Spring 2021

The Impact of Professional Development on Teacher Learning and Use of Technology in The Classroom

Craig R. Bocks

The Impact of Professional Development on Teacher Learning and Use of Technology in The Classroom

An Action Research Project

Presented to

The Faculty of the Kalmanovitz School of Education

Saint Mary's College of California

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts in Educational Administration

By

Craig R. Bocks

Spring 2021

This action research project, written under the direction of the candidate's master's project advisory committee and approved by members of the committee, has been presented to and accepted by the faculty of the Kalmanovitz School of Education, in partial fulfillment of the requirements for the Master of Arts in Educational Administration degree.

_____	_____
Candidate: Craig R. Bocks	Date

Master's Action Research Project Advisory Committee:

_____	_____
Research Advisor: Susan Schultz, Ed. D.	Date
_____	_____
Faculty Advisor: Heidimarie Rambo, Ph.D.	Date
_____	_____
Program Director: Heidimarie Rambo, Ph.D.	Date
_____	_____
Dean: Carol Ann Gittens, Ph.D.	Date

Abstract

The Impact of Professional Development on Teacher Learning and Use of Technology in The Classroom

By

Craig Bocks

Master of Arts in Educational Administration

Saint Mary's College of California, 2021

Susan Schultz, Research Advisor

Many who work in education will remember exactly where we were on March 13, 2020, when schools closed. The COVID-19 global pandemic highlighted the urgency for teachers to learn new technologies to teach in a distance learning environment. But existing research showed that professional development for teachers regarding technology had not always been effective (Liao, 2017). Teachers needed a more dynamic model to engage in authentic learning around technology. The goal of this action research study was to investigate the effect collaborative technology sessions had on teachers' ability to learn and integrate technology into their practice. Six collaborative sessions occurred over a 12-week period. Data collection methods included a pre- and post-technology use survey, semi-structured participant interviews, and field researcher notes. Results of the action research project found that the community of practice format of professional development was an effective method for teachers to learn and use technology.

Dedication

I would like to dedicate this action research paper to my family. It meant the world to me that my wife Barbie, and children Shelby and Justin recognized earning a master's degree in educational leadership was important to me at this point in my life. I cannot express in words how much their love and support mean to me. Also, to my own dad, Paul Bocks. He was previously the only member of my immediate family to earn a master's degree, and I am humbled to finally join his side.

Acknowledgements

I would first and foremost like to thank my wife Barbie for providing me with space in our busy lives to pursue this master's degree. It was not always easy, but your love and support encouraged me to keep going and reach the end line. To my own children, Shelby and Justin, you may not realize it, but each of you motivated and inspired me to go back to school because of your own successful educational journeys.

To the faculty and staff of the Kalmanovitz School of Education, including Dr. Tangela Blakely Reavis and Dr. Monique Lane, thank you for pushing this program forward and sharing your scholastic wisdom even during the distance learning format forced upon us during the COVID-19 pandemic. Of course, the cornerstone of the program and the compassionate and talented leader who deserves my deepest and most heartfelt gratitude is Dr. Heidimarie Rambo. Thank you, thank you, thank you!

I would also like to recognize and give gratitude to my research advisor, Dr. Susan Schultz. From the time your smile came on screen during our first Zoom meeting, you have shown a genuine interest in my action research, provided gentle nudges to keep making progress, and guided the development of my writing and ideas with a high level of expertise and professionalism.

Finally, I would like to say thank you to the teachers who participated in this action research study. Amid a global pandemic, you graciously volunteered to take the leap with me to see how we could learn and grow together as educators.

Table of Contents

Page

List of Figures

Figure

List of Tables

Table

Chapter I

Introduction

Students of the 21st century were born as "digital natives," after the turn of the century and well into the digital technology age. A natural part of their daily reality includes on-demand food service, driverless cars, and video streaming. They carry smartphones in their pockets with more power than the computers that guided the Apollo spacecraft to the moon, have "followers" and "friends" on a variety of social media platforms from across the globe starting at an early age, and can put on a pair of virtual reality goggles to take them on amazing adventures through space and time.

In recent years, however, companies and businesses have taken note of the lack of preparation and technical skills of young people entering the workplace. Several studies have noted that students are ill-prepared to begin work with the skills required for success. (Waycott et al., 2010). Increasingly, the desire and requirement of employers and business owners is to have young workers who enter the workforce with technical skills that match the needs of the current industry.

Meanwhile, elementary and secondary schools are traditional institutions that have developed standards and practices over a period of more than 200 years in the United States. While advances in the first two decades of the current century have seen the introduction and integration of educational technology into the practice of some educators, research indicates that "despite the increased availability of technology in schools, effective integration of technology into teaching and learning, meaning the teacher uses technology as a tool to enhance students' experiences in the classroom, continues to be a challenge" (Li et al., 2019). In other words, even though technology equipment and products have found their place in schools and within

classrooms, teachers as a general rule have yet to embrace technology in ways that promote learning. but that is only part of the solution.

The presence of technology is one piece of the puzzle, but perhaps more importantly, teaching teachers how to use technology, and allowing them opportunities as professionals to develop and hone their practice is another. Educators need ample time to integrate and infuse technology into their pedagogy and collaborate with other teachers in a process of continual learning (Kopcha, 2010). These best practices are of vital importance to the evolution of technology and its use in learning environments. While some teachers have embraced and adopted ways to integrate the use of technology in their teaching, research findings suggest that the teachers who develop additional technical and instructional skills are the ones who integrate technology more effectively as part of their practice (Kempkey, 2016).

Never has the need to provide meaningful and impactful professional development to teachers at all levels been more urgent than during the global pandemic around COVID-19 that closed schools around the world during 2020. Traditional “one and done” professional development sessions aimed at checking the box of some mandated or required educational technology requirements by district and/or state entities do not adequately prepare today’s classroom teachers for the rigorous and complex challenges thrust upon them in the environment of distance learning. According to one study, school administrators too often make quick decisions about professional development that impacts teachers, without giving them the proper support they need in order to quell the frustration and overwhelm they face every day while teaching (Kopcha, 2012). Too often, teachers are not getting what they want and need from professional development, but rather what administrators think they should have (Gotanda, 2014).

This study looked more closely at using effective methods of professional development with teachers at a high-achieving, comprehensive suburban high school, as a way to increase their knowledge and use of technology in their classrooms going forward. Indirect stakeholders included students at the school and administration, plus teacher groups interested in raising the bar on using technology in education.

Statement of the Problem

It is within the context of seeking effective methods of professional development to help teachers learn and use technology in their classrooms that I began this action research study. At the time of writing, I was the vice principal of a comprehensive high school consistently recognized for outstanding academic achievement from its student body with a highly qualified staff of educators. The onset of distance learning during the COVID-19 global pandemic brought to light varying levels of technical proficiency in our teachers and our school's ability to learn and share best practices with each other around educational technology. During the spring semester of 2020, I built and made available to the teachers a bare-bones website of technical resources, several "how-to" videos they could view at any time, and links to digital curriculum tools available to them. While several teachers found some of this interesting and helpful, it seemed like we were only scratching the surface and the commitment of teachers to development of technical proficiency and professional development was sporadic, understandable given the circumstances of the suspension of in-person instruction. Teachers and administrators were in survival mode. But, in my mind, I felt certain there was a better way to engage and provide opportunities to learn for our staff.

As the primary institutions of learning in an increasingly complex and digital world, schools play a vital role in the development of our society. The centerpiece of academic

development for children throughout the world occurs during elementary, middle, and high school, where common school slogans make promises of “Preparing children for success in life” and “Educating all students to achieve today and tomorrow in a global community and economy.” But, while the educational systems throughout much of the United States have well developed standards and defined student outcomes across curricular areas and subject matter, the 21st century skills employers desire around technology have yet to be fully integrated in our schools (Waycott et al., 2010).

Further, common sense tells us that students are as comfortable with the use of technology as they are with any other part of their lives. In fact, digital natives are entering the workforce in increasing numbers (Kennedy & Ferdig, 2018). Students are clearly learning to use technology, but who is teaching them those skills, and could our school system do a better job of infusing technology across the curriculum in meaningful and impactful ways? While there are examples of success around the use of technology in the classroom and the ability of teachers to master these skills, the vast majority of teachers are still tied to traditional methods of instruction in their classrooms (Liao, 2017).

Research has found that when teachers integrate technology effectively into their classroom practice, they provide students with the ability to access a tremendous amount of information, communicate with others both near and far, and demonstrate their learning in innovative ways (Kempkey, 2016). The research also suggested that opportunities to practice, reflect, and interact with other teachers are crucial in the process of facilitating classroom technology adoption. Collaboration and a school culture of experimentation set by school leaders also influenced effective technology integration (Watts, 2009).

In this action research project, I explored whether a more structured set of professional development workshops and mentoring groups focused on the use of technology in the classroom and for distance learning affected the level of engagement and technical aptitude of our staff. It was my hope that staff would take advantage of technology workshops and mentoring groups for professional collaboration, department and grade sharing, accessibility of content/curriculum for students with varied educational needs and learning styles.

Purpose of the Research

The purpose of this study was to examine the impact teacher-led communities of practice had on the increased and effective use of technology in a secondary school staff. Research shows that professional development for teachers is not always effective (Liao, 2017). In fact, there is ample research evidence that the traditional practice of an intermittent and piecemeal professional development is ineffective (Darling-Hammond et al., 2017, Fullan et al., 2020; Opfer & Pedder, 2011; Wei et al., 2010). This research showcases the traditional practice around professional development, where teachers spend a handful of professional development days a year outside of their classrooms participating in activities imposed by their administration. (Martinovic et al., 2019). Teachers as learners are also known to be unique when it comes to acquiring new skills through professional development, mostly where professional development is neither collaborative nor regular. Such training has been shown to have little to no impact on their practice (Kempkey, 2016)

First, teachers need time to collaborate, reflect and experiment with new technology and instructional strategies as a way to disrupt the isolation they face in their day-to-day teaching practice (Cuban et al., 2001). Second, when teachers are isolated, they tend to maintain a static teaching practice -- in this case, a practice that relies heavily on direct instruction. Accordingly,

interventions that have shown promise were designed to provide teachers with collaborative workshop environments where they could experiment with technology and new instructional approaches, in among a group of colleagues and fellow teachers. If society continues to ignore the necessity of training teachers on the use of technology, and by extension giving students access and opportunities to benefit from the use and inclusion of technology in their school careers, then we will fall further behind in preparing the next generation for success.

As opposed to traditional professional development activities that typically involve intensive half or one-day sessions around topics selected by administrators or district personnel, I endeavored to provide the structure and format for teachers to engage with each other, selecting personal areas of interest and focus, working together to move their knowledge, and understanding forward over time. Additionally, I included opportunities for mentoring because research has shown that "moving teachers toward using technology in student-centered ways is a multi-faceted effort that has a better chance of success when implemented over longer periods of time and with appropriate support, such as mentoring" (Kopcha, 2010, p. 187). The use of mentoring groups allows for participation by both experienced teachers who focus on continual improvement in their own practice acting as "mentors," alongside less "tech savvy" teachers who are open to learning about the ways that technology as a part of the professional practice can enhance their role as educators. By extension, teachers who utilize technology as a part of their curriculum present their material to students using a means that is familiar, comfortable, and a part of their preparation to continue as digital citizens in the 21st century.

Action Research Question

The action research question for this study was, *how does participation in a teacher-led community of practice impact teacher's integration of technology in their teaching practice?* The

expectation was that through collaboration with stakeholders at my school site who were interested in developing new technological skills and practice, we could utilize workshops and mentoring groups over time to increase teachers' comfort level with using technology in their classrooms. What is critical, in my mind, is to find and use effective professional development methodologies to infuse a mindset focused on continual improvement in our staff, such that their energy and expertise around using technology in their daily roles provides educational benefit with their digital-native students on a more regular basis. Students can and will surprise us all in ways that demonstrate their mastery of content if we unlock the keys to technology for them and provide them with the right opportunities. Workplaces and business owners expect this proficiency and our students deserve it.

Limitations

There were several limitations that affected the outcome of the research. As the 2020-21 school year began, most school districts across the state of California remained closed to in-person instruction and were desperately transitioning to a full distance learning model for students. Beyond the stresses of providing instruction in an entirely new way, these continued school closures limited the way teachers collaborated with each other. Workshops and mentoring groups were held virtually, at least for the first semester of the school year in most places and for an entire school year in others.

Additionally, the scope of this research project was limited by the likelihood of only a handful of participants in the study, as my role at one comprehensive high school with a staff of approximately 60 teachers meant that data were limited only to the experiences of a few. School demographics and teacher population were also limited in diversity, and results at this school may differ greatly from a similar study conducted at schools with other populations. Last,

technology can be an expensive part of a school's budget; and like any new teaching practice or methodology, the impact of the professional development may not be immediately apparent. It was my hope that teachers would be able to set realistic goals with their technology projects and would recognize themselves as "learners" as they continued to build and perfect their practice.

Positionality of Researcher

My bias is toward technology as a "more effective" teaching method or alternative to traditional "drill and skill" teaching for students. In a technologically-enhanced classroom, the "sage on the stage" is replaced by active learners, who are provided with the tools to make their own learning come alive. My bias is toward the critical need to teach teachers how to infuse technology effectively and efficiently into their practice. As a vice principal at the school where the study will take place, I had a supervisory role to the teachers who participate in the study; and therefore, I had to be careful to stay objective as a researcher and aware that the participants might have a natural tendency to try and "please." To that end, I attempted to lean on the mentoring group structure of "experts" (mentors) and learners (mentees) in order to diffuse the power dynamics that might otherwise arise.

Definitions of Terms

Communities of Practice. Communities of practice (CoPs) are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly (Wenger-Trayner, 1998).

Digital Native. A person born or brought up during the age of digital technology and therefore familiar with computers and the Internet from an early age (Lexico Dictionaries, n.d.).

Educational Technology. Digital technology used to facilitate learning (Lexico Dictionaries, n.d.).

COVID-19 (Coronavirus disease 2019). Respiratory illness that can spread from person to person. There are many types of human coronaviruses, including some that commonly cause mild upper-respiratory tract illnesses (Center For Disease Control and Prevention, n.d.).

Professional Development. Activities that develop an individual's skills, knowledge, expertise, and other characteristics as a teacher. Development can be provided through coaching/mentoring, collaborative planning and teaching, and the sharing of good practices (OECD, 2009).

Professional Learning Communities. A group of educators that meets regularly, shares expertise, and works collaboratively to improve teaching skills and the academic performance of students (The Glossary of Education Reform, n.d.).

Mentoring. The process of serving as a mentor. Someone who facilitates and assists another's development (Pacific Resources for Education and Learning, 1997).

Implications

The purpose of this study was to examine the benefit structured professional development workshops and mentoring groups had on the increased and effective use of technology in a secondary school staff. Beyond the typical set of workshops most often delivered during "teacher workdays," the purpose here was to provide the framework and format for teachers to engage with each other, selecting personal areas of interest and focus, and guide their knowledge and use of technology in their practice forward over time. This study addressed the gap in research studies involving high school teachers who learn and utilize educational technology as a regular and effective part of their classroom methods of instruction. Findings might also lead to areas to explore around successful professional development techniques for "teachers as learners"

especially around the use of technology as a means to deliver curriculum or measure student outcomes.

If the findings of this research study provide evidence that ongoing workshops and mentoring groups are an effective means for professional development around educational technology in secondary teachers, it may generate interest from other schools or teacher groups who are interested in exploring teachers' learning and using technology further. If there is a series of successful outcomes and key learnings from this study, it could be beneficial to continue the study into a second year, both with a new set of teacher-learners and others who may have participated in year one who want to continue their own educational technology learning journey.

Chapter II

Literature Review

The purpose of this study was to examine the impact of collaborative formats of professional development on the increased learning and effective use of technology in a secondary school teaching staff. The research looked at a variety of features: teachers who were part of a community of practice, the unique nature of teachers as learners, effective methods of teacher professional development, and the urgency to transition classrooms toward online and digital tools forced upon schools and teachers in the field of education during the 2020 global pandemic.

One of the key means often cited for school reform and improved student achievement is the "professionalization" of teaching via teacher development (King & Newmann, 2001; Lieberman, 1995). By implementing professional development that directly involves and provides opportunities for ownership of their own learning, teachers as learners are more likely to evolve their practice and become teacher leaders (MacDonald & Weller, 2017). Moreover, professional development related to technology that centers on models carried out over extended periods of time, in collaboration with colleagues, with effective use of best practices such as peer mentors, structured workshops, and communities of practice, is more likely to yield positive outcomes (Kopcha, 2010). This action research study looked at the way teachers as learners best evolve their practice and acquire new technology skills for the classroom. Additionally, this project examined how teacher-led practices helped educators to learn and use technology during the worldwide global pandemic in a distance learning model (Hartshorne et al., 2020). Specifically, the action research question for this study was, *how does participation in a teacher-*

led community of practice impact a teacher's integration of technology in their teaching practice?

Overview of the Literature Review

The intention of this literature review was to provide the basis for this study, which explored the impact of teacher-led professional development practices on the increased learning and effective use of technology in a secondary school teaching staff. First, the literature review will cover the theoretical rationale that guided this action research study. John Dewey's theory of learning through experience (1929) and Paulo Freire's theory of critical pedagogy (1970) provide the cornerstone elements of optimal learning environments, specifically around teachers learning to use and integrate technology in the classroom. Both theorists emphasize an active and participatory approach to learning. Teachers who engage in their own adoption and use of technology will better meet the needs of students in the 21st century.

Next, the review of related research focused on understanding the unique characteristics of how teachers learn and the effective models of professional development within education. My research grew out of how educators have been forced to learn and use technology during the global COVID-19 pandemic. The literature review is divided into three essential categories of research that consisted of: teachers as learners, best practices of professional development, and the impact distance learning during the coronavirus pandemic has had on the use of technology in schools.

The pertinent research articles reviewed in this study were gathered from a variety of sources, including academic databases: EBSCOHost, ERIC, Google Scholar, ProQuest, as well as a number of Dissertations and Theses. The following key terms were of vital importance in conducting the extensive research for this literature review: *online learning, technology in*

education, communities of practice, digital natives, teacher learning, professional development, professional learning, technology integration, workshops, teacher conferences, educational technology, qualitative research, mentoring, communities of practice, educational technology, teacher education, online pedagogy, virtual learning, teacher leadership programs, teacher action research, distance learning, COVID-19 pandemic, and collaborative inquiry.

