be relevant to all participants (e.g. tech ability level, content specific)	Prefer PD that will engage participants with hands on learning and opportunities to work collaboratively and develop authentic materials that they can implement immediately in their classroom

RQ1 RQ2 RQ3 Themes +

Table 4.11

Qualitative Thematic Alignment Table

Themes	Categories	Sample Quotes
Develop hands-on PD that will allow teachers to further develop technology integration skills for remote teaching as schools transition back to in person during a global pandemic. *RQ1*	• Incorporates active learning (e.g., uses collaboration, practice/apply what they had learned) • Need for ongoing technology integration PD was accelerated by Covid-19 pandemic	• Erin: "The difficulty is that I don't know how to design a lesson right now where the kids are working consistently at analyzing or creating level of blooms taxonomy. So, a PD session with built in time for me to explore the tool and [ask questions]." • Fredrick: "Looking at last year how we kind of progressed and set the tone [for using technology] and then things kind of slid back. We need to keep that ball rolling. And to me that's the biggest disappointment is to see everybody slide back into that old [pre Covid-19] routine."
PD to help plan and improve their instruction and is applicable to teacher's needs. *RQ1*	• Opportunity to leave PD with a complete assignment/idea for immediate classroom implementation • PD should be relevant to participants needs/abilities (e.g., tech ability level)	• Whitley: "The most effective pd I've experienced sent us away with immediate tools we could use that same day. If I left with something new to access that I could start benefitting from right away, that has been a good day." • Byron: "not because I would rather do something else, but because [PDs] are usually poorly focused or not well thought out and not reasonably applicable to

		our daily classroom needs."
Technology integration is used for productivity and organization, but student use has additional behavioral challenges. *RQ2*	• Teacher Tech Integration • Student Tech Use	• Susie: "Technology has made giving assessments and grading easier, access to the internet helps immensely when looking for examples students need and the fact that they can get practice through online programs is great." • Kerry: "The main difficulty is teaching RESPONSIBILITY in terms of navigating the internet and preventing cyberbullying."
First order barriers impact technology integration. *RQ2*	• Tech Challenges	• Olivia: "It's difficult if some students don't have technology." • Giselle: "It is hard to integrate technology when so much of the internet is blocked for the students."
Purposeful technology integration is beneficial for enhancing teaching and learning. *RQ3*	• Expands classroom opportunities and resources. • Purposeful use increases individualized learning and student engagement.	• Toni: "I have several students that English is not their first language. We use technology to modify assignments or explain them to the student and parents." • Dee: "When they're able to access things beyond just what they see on a board or hear from the teacher or even each other. That just opens a lot of possibilities, so I think it expands walls of classroom."

Qualitative Themes

RQ1: What are teachers' needs and preferences for technology integration professional development in K-12 schools?

Theme 1: Develop hands-on PD that will allow teachers to further develop technology integration skills for remote teaching as schools transition back to in person during a global pandemic. A recurring talking point throughout the open-ended survey responses and interviews was the impact of the Covid-19 pandemic for teachers. The pandemic identified a pattern of teacher's needs and preferences for technology integration PD and derived into two categories. The categories were (a) incorporates active learning (e.g., uses collaboration, practice/apply what they had learned) and (b) the need for ongoing technology integration PD that was accelerated by Covid-19 pandemic, and the needs for PD participants identified teaching practices before and during the Covid-19 pandemic.

Incorporates active learning (e.g., uses collaboration, practice/apply what they had learned). When attending PD session's participants want active learning, where they are engaged in the learning process through, intentionally designed instruction. Participants shared practices that PD facilitators can use when developing effective PD to support teachers in the workplace. Susie shared an experience of an effective PD she attended and what made it effective: "What made [the PD] effective was how small the group of people were, technology used to make the class smoother and really thought-out examples and questions". Lena shared that an effective PD promoted collaboration: "There was a lot of time to collaborate with colleagues, [it was] easy to interact w/ instructor for immediate feedback". Being able to work with colleagues and receive

feedback from the facilitator was also reflected in Pearl responses as an important part of developing an effective PD: “My most recent professional developments that have been most effective are the trainings that I've have with my small groups of colleagues”. Professional development that provided opportunities for teachers to actively engage in their learning encourages teachers to become more confident in their ability to implement teaching strategies through modeling, collaboration, and reflection (Darling-Hammond et al., 2017; Savitz et al., 2019). Allowing teachers to collaborate during technology integration PD can increase participants’ level of learning (Darling-Hammond et al., 2017; Kalinowski, 2019; Plešec et al., 2016).

Another sentiment among participants, was having a PD session that allows teachers to engage in the learning process by using the technology or software as it is being covered during the PD. Byron explained: “hardware specialists and software specialists that are implementing these new programs and bringing in these new devices and vetting things and then somebody that's actually showing us how to use them.” Like Byron, Cher detailed the need for technology use in PD sessions as in, “Hands-on experiences where we use the tools, we are learning about to make something for ourselves. Sessions that incorporate both the how-to of a new tool with the pedagogical approach.” Providing time for participants to explore the hardware, software, or digital content during a PD session with support and guidance from the facilitator can increase teachers’ abilities to integrate technology (Anyanwu, 2015; Hennessy et al., 2022; Kalinowski, 2019).

Participants did not have a preferred method of PD delivery (e.g., remote, in person), but did show a preference for PD that was not immediately after a school day

with students. Kerry shared “Not doing PD after a full day of school. Our brains are fried by 3pm and the last thing we want to do is meet for 1hr+ and talk/work more.” It is important to use participants’ responses for designing and implanting a technology integration PD.

Need for ongoing technology integration PD was accelerated by Covid-19 pandemic. As schools unexpectedly closed at the onset of the COVID-19 pandemic, teachers were faced with the challenge of immediate transition to remote teaching. As schools began to gradually resume in person learning participants noted the changes they felt during the initial stages of teaching during a pandemic and their return to in person or hybrid learning. Byron commented how immediate remote teaching started, “Because of the lock down, teachers were forced to implement technologies ‘on the spot’”. The rapid transition to remote learning left teachers feeling unprepared. Ali shared how the pandemic impacted technology at her school.

> Sometimes using technology in the classroom and integrating something new is very intimidating and teachers have enough going on with trying to plan [lessons] and meetings. And it was a big factor when Covid-19 came in and everyone had to be virtual and everyone had to use technology, even if it wasn't something they had done on a day-to-day is don't forget what you know.

Likewise, Cher, recalled the lack of support teachers received during the initial transition to remote teaching, and she advised.

> Teachers do not [need to] be afraid of technology because there's a lot of fear. You know the idea of like the digital native and the digital immigrant is so silly because you know, just because we have technologies, that doesn't mean we know

how to use it. Teachers have had laptops for a year with absolutely no training because there were no instructional technology coaches in the district when the pandemic hit.

Participants revealed that the Covid-19 pandemic required immediate transition to remote teaching but as they return to in person instruction, the needs for effective PD tailored to their needs is still present. Participants noted concerns about possibility that teachers were resorting back to pre-pandemic behaviors after returning to in person instruction. Fredrick added that he noticed a trend of pre-pandemic technology teaching practices:

> Looking at last year how we kind of progressed and set the tone [for using technology] and then things kind of slid back. We need to keep that ball rolling. And to me that's the biggest disappointment is to see everybody slide back into that old [pre Covid-19] routine.

Ivy expressed a similar concern about the lack of continuous technology integration.

> I integrated [a learning management system] during Covid to fill the gaps of learning outside the classroom. I was one of a small handful that used it effectively. When we started back this year, I was disappointed to learn that teachers' backslid into the old routines when they had the ability to use tech to hold students accountable for learning while absent.

Throughout the qualitative data, participants continually expressed the ongoing impact made on the educational system by the pandemic and the importance of continuous development of teachers.

Theme 2: PD to help plan and improve their instruction and is applicable to teacher's needs. Overall, for theme 2, participants indicated that PD must be relevant to their needs and ability level. Two categories formed the second theme (a) opportunity to leave pd with a complete assignment/idea for immediate classroom implementation, and (b) pd should be relevant to participants needs (e.g., tech ability level).

Opportunity to leave PD with a complete assignment/idea for immediate classroom implementation. Qualitative data revealed that participants want PD where they can leave the session with hardware, software, or digital product that they can use in their classroom. Cher, Lena and Yara used the phrase "sit and get" to describe ineffective PD that does not engage the participants or give them content to leave with. Further, Cher emphasized the need for "hands-on experiences where we actually use the tools, we are learning about [how] to make something for ourselves". Vanessa explained that a "hands-on approach on how to best use the tools for my classroom and personally … I come away with so many good ideas that I can immediately implement in my classroom." Frederick expressed a similar opinion, that a PD should produce a product that does not require extensive work after a PD session.

> Of course, when you go into the PD session and you're able to take something back to your classroom and be able to apply it without much practice or much research, you know that if I can go to a PD session and get something that I can take back and not have to invest much of my time in it.

PD developers should also consider how the session deliverables will improve participants' productivity and save time. As Frederick explained,

> Train me how to record my lessons and post them online. Train me how to get returns on my time. Figure out how to provide cross planning time so that SS/ELA and Math/Science can develop PBL's that run across subjects/curriculum.

Like Fredrick's PD needs, Erin expressed her needs from a PD session as, "Effective PD's make me feel I'm valuable as an educator, allow me to explore 1-3 tools, allow me to collaborate, allow me to showcase my learning, and they build in something I can go use in my class." Another participant, Ali, emphasized the need for continued support for PDs to provide time to produce a product. As Ali said, "I think the best type of PD are, the types that are hands on that gives you a technology that not only that you could use in class but allows you to set up a lesson."

PD should be relevant to participants needs (e.g., tech ability level). Professional development designers and facilitators should consider their audience when designing PD. PD designers must remember that teachers have a variety of experience, knowledge, and skills (Sims & Fletcher-Wood, 2021). Participants shared how the lack of differentiated PD session are ineffective. Ivy expressed that, "All ability levels together going over the basics with the not technological people asking a thousand questions" and when asked what an example of least effective PD is, Kerry wrote that, "Grouping together the entire faculty and expecting the PD to fit everyone's needs. Grouping us by our content is a good start".

Susie added, "The least effective PDs are ones that don't apply to my grade level or that don't have strategies that are easy to incorporate into the classroom". Kerry also voiced the need for differentiated PD: "we need specifically curated tips and tricks that

are meant for our content and our experience level". Additionally, Uma voiced her experience with non-differentiated PD and how to change that.

> I have experienced a lot of ineffective PD in the last 17 years. Any PD that assumes that all teachers are at the same comfort level with technology ends up being a bad experience. I am sure that there were teachers who needed a basic level training to understand the tech tools, but a pre-assessment and leveled training would have been more effective.

The responses reflected that teacher widely shared needs of effective PD should be relevant to teachers needs and improving their instructional practices.

RQ2: How are teachers currently integrating technology for teaching and learning in their classroom?

Understanding what technology teachers are currently using for teaching and learning can establish a baseline for identifying future needs for technology PD. Barriers, first-order barriers (external) and second-order barriers (internal) can impact technology integration (Durff & Cater, 2019; Ertmer,1999; Hur et al., 2016). Two categories were developed to understand what technology was currently being used and how was it being integrated in classroom for (a) teacher tech integration and (b) student tech use.

Theme 1: Technology integration is used for productivity and organization, but student use has additional behavioral challenges.

Teacher Tech Integration. Teachers expressed multiple usages of technology in their classrooms including, learning management systems, game-based learning platforms, video conferencing and interactive displays. Pearl explains the various ways she uses technology.

> I currently use technology to assess my students, weekly. I use it to differentiate instructions in my small groups. I also use district-based programs to help accelerate and/or remediate my students. I use technology as a form of communication between my parents and myself. And use technology to teach virtually when needed.

Susie added, "I use technology to assign student work, give assessments, and the occasional student project". Byron expressed the importance of technology in math group rotations, "I think with my rotations in math like without technology, my math rotations would look completely different". Kerry added another example of how technology supports learning, while following Covid protocols. "We use Virtual Labs and Simulations to interact with a lot of our content currently because of how limited we are with hands-on activities at the moment".

Frederick added that technology integration was successful for him during the transition from remote to hybrid/in person, due to setting clear expectations with students "I had a lot better attendance online than most everybody in the school, last year [because] I set that expectation early for those kids." Jemison also expressed the importance of clear expectations with students, "I also use a document camera so that I can model writing, math, etc. so that students have clear directions on what they need to do for assignments". Overall, participants are using technology to increase their productivity and organization for instructional.

Student Tech Use. Participants responses showed that the use of technology can help with student engagement, but there are concerns for students' ability to use technology effectively. Pearl explained "While I believe [technology] has lots of benefits

in preparing students for real world opportunities, I also believe that our students are lacking some foundational skills". Bryon gave an example of a foundational skill lacking in his classroom and how he accommodates the deficit "typing is a struggle for them. I think one success is for some of my students that still really struggle [they can use] speech to text".

Uma noticed the need to train students before implementing technology, "Students must be taught how to use new technologies before they can be used for learning activities and assessment" but as expressed by Regine, "The difficulty in integrating technology is that not all students are on the same level of using technology. Therefore, that causes additional learning issues as they cannot keep up simply because of their lack of technology abilities." Jemison added her concern about the time needed for integrating technology "It is very much a challenge trying to use devices without having extra time to teach students how to use these devices and still teach required subject content". Giselle expressed what impacts students' skill level, "Students who have 1) been encouraged to use technology productively and 2) actively and have seen computers and tablets as a consumption device don't have the same confidence as those who have been creating with technology."

With Covid-19 forcing schools to quickly transition to remote learning, all students regardless of their academic ability or level of maturity were now receiving instruction solely through a device. This resulted in challenges with student behaviors. Kerry noticed the impact of the lack of responsible technology use by students.

> Last year we had not blocked [messaging] and this made the ability to trust all students with their device very difficult. It was hard to manage behavior and keep

> an eye on all devices last year. This year we have the [messaging] blocked which has eliminated a lot of possible behavior issues that can potentially get in the way of technology being as helpful as it could be. The main difficulty is teaching RESPONSIBILITY in terms of navigating the internet and preventing cyberbullying.

Participants assigned students to use similar apps, hardware, and digital content for classes. A common response, when explain what technology they use was the issues with monitoring students access to technology. Nina explained that "Technology is difficult to integrate when teachers are unable to monitor the screens of all students or control the content the student views." Additional participants noted their concern to make sure students are on task. Ivy shared her concerns by stating, "My students love using technology, but they are also easily distracted by other apps/websites on their devices. Monitoring [student's sites] can be hard at times." While teachers and students use technology for teaching and learning, additional time is needed to address the student technology used issues.

Theme 2: First order barriers impact technology integration.

Tech Challenges. Challenges with integrating technology included issues with access to resources, limited time, and lack of compatibility with available resources. Participants shared their accounts with dealing with external barriers when integrating technology. One challenged faced by participants is the lack of compatibility between educational technology such as devices and software. Dee discussed the issues with ageing hardware, causing compatibility issues "You have a teacher laptop… it may still be working, but it's so old that it's has a lot of issues and bugs. If you have a [interactive

display] that's 10-12 years old, honestly that's just too old." Ali shared how she navigated challenges with educational technology compatibility in her classroom "They've taken out the desktops and given me a laptop cart [since my desktops] are not compatible with the robotics software. I [still] do a trial run a week or two before I want to try something new."

Additional compatibility issues included district filters for devices using the districts internet and district issued devices. Participants reported filters as a barrier for technology integration. Ali discussed the challenge of district filters, "For instance, programs do not load correctly, or the district's filters do not allow a program to download". Giselle also experienced issues with internet filters, as she said that "it is hard to integrate technology when so much of the internet is blocked for the students". Uma explained how her internet access was different than her students' given that "some things work on my end but not work for the students. For example, I can use [a graphic design tool] on my computer, and when I integrate it into an assignment it is blocked for students".