Theoretical Rationale

During the course of this action research project, the foundational theories of John Dewey and Paulo Freire were used extensively. As one of the earliest and most influential educational philosophers, John Dewey's (1929) work emphasized that learning occurs through experience and is primarily a social experience. Paulo Freire's theory of critical pedagogy (1972) was also essential in this action research project, as it posits that instead of people simply being passive recipients of knowledge, they can engage in a "problem-posing" approach where they become active participants. These two theories provide support and insights for a teacher development approach that is active rather than passive, one where learning naturally results for the benefit of teaching professionals who are given something to do, not something to learn (Dewey, 1916).

Learning through Experience in Education

To know educational theory is to know John Dewey, one of the most influential philosophers, social reformists, and educators of the 20th century. The approach Dewey took in education focused predominantly on meaningful activity in learning and student participation in classroom democracy. According to Dewey, the best learning environment is one in which a student participates in a meaningful task with others, thereby becoming further motivated by completing the joint task (Dewey, 1916). In this action research project, Dewey's theories were directly relevant, as the teachers were active participants in their own professional development.

Further, Dewey's theory of progressive education supports that learners must be invested in what they are learning. My research question then focused specifically on how a teacher-led promising practice impacted the staff's knowledge, use, and integration of technology. Additionally, a primary focus of the action research explored how giving teachers choice in their own professional development would provide personal motivation, help develop a growth mindset toward technology learning, and generate a collective spirit among a staff toward continual improvement.

Beyond individual learners gaining knowledge through active engagement, Dewey also emphasized the importance of interpersonal exchanges in the educational process. According to Dewey, learning happens through social interaction, and the teacher is part of the class social group (Dewey, 1938). The teacher should intentionally set up the learning environment for social learning to occur. In this research project, teachers assumed the role of learners and the professional development environment deliberately included social elements. The importance of collaboration with one's peers and colleagues was developed and included intentionally in alignment with Dewey's theory in order to maximize the learning.

Additionally, for the school itself, as Dewey noted, a model of active and social participation in the learning process provides the "instruments of effective self-direction" to have "the deepest and best guarantee of a larger society which is worthy, lovely and harmonious" (Dewey, 1899). This research project focused on individuals taking a step forward in their knowledge and expertise around their use of technology in the classroom, with an extended goal of building a positive and collaborative culture for professional development at the school.

Critical Pedagogy

Like Dewey's theory of learning by doing, Paolo Freire's theory of critical pedagogy emphasizes the idea that the educational process is never neutral (1970). In other words, education provides liberation to the individual because of their involvement in the learning. By encouraging educators to engage in an active and ongoing process of reflection and action, critical pedagogy is a progressive form of education that places the learner in the role of active participant, rather than being a passive recipient of knowledge. For this action research, the traditional model of professional development dictated to teachers was avoided, and instead a model where teachers were allowed and encouraged to assume an active role was assessed, to derive value in their use of technology in their teaching practice when given time to collaborate, reflect and experiment (Cuban et al., 2001).

Using Freire as a framework for teacher-led professional development then, learning can be seen as the practice of freedom -- as opposed to education as the practice of domination (Pitsoe, 2013). One major goal of this action research was to put the ownership of one's professional development related to technology and use of effective technology in the classroom, into the hands of the teachers themselves. According to Freire (1985), like students who benefit from becoming active participants engaged in a "problem-posing approach," teachers as students can benefit during professional development through this approach. To a greater extent, Freire puts forth the notion that as people who acquire knowledge, especially new knowledge, there is a benefit to linking that new knowledge to action as a way to transform oneself and society, at both a local level and beyond (Freire, 1985). Within the context of this action research, Freire's theory provided the groundwork for individual teachers to not only take the new knowledge around technology into action in the classroom to improve themselves as professional educators, but also

to heighten the knowledge and collective spirit among their colleagues, their students, and for the school community as a whole.

Each of these educational theories helped provide a foundation for the important role active engagement plays in the learning process, even for teachers involved in directing and collaborating on their own professional development. This action research was predicated on the idea that active learning, or *learning by doing*, can provide the basis for a teacher-led promising practice that impacts a secondary school staff's knowledge, use, and integration of technology in the school's subject matter and department collaboration.

Review of Related Research

The review of the related literature was organized and will be presented in three sections: understanding the unique aspects for how teachers learn, effective models of professional development within education, and how educators have been forced to adopt, learn, and use technology during the global COVID-19 pandemic. The research related to how teachers learn focused on the characteristics of teachers as learners themselves, which are unique from other learners. Some studies suggest that in the context of learning new things, teachers take on a dual role as both learner and teacher, where the individual needs to both learn new content or material for themselves, but also understand the pedagogy behind the new learning so that it may be placed in the context of how they will use the knowledge gained in their practice. Methods that allow teachers to approach their learning in formal, informal, and independent ways, which are personally relevant and extend over a period of time, are beneficial.

Further, this research review also presented studies on the best practices of professional development in the educational environment, where teacher-led activities such as practitioner inquiry, mentoring, collaborative workshops, and communities of practice in sustained

environments can lead to teacher improvement. Last, this review of related research shared preliminary findings and information on the use of technology in school settings during the global COVID-19 pandemic, including integration of technology into student-centered classroom projects, as teachers were forced to implement distance learning formats in the spring of 2020.

Teachers as Learners

The unique characteristics of how teachers learn are examined in this section of the research, which presents research where the role of teachers as learners and classroom leaders is seen to be more beneficial through specific types of learning environments.

Several key features about effective ways teachers learn pinpoint the fact that teachers as learners are unique, even among adult learners. Beyond simply learning new content or a new skill, teachers must also understand the pedagogy of the new learning and place it into the context of their classroom curricula. Therefore, opportunities that provide optimal effect for teachers to learn include both formal and informal learning, across time and often in collaboration with colleagues, in accordance with other learning activities (Garet et al., 2001). Formal learning, in the context of the research, most often refers to site or district-initiated professional development programs or systems, whereas informal learning is teacher-initiated and often teacher-led, alongside colleagues and other teaching professionals. Finally, independent learning has also been found to be beneficial and is defined as learning activities teachers engage in on their own initiative and accord, an equally important factor in teacher learning. In other words, when and where teachers are engaged continually in the learning process in an active manner, when their learning is coordinated across a multitude of developmental opportunities and models, there is maximum opportunity for teachers as learners to benefit (Petrie & McGee, 2012).

Research on teachers whose only professional learning comes by means of formal development dictated or directed by the site or school district is discredited as insufficient in maximizing teacher learning (Jones & Dexter, 2014). According to their qualitative study involving math and science teachers from two middle schools in one of the 100 largest districts in the United States, teacher learning was not maximized where content and learning related to technology integration was solely dictated by the organization. Rather, their findings concluded that beyond formal teacher learning opportunities, districts would increase teacher learning by also supporting informal and independent teacher learning. Informal teacher learning opportunities focus on teacher-led learning such as email discussions, face-to-face conversations, and technology integration efforts carried out during common prep periods, or during less structured times. Independent teacher learning centers on self-directed learning carried on outside of formal training, especially among informal learning networks available to teachers across multiple social media platforms. Independent learning is somewhat unique because it is voluntary and can be carried out anonymously (Jones & Dexter, 2014). Findings from the researcher's semi-structured interviews also revealed that informal and independent teacher-led opportunities provided sustained learning and just-in-time support from colleagues, elements often found to be a missing part of one-time, formal teacher learning.

Furthermore, the choice for teachers to informally organize and assemble motivates and changes the approach to the learning experience and better aligns with the unique characteristics of the teacher as a learner (Jones & Dexter, 2014). While formal learning opportunities for teachers serve organizational goals, the opportunities to learn may or may not align with teacher learning goals or preferred learning processes. Therefore, beyond formal and even informal learning, benefits for teacher learning can also be derived from independent learning (Jones &

Dexter, 2014). For teacher learners, independent learning can entail everything from internet search engines to professional organizations to video tutorials and sharing sites. From independent learning activities such as these, it was found that teachers could take more time to dive into a topic raised during formal or informal training sessions, provide opportunity to practice or perfect what has been introduced elsewhere, or even learn something new that wasn't available during formal or informal learning.

As explored in this subsection, the research reviewed emphasized the positive benefits to teacher learners that look to go "beyond what school leaders typically consider when planning for teachers' learning" (Jones & Dexter, 2014, p. 2) and steer away from formal professional development opportunities directed by school districts and administrators. The research points to a more holistic approach, where several varieties of teacher learning are all coordinated by the school and supported by technology (Jones & Dexter, 2014). The learning can be structured as communities of practice (CoPs) that include formal, informal, and independent learning, with a priority and focus on the latter two of these models to accentuate the unique nature of teachers as learners.

An additional method reviewed in the research noted that teachers as learners also benefit from learning opportunities that are continuous, include collaboration, and allow for focused practitioner inquiry. For teachers as learners, cycles of practitioner inquiry are generally defined as a means for people to research their own practice within many work-based contexts (MacDonald & Weller, 2017). The research investigated three forms of teacher professional learning from two experienced high-school biology and geometry teachers working in a K–12 school in the Southeastern United States: knowledge *for* practice, knowledge *in* practice, and knowledge *of* practice, where the latter emphasizes the maximum opportunity for the teacher as a

learner. By utilizing practitioner inquiry as a means for their own learning, teachers generate knowledge and expertise about their own practice, which can spread to other teachers as well. The researchers utilize a framework that begins with what they describe as a “wondering," which describes a particular dilemma that has been noted in their practice. After developing a research question and any subsequent sub-questions based upon their wondering, a narrative describing the methods to be used and a timeline for the inquiry is developed. Data analysis and a final showcase of the inquiry among colleagues yield a reflection for the teacher learner and a community of practitioners who seek continual improvement in their teaching (MacDonald & Weller, 2017). Over a period of 10 years, the researchers have used practitioner inquiry methods continuously to collect and examine data to inform their practice as teachers. As teacher leaders at their school site, they have noted that instead of being receivers of knowledge, continuous, job-embedded learning through practitioner inquiry allows teacher learners to be the creators of knowledge for themselves and other teacher learners. In my own study, an action research model was also used to create a space for teachers in the study to work collaboratively over time to observe, reflect, analyze, and talk with each other about their role as practitioners in the classroom.

Collectively, the review of related research discussed thus far on teacher learning leads next to an exploration of the best-known methods for implementing and maximizing teacher learning opportunities. The specific areas that will be explored in the next section focus on research surrounding communities of practice, also referred to as CoPs. This specific method of professional development includes groups of teacher learners who share a concern or a passion for something they do and learn how to do it better as they interact regularly. Most importantly, and directly aligned with my research goals, communities of practice are defined as a space and

time where teachers choose to come together to share information and work on a problem of practice (Jones & Dexter, 2014).

Best Practices of Professional Development for Enhanced Teacher Learning

In this section, building upon the previous section's focus on teachers as learners, the reviewed research considers how professional development of teachers is defined and how various methods such as teacher-led communities of practices and mentoring have been found to be effective models. As noted previously, research supports the benefits of collaboration among teachers in their learning, so the focus for the professional development models reviewed next center on best practices that showcase the work of teachers learning collectively in formal and informal ways. Researchers MacDonald and Weller (2017) reported in their comprehensive study about collaborative teacher learning that teachers embodied what Lieberman and Miller (2004) described as "the shifting conception of teacher leadership," where the teachers are active constructors of knowledge, feel ownership of their learning, and are empowered with confidence to share and contribute to the collective profession of education. Throughout each of these studies in the review of related research, the focus is on the teacher as a learner who develops their practice through observation, reflection, analysis, and dialogue with others.

To begin, professional development itself is recognized inherently as an important component of improving the quality of education provided by schools and for helping keep teachers trained in current curricular standards, learn new teaching methods and strategies, and acquire new digital technology skills needed to meet the needs of 21st century learners (Lawless & Pellegrino, 2007). In the traditional structure, professional development is directed at the district or school level, is provided on a large scale during single settings without ongoing support and led by people other than the teacher it is designed to help (Jones & Dexter, 2014).

Specific models of professional development related to technology are additionally challenged by the rapid growth of new digital technologies and the pace of change and evolution of technology devices, delivery methods, and feature-sets. It is through this lens then, that research on professional development has been reviewed, to uncover more flexible and sustainable methods that can train teachers as professional learners, especially in the area of technology.

First, the research reviewed provided support for the idea that teacher-led professional development has been shown to yield positive results in non-technical pedagogy (Garet et al., 2001). In a study of more than 1,000 mathematics and science teachers, the empirical comparison of the various effects of different models of professional development showed three primary characteristics for those that were most beneficial to teachers: the format of the activity (active study group), collective participation of teachers from the same school, grade, subject area, and the duration of the activity. Somewhat naturally then, training teachers on the use of technology, and the integration of technology into student-centered projects and assignments in classrooms has shown benefits from similar models, where the research highlights the promising practice of communities of practice (CoPs) among teachers.

Both individually and collectively, these promising practices embed an ongoing culture of learning and development in teachers, which is not automatically present in traditional, isolated professional development programs directed by school districts and administration. In another specific study, Kopcha (2010) extends the research around CoPs and mentoring to include teacher training in the use of technology. The results find that helping teachers to learn and use technology in teacher-led ways with these promising practices are effective.

More specifically, the focus on the promising practices of mentoring and communities of practice aligned these professional development models for teachers across four specific stages

Kopcha outlined in order to create an effective model for technology adoption in teacher learning. These stages each sought to combat typical barriers to learning to use technology - access, vision, beliefs, time, and training - and included an initial setup (stage one), teacher preparation (stage two), curricular focus (stage three), and community of practice (stage four). Over a two-year period of time at an elementary school of 30 teachers, the study examined the effect of sustained communities of practice and mentoring on teacher's perceptions of technology learning and integration into instructional practices. Interviews with participants near the conclusion of the case study revealed teachers who continued to overcome barriers to learning and using technology in their practice and that situated professional development activities had created a school environment that supported teacher's interest and ability to integrate technology in student-centered ways at the school.

Collectively, these stages were useful in my own research project, as communities of practice were generated in order to observe teachers as they learned and developed skills around the use of technology. While not required in my own research study, teacher mentors, if used, were able to begin teacher learning and professional development with an assessment of needs with a mentee, which lead to the creation of both a vision of technology integration plus short and long-term goals created by the teacher for achieving that vision. An additional benefit of these models for professional development is the savings to a school or district for not having to pay outside expert groups or mentor's costly expenditures to conduct one-time training sessions.

Beyond general best practices of professional development for enhanced teacher learning, it is additionally worthwhile to examine the benefits of collaboration among teacher learners in the context of technology integration into the practice. Throughout this subsection, as a result of the research, I operated under the assumption that teachers who are provided with a

collaborative professional development experience, allowed experimentation with technology, would build confidence in using technology over time. Additionally, this collaboration would likely yield teachers who integrate technology into their practice in meaningful and student-centered ways. One research study examined eight teachers who integrated technology in their practice through collaborative professional development sessions over time, in order to measure an increase in confidence and use of technology in the classroom (Kempkey, 2016). Two types of data were collected and analyzed: process and impact data. The process data showed how the professional learning experience developed over time, providing structured work time and modeled use of technology tools to participants in order to develop student-centered practices in instruction, routines, and classroom structures. Meanwhile, the impact data explored how the experience made a difference in the teacher's practice and resulted in an increased use of technology-enabled instructional strategies and organization in their practice.

A natural and expected assumption of the study described here is that for many teachers learning to use technology can be challenging, even where there is an interest to learn and use it as part of classroom practice. During open-ended work time where space was created in order to allow teachers time to create curricula, Kempkey observed that teachers could, in fact, develop their pedagogical and technological confidence. In fact, "the data indicated that professional development designed to increase teacher's effective use and sense of confidence with technology requires that teachers have time to collaborate with like-minded colleagues, experiment with the technology in the context of their curriculum and be provided appropriate levels of technical support" (Kempkey, 2016, p. 83). Overall, this study supports a more constructivist approach to professional development, in alignment with the theories of Dewey, where constructivism in learning is defined as an approach that holds that people actively

construct or make their own knowledge and that reality is determined by the experiences of the learner. By extension then, constructivism can yield positive results for teacher's integration of student-centered technology lessons in their classrooms, as found and summarized in the design development study conducted by Kempkey.

The review of related research revealed additional studies that reinforced the idea of teacher-led professional development practices fostering growth and a community of learners beneficial to individuals and schools (Li, et al., 2019, Martinovic, et al., 2019, Kopcha, 2012). Each placed the emphasis not on teachers having professional development directed at them, or given to them by outside experts, but rather on placing the professional in the role of teacher practitioner and active participant. Several models emerged across the studies of these researchers, but commonalities existed in the structure of the professional development being collaborative, relevant, and continual.

In conclusion, the work of researchers Kopcha (2010), Kempkey (2016), Li et al., (2019), and Martinovic et al., (2019) validated the use of teacher-led promising practices such as mentoring and communities of practice to integrate technology into the curriculum in meaningful ways. These studies each provided direct support for my own research, where I sought to study the impact of professional development on teacher learning and the use of technology in the classroom.

Impact of Distance Learning on Technology Use in Schools

In this section, researchers sought to explain how educators around the globe have been forced to learn, adopt, and use technology during the COVID-19 global pandemic. With schools being closed to in-person learning during the spring, summer, and into the 2020-21 school year, teachers had to adapt their approach to classroom teaching and their own ability to learn to use

technology and integrate it in authentic ways into their curriculum has been a critical part of their success.

First, it is important to recognize the research describing the impact of distance learning on the use of technology in schools is recent and continues to evolve. Recent research from initial studies about the global coronavirus pandemic described the shift to online learning, which had for the past several decades been evolving but had now required immediacy. There were a number of common impediments to change and transition with technology use and integration that seemed to be removed during the pandemic, when one considers the lessons learned from the shift to online learning during the COVID-19 pandemic (McQuirter, 2020). This research points to rapid and unprecedented school closures, and relatively successful conversions of face-to-face instruction to online learning within a matter of months, where previous efforts had failed, especially related to the adoption of technology in the classroom.

Initial and relevant research studies near the start of the global pandemic noted that "strong support from schools for the development of technical skills, coupled with collegial sharing and building on current practices, leads to a sense of agency among instructors and a greater willingness to embrace change" (McQuirter, 2020, p. 50). The research suggested that schools and teachers are in the midst of a three-stage learning model from which educators can adapt to online learning through Disruption, Transition, and finally Reimagining. In this model, *disruption* identifies the initial shift to remote learning where learning is unsettled and inconsistent. The *transition* phase marks the reopening of schools, where a more cohesive management of the structures and processes around what is needed to reopen schools is outlined. Finally, in the *reimagining* phase, the model creates a learning environment which is agile and innovative (Fullan et al., 2020).

According to McQuirter's research, at the time of the COVID-19 school shutdown, teachers were still in the Disruption phase, dealing with the technical aspects of the delivery of content and their curricula, hoping to move to a place where they will be able to ask larger questions related to student pedagogical needs in online learning, as well as develop their own competence in the use of technology across curricular areas. However, eventually, in order for the teachers and schools to stay committed to delivery of online instruction, there will need to be opportunities to transition and reimagine how education is delivered to students in a more permanent manner.

Finally, as both a participant and an observer, the author pondered what makes this experience in the midst of a pandemic different. While the situation is clearly unprecedented, McQuirter (2020) noted that beyond the formal professional development opportunities schools were offering to teachers, a more organic set of support groups with colleagues, meaningful collaboration in curriculum development, discussions among staff regarding authentic assessment practices in online learning, and teachers making real-world connections with each other through online platforms emerged as positive outcomes.

Similar to communities of practice, these informal teacher groups set their own agendas, reached out for institutional support as needed, and grounded discussions and content development scenarios around the real situation that faced them in a school year of distance learning (Wenger-Trayner, 2015). As with other noted best practices for professional development discussed, "building on the strengths of current practices, encouraging and facilitating teacher collaboration, and providing focused, systematic, multi-level implementation support as building blocks for innovation regardless of grade level or curriculum area" (McQuirter, 2020, p. 50). Finally, where there were positive outcomes, institutional support,

collegial sharing, and relevancy in building on current practice were among the reasons for success, just as in the best practices of professional development.

Continuing to look at the impact of COVID-19 on teachers and schools, it is relevant to include a review of literature which investigated how the effect of distance learning on technology use in schools has been addressed in teacher preservice and in-service training programs. Early research looked at the initial data available from Spring 2020, as the coronavirus took hold and schools closed, as well as the future of remote teaching and learning. This research focused on multiple challenges related to remote learning, which included creating content for online spaces, learning new delivery tools, understanding online pedagogy, engaging parents, addressing student mental health issues, and attempting various pedagogical strategies to address both synchronous and asynchronous teaching and learning. Several of the findings in teacher preservice and in-service training programs also supported best practices known to be effective in non-pandemic times, namely building professional communities, providing online professional development/coaching, allowing for simulated teaching experiences, access to digital tools, and equity issues (Hartshorne et al., 2020).

While researchers have argued for years that teachers and educators should be prepared for online and blended instruction by learning and using technology in the classroom, these calls have mostly been unheeded (Kennedy & Ferdig, 2018). The global pandemic, in some cases, forced teachers and educators to accelerate their learning and use of technical tools, and adopt new ways of teaching with digital and technical tools they may have otherwise left alone.

Over the course of one study, five key themes that are worth review emerged (Hartshorne et al., 2020). First, Hartshorne and colleagues found positive outcomes centered on building communities. Second, they pointed out that the use of online professional development/coaching

allowed teachers space and time to develop synchronous and asynchronous content in both collaborative and personalized ways. Third, in some cases, especially where new teachers or teachers who were new to a technology, they found that a simulated/online teaching experience provided value in learning. Fourth, the researchers zeroed in on digital tools, which they noted "foster active learning and allow for collaboration in both synchronous and asynchronous formats" (Hartshorne et al., 2020, p. 138). The fifth and final theme of the study was the recognition of issues around equity in access to technology and professional development that were accentuated during the pandemic. Equity of access to technology and teacher professional development (or the lack thereof) has been a concern for decades (Van Dijk, 2006). While the outcomes of the pandemic are still evolving and will continue to do so for years to come, my research aimed to fill an important gap that reveals an equitable way for teachers and educators to learn and integrate online and blended instruction using technology in the classroom.

Conclusions

John Dewey's (1929) foundational theories emphasized that learning occurs through experience and is primarily a social experience. Paulo Freire's theory of critical pedagogy (1972) was also an essential part of this action research project, as it puts forward that instead of people simply being passive recipients of knowledge, they are self-empowered and construct meaning over time as a direct result of their involvement in the learning.

The extensive research gathered for this action research project reinforced the importance for teachers to be active participants in their professional development, especially in relation to technology and integration of technology into the classroom. While currently there is limited research on the impact COVID-19 will have on teachers' ability to learn and use technology in schools, there is bountiful research on the unique ways teachers learn and the best practices of

professional development that can guide the methods for learning to use technology and integrate it constructively and meaningfully into classrooms. Educational researchers MacDonald and Weller (2017) shared a comprehensive study where teachers engaged collaboratively with school leaders to investigate their practices through cycles of practitioner inquiry, while Jones and Dexter (2014) explored the effectiveness of teacher learning in the context of informal communities of practice (CoPs), where teachers chose to come together to share information and work together on a problem of practice.

Similarly, in a study that focused on the best practices around professional development in schools, Kopcha (2010) highlighted the promising practice of a mentoring model and the development of communities of practice among teachers. Another study by educational researcher Kempkey (2016) showed how the professional learning experience developed over time helped to create a sense of confidence with technology, one which required that teachers had time to collaborate with like-minded colleagues, experiment with the technology in the context of their curriculum and be provided appropriate levels of technical support.

Finally, McQuirter (2020) provided reflections on the number of common impediments to change and transition that seemed to be removed during the pandemic. McQuirter also noted that rapid and unprecedented school closures seemed to lead eventually to relatively successful conversions of face-to-face instruction to online learning. In a similar regard, findings supported best practices also known to be effective in non-pandemic times, namely building professional communities, providing online professional development/coaching, allowing for simulated teaching experiences, access to digital tools, and exposing equity issues (Hartshorne et al. 2020).

Based on the information from the research studies included in this literature review, this action research project brought together underlying foundational research from the theoretical

rationale with the reviewed concepts and ideas presented in the research studies. Moving forward into the coming chapter, I outlined the methods used in my action research study, including procedures, processes, and instruments used for the implementation, data collection, and data analysis of my study.

Chapter III

Methods

Professionals in the field of education face unique and sustained challenges when it comes to learning and using technology to deliver their curricula to students. As quickly as one technology solution is learned and integrated into the classroom, another option is presented or becomes available. Additionally, schools and districts have not universally moved beyond a traditional means of professional development, which is typically directed at teachers during one-day "in-service" sessions at the start of each school year. Despite the rapid growth in technology and technology solutions currently available to schools in the United States, effective integration of technology into teaching and learning by teachers who know and understand how to use it to enhance student learning continues to be difficult (Li et al., 2019).

Teachers at the school site where this study took place have a strong sense that their current practices yield positive and recognizable results. At the conclusion of the 2019-20 school year, for the sixth year in a row, the comprehensive high school was recognized as among the top 250 of all California high schools by the U.S. News and World Report (https://www.usnews.com, 2020). Moreover, students and families at the school site have reported high levels of ownership and availability of technology, presumed to be an indicator that teachers by extension have learned to use technology to help students learn. However, my classroom observations suggested there was a gap between the technology available to the school community's teachers and students and the effective integration of technology into the school's curriculum.

Research suggests that the way teachers learn is unique from other adult learners (Garet et al., 2001; MacDonald & Weller, 2017; Wenger-Trayner, 2015). This research points to a

duality of the teacher learner, where the individual must not only learn the new content or material for themselves but also develop an understanding of the pedagogy that supports the new learning. The research further suggests that the teacher learner benefits where any new content or material is placed in the context of their own practice and is learned in a combination of formal, informal, and independent ways (Garet et al., 2001). When it comes specifically to teachers learning to use new technology in their practice, researchers have specifically concluded that the unique ways that teachers learn is also an important factor in effective professional learning (MacDonald & Weller, 2017). Lastly, there is a solid amount of research supporting the transformation of professional development for teachers to include more teacher-designed and/or teacher-directed learning, including learning around technology; and research has demonstrated that teachers who participate in collaborative, sustained, and contextually relevant professional development in communities of practice learn in a manner that aligns with the unique ways that teachers learn (Wenger-Trayner, 2015).

After reviewing the related literature, I hypothesized that teachers could learn and integrate technology-related content into their curriculum if the best practices related to professional development were utilized. I looked to include the specific element of how teachers learn to use new technologies and integrate digital elements into their curriculum during the 2020 global pandemic, which has required most schools in the United States to shift to a remote, distance learning environment due to the COVID-19 coronavirus.

Several scholars have argued that communities of practice can be transformative in the professional development of teachers (Li et al., 2008). Research has shown that teachers who participate in communities of practice with a peer group often establish goals for integrating technology into their teaching, share solutions to the problems they face, and receive support

while integrating technology (Martinovic et al., 2019; Cuban et al., 2001; Kopcha, 2010). I was interested in better understanding how these dynamic forms of professional development for learning to use and integrate technology into the classroom during and beyond the COVID-19 pandemic. As such, the goal of this action research study was to examine the impact teacher-led communities of practice had on the increased and effective use of technology in a secondary school staff. Hence, my action research question was, *how does participating in a teacher-led community of practice impact teachers' integration of technology in their teaching practice?* This chapter describes the setting of the research project, the participants, the instruments used to measure teacher's comfort/ability to learn, use, and integrate technology into their curriculum, and the plan for analysis of data.

Setting

The comprehensive high school in which this research study took place was located in a suburban, medium-sized city in Northern California. The school site was situated on approximately 40 acres of land in an area with a relatively high socio-economic status among its school community. The school facilities include a multi-media center, performing arts theater, lecture hall, stadium, gymnasium, aquatic facility, as well as graphics, photography, and art studios. There is also a centrally located library at the school with a large collection and large variety of books, which uniquely serves as a gathering spot for students and is a hub of learning activity on a daily basis. Additionally, at the time of the study, the school had an active parent faculty club (PFC) that continually raised funds through a series of one-time initiatives and annual events, with the goal of bridging the gap between public funding and the true cost of the full educational experience. Furthermore, the school was unique among the other high schools in the district for its Special Day Class (SDC) for high-need students, a weekly Strategic Support

academic intervention program for all students, plus “Wellness Days” held each semester to support social-emotional learning opportunities for the entire student body.

School enrollment at the time of the study included a total of just fewer than 1,500 ninth through 12th grade students, where male students were a bit more than 51% of the student population and female students slightly more than 48%. The racial and ethnic makeup of the school in 2018-19 was approximately: 55% White or Caucasian, 15% Asian, 13% Hispanic or Latino, 10% Two or More Races, 5% Filipino, 1% Black or African American, and 1% Other Races. School enrollment data also noted that slightly less than 2% of the students were classified as English language learners (ELLs), while nearly 10% of all students were identified as students with disabilities. As indicated by the 2018-19 Student Accountability Report Card (SARC), less than 13% of the school's student body came from socioeconomically disadvantaged households, with less than 1% listed as Foster Youth and less than 1% as Homeless (California Department of Education, n.d.).

Student achievement results for the 2018-19 California Assessment of Student Performance and Progress (CAASPP) showed that among the 10th-12th grade students at the school, almost 80% were meeting or exceeding the state standards in English Language Arts (ELA), and more than 60% were meeting or exceeding the state standards for mathematics. Notably, these percentages were higher than both the district and state averages for CAASPP results. For the same academic year, the district averages for CAASPP scores were reported to be just less than 50% for ELA proficiency and slightly less than 40% for mathematics proficiency. Statewide, CAASPP averages were just over 51% for ELA and slightly less than 40% for mathematics.

On the school's teaching staff, all but one of the more than 60 teachers were fully credentialed, Cross-cultural Language and Academic Development (CLAD) certified, and generally considered to be highly qualified based on education industry standards. None of the school's teachers were teaching outside their subject area of competence. During the time of the study, there were 32 female and 30 male teachers on staff. Among the teaching staff, 40% (25 out of 62) held advanced degrees in education, administration, or their particular subject area. Furthermore, the racial and ethnic makeup of the teachers was as follows: 83% White or Caucasian, 5% Asian, 6% Hispanic or Latino, 2% of Two or More Races, 2% Filipino, 2% Black or African American, and 0% Other Races. The data here pointed to a racial and ethnic profile of the teaching staff that is not substantially different from the student body at the school.

Demographics of the Participants

The participants for this research study were drawn from the overall teacher pool at the comprehensive high school where I worked as an administrator during the 2020-21 academic year. Each of the more than 60 teachers working at the school were invited to participate in this action research project via an email introduction and announcement at one of our monthly staff meetings, with all seven who participated providing their consent via a Google Form document (Appendix A). Data from each of these seven participants were included in this study.

Among the seven participants in the study, three were female (43%) and four were male (57%). The subject matter teaching departments of the participants were as follows: 57% Math/Science, 21% English/Social Studies, 14% World Languages, and 7% Performing Arts (one participant taught both English and Performing Arts). Additionally, the years of teaching experience of the participants were reported as follows: more than 15 years, 43%, six to 15 years, 43%, and less than three years, 14%. The demographic data of the participants do reflect the

school data related to the overall makeup of the entire staff in terms of gender, subject matter, and years of teaching experience.

An important element for the overall participant pool included in this research study was to make the collaborative professional development sessions open to all levels of expertise and experience with technology, to explore the effect the communities of practice would have on a variety of professionals. For example, equally important to providing a space and opportunity for experienced educators in developing technology curriculum, was the chance for less experienced or novice educators to participate, possibly with a mentor whom they knew and felt comfortable. A study with more participants in a similar setting would benefit from additional variety in terms of both subject matter and years of teaching experience of participants.

Data Collection Strategies

In order to determine the impact teacher-led communities of practice had on the increased and effective use of technology in a secondary school staff, a variety of data collection methods and strategies were used before, during, and after the implementation of the communities of practice. Data were collected and analyzed both quantitatively and qualitatively to ensure the reliability of the results. The pre-post survey (Technology Use Survey, Appendix E) offered quantitative data and included nine statements which participants responded to on a Likert scale of 1 to 7. Qualitative data were collected in the form of participant interviews (Appendix D), and researcher field notes that were informed by exit tickets (Appendix F), to obtain data related to participant thoughts and feelings about their experiences with the collaborative technology development sessions.

Participant Technology Use Survey

This pre-post implementation survey (Appendix E) was a multi-assessment tool I designed for participants to assess their own thoughts about their current skill level and comfort with technology, plus experiences with professional development in their current role. The survey included nine Likert-type questions and three open-ended questions at the end of the survey for participants to share their ideas regarding learning to use new technologies, as well as reflect on their own learning style and their feelings toward communities of practice as a model for professional development. The clarity and validity of questions were not tested prior to the administration of the survey in this study.

Each of the participants in the study took the survey on their own time and not as part of the sessions. For the Likert-type questions, teachers rated themselves on a 7-point scale to indicate how they felt about each statement. The options for responses ranged from *"Strongly Agree"* (7 points) to *"Strongly Disagree"* (1 point). There was an option that read *"Neutral/Unsure"* (4 points). The statements were divided equally amongst areas of focus that ranged from participants' perception and experience with learning to use new technology, their feelings about their own learning, and their overall perception of professional development models in education. The initial statements focused on the participants' personal assessment of their skill level and interest to learn and integrate technology into their practice and included statements such as, "*I have a defined model to develop new technology for use in my classroom and as part of my curriculum"* and *"My confidence learning and using new technology as part of my curriculum is high."* The next few statements asked participants to reflect upon their feelings related to professional development and included statements such as, *"Professional development has helped me to do my job better and helps me to better serve students in my classroom,"* and

"Professional development at my school allows for personal choice and is typically relevant to my current job." Responses to these statements were analyzed quantitatively, and data from the pre-implementation survey were compared with data from post-implementation surveys for each participant.

Furthermore, the survey included three open-ended questions at the end for participants to reflect upon: technologies that are useful in their curricula, their own learning style, and their feelings toward continuing to develop in their professional practice. Answers to these questions were analyzed for themes, and the post-implementation survey responses were also compared to earlier responses determining if collaborative technology sessions had made an impact on the participants' ability to learn, use, and integrate technology.

Participant Interviews

At the completion of the collaborative technology sessions, interviews were conducted with each of the participants. The individual interview questions (Appendix D) were researcher-designed in advance of the study and took place during an open period for each of the teacher participants, or before/after school, as organized between the participant and me. The questions asked in the semi-structured interviews were specifically crafted to elicit input from the participants that was honest and represented feelings about how the collaborative technology sessions had affected their technology learning. Similarly, the interviews provided an opportunity for participants to reflect on their own experiences with communities of practice as a model of professional development and learning. Unique to this action research study was my role as both school administrator and researcher, although the informal nature of the collaborative technology sessions and my existing relationship with the participants hopefully removed any barriers that may have otherwise existed.

Interviews were semi-structured, and each participant was ensured confidentiality of their responses prior to the start of each interview (Appendix D). Questions included *"What do you see as the benefits, if any, to having participated in our collaborative community of practice?," "What, if anything, have you changed in your practice as a result of our collaborative community of practice?,"* and *"Did our collaborative community of practice help you to think differently or more deeply about technology, professional development, or your own teaching? If so, how?"* Each of the interviews were audio-recorded, and participants were reminded and asked again at the start of the interview for permission to record their answers and thoughts. At the conclusion of the series of interviews, I analyzed the responses qualitatively, looking for patterns and themes.

Researcher Field Notes

Throughout the research study, a detailed log of field notes was kept on a personal Google Document (Appendix H). Typically, notes were written in the 30 minutes immediately following each collaborative technology session with the participant group. Whenever I was unable to complete the field notes due to meetings or personal obligations, they were completed at home or the next morning prior to the start of the school day. My field notes were typed using cloud-based Google Docs in order to allow for access from any location and ongoing professional development and changes. Additionally, the typed notes provided an optimal method for information and observations to be captured quickly and efficiently.

As a component of the field notes, each session also ended with an "exit ticket" response from each of the participants to gather input and help shape the direction of the collaborative technology sessions. Examples of the exit ticket format included: open-ended green/yellow/red light prompts to solicit areas of excitement, hesitation, and uncertainty from the participants, a

Google Slide deck where each participant contributed to the prompt “reflect on how/when you as a teacher learn best," and finally a Padlet where each participant posted comments, links, and resources on professional development for each other. The use of exit tickets during the study provided additional qualitative data that could be used during analysis.