Connectivity is another barrier participants identified as a hindrance to integration. Medgar stated that "the Wi-Fi may be out so you won't get to use the instructional videos that you planned to use originally, or a wire may be disconnected and cause you to lose valuable instructional time trying to diagnose the issue". Connectivity issues were reflected in responses from Dorothy, who claimed that "at times, the Internet is down. This is why I have additional plans and materials". Yara extended her concerns about challenges with connectivity "Network crashing has been a challenge as well as students being off task".

There was a reported difference in the available resources that participants have access to. Some participants reported one-to-one technology devices in their schools, including Uma who stated “All students are one to one with technology. I use it at least daily”. Laney also has district provided devices for students. “My district is a one-to-one district, so every student has their own device that they take home at the end of each day and carry with them between classes.” For other participants, they experience a lack of available devices, like Olivia shared in her response, “It’s difficult if some students don't have a device”. Participants reported various levels of technology integration despite first order barriers they face.

RQ3: How do teachers perceive technology benefits and usefulness of technology integration for teaching and learning?

The two primary categories that emerged from data analysis were (a) expands classroom resources and opportunities, and (b) purposeful use increases individualized learning and student engagement.

Theme 1: Purposeful technology integration is beneficial for enhancing teaching and learning.

Expands classroom opportunities and resources. Participants shared how technology can be used to expand access and opportunities for their students. Byron explained the multiple ways to use technology to expand resources in the classroom.

> [To] be able to provide them with like different experiences like beyond the classroom that they want to be able to have without it. Whether there's a virtual field trip or a going to have virtual model. Or if this manipulatives in math. Them having access to that, it’s huge, so they're experiences are broaden.

Dee expressed a similar opinion about technologies ability to expand classroom access to diverse opportunities.

> When they're able to access things, beyond just what they see on a board or hear from one person you know the teacher or even each other that really just opens up a lot of possibilities, so I think it expands walls of classroom, and I think those two things are the key reasons I like technology for students.

Purposeful use increases individualized learning and student engagement. Multiple participants reported that technology was beneficial for students to use and emphasize the importance of using technology for a purpose and not just for simple substitution. Frederick explains how he decides what technology to integrate: “You know, in learning that skill, what’s the end product that I'm going to get by using this piece of technology with these students. What's going to be there that that benefits them?”. After establishing the purpose for using the technology, it’s important to look at different ways technology can be a tool to increase student engagement. Cher collaborated with colleagues to develop a technology integration lesson to engage high school seniors while reading ‘The Crucible’. Students were tasked with creating a podcast covering the events from the trails as news reporters. Cher details a component of the podcast project.

> The podcast was used to promote the play that the drama department was holding.
>
> They came up with advertisements for products that might have been sold at the time [to play in between news segments]. They really got into the story [and were competing to see] who was going to have the best and funniest podcast.

Another benefit of technology integration that participants spoke highly of was the ability to individualize instruction. Whitley explained the way she uses technology to individualize instruction in her class.

> I assign a variety of assignments on different websites that help my students practice their individual IEP goals in reading, writing and math. These sites assess their developing skills and record their data to continue monitoring their progress in their unique areas of need. I use videos, games, and online resources to help supplement our class instruction.

An unexpected development that was discovered during data analysis was multiple participants sharing that they pursued graduate education in educational technology to increase their knowledge of technology integration. Dee and Fredrick enrolled in graduate education program because of their prior interest in technology and wanting to further develop their skills.

> Dee: I have taught for 24 years, and I have always wanted to use technology and I've always been looking for how to incorporate it. Even literally 24 years ago I was trying to, play games with kids, with the computer and a projector and so I can say this with a pretty strong bit of confidence, and I'm enrolled in an educational technology doctorate program.
>
> Fredrick: You know that that's where I want to be, Instructional technologist. You're not only vetting new technology, but you're also creating instruction and that's what I'm getting my masters in right now is instructional design and technology.

Erin discussed her reasoning for attending graduate school to help strengthen her ability to use technology in the classroom: “I am insecure about my usage of technology in the proper way. That is why I signed up for this [graduate] program that I'm in”. Uma and Toni emphasized how their graduate education has benefited their technology skills.

> Uma: My doctoral program in Edtech has taught me the most because schools pretty much expect teachers to solve their own tech needs/problems.”
>
> Toni: My M.Ed. in Learning Design and Technology was the best PD I have ever received. I was in the middle of the program when we shifted [due to] COVID e-learning, and I had the very best support for building online learning as the students were participating in it. Now that I have completed the program … I can design assessments and learning activities for my students that utilize technology in engaging ways.

Overall, participants pursing graduate education in educational technology supports teachers perceive technology integration to be beneficial for teaching and learning.

Summary

In this chapter, I have presented the analysis methods and findings of the quantitative and qualitative data collected through the technology survey and one-on one-interviews. The quantitative data findings produced *M* and *SD* from Likert scale ratings of participants PD needs (*M* = 3.99, *SD* = .17), teacher (*M* = 3.51, *SD* = .21), and student technology use (*M* = 3.44, *SD* = .10), benefits of technology (*M* = 4.51, *SD* = .13), and

frequency of teacher (*M* = 3.75, *SD* = .22), and student technology use (*M* = 3.38, *SD* = .18). The qualitative data findings from the open-ended question and the one-on-one interviews resulted in five themes that focus on the need to develop hand on PD applicable to teacher's needs, how technology is being integrated to improve productivity, but first order behavior and student use are challenges for integration, and participants believe technology when used purposely is effective for teaching and learning.

CHAPTER 5

DISCUSSION, IMPLICATIONS, AND LIMITATIONS

The purpose of this study was to explore teachers' needs and preferences for technology integration PD to make recommendations for the future. Quantitative and qualitative data from the teacher surveys and one-on-one interviews were collected and analyzed to answer three research questions: (1) What are teachers' needs and preferences for technology integration professional development in k-12 schools? (2) How are teachers currently integrating technology for teaching and learning in their classroom? and (3) How do teachers perceive technology benefits and usefulness of technology integration for teaching and learning? This chapter presents a discussion of the findings, implications, recommendations for practice, limitations of this study and conclusion.

Discussion

The findings of this study are situated within existing literature associated with effective PD and technology integration. The discussion section is organized by the three research questions with specific findings from the study discussed for each.

Research Question 1: What are Teachers' Needs and Preferences for Technology Integration Professional Development in K-12 Schools?

Participants noted a high need area for technology PD is in differentiating instruction for students with special learning needs (M = 4.42, SD = .79). Rice (2022) studied how special education teachers used technology during the COVID-19 pandemic

and determined that teachers of students with and without disabilities needed professional learning support for technology to best serve their students. Although technology can provide more access to accessibility tools in the classroom, Wooten et al. (2021) found that during the pandemic educators and administrators may lack the time or access to specialist that can provide the support for accessibility guidance of technology tools. Providing PD opportunities for teachers about using technology to help with differentiating instruction can lead to students can receiving instruction tailored to meet their individual needs (Asim et al., 2020; Mahoney & Hall, 2017; Wolfgang & Snyderman, 2021; Yasar-Akyar et al., 2022).

Qualitative inquiry in the surveys and one-on-one interviews revealed that participants' PD preferences are sessions that focus on content and include collaboration and active learning. For instance, participants shared that they did not like PD that was lecture only and required them to sit and passively receive instruction. Instead, they voiced that they would prefer opportunities to use the tools during the PD session to help them retain a better understanding, have an opportunity to ask the facilitator questions and the ability to work with their colleagues and leave the PD session with a product that can be implemented immediately into their classrooms.

In this study, participants showed a high interest in effective PD, and that aligned with previous scholars' findings of core features of effective PD including collaboration (Hobbs & Coiro, 2016; Yoon et al., 2020), active learning (Patton et al., 2015; Yurtseven Avci et al., 2019), and content focused (Darling-Hammond et al., 2017; Yurtseven Avci et al., 2019). This was echoed in Fenton's (2017) findings that successful PD promotes collaboration between colleagues and allows the participants to learn how their peers

integrated technology into the curriculum. Two common characteristics from previous scholarly findings align with this study's participants' PD preferences: active learning and content focus. Active learning PDs are designed to give teachers the opportunity to actively use and work with the technology tool/device during the PD session (Karlin et al., 2018).

Soto & Marzocchi (2021) implemented the use of active learning in PD to help their participants implement this learning approach into their classroom. The researchers noted that their participants were previously trained through lectures only but were expected to use active learning with their students. Findings showed that their participants benefited from learning in a collaborative, hands-on environment and were able to take their active learning PD experience and implement the practices into their classrooms (Soto & Marzochi, 2021). PD that connects directly to the participants' content area can lead to more student-centered, inquiry-based learning (Johnson et al., 2017; Yurtseven Avci et al., 2019). Garet et al. (2016) found that a year-long, content-focused PD made significant gains in improving teachers' content knowledge and aspects of their instructional practices. These findings suggest that collaboration, active learning, and content focus are core characteristics for designing effective technology integration PD.

The participants in the present study desire PD that promotes active learning where they could use technology tools, develop lessons, and hone their skills that were developed during remote teaching. An active learning PD will allow teachers to develop their current technology skills in a hands-on, interactive PD. The overall perception of participants responses was that the onset of the COVID-19 pandemic created an

immediate need for teacher technology use and helped identified what gaps, if any, they had in their skill set and the ongoing support they need as schools return to in-person learning (Marek et al., 2021; Starkey et al., 2021). The use of the core effective PD elements as identified by participants and researchers can help continue to strengthen the technology integration skills of participants that were developed when teaching remote due to the COVID-19 pandemic and beyond (Darling-Hammond & Hyler, 2020; Gomez et al., 2022).

Research Question 2: How are Teachers Currently Integrating Technology for Teaching and Learning in their Classroom?

Findings showed that participants frequently use technology for communicating and collaborating with educators (M = 4.33, SD = .78) and students' families (M = 4.09, SD = 1.04) and for collecting and analyzing student assessment data (M = 4.03, SD = .85). Participants responded that their students' technology use consists of creating new ideas and representations (M = 4.12, SD = .93) and professional technology tools (i.e., simulations, databases, satellite imagery). During the qualitative analysis of survey responses, it became evident that participants commonly use technology to increase productivity such as collecting and analyzing student assignments. Participant responses display how teachers are using technology in their classroom and how teachers find technology beneficial and are using it based on the needs of their classroom. Overall, participants are integrating technology to improve efficiency and effectiveness in their classroom practices (Blanchard et al., 2016; Hanny et al., 2021; Kopcha et al., 2020; Rice & Ortiz, 2021).

While participants are integrating technology in their classroom for teaching and learning, they are experiencing issues related to student technology use. For example, participants reported that some of the challenges related to technology integration is the unethical use of technologies for classroom assignments, such as using search engines to identify and plagiarize content, and for online bullying using district learning management systems' chat function. This aligns with challenges faced by participants in Bergdahl's (2022) study where she examined emerging practices and persistent challenges teachers faced a year into the COVID-19 pandemic and noted student behavior as a challenge when integrating technology such as "emerging ways of cheating, withdrawing from studies, and a lack of control of student activities" (p. 8-9).

Although there may not be a completely fail-safe strategy for complete ethical student technology use, researchers recommend educational stakeholders consider implementing digital citizenship practices, which is appropriate online behavior, for alleviating unethical student technology use in the classroom (Lauricella et al., 2020; Martin et al., 2020; Waters et al., 2020). As technology integration continues to thrive in classroom learning environments, Lauricella et al. (2020) suggest school districts should implement policies and curriculum for digital technologies in K-12 schools and provide teachers with digital citizenship PD to provide support for teachers to implement the district's digital citizenship policies and curriculum.

While access to technology alone does not guarantee higher quality of technology integration, first order barriers, which are factors beyond teachers' control (Ertmer, 1999), offers challenges for effective technology integration (Ertmer et al., 2012; Moldavan et al., 2022; Vongkulluksn et al., 2018). Participants noted that a challenge with technology

integration is the technology itself, whether it is the lack of devices, internet connectivity issues, lack of time and support, or district website filters. Access to the internet and technology resources over the past 10 years has vastly improved in educational environments (Darling-Hammond et al., 2020; de los Santos & Rosser, 2021), and previous research supports the findings of this study that first-order barriers such as time needed to design and adapt instructional materials (Bergdahl & Bond, 2022; Makki et al., 2018; Moldavan et al., 2022; Tawfik et al., 2021), lack of training to support technology integration (Ertmer et al., 2012; Kelly, 2015; Francom, 2016; Moldavan et al., 2022), and lack of access to resources (i.e. internet, devices, sites) (Ertmer et al., 2012; Francom, 2016; Hanny et al., 2021) still impact teacher technology integration. The results of this study suggest that it is important that school districts continue to address the first order barriers teachers and students face to achieve the full benefits of technology integration.

Research Question 3: How do Teachers Perceive Technology Benefits and Usefulness of Technology Integration for Teaching and Learning?

Perceptions of the benefits of using technology were common amongst all participants including project-based learning (M = 4.73, SD = .52), productivity applications (M = 4.55, SD = .79), and working collaboratively (M = 4.58, SD = .90). Technology is frequently used for completing individual tasks by teachers (M = 4.55, SD = .56) and students (M = 4.27, SD = .72). However, technology use did not always align with how participants perceived technology to be beneficial. For example, participants reported that they "agree" (M = 4.73, SD = .52) that the use of digital tools and resources to explore and solve real-world issues (e.g., project-based learning), yet teachers (M =

3.64, SD = 1.03) and students (M = 3.39, SD = 1.00) use technologies “sometimes”. This indicates a potential area for technology integration PD.

Kormos (2021) examined educators’ technology integration in the middle grades including their frequency of use and perception of effectiveness. Findings revealed that teachers commonly used document creation (e.g., word processing, spreadsheets, and forms) and presentation tools (e.g., Interactive Whiteboard, PowerPoint) and teachers perceived them as the most effective tools to enhance student learning. Findings from this study align with Kormos’ (2021) research findings because participants reported high frequency use of productivity applications (e.g., word processing, spreadsheet) (M = 4.27, SD = .98) and presentation tools (e.g., Interactive Whiteboard, PowerPoint) (M = 4.36, SD = .74) and perceived them as beneficial (M = 4.7, SD = .52; M = 4.55, SD =.79) for teaching and learning.

Participants argued that technology must have a purposeful use when integrated into teaching in learning to obtain the benefits of technology as a tool, which supports findings from previous research. Recent studies have shown that, when used purposely, technology integration can enhance teaching and learning by improving teacher productivity (Hanny et al., 2021; McKnight et al., 2016), increasing student engagement (Cain et al., 2021; Hamilton, 2015; Young & Nichols, 2017; Velasco, 2018), and expanding classroom resources and opportunities (Kenna & Potter, 2018; McKnight et al., 2016). To illustrate, Kopcha et al., (2020) and McKnight et al. (2016) found that teachers integrate technologies that help them efficiently and effectively accomplish their professional responsibilities.

Participants also noted the importance of technology integration to prepare students for real world experiences such as college, career, and life preparation. Participants perceive purposeful technology integration to be beneficial for teaching and learning. Although participants did not expound on obstacles associated with second order barriers, such as dispositions towards technology in education, personal beliefs, and values (Ertmer et al., 2012; Tawfik et al., 2021), it is important to discuss a finding among participants who viewed technology to be important for teaching and learning. Six participants discussed their reasoning for enrolling in advance degree programs with technology emphasis. A common idea was they wanted to do more with technology integration in K-12 classrooms, which may indicate that they have positive attitudes toward learning how to use technology for teaching and learning. When teachers have a positive attitude towards technology integration, they are more open to integrating technology regardless of first order barriers (Blundell et al., 2020; Tawfik et al., 2021). A positive disposition toward the benefits of technology influenced the participants to obtain higher education in technology areas to further their technology integration practices.