Additionally, the researcher field notes were used to detail the specific topics of conversation shared during the introduction with the teachers at each collaborative tech session (for example, a participant’s reflection on the progress made in the technology work in the time since the previous session). Field notes captured observations on the teacher’s progress, questions to the group, plus discussion about integration of project work into the classroom. Furthermore, the participants’ approach to and reflection on their own learning, quotes among the teacher group that were especially insightful, and my personal inquiries and thoughts during the collaborative tech sessions were also recorded as part of the field notes. Lastly, the field notes provided a method to record which participants were present, and which were absent from each of the collaborative technology sessions. At the conclusion of the research study, the field notes were analyzed from a qualitative standpoint to determine specific themes within the research, any overarching trends that were emerging, and any particular or unique occurrences that evolved during the study.

Procedures

This study took place over 12 school weeks between early-February to mid-April. There was a one-week spring break in the middle of the study. The study consisted of six collaborative, technology-focused professional development sessions, held every other week. Prior to the initial meeting, the initial Technology Use Survey was administered in order to gain baseline data for

the study. After this baseline data were collected, the collaborative professional development sessions began.

The In-Session portion of the study utilized a model of communities of practice (CoPs), based primarily upon the work of educational theorist Etienne Wenger. Wenger generally describes CoPs as a forum where people meet regularly to learn how to do something they share in common better in collaboration with each other (Wenger-Trayner, E., & Wenger-Trayner, B., 2015). In the educational setting, and for the purposes of this study, teachers who shared a passion for learning and using technology in their classroom also provided intrinsic motivation for them to participate. At the completion of the study, each participant completed the final technology use survey and took part in an individual interview.

Pre-Session

All teachers at the comprehensive high school where I work were invited to participate in the action research study. Using a link to a Google Form posted in a staff meeting and resending the same link to all teachers via email, interested teachers volunteered to participate in the study. Next, each participant was asked to provide consent and agreement to include their experience as part of the study. Once the initial forms were received, participants were asked to complete the pre-implementation Technology Use Survey (Appendix E). This baseline assessment was used to highlight participants' attitudes toward professional development overall, since the study aimed to determine if communities of practice would be an effective way for teachers to learn.

Additionally, the baseline provided information on each individual's specific interest, ability, and attitude toward technology. Based on these data, teachers who identified at beginner or novice levels of technology knowledge were offered the opportunity to be partnered during the in-session portion of the study with a mentor. These teachers were also ones that I made a

point to observe closely during the in-session trainings, check in with more regularly during the group discussions at the beginnings and endings of the sessions for data to include in the field notes, and spend potentially more time with during the individual interviews at the conclusion of the collaborative technology sessions.

In-Session

During the in-session phase of the study participants went through six individual sessions that were scheduled every other week. Each session lasted for approximately 60 - 75 minutes and was structured as a collaborative technology session held on Wednesday afternoons during the months of February, March, and April. The sessions included a focus on personal choice of technology products, group discussion about learning and the process of professional growth, as well as end products that could be implemented by the participants into their classrooms immediately. Participants imagined, developed, and shared technology projects throughout the entire study. Additionally, participants could work independently on their technology projects during the weeks *throughout* the study. During the sessions, the agenda (Appendix I) allowed participants to engage in whole group discussions and question-answer time at the outset of the session, a simple technology tip from me, then the majority of the session to engage and collaborate on their technology project or learning. At the end of each collaborative technology session, each participant completed an exit ticket (Appendix F), responding to prompts provided by me. These were used to solicit input about the professional development they were participating in, specifically how participants felt about learning new technology in the community of practice format in conjunction with their colleagues.

As a guide for how I should best implement a professional development model based upon communities of practice, I reviewed the Academic Communities of Engagement

Framework (Borup et al., 2020). In this framework, positive outcomes first centered on building communities. Second, the use of online professional development/coaching allowed teachers space and time to develop synchronous and asynchronous content in both collaborative and personalized ways. Third, especially where new teachers or teachers who were new to a technology, a simulated/online teaching experience provided value in learning. Fourth, the study of digital tools fostered active learning and allowed for collaboration in both synchronous and asynchronous formats for teachers. The fifth and final element was the recognition of issues around equity in access to technology and professional development that have especially been accentuated during the COVID-19 global pandemic.

My reference to this model for professional development provided a focus that could have been beneficial in my study. As such, it was my intention to assemble the community of teachers in regular and formatted sessions, allowing space and time for those teachers to develop new skills or expertise in collaborative and personalized ways, and facilitating an overall professional learning experience for teachers aligned with the research on how teachers uniquely learn and acquire new knowledge. Research noted that teachers' choice in organizing and assembling motivates and changes their approach to the learning experience and better aligns with the unique characteristics of the teacher as a learner (Jones & Dexter, 2014). Where teachers are uniquely required to both learn to use a new technology and understand the pedagogical implications of using that technology in their classroom, this model for professional learning seemed likely to have outcomes that were beneficial to teachers.

Post-Session

The final portion of the study was dedicated to administering the post-implementation Technology Use Survey to all participants, as well as conducting the individual interviews

(Appendix D) with each of the participants. Analysis of each participant's survey responses was compared with the data collected during the pre-implementation survey to assess the impact these technology-focused communities of practice had on the increased and effective use of technology in their practice. Data from individual interviews were also analyzed to discover participants' perspectives about participating in professional development in a community of practice.

Plan for Data Analysis

Each data source was collected in support of the research question, *how does participating in a teacher-led community of practice impact teachers' integration of technology in their teaching practice?* Participants took a pre-post implementation Technology Use Survey (Appendix E) and each participated in an interview at the conclusion of the study. In addition, I kept field notes (Appendix H) via a Google Doc, reviewed the exit tickets from each session, and added my reflections at least weekly over the course of the study. Collectively, these data provided a triangulation of sources, which allowed for multiple viewpoints to be considered when interpreting results. The triangulation allowed for a more accurate measurement on how participation in the collaborative technology sessions affected the approach to learning and professional development for the participants.

The results from the nine Likert statements in the pre-post Technology Use Survey were analyzed quantitatively. To begin, baseline data from the initial Technology Use Survey was analyzed for individual participants to see how comfortable and confident they were towards learning new technology and toward professional development. On the survey, numerical values were assigned to each possible response as follows: "Strongly Disagree" (1), Disagree (2), Slightly Disagree (3), Neutral/Unsure (4), Slightly Agree (5), Agree (6), and Strongly Agree (7).

Participant responses were collected and coded according to these ratings, with a total sum score given for each participant's level of confidence toward learning to use new technology and a total score for their overall feeling about this model of professional development. In all cases, the scores were analyzed for central tendency, allowing for a calculation of the mean for all participants. Similarly, the same analysis of the descriptive statistical data was conducted again for the post-sessions Technology Use Survey. To determine any differences in the scores between the pre-post assessment, like responses were compared for the individual participants and the whole group.

The individual interviews and researcher field notes were analyzed qualitatively, coding for common trends and themes. In review of the individual interviews data, the focus was on data that demonstrated how the participants specifically engaged with the new technology and adopted a new understanding of the professional development model of communities of practice (CoPs) being used. Key takeaways from the individual interviews were identified in places where interviewees reported being affected by the collaborative technology sessions, their own experience of learning and integrating technology into their classroom, or how they would approach learning moving forward. Analysis looked for similarities, differences and patterns that emerged within and among these instruments, which would then provide the opportunity to relate the impact of participation in a teacher-led community of practice on a teacher's learning and integration of technology in their teaching practice.

Summary

The goal of this action research study was to investigate the effect collaborative technology sessions had on a teacher's ability to learn and integrate new technology into their professional practice. Existing research showed that professional development models used in

the school environment were outdated, especially when it came to technology. Additionally, the COVID-19 global pandemic in 2020 highlighted the urgency for teachers to learn new technologies and complete an overhaul of their practice in order to meet the needs of their students in a distance learning (remote) environment. Teachers needed to find a more dynamic and effective model to engage in authentic learning around technology.

The collaborative technology sessions took place over a 12-week period and included a focus on personal choice of technology products, group discussion about learning and the process of professional growth, as well as end products that could be implemented into classrooms immediately. Participants imagined, developed, and shared technology projects throughout the entire study. Moreover, participant comfort and confidence with learning and using new technology was measured through the Technology Use Survey, researcher field notes, and individual participant interviews.

This chapter provided an introduction to the setting of the research project, the participants, the instruments used to measure teacher's comfort/ability to learn, use, and integrate technology into their curriculum, and the methods used for collection and analysis of data. The next chapter shifts to a discussion of the findings from the analysis of data that were collected from the study.

Chapter IV

Findings

The purpose of this study was to examine the benefits structured professional development workshops known as communities of practice (CoPs) and mentoring groups had on the increased and effective use of technology in secondary schools by interested staff. Hence, the action research question for this study was, *how does participation in a teacher-focused community of practice impact teachers' integration of technology in their teaching practice?* In my role as an administrator of a comprehensive high school consistently recognized for outstanding academic achievement, the onset of distance learning during the COVID-19 global pandemic in spring of 2020 brought to light varying levels of technical proficiency in our teachers and our school's ability to learn and share best practices with each other around educational technology.

Additionally, traditional professional development directed at the district or school level, often structured at a large scale during single settings without ongoing support, and typically led by people other than the teacher it was designed to help, had shown inconsistent results (Jones & Dexter, 2014). Specific models of professional development related to technology were additionally challenged by the rapid growth of new digital technologies and the pace of change and evolution of technology devices, delivery methods, and product features. My experience had observed teachers at my school site showing inconsistent and intermittent adoption of technology in their classrooms. I undertook my action research to see if an alternative approach would be beneficial and one that members of the staff would adopt.

A review of the literature suggested that a foundational part of effective learning and use of technology in the classroom required an examination and understanding of the unique aspects

for how teachers themselves learn (Garet et al., 2001; Petrie & McGee, 2012; Jones & Dexter, 2014; Rodrigues, 2018; MacDonald & Weller, 2017). Additional research and factors indicated that effective models of professional development within education included multiple methods of active practice and learning to use new technology, often in collaboration with others and carried out over extended periods of time (Lieberman & Miller, 2004; Lawless & Pellegrino, 2007; Kopcha, 2010 and 2012; Kempkey, 2016; Li et al., 2019, Martinovic et al., 2019). Finally, initial studies provided data that demonstrated how educators were forced to adopt, learn, and use technology at an accelerated pace during the global COVID-19 pandemic of 2020 and 2021 (McQuirter, 2020; Durff & Carter, 2019; Fullan et al., 2020; Wenger-Trayner, 2015; Hartshorne et al., 2020; Van Dijk, 2006). Most notably, McQuirter (2020) concluded that strong support by schools and districts for the development of technical skills, alongside sharing and building on current practices by educators, led to a sense of agency among teachers and a greater willingness to embrace technology in their professional practice. I hoped to contribute supporting data and confirmation of optimal methods of professional development for teachers to learn and use technology with this current study.

Overview of Methods and Data Collection

For this action research project, data were collected over a 12-week period. Included in the study were a pre-session phase (one week), an in-session phase (10 weeks), and a post-session phase (one week). During the pre-session phase the pre-implementation Technology Use Survey (Appendix E) was administered to gain a baseline of participants' attitudes toward teacher learning, professional development, and adoption of new technology strategies in classroom teaching. As soon as baseline data were gathered, the collaborative technology sessions phase began. These in-session communities of practice involved voluntary learning

sessions where teachers gathered to learn and discuss simple technology-related ideas to use in their practice, spent time individually or in small groups working on development of self-selected technology-related curricula and materials, and reflection activities focused on their own learning and using technology as classroom teachers. The six collaborative technology sessions were conducted every other week during 60–75-minute sessions, which could be extended slightly if additional time was needed.

Data collection during the in-session phase consisted of a log of researcher field notes (Appendix H) kept in Google Drive, which recorded specifics of conversation shared during each session's introduction with the teacher, noted observations of various teacher's progress on integration of technology project work into the classroom, and captured reflections shared via participant's exit tickets about their own learning.

At the conclusion of the study, each participant completed the Technology Use Survey (Appendix E) again and also took part in a post-session interview with me (Appendix D). During the semi-structured interviews, participants were asked a set of questions to provide an opportunity to share their perspectives about participating in a community of practice focused on learning and using technology, their own experiences with professional development, and reactions to their experience living and teaching through the global pandemic during the 2020 and 2021 school years.

Demographics of the Participants

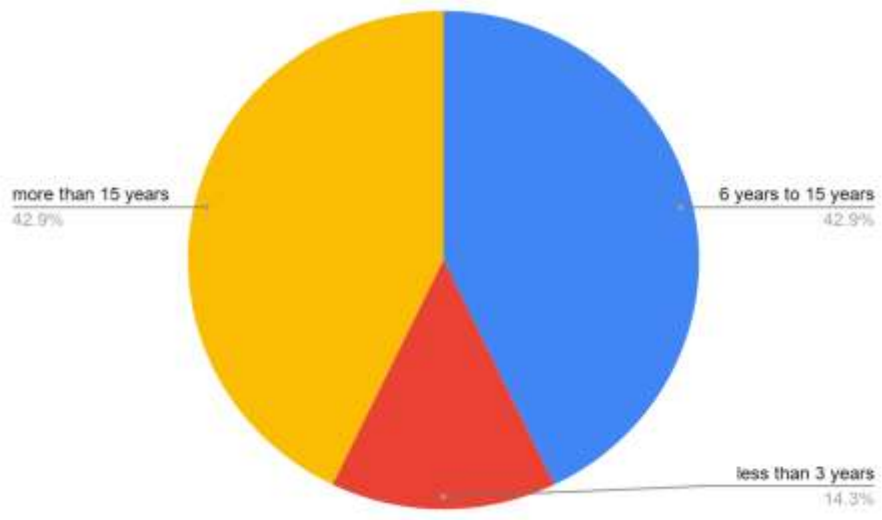
Participants for this action research study were drawn from the teaching staff at the comprehensive high school where I served as an administrator during the 2020-21 academic school year. At the conclusion of a monthly staff meeting where all teachers on staff were

introduced to the study and invited to participate, seven teachers completed an interest form and signed a consent agreement (Appendix A).

Among the seven participants in the study, three were female (43%), four were male (57%), and they represented a variety of subject matter departments as follows: Math/Science 57%, English/Social Studies 21%, World Languages 14%, and Performing Arts 7%. One participant taught both English and Performing Arts. Additionally, as seen in Figure 1, the years of teaching experience of the participants were reported as follows: more than 15 years, 43%, six to 15 years, 43%, and less than three years, 14%. The years of teaching experience of the participants was relatively similar to that of the overall staff of the school site.

Figure 1

Participants Years of Teaching Experience



Analysis of Participant Technology Use Surveys

The Technology Use Survey (Appendix E) was a multi-assessment tool given pre- and post-intervention, designed for participants to assess their own abilities, and share their thoughts about current skill level and comfort with technology. In addition, participants were asked about

experiences with teacher professional development, both generally, as well as during the global pandemic that forced schools into a distance learning format starting in the spring of 2020 and extending until late spring in 2021. Nine Likert-type questions and three open-ended questions at the end of the survey were posed to teachers in order to capture their ideas regarding learning to use new technologies as part of their professional practice, as well as to reflect on their own learning style and feelings toward communities of practice as a model for professional development.

For the Likert-type questions, teachers rated themselves on a 7-point scale to indicate how they felt about each statement. The options for responses ranged from *"Strongly Agree"* (7 points) to *"Strongly Disagree"* (1 point), and also included an option that read *"Neutral/Unsure"* (4 points). The statements were divided equally amongst areas of focus that ranged from participant's perception and experience with learning to use new technology, to their feelings about their own learning preferences, and finally their overall perception of professional development models in education.

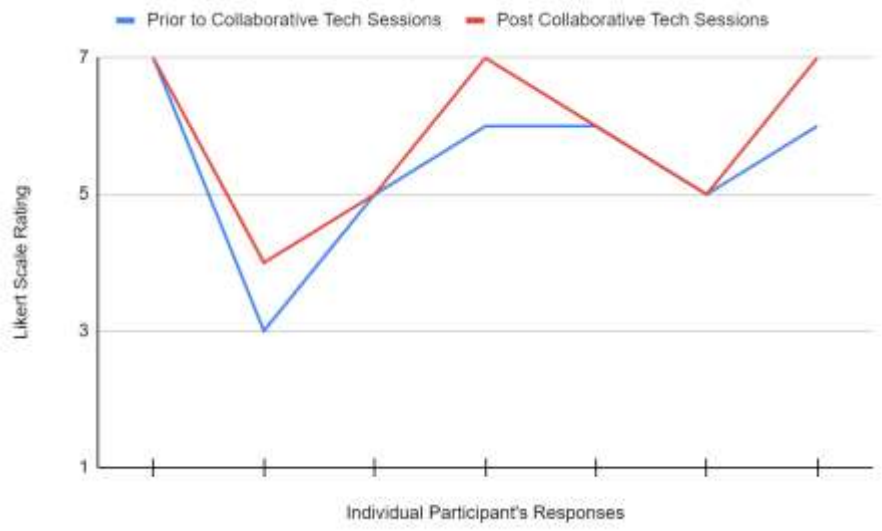
The results were analyzed in two primary ways. Figure 2 demonstrates the results for all participants' (N=7) responses pre- and post-intervention to the prompt *"My confidence in learning and using new technology as part of my curriculum is high"* and reveals that more than half of the participants (57.1%) noted no change in their confidence due specifically to the collaborative technology sessions in this study.

Due to the relatively limited time frame of the study, and small number of participants, survey results did not tell the entire story. In fact, direct feedback, and input from the participants during the sessions and in the post-session interviews revealed additional thoughts about the communities of practice format for professional development that were useful. Specifically,

Teacher 5 reported in one of the open-ended questions, “I am sometimes afraid to try a new technology for the first time, because of the fear that it might not work, or that I might not know how to navigate through a problem. It has been very helpful to simply hear what other teachers do, and to have those teachers demonstrate their technology tools in breakout rooms.”