Implications

This research study has implications for the researcher, the research context, and the possibility of future studies. In this section, three areas of implication will be examined: personal implications, recommendations practice, and implications for future research.

Personal Implications

During the data collection phase of the research study, I transitioned out of the teaching to an instructional designer role in a military agency. As a result, my researcher positionality went from an insider to an outside. Outside researchers are detached for the study due to a lack of relationship with the research site or context (Herr & Anderson, 2014; Holmes, 2020). As an outsider, I was able to use my previous 8 years of classroom experience to connect to prospective participants while having enough distance from the research setting to remove biases from the data collection since I did not work with prospective participants or in their school districts.

In my current role as an instructional designer, I utilize adult learning theories to develop best practices to help improve learning for students and assist instructors in lesson development and classroom facilitation. My experience with this study has strengthen my skills and insight for understanding the needs and preferences of adults to develop professionally. This mixed methods research study reinforced my skills as a researcher by conducting a descriptive study. Conducting a descriptive study allowed me to examine the participants' experience, as it exists, without manipulation (Mertler, 2017; Patten & Newhart, 2017). The research findings extended previous scholarly literature findings to answer what teacher participants needs, and preferences are for technology integration PD. Comparing the research findings of this study to previously published literature helps extend the field of knowledge and fill in literature gaps (Galvan & Galvan, 2017; Patten & Newhart, 2017).

As an instructional designer, I work on the planning, designing, development, and managing of learning activities, to improve instructional practices and learning outcomes

for a military agency. Throughout this study, I learned the importance in building rapport with participants and the value in listening to the audience I intend to develop resources for. In this study, participants showed that they believed technology integration is beneficial for teaching and learning, but they needed someone to support them in implementing in integrating technology effectively. When developing PD and instructional lessons, it is important to gather feedback from the prospective participants to determine their needs and ensure what I am developing is aligned with their needs. The ability to conduct a needs assessment, like this study, is beneficial because it can help provided useful information needed to make decisions for intentional plans for instructional improvement in my agency (Morrison et al., 2019). The personal implications of this study align with my instructional designer role in understanding the needs and preferences of instructors so they can support their students, and it is important that I continually implement the best practices and relevant strategies to ensure I am successful in my position.

Recommendations for Practice

The first recommendation for K-12 school districts to implement a technology PD is for school district personnel to administer a technology needs assessment. Morrison et al. (2019) suggest the use of a needs assessment for strategic planning to identity problems and an appropriate solution. To identify the needs for technology integration, school districts should implement a needs assessment to identity the challenges and solutions for their specific district's needs. A needs assessment is an essential part of the Morrison, Ross, and Kemp model (MRK) (Morrison et al., 2019). Morrison et al. (2019) developed the MRK model to help designers identify the instructional problems based on

the needs, priorities, and constraints of their learner. Conducting a needs assessment ensures the PD will be relevant the resources and needs in their district. Furthermore, the district-developed PD should be flexible and adaptable to school level to meet the individual needs of each classroom. Using a needs assessment to identify the technology integration gaps at the individual school level can help school districts develop an actionable plan to create effective PD and provide the resources needed to meet the needs of individual schools and teachers (Brown, 2021; Morrison et al., 2019; Stefaniak et al. 2018).

The next recommendation is using *best practices* when designing technology integration PD. Utilizing the findings of previous scholars, participants from this study and the data collected from a district administered needs assessments will provide the key components of an effectively designed technology integration PD. Previous studies have identified various distinguishing elements of effective PD that can have positive impacts on teachers' skills and classroom practices. Three key PD elements that I recommend for effective technology integration PD are active learning, sustained duration, and ongoing expert support. Making learning active for technology integration PD can include teachers using digital tools and devices to build lessons with peer and facilitator support, examining student work, observing the using the product (e.g., digital tool, device) with real time support, engaging in discussions, and exchanging feedback (Bates & Morgan, 2018; Desimone & Pak, 2017; Smith et al., 2020). Participants shared that passively receiving information was not beneficial in showing them the full capabilities of technology integration. Allowing participants to actively take part in their learning can

help them deepen their understanding of the PD content and their ability to apply it to their classroom needs.

Sustained duration requires that participants are receiving more than a one isolated PD session (Darling-Hammond et al., 2017; Desimone & Pak, 2017). The duration of the technology integration PD may take place over multiple days, months, semesters and can be face to face, video conferencing or a hybrid approach (Desimone & Pak, 2017; Yurtseven Avci et al., 2020). This is done to ensure participants have the ongoing support for "reflection, exploration, and evaluation of new technologies" (Yurtseven Avci et al., 2020 p.162). Participants shared a variety of time frames of technology integration PD they received for support while teaching during the COVID-19 pandemic. Participant responses ranged from one training about technology to monthly trainings and summer workshops. When navigating the unique challenges that appear when teaching during the COVID-19 pandemic, participants reported support and ongoing training as an important element for successful integration of technology even as a transition back to full-time in-person learning.

The last key element for technology integration professional development is providing teachers with expert support for technology integration. Expert support can be in the form of instructional coaches, technology representatives, peer coaches, and more (Darling-Hammond et al., 2017). Experts can model effective instructional practices for supporting technology integration by "using active learning strategies, collaborative work, and discussions and experiences within a strong content focus" (Bates & Morgan, 2018, p. 624). It is important that teachers have ongoing expert support for technical and instructional technology integration issues so teachers can have guidance they need for

successful technology integration (Yurtseven Avci et al., 2020) Providing expert support can help individualize instruction by the differentiating support based on participants technology integration skill level, by meeting the learning where they are (Cirkony et al., 2021). If developers can design and facilitate PD sessions based on their audiences needs and use the best practices for PDs, they can create thoughtful and intentional PD that emphasizes using technology as a tool for teaching and learning. This is a promising way to strengthen teachers' technology integration skills and lead to an increase in technology integration.

Implications for Future Research

Findings from this study showed a need to expand the study to include a larger sample size to improve the generalizability and applicability of the results. This can be done by reproducing this study on a more localized scale by researching one school district and a larger sample size of teachers. Another way the study can be expanded is to have a greater representation of more than 33 participants from six different U.S states. Having a larger sample size from across the U.S. can provide a greater understanding of PD needs for technology integration across the U.S.

This study examined the needs and preferences of K-12 teachers. Expanding the study to include administrators' perceptions about technology integration PD would be beneficial in determining the similarities and differences of priorities and needs for teachers and their administrators. Future research can look at needs and preferences for technology integration in a post COVID-19 era. While this study is based on participants' perceptions during the 2021-2022 school year, a future study can determine what lasting impact, if any, the pandemic had on their needs and preferences for technology

integration PD, how technology is used in their classroom, and the befits of technology integration.

Another future opportunity of research is using Ajzen's (1991) theory of planned behavior (TPB) to exam the relationship between teacher beliefs and technology integration practices. This study could explore teachers' belief constructs, subjective norms, attitudes, and perceived behavioral control towards technology integration. This study could help researchers better understand teacher intentions towards technology integration.

Limitations

There are limitations within this research study that impact the possibility of generalizing the findings to a greater audience. The primary limitations noted in this study is the sample size of 33 participants from 6 different U.S. states. The small sample size and number of states may not be representative of the larger U.S. K-12 teacher population (Creswell & Creswell, 2017). For the 33 participants that volunteered to participate, they may have elected to participate due to an initial belief in the benefits of technology integration. Also, the six participants who volunteered for the one-on-one interview may have already had a more positive attitude towards technology integration. This is a limitation because the participants' population may mostly be individuals who have a positive attitude towards technology and not include a true representation of teachers who are uncomfortable with technology or possess a negative attitude towards technology. Additionally, this descriptive, mixed method study administered one survey and one-on-one interviews for participants to complete. A longer study that uses additional methods (e.g., additional surveys, observations) throughout a school year can

provide additional insights to participants' needs and preferences for technology integration PD (Creswell & Creswell, 2017; Mertler, 2017).

Self-reported data was collected about the participants' perceptions of their technology use, and their students' technology use. Self-reported data is a limitation due to potential biases (e.g., selective memory, exaggeration) from research participants' responses (Mertler, 2016). Triangulation was used to increase the validity of the findings from the self-reported data (Mertler, 2017; Morrison et al., 2019). Since this study involved a data collection from participants in schools across six states, it was not feasible to conduct observations of participants technology use in their classrooms. Future studies with greater access to their participants can consider implementing self-reported and behavioral measures. When reporting the findings, all the responses were recorded together. This may be a limitation for making a recommendation for developing future PD sessions. It could be useful to look deeper at participants' needs and preferences by grade level taught (i.e., elementary, middle, and high) to understand the specific needs of participants to help the researcher make more specific recommendations for technology integration PD.

As the researcher, access to prospective K-12 teacher participants was a limitation. Due to my career transition from working in a school district to a new career field with adult learners, access to K-12 teachers was vastly reduced. As a result, multiple phases of recruitment took place for over 6 months. During the initial recruitment phase, a limited number of participants were recruited through the outside researcher approval process of K-12 school districts. Factors such as districts not allowing outside

researchers, lack of principal approval and lack of teacher's participation led to an insufficient number of participants.

The recruitment process was then expanded to include recruitment flyers posted through UofSC EdTech program social media platforms, snowball sampling, and professional and personal references. My professional and personal references did not participate in the study themselves, instead they shared my recruitment flyer with prospective participants. This was done to reduce the potential biases in responses due to our previous acquaintance. The extended recruitment phase was a limitation because it took longer than initially anticipated to find prospective participants. In turn extending the dissertation completion process by a semester.

Conclusion

The COVID-19 pandemic significantly shifted education from in person to remote learning and revealed the importance of technology integration in education. As schools continue to navigate transitioning back to in person learning during a pandemic, it is important to note what support teachers need in their integration of technology. The focus of this descriptive mixed-methods study was to examine teachers' current needs and preferences for technology integration PD. Through the collection and analysis of surveys and one-on-one interviews, the findings from this study and the review of literature show that PD is wanted and that the elements of effective PD are essential to designing a technology integration PD to meet teachers' needs and preferences. An analysis of the perceptions of 33 participants showed an alignment between their opinions and scholarly literature. A descriptive mixed-methods study allowed the researchers to explore teacher

needs and preferences for PD and in turn make recommendations based on their perceptions (Aggarwal & Ranganathan, 2019; Mertler, 2017).

Effective technology integration PD is needed as identified by the participants. Findings and recommendations suggest the use of active learning, focusing on content, and providing opportunities for teachers to leave the PD with artifacts (e.g., lessons, units) are all elements that can be implemented into technology integration PD. This study used a survey as a needs assessment to determine participants' needs and preferences and show how their responses can be used to provide opportunities for differentiated instruction, based on respondents expressed needs. If educational stakeholders take the initiative to design PD based on the needs and preferences of teacher input and apply core elements for effective technology integration, the PD can provide teachers with the support and guidance needed to advance their technology integration skills. In doing so, expanding the possibility to further the benefits of technology integration for teaching and learning.

REFERENCES

Acar, İ. H., & Yildiz, S. (2016). Professional development of elementary school teachers through online peer collaboration: A case study. *Turkish Online Journal of Qualitative Inquiry, 7*(4).

Adams Becker, S., Freeman, A., Giesinger Hall, C., Cummins, M., and Yuhnke, B. (2016). *NMC/CoSN Horizon Report: 2016 K-12 Edition*. Austin, Texas: The New Media Consortium.

Adenegan, H. (2019). *Technology and k-12 education: The nces ed tech equity initiative: data collection priorities*. National Center for Education Statistics. https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2019087

Adhabi, E., & Anozie, C. B. (2017). Literature review for the type of interview in qualitative research. *International Journal of Education, 9*(3), 86-97.

Adu, P. (2019). *A step-by-step guide to qualitative data coding*. Routledge.

Aggarwal, R., & Ranganathan, P. (2019). Study designs: Part 2 - Descriptive studies. *Perspectives in clinical research, 10*(1), 34–36.

Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes, 50*(2), 179-211.

Akiba, M., & Liang, G. (2016). Effects of teacher professional learning activities on student achievement growth. *The Journal of Educational Research, 109*(1), 99-110

Alenezi, A. (2017). Obstacles for teachers to integrate technology with instruction. *Education and Information Technologies, 22*(4), 1797-1816

Anney, V.N. (2014). Ensuring the quality of the findings of qualitative research: Looking at trustworthiness criteria. *Journal of Emerging Trends in Educational Research and Policy Studies, 5*(2), 272 .

Anyanwu, K. (2015). Teachers perception in a technology integration workshop: Implications for professional development in the digital age. *Issues and Trends in Educational Technology, 3*(1).

Archambault, L., & Crippen, K. (2009). Examining tpack among k-12 online distance educators in the united states. *Contemporary issues in technology and teacher education, 9*(1), 71-88.

Asim, S., Ponners, P. J., Bartlett, C., Parker, A., & Star, R. (2020). Differentiating instruction: For middle school students in virtual learning environments. *Delta Kappa Gamma Bulletin, 86*(3), 19–31.

Badri, M., Alnuaimi, A., Al Rashedi, A., Yang, G., & Temsah, K. (2017). School children's use of digital devices, social media and parental knowledge and involvement–the case of abu dhabi. *Education and Information Technologies, 22*(5), 2645-2664.

Bae, S. (2017). *It's about time: Organizing schools for teacher collaboration and learning*. Stanford, CA: Stanford Center for Opportunity Policy in Education.

Bakia, M. (2014). *Future ready schools: Building technology infrastructure for learning*. Office of Educational Technology, US Department of Education. https://tech.ed.gov/wp-content/uploads/2014/11/Future-Ready-Schools-Building-Technology-Infrastructure-for-Learning-.pdf

Baron, L. S., Hogan, T. P., Schechter, R. L., Hook, P. E., & Brooke, E. C. (2019). Can educational technology effectively differentiate instruction for reader profiles?. *Reading and Writing, 32*(9), 2327-2352.

Barrett-Greenly, T. C. (2013). *Investigating the impact of professional development on teacher practices and beliefs regarding the use of mobile educational applications in the classroom* (pp. 1-153). University of Delaware.

Basoglu, B. (2017). YouTube or writing tube: A technology-mediated learning tool for TESOL. *International Journal of Humanities, Arts and Social Sciences, 3*(3), 98-105.

Bates, C. C., & Morgan, D. N. (2018). Seven elements of effective professional development. *Reading Teacher, 71*(5), 623–626

Bayar, A. (2014). The components of effective professional development activities in terms of teachers' perspective. *International Online Journal of Educational Sciences, 6*(2), 319–327.

Bekhet, A. K., & Zauszniewski, J. A. (2012). Methodological triangulation: An approach to understanding data. *Nurse Researcher*, *20*(2), 40–43.

Benders, D. & Craft, T. (2016) The effect of flexible small groups on math achievement in first grade. *Networks: An Online Journal for Teacher Research, 18*(1).

Bennett, S., Maton, K. & Kervin, L. (2008). The 'digital natives' debate: A critical review of the evidence. *British Journal of Educational Technology, 39*(5), 775–86.

Bergdahl, N. (2022). Adaptive professional development during the pandemic. *Designs for Learning, 14*(1).

Bergdahl, N., & Bond, M. (2022). Negotiating (dis-) engagement in k-12 blended learning. *Education and Information Technologies, 27*(2), 2635-2660.

Bernard, H. R., Wutich, A., & Ryan, G. W. (2017). Analyzing qualitative data: Systematic approaches. SAGE publications.

Bester, G., & Brand, L. (2013). The effect of technology on learner attention and achievement in the classroom. *South African Journal of Education*, *33*(2).

Biddix, J. P. (2018). *Research methods and applications for student affairs*. Newark: John Wiley & Sons, Incorporated.

Blanchard, M. R., LePrevost, C. E., Tolin, A. D., & Gutierrez, K. S. (2016). Investigating technology-enhanced teacher professional development in rural, high-poverty middle schools. *Educational researcher, 45*(3), 207-220.

Blundell, C., Lee, K.-T., & Nykvist, S. (2020). Moving beyond enhancing pedagogies with digital technologies: Frames of reference, habits of mind and transformative learning. *Journal of Research on Technology in Education, 52*(2), 178–196.

Boelens, R., Voet, M., & De Wever, B. (2018). The design of blended learning in response to student diversity in higher education: Instructors' views and use of differentiated instruction in blended learning. *Computers & Education, 120*, 197-212.

Bolderston, A. (2012). Conducting a research interview. J*ournal of Medical Imaging and Radiation Sciences, 43*(1), 66-76.

Bond, M., & Bedenlier, S. (2019). Facilitating student engagement through educational technology: Towards a conceptual framework. *Journal of Interactive Media in Education, 2019*(1)11, pp. 1–14. doi: https://doi.org/10.5334/jime.528

Bradley, T. J. (2020). Exploring the effects of an asynchronous professional development with the samr integration model on high school teachers' technology integration in the classroom: An action research study. University of South Carolina. (Doctoral dissertation).

Brantley-Dias, L., & Ertmer, P. A. (2013). Goldilocks and tpack: Is the construct 'just right?'. *Journal of Research on Technology in Education*, *46*(2), 103-128.

Brinkerhoff, J. (2006). Effects of a long-duration, professional development academy on technology skills, computer self-efficacy, and technology integration beliefs and practices. *Journal of research on technology in education*, *39*(1), 22-43.

Brown, A. H., & Green, T. D. (2015). *The essentials of instructional design: Connecting fundamental principles with process and practice*. Routledge.

Brown, J. A. S. (2021). Developing a needs assessment plan: A practical guide for public libraries. *Public Library Quarterly, 40*(6), 557–569.

Brown, J. S., Collins, A., & Newman, S. E. (1989). Cognitive apprenticeship: Teaching the crafts of reading, writing, and mathematics. In L. Resnik (Ed.), *Knowing, learning, and instruction: Essays in honor of Robert Glaser*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Cain, J., Cain, S., & Daigle, B. (2021). Constructivist podcasting strategies in the 8th grade social studies classroom: “studycasts” support motivation and learning outcomes. *Social Studies, 112*(6), 310–321.

Cambridge International. (2018). *Global education census report 2018*. https://www.cambridgeinternational.org/Images/514611-global-education-census-survey-report.pdf

Campbell, C., Osmond-Johnson, P., Faubert, B., Zeichner, K., & Hobbs-Johnson, A. (2017). *The state of educators' professional learning in Canada: Final Research Report*. Oxford, OH: Learning Forward.

Caruth, G. (2014). Learning how to learn: A six-point model for increasing student engagement. *Participatory Educational Research, 1*(2), 1-12.

Carver, L. B. (2016). Teacher Perception of Barriers and Benefits in K-12 Technology Usage. *Turkish Online Journal of Educational Technology - TOJET, 15*(1), 110–116.

Cauley, F. G., Aiken, K. D., & Whitney, L. K. (2009). Technologies across our curriculum: A study of technology integration in the classroom. *Journal of Education for Business, 85*(2), 114–118. doi:10.1080/08832320903258600

Caukin, N., & Trail, L. (2019). Samr: A tool for reflection for ed tech integration. *International Journal of the Whole Child, 4*(1), 47-54.

Chai, C. S., Koh, J. H. L., & Tsai, C. C. (2013). A review of technological pedagogical content knowledge. *Journal of Educational Technology & Society, 16*(2), 31-51.

Chang, C. W. (2016). The efficacy of a one-to-one technology initiative in improving the four cs. *Journal of Educational Technology Development and Exchange, 9*(2), 2.

Christensen, R., Eichhorn, K., Prestridge, S., Petko, D., Sligte, H., Baker, R., … Knezek, G. (2018). Supporting learning leaders for the effective integration of technology into schools. *Technology, Knowledge and Learning, 23*(3), 457–472. doi:10.1007/s10758-018-9385-9

Chu, S. K. W., Reynolds, R. B., Tavares, N. J., Notari, M., & Lee, C. W. Y. (2017). Twenty-first century skills and global education roadmaps. In *21st century skills development through inquiry-based learning*. p. 17-32. Springer, Singapore.

Cirkony, C., Rickinson, M., Walsh, L., Gleeson, J., Salisbury, M., Cutler, B., Berry, M., & Smith, K. (2021). Beyond effective approaches: A rapid review response to designing professional learning. *Professional Development in Education,* 1–22.

Clary, R. M., Dunne, J. A., Elder, A. D., Saebo, S., Beard, D. J., Wax, C. L., ... & Tucker, D. L. (2017). Optimizing online content instruction for effective hybrid teacher professional development programs. *Journal of Science Teacher Education, 28*(6), 507-521.

Colvin, A. N. (2018). *The impact of technology integration on the educator in fifth and sixth grade classrooms* (10839795) [Doctoral dissertation, Trevecca Nazarene University]. ProQuest LLC.

Combs, E., & Silverman, S. (2017). Bridging the gap: *Paving the pathway from current practice to exemplary professional learning*. Baltimore, MD: Frontline Research Institute.

Committee on STEM Education. (2018). *Charting a course for success: Americas strategy for STEM*.

https://www.whitehouse.gov/wpcontent/uploads/2018/12/STEM-Education-Strategic-Plan-2018.pdf

Connelly, L. M. (2016). Trustworthiness in qualitative research. *Medsurg Nursing*, 25(6), 435- 437.

Cox, E. (2015). Coaching and adult learning: Theory and practice. *New Directions for Adult & Continuing Education*, *2015*(148), 27–38.

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches*. Fifth edition. Thousand Oaks, CA: Sage Publications.

Creswell, J. W., & Plano-Clark, V. L. (2018). *Designing and conducting mixed methods research*. Sage publications.

Creswell, J. W., & Poth, C. N. (2016). *Qualitative inquiry and research design: Choosing among five approaches*. Sage publications.

Cruz, F. J. F., & Díaz, M. J. F. (2016). Generation z's teachers and their digital skills. *Comunicar. Media Education Research Journal*, *24*(1).

Curry, J. R. & Shillingford, M. A. (Eds.). (2015). *African American students' career and college readiness: The journey unraveled*. Lanham, MD: Lexington.

Cviko, A., McKenney, S., & Voogt, J. (2014). Teacher roles in designing technology-rich learning activities for early literacy: A cross-case analysis. *Computers & education*, *72*, 68-79.

Darling-Hammond, L. (2012). *Powerful teacher education: Lessons from exemplary programs*. John Wiley & Sons.

Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). *Effective teacher professional development.* Palo Alto, CA: Learning Policy Institute.

Darling-Hammond, L., & Hyler, M. E. (2020). Preparing educators for the time of COVID ... and beyond. *European Journal of Teacher Education, 43*(4), 457–465.

Darling-Hammond, L., & McLaughlin, M. W. (2011). Policies that support professional development in an era of reform. *Phi delta kappan, 92*(6), 81-92.

Darling-Hammond, L., Schachner, A., & Edgerton, A. K. (2020). Restarting and reinventing school: learning in the time of covid and beyond. *Learning Policy Institute*.

Darling-Hammond, L., Zielezinski, M. B., & Goldman, S. (2014). *Using technology to support at-risk students' learning*. Washington, DC: Alliance for Excellent Education.

Davies, R. S., & West, R. E. (2014). Technology integration in schools. In *Handbook of research on educational communications and technology* (4th ed., pp. 841–853). Springer New York.

de los Santos, G. E., & Rosser, W. (2021). COVID-19 shines a spotlight on the digital divide. *Change, 53*(1), 22–25.

Decuir-Gunby, J. T., & Schutz, P. A. (2017). *Developing a mixed methods proposal: A practical guide for beginning researchers*. Thousand Oaks, CA: Sage Publications.

Department of Education. (2019). Fiscal year 2019 budget: Summary and background information. https://www2.ed.gov/about/overview/budget/budget19/summary/19summary.pdf

Desimone, L. M., & Garet, M. S. (2015). Best practices in teacher's professional development in the United States. *Psychology, Society, & Education 7*(3), 252-263

Desimone, L. M., & Stuckey, D. A. (2014). Sustaining teacher professional development. In L. E. Martin, S. Krakler, D. J. Quatroche, & K. L. Bauserman (Eds.), *Handbook of professional development in education: Successful models and practices, preK-12* (pp. 467- 482). New York, NY: Guilford.

Desimone, L. M., & Pak, K. (2017). Instructional coaching as high-quality professional development. *Theory Into Practice, 56*(1), 3–12.

DeVellis, R. F. (2017). *Scale development: Theory and applications* (4th ed.). Thousand Oaks, CA: Sage.

Donohoo, J. (2016). *Collective efficacy: How educators' beliefs impact student learning*. Corwin Press.

Dorn, E., Hancock, B., Sarakatsannis, J., & Viruleg, E. (2020). COVID-19 and student learning in the United States: The hurt could last a lifetime. *McKinsey & Company*.

Dwyer, S.C., & Buckle, J.L. (2009). The space between: On being an insider-outsider in qualitative research. *International Journal of Qualitative Methods, 8*(1), 54-63.

Dunlap, J. C. (2005). Changes in students' use of lifelong learning skills during a problem based learning project. *Performance Improvement Quarterly, 18*(1), 5-33.

Durff, L., & Carter, M. (2019). Overcoming second-order barriers to technology integration in k–5 schools. *Journal of Educational Research and Practice, 9*(1), 17.

EducationSuperHighway. (2014). *Connecting America's students: Opportunities for action*. https://www.educationsuperhighway.org/wp-content/uploads/2014/11/Connecting-Americas-Students-K12-E-rate-Spending-Report-April-2014.pdf

EducationSuperHighway. (2019). *Progress*. https://www.educationsuperhighway.org/progress/

EducationSuperHighway. (2020). 2019 State of the states. https://s3-us-west-1.amazonaws.com/esh-sots-pdfs/2019 State of the States.pdf

Eiland, L. S., & Todd, T. J. (2019). Considerations when incorporating technology into classroom and experiential teaching. *The Journal of Pediatric Pharmacology and Therapeutics*, *24*(4), 270-275.

Ertmer, P. A. (1999). Addressing first- and second-order barriers to change: Strategies for technology integration. *Educational Technology Research and Development, 47*(4), 47–61.

Ertmer, P. A., Ottenbreit-Leftwich, A. T., Sadik, O., Sendurur, E., & Sendurur, P. (2012). Teacher beliefs and technology integration practices: A critical relationship. *Computers & education*, *59*(2), 423-435.

Edwards, C., & Willis, J. W. (2014). *Action research : Models, methods, and examples*. Charlotte, NC: Information Age Publishing.

Engel, S., & Randall, K. (2009). How Teachers Respond to Children's Inquiry. *American Educational Research Journal, 46*(1), 183–202. https://doi.org/10.3102/0002831208323274

ESSA. (2015). Every Student Succeeds Act of 2015, Pub. L. No. 114-95 § 114 Stat. 1177 (2015-2016)

Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American journal of theoretical and applied statistics, 5*(1), 1-4.

Fallon, M. (2016). *Writing up quantitative research in the social and behavioral sciences*. Rotterdam: Brill I Sense.

Fredricks, J.A., Filsecker, M & Lawson, M.A. 2016. Student engagement, context and adjustment: Addressing definitional, measurement, and methodological issues. *Learning and Instruction, 43*, 1–4.

Feller, R. (2011). *STEM careers for those seeking and promoting STEM careers*. http://www.stemcareer.com/

Fenton, D. (2017). Recommendations for professional development necessary for ipad integration. *Educational Media International, 54*(3), 165–184.

Ferdig, R. E., Baumgartner, E., Hartshorne, R., Kaplan-Rakowski, R., & Mouza, C. (2020). Teaching, technology, and teacher education during the covid-19 pandemic: Stories from the field. Waynesville, NC, USA: *Association for the Advancement of Computing in Education (AACE)*.

Firmin, M. W., & Genesi, D. J. (2013). History and implementation of classroom technology. *Procedia-Social and Behavioral Sciences*, *93*, 1603-1617.

Fishman, B., Konstantopoulos, S., Kubitskey, B. W., Vath, R., Park, G., Johnson, H., & Edelson, D. C. (2013). Comparing the impact of online and face-to-face professional development in the context of curriculum implementation. *Journal of teacher education*, *64*(5), 426-438.

Floris, F. D., & Renandya, W. A. (2019). Unlocking the potential of SAMR. *English teaching professional*, (120), 55-57.

Forero, R., Nahidi, S., De Costa, J., Mohsin, M., Fitzgerald, G., Gibson, N., ... & Aboagye-Sarfo, P. (2018). Application of four-dimension criteria to assess rigour of qualitative research in emergency medicine. *BMC health services research*, *18*(1), 120.

Francom, G. M. (2016). Barriers to technology use in large and small school districts. *Journal of information technology education: Research*, *15*(1), 577-591.

Francom, G. M. (2020). Barriers to technology integration: A time-series survey study. *Journal of Research on Technology in Education*, *52*(1), 1-16.

Friday Institute for Educational Innovation (2016). School Technology Needs Assessment (STNA) – Version 3.0. US: SERVE Center at UNC Greensboro

Fullan, M., & Hargreaves, A. (2012). Reviving teaching with 'professional capital'. *Education Week*, *31*(33), 30-36.

Gallup Organization. (2019). *Education technology use in schools: Student and educator perspectives*. Washington, D.C: Gallup Organization.

Gardner, L. (2020). Covid-19 has forced higher ed to pivot to online learning. Here are 7 takeaways so far. *The Chronicle of Higher Education*, *20*.

Garet, M. S., Heppen, J., Walters, K., Smith, T., & Yang, R. (2016). Does content-focused teacher professional development work? Findings from three institute of education sciences studies. *National Center for Education Evaluation and Regional Assistance.*

Gemin, B., Pape, L., Vashaw, L., & Watson, J. (2015). Keeping pace with k-12 digital learning: An annual review of policy and practice. *Evergreen Education Group*.

Gerard, L. F., Bowyer, J. B., Linn, M. C. (2010). A principal community: Building school leadership for technology-enhanced science curriculum reform. *Journal of School Leadership, 20*, 145–183.

Gilakjani, A. P. (2013). Factors contributing to teachers' use of computer technology in the classroom. *Universal Journal of Educational Research, 1*(3), 262-267.

Gomez, F. C., Trespalacios, J., Hsu, Y. C., & Yang, D. (2022). Exploring teachers' technology integration self-efficacy through the 2017 ISTE Standards. *TechTrends, 66*(2), 159-171.

Goodnough, K., Pelech, S., & Stordy, M. (2014). Effective professional development in stem education: The perceptions of primary/elementary teachers. *Teacher Education & Practice, 27*(2/3), 402–423.

Goodwin, A.L., Low, E.L, Ng, P.T., Yeung, A.S. (2015). Enhancing playful teachers' perception of the importance of ict use in the classroom: The role of risk taking as a mediator. *Australian Journal of Teacher Education, 40*(4), 131-149.

Great Schools Partnership. (2016). *21st century skills*. The Glossary of Education Reform. https://www.edglossary.org/21st-century-skills/

Green, L. S. (2014). Through the looking glass. *Knowledge Quest, 43*(1), 36-43.

Griffin, C. C., Dana, N. F., Pape, S. J., Algina, J., Bae, J., Prosser, S. K., & League, M. B. (2018). Prime online: Exploring teacher professional development for creating inclusive elementary mathematics classrooms. *Teacher education and special education*, *41*(2), 121-139.