Figure 2

Teacher Comfort with Learning and Using Technology in the Classroom

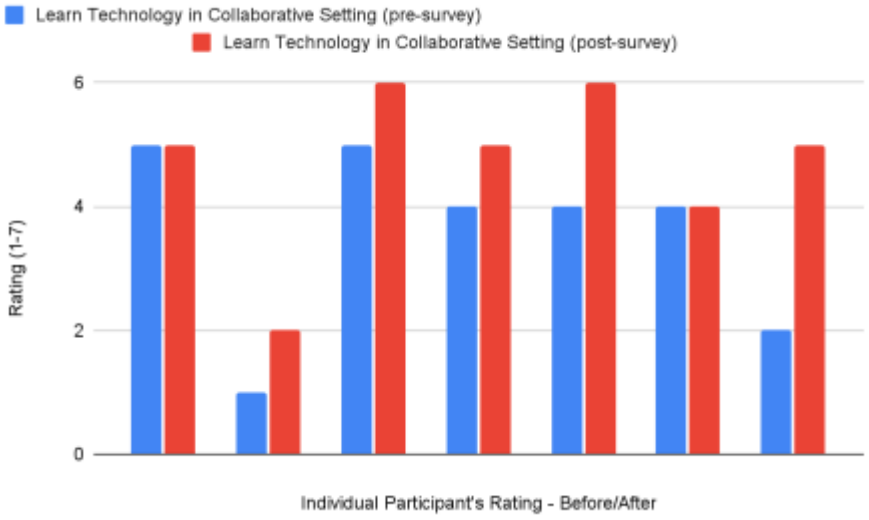


It was also important to collect data regarding teacher interest and likelihood to participate in professional development related to technology in collaboration with colleagues. As noted previously, while traditional professional development experiences for most teachers have been limited to experiences directed by the school or district, often without teacher choice with regard to content, and delivered in a non-collaborative, lecture or large-group presentation format, this study created a community of practice over a period of time with teacher-choice in order to learn and practice using new technology with others. Figure 3 demonstrates the pre- and post-session survey ratings for each participant’s response to the prompt *“Learning to use new*

technology as part of my professional practice is something that I often do alongside colleagues, and if needed, a mentor."

Figure 3

Learning Technology in a Collaborative Setting



When comparing results, a majority of the participants (71.4%) noted an increase in their practice of learning and using technology alongside colleagues in the post-survey response, with the largest rating increase from two to five coming from the participant (Teacher 7) who had the second lowest outlook about collaborative professional development at the outset of the study.

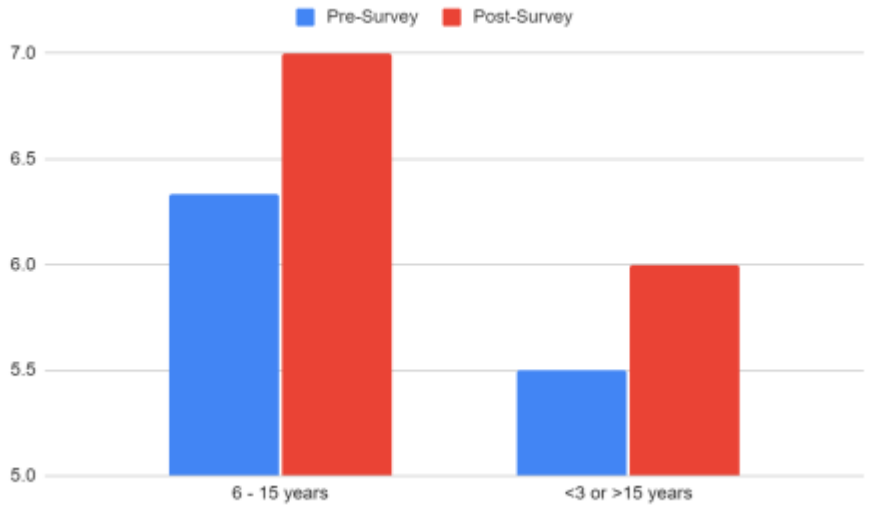
Furthermore, the overall mean for the participants' responses to this area of focus increased by 31%, from 3.6 to 4.7 on the Likert rating scale between the pre- and post-survey. While the sample size for the study was relatively small (N=7), there was an increased awareness on the part of the participants that professional development in a collaborative setting could be beneficial. Notably, in the open-ended responses, one participant stated, "I liked the collaborative feeling of the sessions and the choice of what to work on for each session. I liked the mentoring I received and the support from my colleagues," while another simply noted "These collaborative tech sessions were very helpful! Can we do something like this next year?"

The data also revealed, in general, that the teachers felt better prepared as classroom teachers to utilize technology once schools returned to in-person learning. In many cases, the COVID-19 global pandemic had forced schools to close for more than one full year starting in March 2020, but also prompted action on the part of teachers to learn and use technology in entirely new ways. While the overall mean score in response to the prompt *"I feel more prepared as a classroom teacher to utilize technology once schools return to in-person learning"* was among the highest in the pre-survey (5.9 out of 7) and post-survey (6.4 out of 7), it was of further interest to analyze the data across the participant's years of teaching experience.

Notable in Figure 4 were two results that would be interesting to pursue in further data collection and analysis. First, teachers who have either less than three years', or more than 15 years' teaching experience, showed a lower feeling of preparation to utilize technology once schools return to in-person learning, both in the pre-survey (5.5 out of 7) and the post-survey (6.0 out of 7) results. With high results in both the pre-survey (6.3 out of 7) and post-survey (7.0 out of 7), mid-level experienced teachers (those with 6 to 15 years' experience) generally felt more prepared to use technology once schools returned to in-person learning.

Figure 4

Prepared to Use Technology When In-Person Learning Returns



Second, an interesting result was the shift in teacher's feelings of preparation in using technology when schools return to in-person learning, where the teachers who have between six and 15 years of classroom experience had a greater mean increase between the pre- and post-survey (6.3 to 7.0) than did the teachers with either less than three years of teaching experience, or more than 15 years of teaching experience (5.5 to 6.0). Finally, while it is not clear there is enough data for correlation, when the data set was analyzed by teacher subject area, the participants from the science department had a 6.3 to 6.8 increase in response to this prompt, while non-science department participants had a lower 5.3 to 6.0 increase in response.

In summary, this quantitative data analysis provides support for the idea that using collaborative communities of practice as a means for teachers to learn and use technology is a model of professional development that recognizes the unique ways that teachers learn and can be useful beyond the current COVID-19 pandemic. Overall, the participant's ratings of professional development, willingness to collaborate with colleagues, plus sample commentary related to the ability to learn and use technology, increased between the pre- and post-

intervention surveys. In the following section, the field notes taken during the study were analyzed to showcase qualitative outcomes from the data collected.

Analysis of Researcher Field Notes

The researcher field notes were recorded in a Google Drive file (Appendix H) at the conclusion of each of the collaborative technology sessions that took place, approximately every other week for the duration of the study. The notes recorded the researcher's observations of notable and unique conversations or events related to learning and using technology, feelings and opinions about professional development, plus teacher reaction and reflection on teaching with technology in a distance learning format forced upon them throughout the COVID-19 pandemic. In total, there were 12 field note entries, typically ranging in length from one or two paragraphs to a full page of text.

As the collaborative technology sessions continued, the entries were coded so that qualitative data could be analyzed relative to the action research question. I began to notice the following general themes, which emerged consistently through several of the community of practice sessions with the teachers: *mentor and mentee roles evolved organically; practice and implementation time was being spent beyond the collaborative technology sessions;* and *the communities of practice model of professional development provided a safe space for teachers to take risks and test their work.* Each of these three themes will be described further below and samples from the collaborative technology sessions will be provided.

Mentor and Mentee Roles Evolved Organically

One topic that had been of interest to me from early on in my research exploration was the role that mentors played in professional development for teachers, especially with the community of practice model. At various points in the process, I had considered identifying

participants as either a mentor or a mentee permanently, with the overall idea that there were some teachers who were more confident and competent at learning and using technology, while there were others who were not. Eventually, I abandoned that idea, and instead I decided to pay attention to how this evolved.

After the first collaborative technology session was held, my field notes identified two teachers in the group who I had suspected would naturally take on the role of a mentor. However, as the sessions continued and I documented my observations, those same two teachers were not always serving in the role of a mentor. In fact, they seemed to specifically seek out the opportunity to switch to the role of learner (mentee) in some sessions. Showcased in Table 1, this theme played out during the course of the technology sessions somewhat routinely and in each case it was an organic transition that emerged naturally from within the informal discussions of the group at the start of the sessions. After analyzing the coding used in my field notes to mark mentors and mentees during each session, I noticed that all but one of the participants flipped back and forth between these two roles.

Table 1

Collection of Key Themes from Researcher Field Notes

Theme	Example 1	Example 2	Example 3
1. *Mentor and mentee roles evolved organically*	Teacher 1, who had mastered Google Classroom and shared several tips with others throughout the sessions, suddenly took on the role of mentee when a question about Aeries integration & Google Classroom was asked. (Session 4)	I noticed quickly that several colleagues looked to Teacher 4 for help, although she specifically came to one session stating her inability to get Jamboard working in her class and Teacher 1 offered to help. (Session 3)	Teacher 3 spent most sessions as an "expert" working on his own tech or showing others how to use a tool, but in the last session he asked a colleague to teach him how to make a website. (Session 6)
2. *Practice and implementation time was being*	Teacher 6 came to CoP having just given her first Google Form test in a	After spending two sessions learning about the assessment tool	A small group helped Teacher 7 figure out best fonts to use to make his

spent beyond the collaborative technology sessions	class. She thanked others because she had learned how to do it in a previous session with the group. (Session 5)	Illuminate, Teacher 3 created a science unit test bank and administered it to his class. (Session 3)	PowerPoint slides more accessible to students with disabilities; he returned and shared that he had updated his whole curriculum. (Session 2)
3. *The communities of practice model of professional development provided a safe space for teachers to take risks and test their work*	A nervous Teacher 2 wanted to offer students the choice of building a website for a final project, but knew he needed to learn how the website-creation tool worked. He spent two entire sessions with colleagues asking questions, practicing his skills. (Sessions 1 & 2)	Prior to sharing a Parlay discussion with students, Teacher 4 tested it out with colleagues in the CoP group in order to practice and see how to introduce, monitor, and assess the lesson in class. (Session 4)	Teacher 5 had never used Peardeck but had heard it was more interactive than Google Slides, so asked if someone in the group would help him learn it because he said he felt comfortable with this tech group. Several jumped into a breakout room and collaborated with the teacher. (Session 5)

Practice and Implementation Time Spent Outside Collaborative Technology Sessions

Beyond my curiosity of how the role mentoring might play in the technology communities of practice in this research study, it was also of interest to me how teachers would utilize the overall professional development time. It would not have been a surprise to me, given how busy all teachers were working to manage their workload during Covid-19, if the participants showed up to the sessions to do some technology practice, but then spent no other time outside of the sessions learning or practicing new technologies. By coding the informal introductory discussions our group had at the start of each session, and tabulating responses from teacher's comments in the exit tickets, I was able to identify this second theme.

Namely, it became clear to me through several examples summarized in Table 1 that practice and implementation time was being spent beyond the collaborative technology sessions. As just one example where this was documented in my field notes, Teacher 3 spent time in each of the initial sessions learning how to use a new assessment tool called Illuminate. About halfway through the sessions, the teacher shared with the group that they had spent time outside

of the sessions, adding questions from the test bank in order to create one final unit exam for his class. Others noted examples where they had spent time building a class website, creating and administering a quiz using Google Forms, and modifying an entire year's worth of class slide materials just to update the fonts to be more accessible for students with disabilities.

Communities of Practice Provided a Safe Space for Teachers to Take Risks and Test Their Work

A final theme that emerged from the analysis of the researcher field notes was the communities of practice model of professional development provided a safe space for teachers to take risks and test their work. On eight different occasions in my field notes, a teacher arrived at one of the sessions with the specific goal of "testing out" some piece of technology curriculum they had developed and were getting ready to unveil in a student lesson. From asking colleagues to participate in a Parlay discussion that one teacher had developed, to taking an assessment in Illuminate to make sure all questions and answers were logical and correct, to filling out a Google Form with sample data so that a teacher could see how the resulting inputs were displayed in spreadsheet form, several teachers took the opportunity of these collaborative technology sessions to build confidence in their use of a technology tool or lesson.

Additionally, the ability to collaborate with a small group of like-minded colleagues provided a safe space to take risks, ask questions, and experiment with technology. Even for teachers with several years of experience and a high level of aptitude with technology, learning something new or using it for the first time can be a challenge. Teacher 5 specifically called out that learning to use Pear Deck, which is an interactive slide presentation tool, was something they had avoided until these sessions because they "didn't feel comfortable" asking for help in other professional development formats.

The examples drawn from my field notes demonstrate how the mentor and mentee roles evolved organically, that teachers were utilizing time outside of the collaborative technology sessions to practice or implement their technology lessons, and the communities of practice (CoP) model provide a safe space for teachers to take risks and test their work. In the next section, an analysis of the participant interviews will be provided.

Analysis of Participant Interviews

The participant interviews (Appendix D) were conducted during the final week of the action research study, once the collaborative technology sessions had ended. Seven study participants were invited to an individual online meeting to discuss the study and share thoughts and reflections on themselves as teacher learners, models of professional development for teachers, and their personal experience with technology before, during and after the global pandemic that shut down schools for over one year, starting in the spring of 2020. Each participant was interviewed for approximately 30 minutes during the teacher's prep period or just prior to, or at the end of, the school day. Participants had each signed a Confidentiality Agreement (Appendix A) prior to the start of this study and were reminded that the interview would be recorded and reviewed only by the researcher and not shared outside of the study.

During each semi-structured interview, six to 10 questions were asked in order to guide the discussion and solicit input related to the research. Questions focused primarily on participants' reflections of themselves as teacher learners, their perceptions and experiences with professional development, and their feelings about how their teaching practice had evolved during the global pandemic that pushed schools to a fully remote learning model in spring of 2020. In all cases, the overarching theme of technology was interspersed both in the questions and the interviewee's responses.

Among the interviewee's responses, three primary themes emerged: *relevance of subject matter makes learning worthwhile for teacher learners; presence of choice in content increases the appeal of professional development*; and *learning technology in collaborative small group settings appeals to teacher learners*.

Relevance of Subject Matter Makes Learning Worthwhile for Teacher Learners

To maximize teacher learning, the content and structure of professional development must be relevant for the individual. One high school participant shared an experience of being obligated to attend a start-of-the-year professional development workshop put on by the school district where the training targeted elementary school teachers and made no effort to address other grade levels. The district had designated only a handful of days each school year for training, yet this entire day of professional development was irrelevant to the teacher's needs. Similarly, several teachers reflected on their own learning journey and noted struggles where they had little or no interest in the subject matter and felt that it had no relevance to their own role as high school teachers. Table 2 lists examples of dialogue teachers mentioned in support of the need for relevance in teacher learning, especially related to technology.

Table 2

Sample Responses from Participant Interviews

Theme	Example 1	Example 2	Example 3	Example 4
1. *What's one example of professional development that you have found to be beneficial?*	What comes to mind is "one size fits none". They had a room full of high school teachers and they were teaching us an elementary school standard. There was nothing from that 3-hour session that I could take back and use in	Working on an actual project or learning something that is needed for my curriculum or classroom makes it worthwhile to me. Not something that I'm never going to use. (T4)	I went there thinking "I have a need to make virtual labs this year. This is a program that will fill my need, so I was invested in learning going into the professional development" (T5)	Honestly, I feel a lot of times like it's a waste of time. It's like what are they going to cover now that I already know how to do, or how many lectures or sessions am I going to have to sit through that have nothing to do with

		my classroom. (T7)			what I'm interested in. I want it to be relevant to me. (T1)
2.	*What comes to mind when I say the phrase "professional development"?*	It was my choice to go to AP training at Stanford, so that was good. A lot of that was me being able to choose the subject and it was a topic I was interested in learning.(T1)	When I had a choice of which session to attend, and they had a beginner and advanced level available for me to select, I could pick the one that suited me best. (T3)	When I was trying to get my units to move up the pay scale, I got to choose my classes and those seemed to be the best places for me to learn, maybe because it was my choice and I wasn't being told what to learn. (T4)	These tech sessions….we were allowed to choose what we wanted to work on each time and so I got more out of it because it was something I wanted to work on, something I wanted to learn, and got a chance to practice it.(T5)
3.	*As a teacher, what are the environments where you feel that you learn best?*	It was teachers that I collaborated with that started to light the spark that gave me the motivation to learn how to use technology to survive during the pandemic. It was human beings that helped make the technology work. (T2)	Our small groups worked for me. I was usually on the receiving end, because people would show how they used a technology, I could ask questions or get time to practice with another person. Having a person who could hold my hand, especially around technology, is so valuable. (T6)	I really, really liked how the style of this professional development was small groups. Especially for technology, where I could work with someone else to figure something out, or practice with someone. I felt obligated to attend and didn't want to let anyone down. (T7)	I wasn't doing it on my own. I actually had a partner with me to learn it and to test it out, so it made that whole process more enjoyable and I was able to learn it a whole lot faster. Then, I also found a group online where I could ask questions and get help. (T3)

Alternatively, responses from Teacher 1 and Teacher 5 demonstrated specific examples where relevance of subject matter being provided in a prior professional development experience had been beneficial. Teacher 1 provided a description of an opportunity they were given to attend training sessions that would qualify them to teach an Advanced Placement (AP) course. Additionally, Teacher 5 shared the experience of attending a workshop about a technology tool that would allow them to conduct science labs virtually, which related directly to a curricular need they knew existed during the global pandemic. These training examples took place over multiple days and included a group of like-minded educators who shared a common goal. Again,

these teachers knew throughout the process that the learning was relevant to a course being taught during the next school year. In both cases, the teacher learner knew throughout the professional development experience that the skills being acquired could be applied immediately to practice. Both experiences exemplify the importance of relevance in subject matter in making learning worthwhile for teacher learners.

Presence of Choice in Content Increases the Appeal of Professional Development

Another element of professional development noted consistently throughout the participant interviews was the concept of choice. As noted in Table 2, nearly all responses related to the questions about positive experiences with professional development included the idea that the teacher learner was interested, and felt that meaning and value was derived, when the individual was given the opportunity to choose the area of focus for the learning. While some teachers appreciated the examples where the school district and/or site provided a "buffet menu" style of professional development choices, the more desired model allowed for even more independent self-directed learning. Overwhelmingly, the responses from interviewees to a question such as "what words or thoughts immediately come to mind when you hear the term professional development?" were negative. Responses such as "useless," "waste of time," and "boring" were shared in almost every case.