Griffin, P., & Care, E. (Eds.). (2015). *Assessment and teaching of 21st century skills: Methods and approach*. Springer.

Guest, G., Namey, E., & Mitchell, M. (2013). *Collecting qualitative data: A field manual for applied research.* Thousand Oaks: SAGE Publications, Ltd.

Hamilton, B. (2015). *Integrating technology in the classroom: Tools to meet the needs of every student* (1st ed.). International Society for Technology in Education.

Hamilton, E. R., Rosenberg, J. M., & Akcaoglu, M. (2016). The substitution augmentation modification redefinition (SAMR) model: A critical review and suggestions for its use. *TechTrends, 60*(5), 433-441. doi: http://dx.doi.org.sdl.idm.oclc.org/10.1007/s11528-016-0091-y

Hammond, L., & Moore, W. M. (2018). Teachers taking up explicit instruction: The impact of a professional development and directive instructional coaching model. *Australian Journal of Teacher Education, 43*(7), 110–133.

Hamilton, B. (2015). *Integrating technology in the classroom: Tools to meet the needs of every student* (1st ed.). International Society for Technology in Education.

Hancock, V., & Betts, F. (2002). Back to the future: Preparing learners for academic success in 2004. *Learning and Leading with Technology, 29*(7), 10-14.

Hancock, V., & Betts, F. (2002). Back to the future: Preparing learners for academic success in 2004. *Learning and Leading with Technology, 29*(7), 10-14.

Hennessy, S., D'Angelo, S., McIntyre, N., Koomar, S., Kreimeia, A., Cao, L., ... & Zubairi, A. (2022). Technology use for teacher professional development in low- and middle-income countries: A systematic review. *Computers and Education Open*, 100080.

Hapsari, T., & Dahlan, J. A. (2018). Understanding and responding the students in learning mathematics through the differentiated instruction. *Journal of Physics Conference Series 1013*(1), p. 012136.

Hargreaves, A. (2014). *Handbook of professional development in education: Successful models and practices, PreK-12*. Guilford Publications.

Hargreaves, A., & Fullan, M. (2015). *Professional capital: Transforming teaching in every school*. Teachers College Press.

Hargrove, C.M. (2019). *Integrating technology into the literacy curriculum within a first grade classroom* (13858519) [Masters thesis, Rowan University]. ProQuest LLC.

Harrell, S., & Bynum, Y. (2018). Factors affecting technology integration in the classroom. *Alabama Journal of Educational Leadership, 5*, 12-18.

Haug, B. S., & Mork, S. M. (2021). Taking 21st century skills from vision to classroom: What teachers highlight as supportive professional development in the light of new demands from educational reforms. *Teaching and Teacher Education*, *100*, 103286.

Haymon, C.(2019). *Technology with differentiated instruction for advanced middle school students' reading achievement*. [Doctoral dissertation, Walden University].

Herr, K., & Anderson, G. L. (2005). The action research dissertation: *A guide for students and faculty*. Thousand Oaks, Calif: SAGE Publications.

Herr, K., & Anderson, G. L. (2014). *The action research dissertation: A guide for students and faculty*. Sage publications.

Hew, K. F., & Brush, T. (2007). Integrating technology into K-12 teaching and learning: Current knowledge gaps and recommendations for future research. *Educational technology research and development, 55*(3), 223-252.

Hilton, J. T. (2016). A case study of the application of SAMR and TPACK for reflection on technology integration into two social studies classrooms. *Social Studies, 107*(2), 68–73.

Hobbs, R., & Coiro, J. (2016). Everyone learns from everyone. *Journal of Adolescent & Adult Literacy, 59*(6), 623–629.

Hobbs, R., & Tuzel, S. (2017). Teacher motivations for digital and media literacy: An examination of turkish educators. *British Journal of Educational Technology*, *48*(1), 7-22.

Hochberg, E. D., & Desimone, L. M. (2010). Professional development in the accountability context: Building capacity to achieve standards. *Educational psychologist, 45*(2), 89-106.

Holmes, A. G. D. (2020). Researcher positionality--a consideration of its influence and place in qualitative research--a new researcher guide. *Shanlax International Journal of Education, 8*(4), 1-10.

Holter, C. P. (2018). Children and technology. *Children's Technology & Engineering, 22*(3), 5- 6.

Howard, S. K., & Mozejko, A. (2015). Teachers: Technology, change and resistance. *Teaching and digital technologies: Big issues and critical questions*, 307-317.

Houston-Wilson, C., & Lieberman, L. J. (2020). A Needs Assessment for Inclusive Physical Education: A Tool for Professional Development. *JOPERD: The Journal of Physical Education, Recreation & Dance*, *91*(7), 43–48.

Hur, J. W., Shannon, D., & Wolf, S. (2016). An investigation of relationships between internal and external factors affecting technology integration in classrooms. *Journal of Digital Learning in Teacher Education*, *32*(3), 105-114.

Hussar, B., NCES; Zhang, J., Hein, S., Wang, K., Roberts, A., Cui, J., Smith, M., AIR; Bullock Mann, F., Barmer, A., and Dilig, R. (2020). *The condition of education 2020*. National Center for Education Statistics. https://nces.ed.gov/pubs2020/2020144.pdf.

Imbeau, M. B., & Tomlinson, C. A. (2013). Managing a differentiated classroom. *The Mold of Classroom Management: What Educators Should Know and Do to Enable Student Success*, *5*(5), 5, 11.

Ismajli, H., & Imami-Morina, I. (2018). Differentiated instruction: Understanding and applying interactive strategies to meet the needs of all the students. *International journal of instruction*, *11*(3), 207-218.

ISTE. (2016). *Breaking down ESSA: A guide to the new ed tech provisions in the federal education law*. https://id.iste.org/docs/advocacy-resources/edtekwhitepaper_advocacy_nclb-essa.pdf

J-PAL Evidence Review. (2019). Will technology transform education for the better?. Cambridge MA: Abdul Latif Jameel Poverty Action Lab.

Johnson, A. M., Jacovina, M. E., Russell, D. G., & Soto, C. M. (2016). Challenges and solutions when using technologies in the classroom. In *Adaptive Educational Technologies for Literacy Instruction* (pp. 13-32). Taylor and Francis. https://files.eric.ed.gov/fulltext/ED577147.pdf

Johnson, B. & Turner, L. A. (2003). Data collection strategies in mixed methods research. *Handbook of mixed methods in social and behavioral research*. Thousand Oaks, CA: Sage.

Johnson, C. C., Sondergeld, T., & Walton, J. B. (2017). A statewide implementation of the critical features of professional development: Impact on teacher outcomes. *School Science and Mathematics, 117*(7-8), 341-349.

Jones, R. (2013). *2.1 Perception process*. University of Minnesota Libraries Publishing, Communication in the real world: An introduction to communication studies. The Saylor Foundation.

Joosten, T., Lee-McCarthy, K., Harness, L., Paulus, R., & Online Learning Consortium (OLC). (2020). Digital Learning Innovation Trends. In *Online Learning Consortium*. Online Learning Consortium.

Joseph, S., Thomas, M., Simonette, G., & Ramsook, L. (2013). the impact of differentiated instruction in a teacher education setting: Successes and challenges. *International Journal of Higher Education, 2*(3), 28-40.

Kaden, U. (2020). COVID-19 School Closure-Related Changes to the Professional Life of a K–12 Teacher. *Education Sciences, 10*(6), 165.

Kafyulilo, A., Fisser, P., & Voogt, J. (2016). Factors affecting teachers' continuation of technology use in teaching. *Education and Information Technologies, 21*(6), 1535-1554. https://doi.org/10.1007/s10639-015-9398-0

Kalinowski, E., Gronostaj, A., & Vock, M. (2019). Effective professional development for teachers to foster students' academic language proficiency across the curriculum: A systematic review. *AERA Open, 5*(1), 1-23.

Kalu, F. A., & Bwalya, J. C. (2017). What makes qualitative research good research? An exploratory analysis of critical elements. *International Journal of Social Science Research, 5*(2), 43-56.

Karatza, Z. (2019). Information and communication technology (ICT) as a tool of differentiated instruction: An informative intervention and a comparative study on educators' views and extent of ICT use. *International Journal of Information and Education Technology, 9*(1), 8-15.

Karlin, M., Ottenbreit-Leftwich, A., Ozogul, G., & Liao, Y.-C. (2018). K-12 technology leaders: Reported practices of technology professional development planning, implementation, and evaluation. *Contemporary Issues in Technology & Teacher Education, 18*(4), 722–748.

Kelly, D. P. (2015). Overcoming barriers to classroom technology integration. *Educational Technology, 55*(2), 40–43.

Kenna, J. L., & Potter, S. (2018). Experiencing the world from inside the classroom: Using virtual field trips to enhance social studies instruction. *Social Studies, 109*(5), 265–275.

Kent, A.M., Giles, R.M. (2017). Preservice teachers' technology self-efficacy. *SRATE Journal, 26*(1). 9-20.

Kolb, L. (2017). *Learning first, technology second: The educator's guide to designing authentic lessons*. Portland, Oregon: ISTE.

Kihoza, P., Zlotnikova, I., Bada, J., & Kalegele, K. (2016). Classroom ICT integration in Tanzania: Opportunities and challenges from the perspectives of TPACK and SAMR models. *International Journal of Education and Development using ICT, 12*(1).

Kim, C., Kim, M. K., Lee, C., Spector, J. M., & DeMeester, K. (2013). Teacher beliefs and technology integration. *Teaching and teacher education, 29*, 76-85.

King, J., & South, J. (2017). *Reimagining the role of technology in higher education: A supplement to the national education technology plan*. US Department of Education, Office of Educational Technology.

Knowles, M. S., Holton, E. F. & Swanson, R. A. (1998). *The adult learner: The definitive classic in adult education and human resource development* (5th ed.). Houston, Tx.: Gulf Publishing Company

Koehler, M., & Mishra, P. (2009). What is technological pedagogical content knowledge (TPACK)?. *Contemporary issues in technology and teacher education, 9*(1), 60-70.

Koehler, M. J., Shin, T. S., & Mishra, P. (2012). How do we measure TPACK? Let me count the ways. In *Educational technology, teacher knowledge, and classroom impact: A research handbook on frameworks and approaches* (pp. 16-31). IGI Global.

Kopcha, T. J. (2012). Teachers' perceptions of the barriers to technology integration and practices with technology under situated professional development. *Computers & Education, 59*(4), 1109-1121.

Kopcha, T. J., Neumann, K. L., Ottenbreit-Leftwich, A., & Pitman, E. (2020). Process over product: The next evolution of our quest for technology integration. *Educational Technology Research and Development*, 1-21.

Kormos, E. (2021). An exploration of educators' technology integration in the middle grades. *Computers in the Schools, 38*(3), 232–248.

Kurvinen, E., Kaila, E., Laakso, M. J., & Salakoski, T. (2020). Long term effects on technology enhanced learning: The use of weekly digital lessons in mathematics. *Informatics in Education*, *19*(1), 51-75.

Kyndt, E., Gijbels, D., Grosemans, I., & Donche, V. (2016). Teachers' everyday professional development: Mapping informal learning activities, antecedents, and learning outcomes. *Review of Educational Research, 86*(4), 1111-1150.

Lantz, J. L., Myers, J., & Wilson, R. (2020). Digital storytelling and young children: Transforming learning through creative use of technology. In *Handbook of Research on Integrating Digital Technology With Literacy Pedagogies* (pp. 212-231). IGI Global.

Lawrence, G., Ahmed, F., Cole, C., & Johnston, K. P. (2020). Not more technology but more effective technology: Examining the state of technology integration in eap programmes. *RELC Journal*, *51*(1), 101-116.

Lauricella, A. R., Herdzina, J., & Robb, M. (2020). Early childhood educators' teaching of digital citizenship competencies. *Computers & Education, 158*, N.PAG.

Lazar, S. (2015). The importance of educational technology in teaching. *International Journal of Cognitive Research in Science, Engineering and Education*, *3*(1).

Le, V. N., Stecher, B. M., Lockwood, J. R., Hamilton, L. S., Robyn, A., Williams, V. L., … Klein, S. P. (2006). *Improving mathematics and science education: A longitudinal investigation of the relationship between reformoriented instruction and student achievement*. Santa Monica, CA: RAND Corporation, MG-480-NSF. http://www.rand.org/pubs/monographs/MG480.html

Le Fevre, D. M. (2014). Barriers to implementing pedagogical change: The role of teachers' perceptions of risk. *Teaching & Teacher Education*, *38*, 56–64.

Leaman, H., & Corcoran, R. (2018). Teacher action research in elementary social studies: Use of ipads in 6th grade geography instruction. *IE: Inquiry In Education, 10*(2), 5.

Lee, H.-S., Linn, M. C., Varma, K., Liu, O. L. (2009). How do technology-enhanced inquiry science units impact classroom learning? *Journal of Research in Science Teaching, 47*, 71–90.

Lei, H., Cui, Y., & Zhou, W. (2018). Relationships between student engagement and academic achievement: A meta-analysis. *Social Behavior and Personality: an international journal*, *46*(3), 517-528.

Leavy, P. (2017). Research design: Quantitative, qualitative, mixed methods, arts-based, and community-based participatory research approaches. Guilford Publications.

Levin-Goldberg, J. (2012). Teaching generation techx with the 4cs: Using technology to integrate 21st century skills. *Journal of Instructional Research, 1*, 59-66.

Li, L., Worch, E., Zhou, Y. (2015). How and why digital generation teachers use technology in the classroom: An explanatory sequential mixed methods study. *International Journal for the Scholarship of Teaching and Learning, 9*(2), 1-9.

Liao, Y. C., Ottenbreit-Leftwich, A., Karlin, M., Glazewski, K., & Brush, T. (2017). Supporting change in teacher practice: Examining shifts of teachers' professional development preferences and needs for technology integration. *Contemporary Issues in Technology and Teacher Education*, *17*(4), 522-548.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Newbury Park, CA: Sage Publications.

Lincoln, Y. S., & Guba, E. G. (1986). But is it rigorous? Trustworthiness and authenticity in naturalistic evaluation. *New directions for program evaluation*, (30), 73-84.

Lindvall, J., & Ryve, A. (2019). Coherence and the positioning of teachers in professional development programs. A systematic review. *Educational Research Review*, *27*, 140-154.

Linton, J., & Geddes, C. (2013). Growing technology leaders: Learn how a small, underserved school district built capacity through collaborative, teacher-led professional development. *Learning & Leading with Technology, 41*(1), 12-15.

Liu, L. (2016). Using generic inductive approach in qualitative educational research: A case study analysis. *Journal of Education and Learning*, *5*(2), 129-135.

Liu, M., Horton, L., Olmanson, J., Toprac, P. (2011). A study of learning and motivation in a new media enriched environment for middle school science. *Educational Technology Research and Development, 59*(2), 249–265.

Liu, M., Ko, Y., Willmann, A., & Fickert, C. (2018). Examining the role of professional development in a large school district's iPad initiative. *Journal of Research on Technology in Education, 50*(1), 48-69.

Liu, M. H., & Kleinsasser, R. (2015). Exploring EFL teachers' knowledge and competencies: In-service program perspectives. *Language Learning & Technology, 19*(1), 119-138.

Liu, F., Ritzhaupt, A. D., Dawson, K., & Barron, A. E. (2017). Explaining technology integration in K-12 classrooms: a multilevel path analysis model. *Educational Technology Research and Development, 65*(4), 795–813.

Liu, S. H. (2011). Factors related to pedagogical beliefs of teachers and technology integration. *Computers & Education, 56*(4), 1012-1022.

Liu, S. H. (2013). Teacher professional development for technology integration in a primary school learning community. *Technology, Pedagogy and Education, 22*(1), 37-54.

Logan, B. (2011). Examining differentiated instruction: Teachers respond. *Research in higher education journal, 13*.

Lu, R., & Overbaugh, R. C. (2009). School environment and technology implementation in K–12 classrooms. *Computers in the Schools, 26*(2), 89-106.

Lynch, M. (2020). E-Learning during a global pandemic. *Asian Journal of Distance Education, 15*(1), 189–195.

Machado, L. J., & Chung, C. J. (2015). Integrating technology: The principals' role and effect. *International Education Studies, 8*(5), 43–53. doi:10.5539/ies.v8n5p43

Macià, M., & García, I. (2016). Informal online communities and networks as a source of teacher professional development: A review. *Teaching and teacher education, 55*, 291-307.

Maher, D., & Yoo, J. (2017). Project-Based Learning in the Primary School Classroom. *Journal of Education Research, 11*(1), 77–87.

Mahoney, J., & Hall, C. (2017). Using technology to differentiate and accommodate students with disabilities. *E-Learning and Digital Media, 14(*5), 291–303.

Makki, T. W., O'Neal, L. J., Cotten, S. R., & Rikard, R. V. (2018). When first-order barriers are high: A comparison of second-and third-order barriers to classroom computing integration. *Computers & Education*, *120*, 90-97.

Main, K., & Pendergast, D. (2015). Core features of effective continuing professional development for the middle years: A tool for reflection. *RMLE Online, 38*(10), 1-18.

Marchisio, M., Barana, A., Fioravera, M., Fissore, C., Anna, B., Massimo, E., ... & Rabellino, S. (2018). Online asynchronous collaboration for enhancing teacher professional knowledges and competencies. *ELearning & Software for Education, 1*, 167–175.

Martin, F., Hunt, B., Wang, C., & Brooks, E. (2020). Middle school student perception of technology use and digital citizenship practices. *Computers in the Schools, 37*(3), 196–215.

Martin, L. E., Kragler, S., Quatroche, D., & Bauserman, K. (2019). Transforming schools: The power of teachers' input in professional development. *Journal of Educational Research and Practice, 9*(1), 13.

Martinez Aleman, A.M., Rowan-Kenyon, H., & Savitz-Romer, M. (2018). *Using Technology to Help First-Gen Students*. https://www.insidehighered.com/digital-learning/views/2018/10/10/how-use-technology-improve-success-first-generation-college

Matherson, L., & Windle, T. M. (2017). What do teachers want from their professional development? Four emerging themes. *Delta Kappa Gamma Bulletin, 83*(3).

McConnell, T. J., Parker, J. M. Eberhardt, J., Koehler, M. J., & Lundeberg, M. A. (2013) Virtual professional learning communities: Teachers' perceptions of virtual versus face-to-face professional development. *Journal of Science Education and Technology, 22*, 267- 277.

McFarland, J., Hussar, B., Zhang, J., Wang, X., Wang, K., Hein, S., Diliberti, M., Forrest Cataldi, E., Bullock Mann, F., and Barmer, A. (2019). *The condition of education 2019* (NCES 2017- 144). U.S. Department of Education. Washington, DC: National Center for Education Statistics. https://nces.ed.gov/pubs2019/2019144.pdf.

McFarling, P., Owens, D. C., & Woodford-Thomas, T. (2018). Professional Development for Missouri's STEM Teachers: A Statewide Needs Assessment of K-12 STEM Teachers.

McKnight, K., O'Malley, K., Ruzic, R., Horsley, M. K., Franey, J. J., & Bassett, K. (2016). Teaching in a digital age: How educators use technology to improve student learning. *Journal of Research on Technology in Education, 48*(3), 194–211.

McQuirter Scott, R., & Meeussen, N. (2017). Self-regulated learning: A touchstone for technology-enhanced classrooms. *The Reading Teacher, 70*(6), 659-666.

Meral, M., Colak, E., & Zereyak, E. (2012). The relationship between self-efficacy and academic performance. *Procedia-Social and Behavioral Sciences, 46*(2012), 1143-1146.

Mertler, C. A. (2016). *Introduction to educational research*. Sage publications.

Mertler, C. A. (2017). *Action research: Improving schools and empowering educators*. Thousand Oaks, California: SAGE Publications, Inc.

Miles, M. B., Huberman, A. M., & Saldaña, J. (2018). *Qualitative data analysis: A methods sourcebook.* Sage publications.

Mills, G. E., & Gay, L. R. (2019). *Educational research: Competencies for analysis and applications*. Pearson. One Lake Street, Upper Saddle River, New Jersey 07458.

Mishra, P., & Mehta, R. (2017). What we educators get wrong about 21st-century learning: Results of a survey. *Journal of Digital Learning in Teacher Education, 33*(1), 6-19.

Moldavan, A. M., Capraro, R. M., & Capraro, M. M. (2022). Navigating (and disrupting) the digital divide: Urban teachers' perspectives on secondary mathematics instruction during covid-19. *Urban Review, 54*(2), 277–302.

Molnar, A., Miron, G., Elgeberi, N., Barbour, M. K., Huerta, L., Shafer, S. R., & Rice, J. K. (2019). *Virtual schools in the us 2017*. Boulder, CO: National Education Policy Center. http://nepc.colorado.edu/publication/virtual-schools-annual-2017

Moore, D. (2011). Technology literacy: The extension of cognition. *International Journal of Technology & Design Education, 21*(2), 185–193.

Moore, S., Haviland, D., Moore, W., & Tran, M. (2016). Preparing teachers to use gis: The impact of a hybrid professional development program on teachers' use of gis. *Journal of Science Education & Technology, 25*(6), 930–946.

Morrison, G. R., Ross, S. J., Morrison, J. R., & Kalman, H. K. (2019). *Designing effective instruction*. John Wiley & Sons.

Morrison, J. R., Ross, S. M., & Cheung, A. C. K. (2019). From the market to the classroom: how ed-tech products are procured by school districts interacting with vendors. *Educational Technology Research & Development*, *67*(2), 389–421.

Morsink, P.M., Hagerman, M.S., Heintz, A., Boyer, D.M., Harris, R., Kereluik, K., Hartman, D.K., Wood, A., White, A., Woodruff, C. and Anderson, T. (2011). Professional development to support TPACK technology integration: The initial learning trajectories of thirteen fifth-and sixth-grade educators. *Journal of Education, 191*(2), 3-16.

Mraz, M., Salas, S., Mercado, L., & Dikotla, M. (2016). Teaching better, together: Literacy coaching as collaborative professional development. *English Teaching Forum, 54*(4), 24–31.

Murray, J. (2014). *Designing and implementing effective professional learning.* Thousand Oaks, CA: Corwin Press.

Nasir, N.S., Cabana, C., Shreve, B., Woodbury, E., & Louie, N. (2014). *Mathematics for equity: A framework for successful practice.* New York: Teachers College Press.

Nasr, N. (2020). Teachers as students: Adapting to online methods of instruction and assessment in the age of covid-19. *The Electronic Journal for Research in Science & Mathematics Education*, *24*(2), 168-171.

National Assessment of Educational Progress Report Cards. (2017). *How did U.S. students perform on the most recent assessments?*. https://www.nationsreportcard.gov/#

National Center for Education Statistics. (2016). *2015 Mathematics grades 4 and 8 assessment report cards: Summary data tables for national and state average scores and achievement level results*. https://www.nationsreportcard.gov/reading_math_2015/files/2015_Results_Appendix_Math.pdf

National Center for Education Statistics. (2016). *NAEP - 2015 science assessment*. https://www.nationsreportcard.gov/science_2015/#?grade=4

National Center for Education Statistics (2016). *The nation's report card: Students' computer access and use*. National Center for Education Statistics. Institute of Education Sciences. U.S. Department of Education, Washington, D.C.

National Center for Education Statistics. (2018). *Student access to digital learning resources outside of the classroom*. https://nces.ed.gov/pubs2017/2017098/section5.asp

National Center on Safe Supportive Learning Environments. (n.d.) *Title iv, part a statute*. https://safesupportivelearning.ed.gov/title-iv-part-a-statute

National Education Association. (2014). Preparing 21st century students for a global society: An educator's guide to the "four cs". *Alexandria, VA: National Education Association*.

National Governors Association Center for Best Practices, Council of Chief State School Officers. (2010). *Common core state standards: About the standards*. National

Governors Association Center for Best Practices, Council of Chief State School Officers, Washington D.C.

Next Generation Science Standards. (2017). *How the new budget funds stem in essa*. https://www.nextgenscience.org/resources/how-new-budget-funds-stem-essa

Nishimura, T. (2014). Effective professional development of teachers: A guide to actualizing inclusive schooling. *International Journal of Whole Schooling, 10*(1), 19-42.

Noonan, J. (2019). An affinity for learning: Teacher identity and powerful professional development. *Journal of Teacher Education, 70*(5), 526-537.

Northey, G., Govind, R., Bucic, T., Chylinski, M., Dolan, R., & van Esch, P. (2018). The effect of "here and now" learning on student engagement and academic achievement. *British Journal of Educational Technology, 49*(2), 321-333.

Nouri, J., Zhang, L., Mannila, L., & Norén, E. (2020). Development of computational thinking, digital competence and 21st century skills when learning programming in k-9. *Education Inquiry, 11*(1), 1-17.

Obama White House Archives. (2016). *ConnectED*. https://obamawhitehouse.archives.gov/issues/education/k-12/connected

OECD. (2013). *OECD skills outlook 2013: First results from the survey of adult skills*. OECD Publishing. Paris.

OECD. (2015). *Education at a Glance 2015: OECD Indicators*. OECD Publishing. Paris.

OECD (2018). Preparing our youth for an inclusive and sustainable world. The OECD PISA global competence framework. *Teaching in Focus*, OECD Publishing, Paris.

OECD (2020). Teachers' training and use of information and communications technology in the face of the COVID-19 crisis. *Teaching in Focus*, No. 35, OECD Publishing, Paris.

O'Reilly, E. (2016). Developing technology needs assessments for educational programs: An analysis of eight key indicators. *International Journal of Education and Development using ICT, 12*(1).

Ornelles, C., Ray, A. B., & Wells, J. C. (2019). Designing online courses in teacher education to enhance adult learner engagement. *International Journal of Teaching and Learning in Higher Education, 31*(3), 547-557.

Ottenbreit-Leftwich, A. T., Glazewski, K. D., Newby, T. J., & Ertmer, P. A. (2010). Teacher value beliefs associated with using technology: Addressing professional and student needs. *Computers & education, 55*(3), 1321-1335.

Packer, M. J. (2011). *The Science of qualitative research*. New York: Cambridge University Press.

Pan, S. C., & Franklin, T. (2011). In-Service Teachers' Self-Efficacy, Professional Development, and Web 2.0 Tools for Integration. *New Horizons in Education, 59*(3), 28-40.

Pane, J. F., Steiner, E. D., Baird, M. D., Hamilton, L. S., & Pane, J. D. (2017). *Informing progress: Insights on personalized learning implementation and effect*s. https://www.rand.org/pubs/research_reports/RR2042.html.

Park, G., Johnson, H., Vath, R., Kubitskey, B., & Fishman, B. (2013). Examining the roles of the facilitator in online and face-to-face professional development contexts. *Journal of Technology and Teacher Education, 21*(2), 225-245.

Parker, W.C., Lo, J., Yeo, A.J., Valencia, S.W., Nguyen, D., Abbott, R.D., … Vye, N.J. (2013). Beyond breadth-speed-test: Toward deeper knowing and engagement in an advanced placement course. *American Educational Research Journal, 50*(6), 1424-1459

Parsons, S. A., Hutchison, A. C., Hall, L. A., Parsons, A. W., Ives, S. T., & Leggett, A. B. (2019). US teachers' perceptions of online professional development. *Teaching and Teacher Education: An International Journal of Research and Studies, 82*(1), 33-42.

Paskevicius, M., & Bortolin, K. (2016). Blending our practice: Using online and face-to-face methods to sustain community among faculty in an extended length professional development program. *Innovations in Education & Teaching International, 53*(6), 605–615.

Patten, M. L., & Newhart, M. (2017). *Understanding research methods: An overview of the essentials*. Routledge.

Patti, J., Holzer, A. A., Brackett, M. A., & Stern, R. (2015). Twenty-first-century professional development for educators: a coaching approach grounded in emotional intelligence. *Coaching: An International Journal of Theory, Research and Practice, 8*(2), 96-119.

Patton, K., Parker, M., & Tannehill, D. (2015). Helping teachers help themselves: Professional development that makes a difference. *NASSP bulletin, 99*(1), 26-42.

Pearce, E., de la Fuente, Y., Hartweg, B., & Weinburgh, M. (2019). Peer-coaching as a component of a professional development model for biology teachers. *School Science & Mathematics, 119*(3), 117–126.

Peel, Karen L. (2020). A beginner's guide to applied educational research using thematic analysis. *Practical Assessment, Research & Evaluation, 25*(2).

Penuel, W. R., Briggs, D. C., Davidson, K. L., Herlihy, C., Sherer, D., Hill, H. C., ... & Allen, A. R. (2016). Findings from a National Study on Research Use among School and District Leaders. Technical Report No. 1. *National Center for Research in Policy and Practice*.

Penuel, W. R., Gallagher, L. P., & Moorthy, S. (2011). Preparing teachers to design sequences of instruction in Earth systems science: A Comparison of three professional development programs. *American Educational Research Journal, 48*(4), 996–1025.

Pew Research Center. (2020). *Experts predict more digital innovation by 2030 aimed at enhancing democracy*. https://www.pewresearch.org/internet/wp-content/uploads/sites/9/2020/06/PI_2020.06.30_digital-innovation_REPORT.pdf

Pfeiffer, S. I., Overstreet, M., & Park, A. (2010). The state of science and mathematics education in state-supported residential academies: A nationwide survey. *Roeper Review, 32*(1), 25-31.

Piliouras, T., Yu, R., Villanueva, K., Chen, Y., Robillard, H., Berson, M., ... & Attre, M. (2014). A deeper understanding of technology is needed for workforce readiness–Playing games, texting, and tweets aren't enough to make students tech-savvy. *Proceedings of the 2014 Zone 1 Conference of the American Society for Engineering Education*. Bridgeport, CT. p. 1-8,.

Pine, G. J. (2009). *Teacher action research: Building knowledge democracies*. Thousand Oaks: SAGE Publications, Inc.

Pittman, T., & Gaines, T. (2015). Technology integration in third, fourth and fifth grade classrooms in a florida school district. *Educational Technology Research and Development, 63*(4), 539-554.

Plešec Gasparič, R., & Pečar, M. (2016). Analysis of an asynchronous online discussion as a supportive model for peer collaboration and reflection in teacher education. *Journal of Information Technology Education: Research, 15*, 377-401.

Polly, D., McGee, J., Wang, C., Martin, C., Lambert, R., & Pugalee, D. K. (2015). Linking professional development, teacher outcomes, and student achievement: The case of a learner-centered mathematics program for elementary school teachers. *International Journal of Educational Research, 72*, 26-37.

Prensky, M. (2001). Digital natives, digital immigrants part 1. *On the Horizon, 9*(5), 1–6. https://www.marcprensky.com/writing/Prensky%20-%20Digital%20Natives,%20Digital%20Immigrants%20-%20Part1.pdf

Price, J., Govett, A., Davis,M., Ivester, R., Howard, T., & Messimer, L. (2019). PBL meets PBL: Project-based learning meets planet-based learning. *Teaching Science: The Journal of the Australian Science Teachers Association, 65*(1), 28–33.

Puhala, J. J. (2020). Changing Classroom Practice: Elementary Teacher Experiences of a Professional Development Program. *Technology, Knowledge and Learning, 25*(1), 129-147.