As I analyzed the interview responses, I noticed that the concept of choice was described repeatedly as one of the primary appeals of the collaborative technology sessions we conducted during this study. The teacher learners found value in the structure of the community of practice model, where participants would arrive at each session with a particular area of focus for their technology learning on that day. In some cases, an individual would continue to focus on learning that was being carried over from previous sessions, while in other cases there was an

immediate technology issue or goal the teacher learner wanted to explore. The format of the community of practice allowed for teacher learners to choose how their time was spent, which is something they derived value from in these sessions.

For example, one teacher noted that they had primarily used the technology sessions to focus on a new assessment tool they had wanted to use in their classroom, often asking other participants to "test out" their work in progress. The feedback and input allowed them to gain confidence as they administered the assessment in classes. However, they also noted during the participant interview that a highlight from the sessions for them had actually been the experience of choosing to join another teacher's group to take on the role of student, allowing the colleague to demonstrate a new technology tool. Again, the option to choose an area of focus allowed for multiple types of learning experiences for this teacher. Table 2 shows several additional examples where teachers included language related to choice in speaking about the benefits of the community of practice technology sessions included in this study.

Learning Technology in Collaborative Small Group Settings Appeals to Teacher Learners

More than one of the interviewees described an experience at previous professional development sessions where they sat as an individual teacher in the audience among a room of other teachers, most of whom they did not know at all, shared very little in common with, or knew they would not have an ongoing relationship with beyond the professional development experience. Alternatively, my analysis of the interviews from our community of practice found the nature of the technology sessions held during this study being commended for their collaborative nature. Teacher learners were working alongside like-minded colleagues from the same staff, which created an environment that was familiar to the participants.

Responses from Teachers 6 and 7 provide specific examples of how collaboration made a positive impact for participants in the collaborative technology sessions. In one response, Teacher 6 described how they wanted to join a breakout session focusing on Google Forms, not only because they were interested to work on an upcoming classroom assignment they were creating, but because a colleague for whom they had respect was also going to be in the breakout room. “She is pretty advanced at Google Forms, so I knew she would not only be able to help me with my project but would also do it with kindness and a helpful hand.” In another interview response, Teacher 7 shared that the motivation to attend the community of practice sessions was primarily driven by the desire to learn together with like-minded employees they enjoy being around and even the idea that the sessions were collaborative provided incentive to attend in order to “avoid letting anyone down." So, while a portion of each technology session was dedicated to a short, quick technology tip provided by me for the participants, the most valuable learning opportunities clearly came from the collaborative time spent working together to learn and expand knowledge about technology. For new and experienced teachers, collaboration was a valued part of this professional development experience.

It is also important to consider how the collaborative nature of these communities of practice were received by the participants during this specific school year of remote learning. Part of the initial reason for conducting this study was to look at how teachers had experienced the global pandemic that shut down schools in the spring of 2020. How well prepared they were from a technology standpoint when the coronavirus quickly spread among communities throughout the world is one of the questions I had when I began the study. Had their practice been one that took advantage of the power and flexibility of technology in their classrooms prior to the shutdown, or had they continued to put off updates and new methods of teaching and

learning with technology in exchange for repeating the same lessons year after year? Within this particular study pool, the average rating in response to questions related to comfort with learning and using technology prior to the pandemic was relatively high. But during the interviews, respondents mostly mentioned that they had learned how to use technology previously in isolation, or on their own. They had not been provided with professional development structured in a collaborative setting with like-minded teacher learners, which for several became one very positive takeaway from this research study.

Additionally, two interviewees talked about an additional form of collaboration that had become part of their learning as teachers during the pandemic: online groups. Teacher 6 specifically stated, "I don't know how I would have made it through this year without that Facebook group. Those people were all so willing to help each other out." This is an important takeaway for teachers who at times feel isolated in their own classroom, stuck at their own school, and handcuffed by their own district's approach to professional development. Teacher 2 spoke during the interview of a collection of like-minded professionals who had started an online forum group where they posted ideas for new lessons and technologies that could be used during remote learning. Both of these examples reinforced the related research reviewed for this study, which suggested that beyond formal learning, teacher learners also benefit greatly from the informal learning opportunities that are available through online and digital teacher groups.

Summary

The purpose of this study was to examine the benefits structured professional development workshops and communities of practice could have on the increased and effective use of technology in secondary schools by interested staff. An action research study consisted of six collaborative, technology-focused professional development sessions, held every other week

over a 12-school week period of time. Three different data gathering strategies were utilized to assess the effect of the professional development sessions on the participants' ability to learn and use technology in their outlook on their approach to learning. Quantitative data was collected by means of the pre-post technology use survey, and qualitative data were collected both through the researcher's field notes and the participant interviews. Prior to the first session, the initial technology use survey was administered in order to gain baseline data for the study. Throughout the 12 weeks, researcher field notes captured the teachers' feedback during the collaborative technology sessions, and participant interviews allowed for reflection and thoughts to be shared about learning and using technology in a community of practice format.

When synthesizing the data provided by the participant interviews, three major themes emerged: relevance of subject matter makes learning worthwhile for teacher learners, presence of choice in content increases the appeal of professional development, and opportunity for learning in collaborative small group settings appeals to teacher learners.

In the next chapter, the results of the study will be discussed further and compared in more detail to the studies previously discussed in the literature review. The implications and outcomes of this action research study will be explored. Chapter V will conclude with an overview of the plans I have for further research as a secondary school administrator as a result of conducting this project.

Chapter V

Conclusions and Next Steps

Like millions of people who recall their exact location when they learned President Kennedy had been shot, or when Apollo 13 landed on the moon, most of us who work in education will remember for the rest of our lives exactly where we were on March 13, 2020 when we learned of an impending announcement. With no possible way to comprehend the overwhelming gravity of what was to come, the superintendent of our school district, like many other school leaders across the country and rest of the world, sent word out that schools in the district would be closed for two weeks due to a global pandemic simply referred to as “coronavirus." While the health and safety of everyone was paramount, and the initial reaction of many was simply a bit of joy that spring break would be extended by two additional weeks, the months to come would bring to the forefront the importance of technology in reaching and teaching our children. Suddenly, the simple act of students and teachers learning and thriving together in a classroom was forbidden. There would be no way for a high school English class to hold a Socratic seminar, a science class to conduct a squid dissection, or a drama class to perform the spring play in front of friends and family. Schools, like so many other parts of routine life around the globe, had been shut down and education came to a standstill.

As the renowned educational theorist John Dewey explained, the importance of interpersonal exchanges in the educational process is critical. According to Dewey, learning happens through social interaction and the teacher is part of the social group developed within a classroom (Dewey, 1938). In other words, the teacher should intentionally set up the learning environment for social learning to occur and interpersonal connection accentuates opportunities for students to reach their potential. But how to do that in the era of a global pandemic and with a

model of distance learning that was anything but social? While there will likely be countless research studies done in the years to come on various effects the COVID-19 global pandemic had on students, teachers, and schools, my background in the technology private sector and in my current role as a public high school administrator provided the spark that initiated this action research around technology and professional development. Never had the need to provide meaningful and impactful professional development to teachers at all levels been more urgent than during the pandemic that closed schools around the world during 2020.

This action research project sought specifically to identify a form of professional development that could be consistently used by teachers to learn and use technology in their classrooms more confidently and comfortably. Traditional "one and done" professional development sessions aimed at checking the box of some mandated or required educational technology requirements by district and/or state entities, from my personal observation, had not adequately prepared today's classroom teachers for the rigorous and complex challenges thrust upon them in the environment of a 21st century classroom full of digital-native students. Further, the rapid change, high costs, and slow adoption of technology solutions in the school environment has been frustrating to many educators. According to one study, school administrators often make quick decisions about professional development that impacts teachers, without giving them the proper support needed to quell the short- and long-term challenges of learning to use a new technology while teaching (Kopcha, 2012).

Quite simply, in many well-established models for teacher learning, these classroom professionals are not getting what they want or need from professional development, but rather what administrators think they should have (Gotanda, 2014). In the spring of 2020, with schools

and teachers scrambling to provide curricula to students through digital means, traditional professional development was not going to yield much success.

It was against this backdrop in the early summer of 2020 that I began to consider my action research project as one way to learn more about the role technology and professional development had played in the teaching profession. During the in-session phase of this research study participants went through six collaborative technology communities of practice sessions scheduled every other week. Each session lasted for approximately 60 - 75 minutes, during which time participants engaged in a short question-answer time at the outset of each session, followed by the bulk of each session dedicated to the teacher learners choosing a technology or technology project they wanted to work on, with self-selected groups. At the end of each collaborative technology session, participants completed an exit ticket, responding to prompts provided by the researcher. These were used to solicit input about the professional development they were participating in, and specifically how participants felt about learning new technology in the community of practice format over a period of time in conjunction with their colleagues. Eventually, this study aimed to answer the question: *how does participation in a teacher-focused community of practice impact teachers' integration of technology in their teaching practice?*

Chapter IV presented the findings of this action research study from the triangulation of data collected during the collaborative technology sessions. Overall, these data showed themes that supported communities of practice as a positive form of professional development for teachers. Collectively, the relevance of subject matter made learning worthwhile for teacher learners, the presence of choice in content increased the appeal of professional development for teacher learners, and the opportunity for learning and using technology in collaborative small group settings over time appealed greatly to most teachers. For this chapter, the organization will

include five sections organized as follows: summary of findings, interpretation of findings, limitations, summary, and plan for future action.

Summary of Findings

To gather relevant data for this study, a mixed-methods approach was used to carefully examine communities of practice as a method of professional development for classroom teachers to learn and use technology. A selection of three data collection instruments were used to collect and measure participants' awareness of their own style of learning as unique teacher learners, their perceptions and approaches to professional development related to technology, and how they perceived the role technology had played in their professional practice as classroom teachers before, during, and after the global pandemic.

The instruments included: a pre- and post-Technology Use Survey (Appendix E), a log of researcher field notes (Appendix H), and semi-structured participant interviews, conducted post-session with the researcher (Appendix D). Data were collected from the secondary school teaching staff who chose to participate (N = 7) at the comprehensive site where I work, and consent forms (Appendix A) were collected from each participant prior to the start of the study. Each of the seven teachers completed the pre- and post-survey, participated in the six collaborative technology sessions, and discussed their experiences with technology and professional development individually with the researcher during the semi-structured interview. The first of the data collection instruments was the Technology Use Survey, the results of which will be summarized here, followed by the researcher field notes and participant interviews.

Technology Use Survey

The pre- and post-Technology Use Survey provided support for the idea that using collaborative communities of practice as a means for teachers to learn and use technology was a

model of professional development that recognized the unique ways teachers learn and could be a useful professional development model to use beyond the COVID-19 pandemic. Overall, the participant's ratings of professional development, willingness to collaborate with colleagues, plus sample commentary related to the ability to learn and use technology, increased between the pre- and post-intervention surveys.

One notable outcome from the survey was that the level of confidence a teacher has when learning or mastering a new technology matters. The results to the prompt "My confidence in learning and using new technology as part of my curriculum is high" revealed that more than half of the participants increased in their confidence due specifically to the collaborative technology sessions in this study and none of the participants (N = 7) showed a decrease in confidence. Furthermore, direct feedback and input from the participants during the sessions and in the post-session interviews also revealed that the communities of practice format for professional development was preferred and over time would likely increase confidence. Teacher confidence, especially related to learning and using technology in the classroom, seemed to be an important factor in professional development.

A second notable outcome from the data collected through the pre- and post-survey was that teachers found that participating in technology-focused professional development with colleagues was appealing. The community of practice format allowed teachers to meet regularly as a group over a period of time, with teacher-choice embedded to allow participants the opportunity to learn and practice using new technology with others. When participants responded to the prompt *"Learning to use new technology as part of my professional practice is something that I often do alongside colleagues, and if needed, a mentor"* during pre- and post-survey, a majority (71.4%) noted an increase in their practice of learning and using technology alongside

colleagues in the post-survey response. In fact, the largest rating increase from two to five came from the participant (Teacher 7) who had the second lowest outlook about collaborative professional development at the outset of the study. The overall mean for the participants' responses to this area of focus also increased by 31%, from 3.6 to 4.7 on the Likert rating scale between the pre- and post-survey. While the sample size for the study was relatively small (N=7), there was an increased awareness on the part of the participants that professional development in a collaborative setting was beneficial.

A final outcome from the pre- and post-Technology Use Survey data that was noted during analysis was that teachers generally felt more prepared to learn and use technology in their professional practice post-COVID 19. Interestingly, the overall mean score in response to the prompt *"I feel more prepared as a classroom teacher to utilize technology once schools return to in-person learning"* was among the highest in the pre-survey (5.9 out of 7) and post-survey (6.4 out of 7). When the data were further disaggregated, several other key themes emerged. First, teachers who have either less than three years', or more than 15 years' teaching experience, showed a lower feeling of preparation to utilize technology once schools return to in-person learning, both in the pre-survey (5.5 out of 7) and the post-survey (6.0 out of 7) results. Mid-level experienced teachers, on the other hand, showed higher results in both the pre-survey (6.3 out of 7) and post-survey (7.0 out of 7), and generally felt more prepared to use technology once schools returned to in-person learning.

Second, the ratings of teachers in one department at our school showed higher results in both the pre-survey (6.3 out of 7) and post-survey (6.8 out of 7) than did teachers from all other departments (pre-survey 5.3 out of 7 and post-survey 6.0 out of 7). More research and study in

this area would help reveal if this were indicative of something more significant within this specific department at our school and/or with this model of professional development.

In summary, this quantitative data analysis of the pre- and post-technology use surveys provides support for the idea that using collaborative communities of practice as a means for teachers to learn and use technology is a model of professional development that recognizes the unique ways that teachers learn and can be useful beyond the current COVID-19 pandemic. Overall, the participant's ratings of professional development, willingness to collaborate with colleagues, plus sample commentary related to the ability to learn and use technology, increased between the pre- and post-intervention surveys.

Researcher Field Notes

Three primary themes emerged from the researcher field notes (Appendix H) collected during this action research project, which were: *mentor and mentee roles evolved organically, practice and implementation time was being spent beyond the collaborative technology sessions, and the communities of practice model of professional development provided a safe space for teachers to take risks and test their work.*

During the collaborative technology sessions, it was noted that mentor and mentee roles evolved organically from session to session. While I had initially expected there to be more permanent, albeit informal, roles participants would assume in the community of practice groups, this did not turn out to be the case. After analyzing the coding used in my field notes to mark mentors and mentees during each session, I noticed that all but one of the participants flipped back and forth between these two roles at some point in the sessions. In one example (Table 1), Teacher 3 spent most sessions as an "expert" working on their own tech or showing others how to use a tool, but in the last session they asked a colleague to explain how to make a website, as it

was a new area of interest for them. Moving back and forth between these two roles seemed natural and comfortable for the participants.

Several examples also became apparent during analysis of the data collected where time was being spent outside of the technology sessions by participants in order to practice or implement new skills. These were coded from observations made in the researcher field notes and gleaned from comments made during the introductory portion of each session and/or collected via the participant's responses in the exit tickets collected at the conclusion of each session. There were 13 instances in the field notes where I recorded a participant providing an example of work or time being spent outside of the community of practice (CoP) to develop a technology lesson started during one of our collaborative sessions. Examples included building test banks of questions in a new assessment tool, developing a class website, creating a class quiz using Google Forms, implementing a Parlay discussion lesson, and even one participant who modified an entire set of class slide decks to include more accessible fonts for students with disabilities. These instances demonstrated to me that teachers were finding benefit from the format of this professional development and were willing to dedicate additional time to continue their learning outside of the sessions.

The final theme that emerged from an analysis of researcher field notes was that the communities of practice model of professional development provided a safe space for teachers to take risks and test their work. Meeting regularly with a small group of like-minded colleagues to learn and experiment with technology was noted by the participants as a comfortable learning environment. One participant simply shared "These collaborative tech sessions were very helpful! Can we do something like this next year?" Marking instances where teachers made a request of the participant group to "test out" a piece of technology curricula that had been

developed, I noted eight different instances in my researcher's field notes. Several examples are noted in Table 1. One teacher asked colleagues to participate in a Parlay discussion prior to trying it in the classroom with students, while another asked the group to explain how to extract and review the responses collected from a Google Form in spreadsheet form. A third teacher specifically called out that learning to use Pear Deck, which is an interactive slide presentation tool, was something they had avoided until these sessions because they "didn't feel comfortable" asking for help in other professional development formats.

Semi-Structured Participant Interviews

At the conclusion of the sixth collaborative technology session, each of the participants took part in a post-session interview with the researcher (Appendix D). During these semi-structured interviews, participants were asked a series of questions about participating in a community of practice focused on learning and using technology, their own experiences with professional development, and reactions to their experience living and teaching through the global pandemic in the 2020 and 2021 school years. From the data collected, three central themes emerged. Namely, *relevance of subject matter makes learning worthwhile for teacher learners; presence of choice in content increases the appeal of professional development;* and *learning technology in collaborative small group settings appeals to teacher learners.*

The content and structure of professional development must be relevant for the individual in order to maximize teacher learning. When one participant was asked during the interview to share an honest opinion of traditional professional development offered by the district, it was noted "honestly, I feel a lot of times like it's a waste of time. It's like what are they going to cover now that I already know how to do, or how many lectures or sessions am I going to have to sit through that have nothing to do with what I'm interested in. I want it to be relevant to me".

This quote exemplified the reaction several participants had when asked to respond to the question *"what words come to mind, or please share some immediate reactions, when I say 'professional development'?"* It was clear, at least from the participants in this research study, that professional development had not primarily been seen as relevant to these teachers. Table 2 lists additional examples of dialogue teachers mentioned in support of the need for relevance in teacher learning, especially related to technology.

Another key theme identified in the participant interviews was the importance that choice in content played in an increased appeal of professional development for teacher learners in this study. Several responses to prompts that asked teachers to recall positive experiences with professional development alluded to the idea that the teacher learner was interested, and felt that meaning and value was derived, when given the opportunity to choose the area of focus for the learning. Since the structure of the community of practice model utilized in this study inherently allowed for choice, participants would arrive at each session with a particular area of focus they had selected for their technology learning on that day.

There were several examples where teachers included language related to choice when they spoke about the benefits of the community of practice technology sessions included in this study (Table 2). One participant specifically said, "these tech sessions…we were allowed to choose what we wanted to work on each time and so I got more out of it because it was something I wanted to work on, something I wanted to learn, and got a chance to practice it."

The final theme to emerge from the participant interviews related to how the opportunity for learning and using technology in collaborative small group settings over time appealed greatly to the teachers who participated in this study. According to the data tabulated during the interviews, each of the teachers with less than three years of teaching experience, as well as those

with more than 15 years of experience, mentioned collaboration as the most valued part of this professional development experience. It would be interesting in further studies to explore whether years of service has a correlation to collaboration when it comes to learning and using technology.

The collaborative nature of these communities of practice sessions had an additional benefit mentioned by six out of seven participants during the interviews. Each of these respondents mentioned that they had learned to use technology previously mostly in isolation, or only as dictated by someone else. Because part of the initial reason for conducting this study was to look at how teachers were experiencing the global pandemic that shut down schools in the spring of 2020, it was a shift in mindset for these teachers to recognize the value they derived from the collaborative format of the CoPs. In fact, responses during the interviews to questions related to learning and using technology pre- and post-pandemic in collaboration with others mirrored the increase in scores seen from the Technology Use Survey (from 3.6 to 4.7). It was an important takeaway for teachers who at times feel isolated in their own classroom, that collaboration with colleagues to learn and use technology was beneficial.

Interpretation of Findings

Based upon an overall review and analysis of both the quantitative and qualitative data gathered during this action research project, I was able to conclude that participation in a teacher-led community of practice had a positive impact on teachers' learning and integration of technology into their teaching practice. This collaborative format of professional development over time allowed teachers an opportunity to develop their professional practice in ways that were appealing and impactful to them. The interpretation of findings will be presented by themes, which summarize ways in which the literature review provided the foundation on which

the study was based and the results of the Technology Use Survey, field notes, and participant interviews supported the desired outcome.

Active Learning Enhances Professional Development

Renowned educational theorist John Dewey was clear in his conviction when he wrote "education is not an affair of 'telling' and being told, but an active and constructive process" (Dewey, 1937). Unlike traditional professional development in the education field, where teacher training is often school or district-directed in single setting experiences with learning expected to be delivered to teachers from external experts, communities of practice showcase teachers' ability to participate actively in their own learning.

In fact, the results of this action research study found over 70% of the participants noting an increase in their practice of learning and using technology alongside colleagues in the post-Technology Use Survey response when prompted *"Learning to use new technology as part of my professional practice is something that I often do alongside colleagues, and if needed, a mentor."* Also, the data gathered from field notes and participant interviews demonstrated that participating in technology-focused professional development as active participants, alongside colleagues, was appealing to these teachers. They were cognizant of themselves as active participants in learning and developing their own technology-related projects. Furthermore, the community of practice format allowed teachers to meet regularly as a group over a period of time, with teacher-choice embedded. Several examples of active participation were analyzed during the study, with one example being the teacher who had directly asked if anyone in the group would help with Peardeck because the teacher felt comfortable with this tech group and needed to learn and play around with the tool in order to really understand it. Several jumped into a breakout room and collaborated with the teacher.

These findings connected to the reviewed research, which reported that opportunities that provide optimal effect for teachers to learn include both formal and informal learning, across time and often in collaboration with colleagues, in accordance with other learning activities (Garet et al., 2001). Formal learning, in the context of the reviewed research, most often refers to site or district-initiated professional development programs or systems, whereas informal learning is teacher-initiated and often teacher-led, alongside colleagues and other teaching professionals. The final component, independent learning, is recognized to be beneficial and is defined by learning activities teachers engage in on their own initiative and accord, an equally important factor in teacher learning. In other words, when and where teachers are actively engaged in the learning process, when their learning is coordinated across a multitude of developmental opportunities and models, there is maximum opportunity for teachers as learners to benefit (Petrie & McGee, 2012). This multi-component approach to professional development promotes active involvement by teachers and is especially useful when learning is related to new technology.

Teachers in this study recognized the difference between the communities of practice (CoP) model of professional development they participated in when compared to their traditional experiences. One teacher described the experience of typical district-led professional development as “one size fits none” and stated in response to one interview question “there was nothing from that 3-hour session that I could take back and use in my classroom." In contrast, as active participants in the collaborative technology session format that guided this study, each teacher was involved personally and directly with their own learning and could customize it specifically to the needs of their classroom.

Additionally, the mean score resulting from the prompt “There is a clear benefit to my teaching practice when I attend one-day professional development sessions or workshops” in the Technology Use Survey was among the lowest on the 7-point Likert scale at just 3.0. In the communities of practice model used in this study, active learning enhanced teacher learning, especially when compared to teacher perceptions of previous experiences with standard professional development. The community of practice model of professional development for teachers to learn and use technology was effective and aligns with Dewey’s premise around active learning.

Practice and Repetition Benefit Teachers’ Ability to Learn Technology

Beyond the finding that active learning enhances professional development, it was a notable outcome from this study that practice and repetition benefited participants’ ability to learn and use technology. Unlike single session “one and done” professional development formats, which might work for rollout of new set of curriculum standards, or a district’s updated policy, learning and effectively using a new technology requires practice and repetition. To learn effectively, teachers require time during professional development to learn and practice through trial and error, initially to discover how the new technology functions, then possibly discussing or testing it out in collaboration with others, then developing or integrating the technology into curricular materials. Going from never using a new technology, to trying it once, to making tweaks/adjustments for improvement, then adopting/using it more often as an integrated part of the professional practice is time consuming. Building confidence and becoming comfortable with new technology is not a quick and easy thing to do in general, and for teachers it’s no different.

The findings in this action research study found several examples that benefited the teachers’ ability to learn and use technology through practice and repetition. Teacher 3 spent

time in each of the initial sessions learning how to use a new assessment tool called Illuminate. About halfway through the sessions, it was shared with the group that this teacher had spent time outside of the sessions, added questions from the test bank in order to create one final unit exam for his class, then asked the group to help test it out for him. Others noted examples where they had gone from never using the technology required to build a class website to asking a colleague to review and make suggested edits, then eventually teaching another participant how to use the website creation technology. In a final example, one teacher used an early collaborative technology session to learn how to create a Google Form quiz for her class, then returned at a subsequent session to ask for help updating the settings because she had forgotten to ask students to enter their names and didn't know how to automatically collect their email addresses. A quick chance to check in with the community of practice gave her a quick chance to practice creating a new Google Form quiz and perfect her knowledge through repetition.

Communities of practice are defined as "groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly." (Wenger-Trayner, 2015, p.1) The data from this research study demonstrated that practice and repetition benefited teachers' ability to learn and use technology, which aligns with Wenger-Trayner's research and findings. Through this research study's technology-focused community of practice sessions, teachers were able to come together at regular intervals over a twelve-week period, to learn, collaborate, and practice as a collegial community focused on the common goal of improving their knowledge and use of technology. The data also revealed, as evidenced by a 5.9 to 6.4 rating increase between pre- and post-survey data, that the participants in this study felt better prepared as classroom teachers to utilize technology once schools returned to in-person learning. The community of practice method of professional development, especially in the

context of technology learning, provided opportunities for practice and repetition that were beneficial.

Format of Professional Development Should Match How Teachers Learn Best

Freire emphasized the importance of learners not being put in the position of receiving information solely from others. He shared that "leaders who do not act dialogically, but insist on imposing their decisions, do not organize the people–they manipulate them. They do not liberate, nor are they liberated: they oppress" (Freire, 1970, p. 127). By encouraging educators to engage in an active and ongoing process of reflection and action, Freire's theory of critical pedagogy is a form of education that places the teacher learner in the role of active participant, rather than being a passive recipient of knowledge.

The review of research had indicated clearly that professional development formats that accentuated the teacher learner's roles in an active manner yielded positive outcomes. Garet (2001) emphasized that beyond simply learning new content or a new skill, teachers must also understand the pedagogy of the new learning and place it into the context of their classroom curricula. Therefore, opportunities that provide optimal opportunities for teachers to actively learn include both formal and informal learning environments, across time and often in collaboration with colleagues, in accordance with other learning activities. Research on teachers learning that comes only by means of professional development dictated or directed by the site or school district is discredited as insufficient in maximizing teacher learning (Jones & Dexter, 2014). The participants in this research study concurred and voiced general displeasure and a negative outlook on traditional professional development that placed them in the role of passive recipients of knowledge.

Specifically, when it came to learning and using technology, this action research intended to match the best practices of professional development formats revealed during the review of research on teacher learners. Several studies reviewed highlighted a more holistic approach to professional development, where several varieties of teacher learning are all coordinated with and among teachers and leaders at the school and supported by technology (Garet et al., 2001; Jones & Dexter, 2014; Kempkey, 2016; Kopcha, 2010; Lawless & Pellegrino, 2007; Li et al., 2019; MacDonald & Weller, 2017; Martinovic et al., 2019). The learning can be structured as communities of practice (CoPs) to include several opportunities for teachers to learn in a format that maximizes teacher learning and interaction. The data from this research study accentuated this point when one participant stated "It was teachers that I collaborated with that started to light the spark that gave me the motivation to learn how to use technology to survive during the pandemic. It was human beings that helped make the technology work." Just as Freire encouraged educators to engage in an active and ongoing process of reflection and action, professional development formats that place the teacher in the role of active participant seem to yield optimal results.

Education Has Changed Because of COVID-19

Various efforts to infuse new technologies into the classroom since late in the 20th century have been met with mixed results (Durff & Carter, 2019). With the pace of change in technological solutions, the high costs associated with hardware and software in schools, and the complexity associated with training on tools that can be effectively weaved into a teacher's curriculum, technology and education have had a bumpy relationship to date. The purpose of this study was to examine the impact teacher-led communities of practice had on the increased and effective use of technology in a secondary school staff.

An unintended coincidence of this action research was the timing of the study itself. The school where I work closed its doors on March 13, 2020, due to the COVID-19 virus, for what at the time was imagined to be a two-week closure. It would be nearly 18 months before the full population of our student body would be invited to return for in-person learning. The early research from this time points to these rapid and unprecedented school closures being followed by relatively successful conversions of face-to-face instruction to online learning within a matter of months. Suddenly, where previous efforts to migrate educational systems and teacher curriculum to more digital platforms had failed, the adoption of technology was the default method of delivering instruction for teachers across the globe. There was no choice but to rely on technology to reach and teach our students.

And teachers did it! In my research study, participants joined each Zoom session without hesitation, and spent time working on everything from Flipgrid, Weebly, Illuminate, Peardeck, Parlay, and Gizmos, to nearly all of the products in the Google Suite. The teacher learners were thrust into an unprecedented situation but found value in the community of practice format of the action research project, which allowed them an opportunity to grow and develop as professionals. Interestingly, this fits within research that suggests schools and teachers are in the midst of a three-stage learning model from which educators can adapt to online learning through phases of disruption, transition, and finally reimagining (McQuirter, 2020).

In this model, disruption identifies the initial shift to remote learning where learning is unsettled and inconsistent, plus where "strong support from schools for the development of technical skills, coupled with collegial sharing and building on current practices, leads to a sense of agency among instructors and a greater willingness to embrace change" (McQuirter, 2020, p. 49). The transition phase marks the reopening of schools, where a more cohesive management of

the structures and processes around what is needed for effective learning and use of technology is outlined. Finally, in the reimagining phase, the model creates a learning environment which is agile and innovative. While the education system is only just beginning to emerge from the disruption phase, according to the researchers, I found in my study that participants were eager to evolve not only during the pandemic, but also as they imagined themselves returning to the classroom for in-person instruction.

The interpretation of findings showcased several valuable learnings that benefited me as an educational leader. The first takeaway was that active learning enhances professional development. Second, practice and repetition benefit teachers' ability to learn technology. Third, it is important to match the format of professional development to the teacher learners. Finally, education has changed because of COVID-19. While there were many aspects from this action research study that were rewarding, these themes stood out.

Reflection on Limitations

The action research study was conducted over a 12-week period, which is one of the constraints of the project, creating a limitation of time on the data and findings. A study that captured longitudinal data from a community of practice of teachers learning and using technology in their classroom across multiple school years would be beneficial in tracking the individual teacher learners' interests and abilities in a more conclusive way. Additionally, the relatively small sample size of seven active participants in the study was also a limitation. As a direct result of this small sample size, the results cannot be assumed for all teacher populations, or for teachers in different school environments.

Further, my role within the action research study was that of both vice principal and researcher, which could have affected teacher's responses during the collaborative technology

sessions or in the data collection process. While I presented information throughout the study to emphasize my role as researcher, the fact that I serve in the role of school administrator at the site where all of the participants work could have had an impact on the responses to the surveys, interviews, and even their participation overall. It is also possible that my pre-existing relationship with the participants and the fact that we work well together as professional colleagues could lead to the generally positive reactions each of them had to the collaborative technology sessions. In other words, an outsider conducting similar communities of practice technology sessions, or having a set of participants who were not as comfortable with each other as this group, could yield a different set of results.

Finally, as noted throughout the document, this action research study was conducted in a fully remote learning environment, which led to a unique set of potential limitations. The participants joined a video conference for each of the sessions and while technical difficulties and connection issues were not frequent disruptions, they did occur for both the researcher and for the participants. This may have affected the teacher's level of engagement with the sessions. Additionally, having to rely on the teacher learners joining an online video conference also meant that they could be distracted before, during, or after the sessions. This could result in findings that are incomparable to a series of collaborative technology sessions conducted in person and would be a key differentiating factor for continued study. Equally important was the core limitation of participants missing out on the human interaction and nuance of face-to-face learning.

Plan for Further Action

Like most professionals in the field of education, I have been required to attend any number of professional development sessions. Typically, these were half-, or full-day events held

at my school or another school in the district, and included content or topics selected by someone else and were often delivered by an outside expert in a lecture or trainer-directed format. Results from the participant interviews during this action research project demonstrated that the teacher participants overall had similar perceptions of professional development and found most required sessions to be passive, boring, and irrelevant to their job. Meanwhile, the desire and requirement of employers and business owners to have young workers who enter the workforce with technical skills that match the needs of the current industry is of critical importance. Several studies have noted that students are ill-prepared to begin work with the skills required for success (Wolcott et al., 2010). It was clear to me, from the outset of this study, that in order to effectively reach and teach digital native students, our teachers need to be exposed to professional development methods that allow them effective ways to learn and use technology more seamlessly in their classroom. The COVID-19 global pandemic only heightened my desire to look in more detail at this complex challenge.

The results of the technology-focused communities of practice model utilized in this study were positive and have given me reason to continue exploring this concept further. Initially and most directly, I plan to continue to offer what came to be called “Bronco Tech Sessions” at the high school where I serve as vice principal during the next school year. Ideally, there would be increased and additional interest from the teaching staff in order to scale the initiative, not only due to the positive feedback from the initial participants, but also from an opportunity to participate in the CoPs in person rather than over video conference. Additionally, as a site administrator and district leader who is capable and interested in sharing my enthusiasm for learning and using technology for educational purposes, I will look for opportunities to bring the model to larger audiences of teachers by continuing to share the model with co-administrators,

district technology experts, and the educational services resources who oversee professional development for the more than 50 schools in our district.

The communities of practice were successful because of several elements consistent with theories about learning in general. In Freire's theory of critical pedagogy, education that places the learner in the role of active participant, rather than being a passive recipient of knowledge is paramount. The Bronco Tech Session focused on a model of learning and using technology that required the teachers to actively participate during each session. The relatively small size of the group (N=7) also allowed for each participant to take an active role in their own learning. Beyond active participation, the CoP model of professional development also provided the teachers with the benefit of choice throughout the sessions. At each gathering, the initial discussion that led into the central focus of our time together was focused on asking each participant to share out what they planned to work on for that day. Feedback collected in the research field notes made it clear that teachers arrived at the session with a technology project in mind, or genuinely showed interest in joining a subset of participants who were going to be working on a technology of interest. Furthermore, the CoP as a professional development model for learning and using technology specifically greatly benefitted from collaboration between and among participants. No matter the skill level (which would sometimes change from one session to the next in both directions), participants mentioned in their interview responses that they appreciated and valued the collaborative nature of these sessions. The CoP format provided a "safe space" for teachers to learn and test out their knowledge with others.

Finally, the study revealed the nature of the CoP professional development model was aligned well to the related research, which emphasizes the importance of learning environments where subject matter learned is applicable in the classroom. In so much as teacher learners are

unique in that they not only have to learn the subject matter or new material, but also must consider the pedagogy of the new technology learned, the community of practice format supports their learning.

While results from the data collected in the study indicated several areas of success, my plans for future research would focus on a revised set of questions in the pre- and post-Technology Use Survey that more directly measured the outcomes of the communities of practice. The nature of the questions designed did not adequately showcase the impact derived from the sessions, which required me to rely more heavily on the qualitative data gathered through the field notes and semi-structured interviews. During this action research study, I was also not fully able to assess the degree to which the participants fully understood the aspects of the community of practice format designed for them. I would be interested to invest more time in learning the value teachers place on knowing that communities of practice are purposeful in being scheduled over a period of time, completed in collaboration with others, and support an emphasis on teacher choice. In further research, I would also be interested to determine how this approach to learning and using technology would be received by non-high school level teachers, teachers of various subject areas, or at sites who have very well-defined goals centered around technology or specific technology tools.

All of this finally provides a space within the educational landscape where my decade of experience as a product executive in the technology sector managing teams and projects could benefit others in public education. The K-12 education market seems primed with an opportunity for change when it comes to technology use in the classroom, especially coming out of the COVID-19 global pandemic. Finally, it would seem to me, the accelerated learning and experiences teachers gained during the school closures can be applied to an in-person return to

school that effectively integrates technology into the curriculum for the benefit of student learning. Educational technology is not just a set of fancy tools but should be interwoven into the fabric of every classroom to allow students to construct meaning. It should not only be used as a primary teaching tool, but also used to supplement and enrich the curriculum. My personal role as an educational leader will be to foster and support teacher's professional development in these areas.