Puentedura, R. R. (2013). *SAMR: Getting to transformation*. [Web blog post]. http://www.hippasus.com/rrpweblog/archives/2013/04/16/SAMRGettingToTransformation.pdf

Purcell, K., Heaps, A., Buchanan, J., & Friedrich, L. (2013). How teachers are using technology at home and in their classrooms. *Washington, DC: Pew Research Center's Internet & American Life Project*.

Raufelder, D., Bukowski, W. M., Mohr, S. (2013). Thick description of the teacher-student relationship in the educational context of school: Results of an ethnographic field study. *Journal of Education and Training Studies, 1*(2), 1-18.

Reeves, T. C., & Oh, E. G. (2016). The goals and methods of educational technology research over a quarter century (1989–2014). *Educational Technology Research and Development, 1*(15). http://doi.org/10.1007/s11423-016-9474-1

Reis, S. M., McCoach, D. B., Little, C. A., Muller, L. M., & Kaniskan, R. B. (2011). The effects of differentiated instruction and enrichment pedagogy on reading achievement in five elementary schools. *American Educational Research Journal, 48*(2), 462-501.

Revilla Muñoz, O., Alpiste Penalba, F., Fernández Sánchez, J., & Santos, O. C. (2017). Reducing techno-anxiety in high school teachers by improving their ICT problem-solving skills. *Behaviour & Information Technology*, *36*(3), 255–268

Rice, M. F. (2022). Special education teachers' use of technologies during the covid-19 era (spring 2020—fall 2021). *TechTrends: Linking Research & Practice to Improve Learning, 66*(2), 310–326.

Rice, M., & Ortiz, K. (2021). Evaluating digital instructional materials for k-12 online and blended learning. *Tech Trends, 65*(6), 977-992.

Richmond, E. (2015). Schools on U.S. military bases are adopting common core—but don't call it that. *Education Digest, 81*(2), 18–24.

Riegel, C., & Kozen, A. (2016). Attaining 21st century skills in a virtual classroom. *Educational Planning, 23*(3), 41-55.

Rivera-Vargas, P., & Mino-Puigcercos, R. (2020). Moving beyond the predictable failure of ed-tech initiatives. *Learning, Media & Technology.*, *45*(1), 61–75.

Romrell, D., Kidder, L., & Wood, E. (2014). The samr model as a framework for evaluating mlearning. *Online Learning Journal, 18*(2).

Roumell, E. A., & Salajan, F. D. (2016). The evolution of us e-learning policy: A content analysis of the national education technology plans. *Educational Policy*, *30*(2), 365-397.

Rotermund, S., DeRoche, J., & Ottem, R. (2017). Teacher professional development by selected teacher and school characteristics: 2011-12. Stats in Brief. NCES 2017-200. *National Center for Education Statistics*. https://nces.ed.gov/pubs2017/2017200.pdf.

Russell, M., Carey, R., Kleiman, G., & Venable, J. D. (2009). Face-to-face and online professional development for mathematics teachers: A comparative study. *Journal of asynchronous learning networks*, *13*(2), 71-87.

Sabzian, F., Gilakjani, A. P., & Sodouri, S. (2013). Use of technology in classroom for professional development. *Journal of Language Teaching and Research*, *4*(4), 684.

Sahin, A., & Top, N. (2015). STEM students on the stage (SOS): Promoting student voice and choice in stem education through an interdisciplinary, standards-focused, project based learning approach. *Journal of STEM Education: Innovations & Research, 16*(3), 24–33.

Sankar, L., & Sankar, C. S. (2010). Comparing the Effectiveness of Face-to-Face and Online Training on Teacher Knowledge and Confidence. In *In SITE 2010: Informing Science+ IT Education Conference* (Vol. 10, pp. 667-691).

Saldaña, J. (2009). *The coding manual for qualitative researchers*. Thousand Oaks, CA: Sage.

Saldaña, J. (2011). *Fundamentals of qualitative research*. New York: Oxford University Press.

Saldaña, J. (2013). *The coding manual for qualitative researchers*. SAGE Publications, Inc.

Sancho-Gil, J. M., Rivera-Vargas, P., & Miño-Puigcercós, R. (2020). Moving beyond the predictable failure of Ed-Tech initiatives. *Learning, Media and Technology, 45*(1), 61-75.

Savitz, R. S., Silva, A., & Dunston, P. J. (2019). Situated learning, the secondary-education preservice/in-service teacher, and the taming of the literacy education shrew. *Clearing House, 92*(6), 224–234.

Scalise, K. (2016). Student collaboration and school educational technology: Technology integration practices in the classroom. Journal on School Educational Technology, 11(4), 53-63.

Scheuerell, S. (2008). The great migration: Using a problem-based learning approach and the Internet. *Social Studies Research and Practice*, *3*(1), 68–79.

Seel, N. M., Lehmann, T., Blumschein, P., & Podolskiy, O. A. (2017). *Instructional design for learning: Theoretical foundations*. Springer.

Sharma, G. (2017). Pros and cons of different sampling techniques. *International journal of applied research, 3*(7), 749-752.

Shenton, A. K. (2004). Strategies for Ensuring Trustworthiness in Qualitative Research Projects. *Education for Information, 22*(2), 63–75.

Shin, W. S., Han, I., & Kim, I. (2014). Teachers' technology use and the change of their pedagogical beliefs in korean educational context. *International Education Studies, 7*(8), 11-22.

Sims, S., & Fletcher-Wood, H. (2021). Identifying the characteristics of effective teacher professional development: A critical review. *School Effectiveness and School Improvement, 32*(1), 47-63.

Smale-Jacobse, A. E., Meijer, A., Helms-Lorenz, M., & Maulana, R. (2019). Differentiated instruction in secondary education: A systematic review of research evidence. *Frontiers in Psychology, 10*, 2366.

Smith, R., Ralston, N. C., Naegele, Z., & Waggoner, J. (2020). Team teaching and learning: A model of effective professional development for teachers. *Professional Educator, 43*(1), 80–90.

Soto, R. C., & Marzocchi, A. S. (2021). Learning about active learning while actively learning: Insights from faculty professional development. *Primus: Problems, Resources & Issues in Mathematics Undergraduate Studies, 31*(3–5), 269–280

Sriram, R. (2017). *Student affairs by the numbers: Quantitative research and statistics for professionals*. Sterling, Virginia: Stylus Publishing.

Starkey, L., Shonfeld, M., Prestridge, S., & Cervera, M. G. (2021). Covid-19 and the role of technology and pedagogy on school education during a pandemic. *Technology, Pedagogy and Education, 30*(1), 1-5.

Stefaniak, J., Baaki, J., Hoard, B., & Stapleton, L. (2018). The influence of perceived constraints during needs assessment on design conjecture. *Journal of Computing in Higher Education, 30*(1), 55-71.

Stozhko, N., Bortnik, B., Mironova, L., Tchernysheva, A., & Podshivalova, E. (2015). Interdisciplinary project-based learning: Technology for improving student cognition. *Research in Learning Technology, 23*, 1–13.

Stringer, E. T., Baldwin, S. C., & Christensen, L. M. (2010). *Integrating teaching, learning, and action research: Enhancing instruction in the K-12 classroom*. Thousand Oaks, California: SAGE Publications, Inc.

Stuckey, H. L. (2015). The second step in data analysis: Coding qualitative research data. *Journal of Social Health and Diabetes, 3*(01), 007-010.

Swagerty, L. M., & Hodge, T. (2019). Fostering creativity and curiosity: Developing safer elementary STEM learning spaces. *Technology & Engineering Teacher, 78*(8), 20–23.

Sutton, P. S., & Knuth, R. (2017). A schoolwide investment in problem-based learning. *Phi Delta Kappan, 99*(2), 65–70.

Tarling, I., & Ng'ambi, D. (2016). Teachers pedagogical change framework: A diagnostic tool for changing teachers' uses of emerging technologies. *British Journal of Educational Technology, 47*(3), 554–572.

Tawfik, A. A., Shepherd, C. E., Gatewood, J., & Gish-Lieberman, J. J. (2021). First and second order barriers to teaching in k-12 online learning. *TechTrends: Linking Research & Practice to Improve Learning, 65*(6), 925–938.

Taylor, B. K. (2015). Content, process, and product: Modeling differentiated instruction. *Kappa Delta Pi Record, 51*(1), 13-17.

Terrazas-Arellanes, F. E., Knox, C., Strycker, L. A., & Walden, E. (2016). A face-to-face professional development model to enhance teaching of online research strategies. *Journal of Information Technology Education*, *15*, 335-376.

Thieman, G. (2008). Using technology as a tool for learning and developing 21st century skills: An examination of technology use by pre-service teachers with their K-12 students. *Contemporary Issues in Technology and Teacher Education*, *8*(4), 342-366.

Thompson, P. (2013). The digital natives as learners: Technology use patterns and approaches to learning. *Computers & Education, 65*, 12-33.

Throne, R. (Ed.). (2021). *Practice-based and practice-led research for dissertation development*. IGI Global.

Tomal, D. R. (2010). *Action research for educators*. Rowman & Littlefield Publishers.

Tondeur, J., Braak, J., Ertmer, P., & Ottenbreit-Leftwich, A. (2017). Understanding the relationship between teachers' pedagogical beliefs and technology use in education: A systematic review of qualitative evidence. *Educational Technology Research & Development, 65*(3), 555–575.

Tsang, S., Royse, C. F., & Terkawi, A. S. (2017). Guidelines for developing, translating, and validating a questionnaire in perioperative and pain medicine. *Saudi journal of anaesthesia, 11*(Suppl 1), S80.

Turner, J. (2020). Improving black students' college and career readiness through literacy instruction: A freirean-inspired approach for k–8 classrooms. *The Journal of Negro Education, 88(*4), 443-453.

Tyner, K. C. (2018). *The effect of professional development on middle school teachers' technology integration: An action research study* (599580) [Doctoral dissertation, University of South Carolina]. ProQuest LLC.

UNESCO. (2020). Covid-19 impact on education. https://en.unesco.org/covid19/educationresponse

U.S. Department of Education. (2002). *Supplement Not Supplant and Comparability Requirements under NCLB Handout -- SASA Conference*. Retrieved from https://www2.ed.gov/admins/grants/find/edlite-sns.html

U.S. Department of Education. (2005). *Part d - enhancing education through technology*. https://www2.ed.gov/policy/elsec/leg/esea02/pg34.html

U.S. Department of Education. (2013). *College- and Career-Ready Standards*. https://www.ed.gov/k-12reforms/standards.

U.S. Department of Education. (2014). *Integrated postsecondary education data system (ipeds): Fall enrollment component*. National Center for Education Statistics. https://nces.ed.gov/ipeds/Search?query=distance&query2=distance&resultType=table&page=2&sortBy=relevance&overlayTableId=11967.

U.S. Department of Education. (2016). *Non-regulatory guidance for title ii, part a: Building systems of support for excellent teaching and leading*. U.S. Department of Education Non-Regulatory Guidance Title II, Part A of the Elementary and Secondary Education Act of 1965, as Amended by the Every Student Succeeds Act of 2015. https://www2.ed.gov/policy/elsec/leg/essa/essatitleiipartaguidance.pdf

U.S. Department of Education. (2019). *Integrated postsecondary education data system (ipeds): Fall enrollment component*. National Center for Education Statistics. https://nces.ed.gov/ipeds/TrendGenerator/app/build-table/2/42?rid=6&cid=85.

U.S. Department of Education. (2020). *The elementary secondary education act (The every student succeeds act of 2016)*. https://www2.ed.gov/policy/elsec/leg/essa/index.html

Unger, K. L., & Tracey, M. W. (2013). Examining the factors of a technology professional development intervention. *Journal of Computing in Higher Education, 25*(3), 123-146.

Velasco, R. C. L. (2018). infusing classrooms with web 2.0 technologies: The idea of using Web 2.0 technologies in educational settings should be embraced. *Technology & Engineering Teacher, 77*(6), 36–39.

Vongkulluksn, V. W., Xie, K., & Bowman, M. A. (2018). The role of value on teachers' internalization of external barriers and externalization of personal beliefs for classroom technology integration. *Computers & Education, 118*, 70–81.

Wang, S. K., Hsu, H. Y., Campbell, T., Coster, D. C., & Longhurst, M. (2014). An investigation of middle school science teachers and students use of technology

inside and outside of classrooms: considering whether digital natives are more technology savvy than their teachers. *Educational Technology Research and Development, 62*(6), 637-662.

Wang, Y. H. (2020). Integrating games, e-books and ar techniques to support project-based science learning. *Educational Technology & Society, 23* (3), 53–67.

Waters, S., Russell, W. B., & Hensley, M. (2020). Cyber bullying, social media, and character education: Why it matters for middle school social studies. *Clearing House*, *93*(4), 195–204.

Watkins, J., Jaber, L. Z., & Dini, V. (2020). Facilitating scientific engagement online: responsive teaching in a science professional development program. *Journal of Science Teacher Education, 31*(5) 1-22.

Weng, X., Cui, Z., Ng, O. L., Jong, M. S., & Chiu, T. K. (2022). Characterizing students' 4c skills development during problem-based digital making. *Journal of Science Education and Technology, 31*(3), 372-385.

Wever Frerichs, S., Pearman Fenton, M. S., & Wingert, K. (2018). A model for out-of-school educator professional learning. *Adult Learning, 29*(3), 115–122.

White House Office of the Press Secretary. (2016). *President obama announces connectall initiative* [Fact Sheet]. https://obamawhitehouse.archives.gov/the-press-office/2016/03/09/fact-sheet-president-obama-announces-connectall-initiative

Whitworth, B. A., & Chiu, J. L. (2015). Professional development and teacher change: The missing leadership link. *Journal of Science Teacher Education, 26*(2), 121-137.

Will, M. (2018). Early-grades science: A first key STEM opportunity. *Education Week, 37*(32), 4–6.

Willis, J. (2008). *Qualitative research methods in education and educational technology*. Charlotte, NC: Information Age Publishing.

Wolfgang, C., & Snyderman, D. (2022). An analysis of the impact of school closings on gifted services: Recommendations for meeting gifted students' needs in a post-COVID-19 world. *Gifted Education International, 38*(1), 53–73.

Wooten, R., Giosta, A., & Howorth, S. (2021). Reimagining special education technology: Lessons from the pandemic. *Teaching Exceptional Children, 54*(2), 154–156.

Van Broekhuizen, L. (2016). *The paradox of classroom technology: Despite proliferation and access, students not using technology for learning*. AdvancED Research. Alpharetta, GA: AdvancED.

Vega, V., & Robb, M. B. (2019). *The common sense census: Inside the 21st-century classroom*. San Francisco, CA: Common Sense Media.

Verma, A. K., Dickerson, D., & McKinney, S. (2011). Engaging students in STEM careers with project-based learning -- marine tech project. *Technology & Engineering Teacher, 71*(1), 25–31.

Yalcinalp, S., & Avci, Ü. (2019). Creativity and emerging digital educational technologies: A systematic review. *Turkish Online Journal of Educational Technology-TOJET, 18*(3), 25-45.

Yang, D., & Baldwin, S. J. (2020). Using technology to support student learning in an integrated stem learning environment. *International Journal of Technology in Education and Science*, *4*(1), 1-11.

Yasar-Akyar, O., Rosa-Feliz, C., Sunday-Oyelere, S., Muñoz, D., & Demirhan, G. (2022). Special education teachers' professional development through digital storytelling. *Comunicar*, *30*(71), 89–99.

Yoon, S. A., Miller, K., & Richman, T. (2020). Comparative study of high-quality professional development for high school biology in a face-to-face versus online delivery mode. *Educational Technology & Society, 23* (3), 68–80.

Yoon, S. A., Miller, K., Richman, T., Wendel, D., Schoenfeld, I., Anderson, E., & Shim, J. (2020). Encouraging collaboration and building community in online asynchronous professional development: Designing for social capital. *International Journal of Computer-Supported Collaborative Learning, 15*(3), 351–371.

Young, J. L., Young, J. R., & Capraro, R. M. (2018). Gazing past the gaps: A growth-based assessment of the mathematics achievement of black girls. *Urban Review*, *50*(1), 156–176.

Young, M. R., Rapp, E., & Murphy, J. W. (2010). Action research: Enhancing classroom practice and fulfilling educational responsibilities. *Journal of Instructional Pedagogies*, *3*(1), 1-10.

Young, S., & Nichols, H. (2017). A reflexive evaluation of technology-enhanced learning. *Research in Learning Technology, 25*, 1–13.

Yu, C. (2013). The integration of technology in the 21st century classroom: Teachers' attitudes and pedagogical beliefs toward emerging technologies. *Journal of Technology Integration in the Classroom*, *5*(1), 5-11.

Yurtseven Avci, Z., O'Dwyer, L. M., & Lawson, J. (2020). Designing effective professional development for technology integration in schools. *Journal of Computer Assisted Learning*, *36*(2), 160-177.

Zimmerman, J. (2020). *Coronavirus and the great online-learning experiment*. Chronicle of Higher Education.

Zohrabi, M. (2013). Mixed method research: Instruments, validity, reliability and reporting findings. *Theory and Practice in Language Studies*, *3*(2), 254-262

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APPENDIX A
TECHNOLOGY SURVEY

Demographics

Gender

- Male
- Female
- Non-binary / third gender
- Prefer not to say

Race and ethnicity. Select all that apply.

- American Indian or Alaska Native
- Asian
- Black or African American
- Hispanic or Latino
- Native Hawaiian or Pacific Islander
- White
- Other: _____

What is the highest level of school you have completed or the highest degree you have received?

- Less than high school
- High school graduate
- Some college
- 2-year degree
- 4-year degree
- Professional degree (i.e., J.D., M.S.W.)
- Doctorate

Age Range

- 18 - 24
- 25 - 34
- 35 - 44
- 45 - 54
- 55 - 64
- 65 or older

Current teaching assignment

- Classroom Teacher
- Specialist Teacher (e.g., Media, P.E., Music, Sped, etc.)
- Other: _____

Current school assignment

- Elementary School
- Middle School

- High School

In which state do you currently teach? [Drop down of 50 U.S. States and Territories]

Total number of years you've been at your present school: _____

Total number of years of teaching experience: _____

Part I:

Teaching and Learning

- For each item, check the box below the response that best matches how frequently the statement occurs - “Never = not at all”, “Rarely = once a month or less”, “Sometimes = once per week”, “Often = several times a week” or “Always = everyday/multiple times a day”.

Teacher Technology Use

1. I consult publications, online journals, or other resources to identify research-based practices I can use in teaching with technology.
2. I identify, locate, and evaluate technology resources for use by my students, e.g., websites.
3. I apply performance-based student assessment to technology enhanced lessons, e.g., student portfolios, student presentations.
4. I use technology regularly to collect and analyze student assessment data.
5. My lessons include technology enhanced, learner-centered teaching strategies, e.g., project-based learning.
6. I use technology to differentiate instruction for students with special learning needs.

7. I use technology to communicate and collaborate with families about school programs and student learning.
8. I use technology to communicate and collaborate with other educators.
9. My lesson plans refer to both content standards and student technology standards.
10. I do research or action research projects to improve technology enhanced classroom practices.

Student Technology Use

1. Students use a variety of technologies, e.g., productivity, visualization, research, and communication tools.
2. Students use technology during the school day to communicate and collaborate with others, beyond the classroom.
3. Students use technology to access online resources and information as a part of classroom activities.
4. Students use the same kinds of tools that professional researchers use, e.g., simulations, databases, satellite imagery.
5. Students work on technology-enhanced projects that approach real world applications of technology.
6. Students use technology to help solve problems.
7. Students use technology to support higher-order thinking, e.g., analysis, synthesis, and evaluation of ideas and information.
8. Students use technology to create new ideas and representations of information.

Technology Benefits and Frequency of Use

- For the Technology Benefits and Frequency of Use section, participants indicate how beneficial they think the technology is in teaching the topics listed in the question on the scale from “Strongly Agree," to "Strongly Disagree.”
- They were then asked the same questions again but to responded with the Frequency of Teacher Use and Student Technology Use on a scale of “Never” to “Always”

1. Practice or review topics (e.g., programs that teach specific subject matter).
2. Visually represent or investigate concepts (e.g., concept mapping, graphing, graphic organizers).
3. Use digital tools and resources to explore and solve real-world issues (e.g., project-based learning).
4. Work individually using technology.
5. Work collaboratively using technology.
6. Present multimedia projects to the class (e.g., Interactive Whiteboard, PowerPoint).
7. Simulations (e.g., frog dissections, science experiments).
8. Editing software (e.g., Photoshop, Audacity, Movie Maker).
9. Productivity applications (e.g., word processing, spreadsheet).
10. Conduct online research using databases (e.g., Britannica, Pebble Go Next).
11. Use the Internet to communicate and collaborate with experts or peers in or beyond your school.

Professional Development

- For each item, check the box below the response that best matches how much you agree with the statement - “Strongly Agree," "Agree," "Disagree," or "Strongly Disagree.”
- If you are simply split between “Agree” and “Disagree,” select “Neutral.”

I would benefit from professional development on...

1. Research-based practices I can use in my teaching.
2. Identification, location, and evaluation of technology resources, e.g., websites that I can use with my students.
3. Performance-based student assessment of my students.
4. The use of technology to collect and analyze student assessment data.
5. Learner-centered teaching strategies that incorporate technology, e.g., project based or cooperative learning.
6. Online security and safety.
7. The use of technology for differentiating instruction for students with special learning needs.
8. Uses of technology to increase my professional productivity.
9. Ways to use technology to communicate and collaborate with families about school programs and student learning.
10. Ways to use technology to communicate and collaborate with other educators.
11. Alignment of lesson plans to content standards and student technology standards.
12. Use of research or action research projects to improve technology-enhanced classroom practices.

13. Use of data for reflecting on my professional practices.
14. Use of data to make decisions about the use of technology.
15. Use of technology to participate in professional development activities, e.g., online workshops, hands-on training in a computer lab.

Part II:

Open-ended Questions

I will ask you a total of 5 open ended questions. The information you provide will be valuable in understanding your perceptions of the use of technology in your education setting and your needs and preferences for professional development. Responses will be kept strictly confidential and individual responses will not be identified. The survey will take approximately 10-15 minutes to complete. Thank you for your time and participation.

1. How do you currently utilize technology in your classroom?
2. How would you rate the impact of technology on education on a scale of 1 to 5, in which 1 means having a low impact and 5 having a great impact? Explain your reason for this rating.
3. Describe your experience when integrating technology in your classroom. What are difficulties or successes you faced when integrating technology into your classroom?
4. What have been the most effective professional development (any subject) that you have experienced, and explain what made them effective?
5. What have been the least effective professional development (any subject) that you have experienced, and explain what made them ineffective?

6. Would you like to participate in an interview about your perceptions as an educator, related to the use of technology in your education setting? The interview will not last more than 30 minutes.

- Yes, I would like to participate in an interview.
- No, I would not like to participate in an interview.

APPENDIX B

INTERVIEW QUESTIONS

Thank you for agreeing to participate in my study. I will ask you a total of 6 questions. The information you provide will be valuable in understanding your perceptions of the use of technology in your education settings. I would like to record this interview, so that I can review it later for accuracy, do you agree to be a part of the recorded interview? What you say is important, so I'd like to take notes. I'll now proceed with the questions.

1. What is your ideal technology professional development session? What makes it ideal?
2. In your opinion, what are the benefits of integrating technology in instruction?
3. Describe your experience when integrating technology in your classroom? What are difficulties or successes you faced when integrating technology into your classroom?
4. What are the most significant factors that help you decide what technology to integrating into your classroom?
5. What was your most successful technology-based lesson or activity you have used in your classroom? What made the lesson successful?
6. Is there any additional information you would like to share?

Thank you for participating in the interview.

APPENDIX C

IRB APPROVAL

UNIVERSITY OF
SOUTH CAROLINA

OFFICE OF RESEARCH COMPLIANCE

INSTITUTIONAL REVIEW BOARD FOR HUMAN RESEARCH
EXEMPT AMENDMENT APPROVAL LETTER

Amber Birden
[redacted]

Re: **Ame5_Pro00108616**

Dear Amber Birden:

This is to certify that the Amendment requested on **6/24/2022** for research study ***A Descriptive Mixed-Methods Study Examining Teachers' Needs and Preferences for Technology Integration Professional Development*** was reviewed and approved by the University of South Carolina Institutional Review Board (USC IRB) on **7/5/2022**.

The requested revision does not change the current Exempt status; therefore, further IRB oversight is not required unless additional changes are required. Because changes could result in a reclassification of the study, you must inform the IRB of any changes in procedures involving humans.

All research related records, including Informed Consent document(s), if applicable, are to be retained for at least three (3) years after termination of the study.

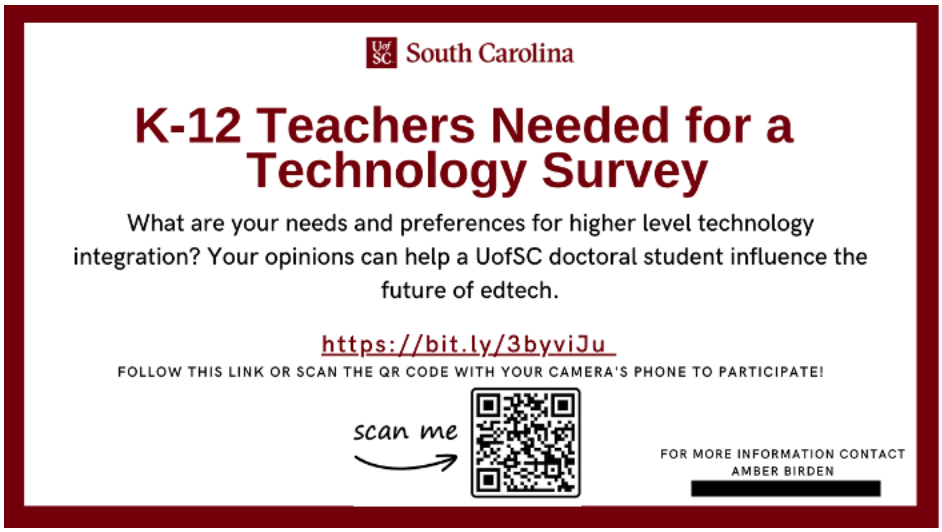
The Office of Research Compliance is an administrative office that supports the University of South Carolina Institutional Review Board (USC IRB). If you have questions, contact Lisa Johnson at lisaj@mailbox.sc.edu or (803) 777-6670.

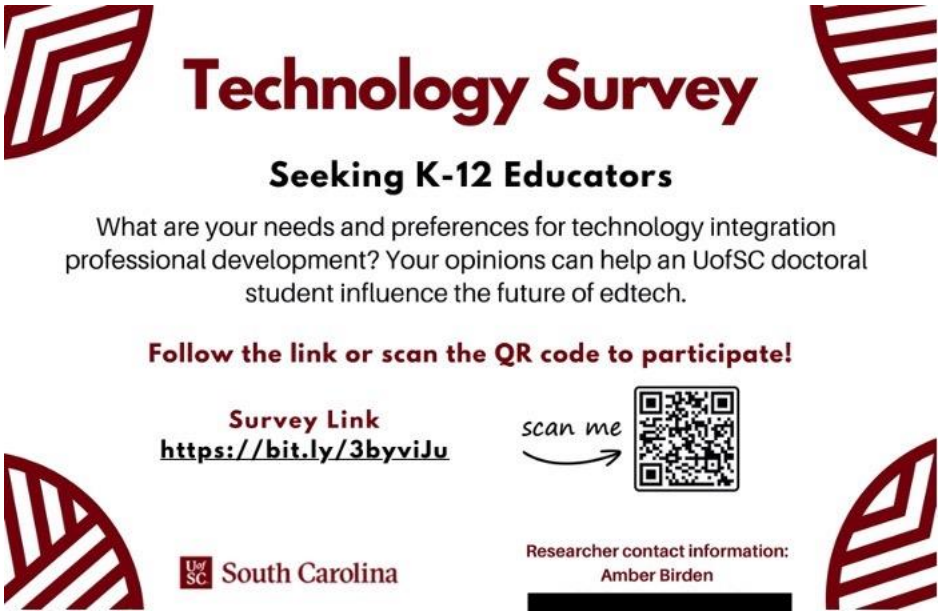
Sincerely,

Lisa M. Johnson
ORC Assistant Director and IRB Manager

APPENDIX D

SAMPLE RECRUITMENT FLYERS





APPENDIX E

CONSENT FORM

UNIVERSITY OF SOUTH CAROLINA

CONSENT TO BE A RESEARCH SUBJECT

A Descriptive Mixed-Methods Study Examining Teachers' Needs and Preferences for Technology Integration Professional Development

KEY INFORMATION ABOUT THIS RESEARCH STUDY:

You are invited to volunteer for a research study conducted by Amber Birden. I am a doctoral student in the College of Education at the University of South Carolina. I am conducting a research study as part of the requirements of my doctoral degree in Curriculum & Instruction — Educational Technology, and I would like to invite you to participate. I am studying teachers' needs and preferences for technology integration professional development.

PROCEDURES: If you decide to participate, you will be asked to do the following:

1. Complete a survey (Part I and Part II) about your perceptions as an educator, related to the use of technology in their education setting. Part I of the survey includes four sections: demographic, teaching and learning, technology benefits and frequency of use, and professional development. Part II of the survey includes five written response questions.

2. There will be an OPTIONAL interview about your perceptions as an educator's, related to the use of technology in your education setting. The interview will be recorded so that I can accurately transcribe what is discussed.

DURATION: Participation in the study a survey (Part I and Part II). Each part of the survey will last no more than 15 minutes. There will be an OPTIONAL one-on-one interview. The interview will last no more than 30 minutes.

RISKS/DISCOMFORTS: No known risks or discomforts

BENEFITS: Taking part in this study is not likely to benefit you personally. However, this research may help researchers understand teachers' needs and preferences for technology integration professional development.

COSTS: There will be no costs to you for participating in this study.

CONFIDENTIALITY OF RECORDS: Information obtained about you during this research study will remain confidential. Data will be aggregated via the Qualtrics reporting function. Study information will be securely stored in locked files and on password-protected computers. Results of this research study may be published or presented at seminars; however, the report(s) or presentation(s) will not include your name or other identifying information about you.

The optional focus group interview will be recorded so that I can accurately transcribe what is discussed. The recording will only be reviewed by members of the research team and destroyed upon completion of the study. In particular, you will discuss your experience during the professional development.

VOLUNTARY PARTICIPATION: Participation in this research study is voluntary. You are free not to participate, or to stop participating at any time, for any reason without

negative consequences. In the event that you do withdraw from this study, the information you have already provided will be kept in a confidential manner. If you wish to withdraw from the study, please call or email Amber Birden [redacted] or [redacted].

CONTACT INFORMATION: If you have any questions about your participation in this study, contact Amber Birden at [redacted] or [redacted]., or my faculty advisor, [redacted]

ELECTRONIC CONSENT: By selecting your choice below you are indicating your right to consent or not consent electronically.

- Selecting "Yes, I Consent" below indicates that you are at least 18 years old and have read and understand the terms of this study and thus voluntarily agree to participate.
- If you do NOT wish to participate in this study, please select "No, I do not Consent" to decline participation.

- Yes, I Consent
- No, I do not Consent

Thank you for your voluntary participation. Please complete the questions below.

Type your first and last name: _____.

Email address: _____.