Summary

When I began teaching middle school during the 1990s, educational technology was just beginning to appear in schools and classrooms. Adoption and integration in the curriculum was not widespread or consistent, a trend which has continued even into the 21st century as the complexities of both the school environment and the rapidly evolving set of technologies available aren't always well aligned. But just as I witnessed one of the D/F students in my middle school history class come alive each time we visited the school's new computer lab and excel at digital lessons, or even become the "expert" other students look to for answers when we used the popular game "Where In The World Is Carmen Sandiego" to learn about geography, I knew technology had the potential to change education. However, countless professional development experiences I attended had been ineffective and the number of misdirected technology tools and solutions thrown at the education system had made many teachers turn a blind eye toward genuinely weaving technology into the classroom. It was my overarching belief in technology as a means to enhance the curricula and make connection with digital native students that ultimately inspired my desire to conduct a systematic, research-based investigation into ways that I might help teachers uncover and use a model of professional development that would allow them to learn and use technology more confidently in their classrooms.

Research had shown that communities of practice as a method of professional development provided optimal effect for teachers to learn in both formal and informal settings, across time and often in collaboration with colleagues, in accordance with other learning activities (Garet et al., 2001). Further, research importantly noted that the way teachers learn was unique from other adult learners (Garet et al., 2001; MacDonald & Weller, 2017; Wenger-Trayner, 2015). This research pointed to a duality of the teacher learner, where the individual must not only learn the new content or material for themselves but also develop an understanding of the pedagogy that supports the new learning. Through this action research study, I was particularly interested in bringing a model of effective professional development into my school as an immediate solution to help during the global pandemic that caused school closures in 2020 and 2021, but also could ignite a love of learning and using technology in teacher's professional practice for years to come.

The theoretical rationale for my research study was grounded by John Dewey's theory of learning through experience (1929) and Paulo Freire's theory of critical pedagogy (1972) with a goal to provide a teacher-focused community of practice over time that would positively impact teachers' integration of technology in their teaching practice. Both theorists emphasize an active and participatory approach to learning. After reviewing the related literature, I hoped the collaborative technology sessions developed for this study would determine if teachers who engaged in their own adoption and use of technology would feel more confident and comfortable to meet the needs of digital native students in their 21st century classrooms.

This action research study was carried out over a twelve-week period of time in the spring of 2021. Participants were involved in six collaborative technology sessions of approximately 60-75 minutes each to learn and practice use of technology tools for use in their

classrooms. During the study, teacher learners were provided with full choice for how they used the time, either working independently or in collaboration with colleagues, continuing development of curriculum using a tool they were already familiar with, or engaging in learning a completely new technology tool. An organic outcome of the collective sessions was the natural shift that nearly all participants made from one session to the next, at times serving as an expert or mentor, while at other times making a request of the group to learn something entirely new. The collaborative technology sessions provided participants with meaningful experiences with a group of colleagues for whom they had respect and allowed for them to take risks and learn in a low-key and positive learning environment.

From a thoughtful review of the data and analysis of the triangulation of sources used in the study, I concluded from the Technology Use Survey that teacher learner participants in this study did benefit from the communities of practice sessions. They were active participants in their own learning, had choice in directing their own learning, and collaborated with colleagues in a safe learning space that built their confidence with technology. Looking for opportunities to scale this model of professional development at my school and within my district will be a focus going forward.

From the researcher field notes, the major themes that emerged were that mentor and mentee roles evolved organically during the CoPs, practice and implementation time was being spent outside each technology session, and the communities of practice model of professional development provided a safe space for teachers to take risks and test their work. Finally, the individual interviews with participants revealed that relevance of subject matter, choice in professional development, and a structure of professional development that is collaborative in nature is beneficial.

The action research question for this study was, *how does participation in a teacher-led community of practice impact a teacher's integration of technology in their teaching practice?* producing positive results. Findings in this study substantiated previous research that educators need ample time to integrate and infuse technology into their pedagogy and collaborate with other teachers in a process of continual learning (Kopcha, 2010). These best practices are of vital importance to the evolution of technology and its use in learning environments. While some teachers have embraced and adopted ways to integrate the use of technology in their teaching, communities of practice as a model for professional development provides the time and space for teachers to develop additional technical and instructional skills. Teachers who are given the opportunity to engage with communities of practice will be the teachers best able to reach and teach the digital natives who attend our schools.

References

Borup, J., Graham, C. R., West, R. E., Archambault, L., & Spring, K. J. (2020). Academic communities of engagement: an expansive lens for examining support structures in blended and online learning. *Educational Technology Research & Development, 68(2), 807.*

California Department of Education. (n.d.). *Student Accountability Report Card.* California Department of Education. Retrieved March 24, 2021, from https://www.cde.ca.gov/ta/ac/sa/

Centers for Disease Control and Prevention. (n.d.). *Coronavirus Disease 2019 (COVID-19).*Retrieved July 3, 2021, from https://www.cdc.gov/

Cuban, L. Kirkpatrick, H., & Peck, C. (2001). High access and low use of technology in high school classrooms: Explaining an apparent paradox. *American Educational Research Journal, 38(4), 813–834.*

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

Dewey, J. (1899). *The school and society: Being three lectures.* University of Chicago Press.

Dewey, J. (1916). *Democracy and education: An introduction to the philosophy of education.* New York: Macmillan.

Dewey, J. (1929). *The quest for certainty: A study of the relation of knowledge and action.* New York: Minton, Balch.

Dewey, J (1937). *Education and social change.* Bulletin of the American Association of University Professors, 23(6), 472-474

Dewey, J. (1938). *Experience and education.* New York, NY: Collier Books.

Durff, Lisa & Carter, Maryfriend. (2019). Overcoming second-order barriers to technology integration in K-5 schools. *Journal of Educational Research and Practice. 9. 246-260. 10.5590/JERAP.2019.09.1.18.*

Farnsworth, V., Kleanthous, I., & Wenger-Trayner, E. (2016). Communities of practice as a social theory of learning: a conversation with Etienne Wenger. *British Journal of Educational Studies, 2, 139.*

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. *Association for the Advancement of Computing in Education (AACE).*

Friere, P. (1970). *Pedagogy of the oppressed.* 30th anniversary ed. New York: Continuum.

Fullan, M., Quinn, J., Drummy, M., Gardner, M. (2020), "Education reimagined; the future of learning". *New Pedagogies for Deep Learning.*

Garet, M. S., Porter, A. C., Desimone, L., Birman, B. F., & Yoon, K. S. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal, 38(4), 915–945.*

Gotanda, L. (2014). *K-12 Online: An Action Research Project on Professional Development for High School Online Pedagogy.*

Ed Glossary (n.d.). The Glossary of Education Reform and Great Schools Partnership. Retrieved July 3, 2021, from https://www.edglossary.org/

Hartshorne, R., Baumgartner, E., Kaplan-Rakowski, R., Mouza, C., & Ferdig, R. E. (2020). Special Issue Editorial: Preservice and inservice professional development during the COVID-19 pandemic. *Journal of Technology & Teacher Education, 28(2), 137–147.*

Jones, W.M. & Dexter, S. (2014). How teachers learn: The roles of formal, informal, and independent learning. *Educational Technology Research and Development, 62(3), 367-384.*

Kempkey, J. (2016). *Creating a Technology-Enabled Practice: Integrating Technology through Collaborative Professional Development.*

Kennedy, K. & Ferdig, R.E. (Eds.). (2018). Handbook of research of K12 online and blended learning (2nd Edition). Pittsburgh, PA: Carnegie Mellon University: ETC Press.

King, M. & Newmann, F. (2001). Building school capacity through professional development: Conceptual and empirical considerations. *International Journal of Educational Management.*

Kopcha, T.J. (2010). A systems-based approach to technology integration using mentoring and communities of practice. *Educational Technology Research and Development, 58, 175-190.*

Koki, S. (1997*). The role of teacher mentoring in educational reform.* Pacific Resources for Education and Learning.

Lawless, K. A., & Pellegrino, J. W. (2007). Professional development in integrating technology into teaching and learning: Knowns, unknowns, and ways to pursue better questions and answers. *Review of Educational Research, 77(4), 575-614.*

Leistyna, P. (2004). *Cultural Studies: From Theory to Action,* Blackwell Publishing Malden, MA, 2004.

Lexico Dictionaries. (n.d.). Oxford Dictionary on Lexico.com. Retrieved July 2, 2021, from https://lexico.com/.

Li, Y., Garza, V., Keicher, A., & Popov, V. (2019). Predicting high school teacher use of technology: Pedagogical beliefs, technological beliefs and attitudes, and teacher training. *Technology, Knowledge and Learning, 24(3), 501–518.*

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 (CITE Journal), 17(4).*

Lieberman, A. (1995). Practices that support teacher development: Transforming conceptions of professional learning. *Phi Delta Kappan, 76, 591-596.*

Lieberman & Miller (2004). Teachers as Leaders. *The Educational Forum.*

MacDonald & Weller. (2016). Redefining our roles as teachers, learners, and leaders through continuous cycles of practitioner inquiry. *The New Educator. 13(1), 1-11.*

Martinovic, D., Kolikant, Y. B.-D., & Milner-Bolotin, M. (2019). The usefulness of technology in teacher professional development: Extending the frameworks. *Journal of the International Society for Teacher Education, 23(2), 21–36.*

McQuirter, R (2020 Lessons on change: Shifting to online learning during COVID-19. *Brock Education. A journal of educational research and practice 2020 Vol. 29 (2) 47-51.*

OECD. (2009). *Creating Effective Teaching and Learning Environments.* The Organization of Economic Cooperation and Development.

Opfer, V. D., & Pedder, D. (2011). Conceptualizing teacher professional learning. *Review of Educational Research, 81(3), 376–407. https://doi.org/10.3102/0034654311413609*

Petrie, K & McGee, C. (2012). Teacher professional development. Who is the learner? *Australian Journal of Teacher Education, 37(2), 59-72.*

Pitsoe, V. (2013). Re-thinking teacher professional development through Schön's reflective practice and situated learning lenses. *Mediterranean Journal of Social Sciences. 4. 211-218. 10.5901/mjss.2013.v4n3p211.*

Rodrigues, Pietri, Sanchez, & Kuchah. (2018). The role of experienced teachers in the development of pre-service language teachers' professional identity: Revisiting school memories and constructing future teacher selves. *International Journal of Educational Research. 88.*

Van Dijk, Jan A.G.M.. (2006). Digital divide research, achievements and shortcomings. *Poetics. 34.*

Watts, C. D. (2009). *Technology leadership, school climate, and technology integration: A correlation study in K-12 public schools.* Ph.D. thesis, The University of Alabama.

Wei, R. C., Darling-Hammond, L., & Adamson, F. (2010). Professional development in the United States: Trends and challenges. Dallas, TX. *National Staff Development Council.*

Wenger, E. (1998). *Communities of practice: Learning, meaning and identity.* New York: Cambridge University Press.

Wenger-Trayner, E., & Wenger-Trayner, B. (2015). *Introduction to communities of practice: A brief overview of the concept and its uses.*

Waycott, J., Bennett, S., Kennedy, G., Dalgarno, B., & Gray, K. (2010). Digital divides? Student and staff perceptions of information and communication technologies. *Computers & Education. 54. 1202-1211. 10.1016/j.compedu.2009.11.006.*

Appendices

Appendix A
Consent Form for Adult Participants

Dear Colleague,

I am a graduate student at Saint Mary's College of California in Moraga. I am also a Vice Principal in the Mount Diablo Unified School District at Northgate High School. I am conducting a study on how teachers learn to use technology in the classroom. The purpose of my study is to find out if a professional development model of teacher-led, collaborative communities of practice will make a positive impact on a teacher's learning and use of technology in the classroom.

By participating in this study, you will collaborate with me and other staff members during a series of group sessions and give feedback at the beginning and end about the process, including what you learned and what would have made it more helpful. This feedback will be invaluable in helping me to improve my practice as a school leader. With your agreement, these collaboration sessions as well as some of your technology project artifacts will be video or audio recorded, as detailed in the attached video and audio recording waiver. There will be 6 one-hour community of practice sessions in total, taking place every other Wednesday over a period of 12 weeks, to provide regular chances to meet and discuss projects and priorities. During each session, we will collaborate with others in the group, then you will have time to work independently or with a mentor, on your technology project. Each session will end with a short reflection at the end of the 60 minute sessions. In order to participate, you must be at least 18 years old and a 9th-12th grade teacher at Northgate High School.

Risks to participating in this study include discussing areas of struggle or confusion with technology, as well as observations about your own learning in a professional development environment. Benefits include greater confidence and skill in teaching with technology, development of a new piece of technology that can be integrated into your practice, and an opportunity to grow alongside colleagues on our staff.

Your participation is voluntary, and you may choose to withdraw at any time or choose not to provide feedback at the end or provide only partial feedback. Your decision to participate in my study or your responses in my study will not alter my relationship to you in any way.

I assure you that if you choose to participate, your responses, comments, opinions, etc. will remain confidential. Additionally, no "raw data" beyond thoughtfully selected direct quotes will be used in the paper and without use of your name directly. There may be a need for discussion of areas of struggle and confusion in this study, so speakers and the direct verbiage will be anonymized.

At the conclusion of this study, the data collected will be analyzed and a final report will be written and presented to Saint Mary's College Master's of Educational Administration faculty. You are welcome to ask me for a copy of my report when it is completed.

Should you have any questions or concerns at any point during the duration of my study, please feel free to contact me by email at bocksc@mdusd.org. You may also contact my advisor, Heidimarie Rambo, at hrambo@stmarys-ca.edu. Thank you in advance for your assistance with my research.

Sincerely,
Craig Bocks

You affirm that you have read the above information and have been given a chance to ask questions to the researcher, if you are uncertain or unclear about any of the information described above.

_____
PRINT Name of the Participant

_____ _____
Signature of Participant Date

Appendix B
Audio/Video Release

I will be recording both the video and audio of the technology sessions that we hold over video conference, including collaborative discussions, technology curriculum development, and de-briefing. Additionally, I will be recording our interviews at the end of the technology sessions. As part of your participation in this research, I request that you have your camera on during the recordings.

These recordings will be reviewed only by me, and your name will not be associated with the recording in any final materials. The recordings will be used in order to catch nuances and precise phrasing my notes may miss. The recordings will be stored only on my computer, and the files will be deleted upon acceptance of my research paper, anticipated to be early to mid-June of 2021.

If you agree to participate in this study, your signature on this form gives the researcher permission to make and retain the audio/video recordings for this study. You have the right to review the recordings and to request that all or any portion of the recording be erased.

You are entitled to and will be given a copy of this signed release form.

Do you give me your permission for the collaborative sessions to be audio/video recorded and for your participation during those recordings to be used in my study? Please mark an option below.

- □ Yes, I agree to be audio/video recorded.
- □ No, I DO NOT agree to be audio/video recorded.

_____
PRINT Name of the Participant

_____ _____
Signature of the Participant Date

Appendix C
Introductory Script & Email

Dear [name of teacher],

Thank you for letting me collaborate with you on your professional journey around the use of technology in your practice as a teacher! I will be more than happy to participate with you while you work on the personal project you've selected. As you may or may not know, I am a graduate student at St. Mary's College of California. I'm asking for your assistance with the research project I'm conducting, which is to look at how collaborative communities of practice at a school can provide opportunities for teachers to learn technology skills to use in the classroom. I am hoping that you will allow me to include the work we do together in my study.

Showing up to our collaborative team technology sessions and signing a few consent forms is all this entails. I would be happy to talk further with you about what is involved and answer any questions you might have. Consent is completely voluntary and I am thrilled to get to work with you either way! Please let me know if you would be willing to participate!

Sincerely,
Craig Bocks

Appendix D
Semi-Structured Participant Interviews

Questions will include soliciting information about the professional development technology sessions, including: how teacher participants felt about the community of practice, how it impacted their practice or didn't, what the challenges were, how (if at all) they saw collaborating on technology impact their curricula. Follow up questions might probe how teachers thinking about their own learning and professional development overall changed as a result of the sessions, as well as their thinking about how teachers learn, and how/if they see their ability to learn new technology and their ability to use it in the classroom differently. Below are some example questions. Not all questions will be asked of all participants and additional follow up questions might be added to best solicit more information based on teacher responses.

- In the beginning you were concerned about [problem of practice]. In the end, how, if at all, do you feel that our collaborative community of practice addressed those concerns?

- What do you see as the benefits, if any, to having participated in our collaborative community of practice?

- Did our collaborative community of practice help you to think differently or more deeply about your own teaching? If so, how?

- What was challenging about working in a collaborative community of practice? What might have made it easier?

- What, if anything, have you changed in your practice as a result of our collaborative community of practice?

- Have you noticed any impact on your students as a result of any changes you have made?

- Did our collaborative community of practice sessions change how you observe or gather data about your students? If so, how?

- How do you feel about [problem of practice articulated at the beginning of the collaborative community of practice sessions] now?

- What questions or concerns do you still have about [problem of practice]?

Appendix E
Technology Use Pre & Post Survey

Name:_____

1) Which describes your total number of years as a classroom teacher?
   a. less than years
   b. 3 years to 6 years
   c. 6 years to 15 years
   d. more than 15 years

2) In which department do you teach? _____

3) What is your gender?
   a. Female
   b. Male

Circle the number to indicate whether you agree or disagree:
(1 = Strongly disagree 7= Strongly agree)

1) I felt well prepared with my technology skills as a teacher prior to the onset of distance learning due to the COVID-19 pandemic.

1 2 3 4 5 6 7

2) My professional practice as a teacher utilizes technology more regularly as a result of time spent in a distance learning format due to the COVID-19 pandemic.

1 2 3 4 5 6 7

3) I feel more prepared as a classroom teacher to utilize technology once schools return to in-person learning.

1 2 3 4 5 6 7

4) My confidence learning and using new technology as part of my curriculum is high.

1 2 3 4 5 6 7

5) I have a defined model I use to develop new technology lessons for my classroom and as part of my curriculum.

1 2 3 4 5 6 7

6) Learning to use new technology as part of my professional practice is something that I often do alongside colleagues and if needed, a mentor.

1 2 3 4 5 6 7

7) Professional development at my school (or in my district) has helped me to do my job better and helps me to better serve students in my classroom.

1 2 3 4 5 6 7

8) Professional development at my school (or in my district) allows for personal choice and is typically relevant to my current job.

1 2 3 4 5 6 7

9) There is clear benefit and I find value from attending one-day professional development sessions and/or workshops.

1 2 3 4 5 6 7

Please feel free to share below any additional comments or thoughts on professional development, technology, or distance learning.

Appendix F
Exit Tickets

Exit Tickets will be used at the conclusion of each collaborative session, in order to solicit further information about the professional development technology sessions, including: how teacher participants felt about the collaborative community of practice, how it impacted (or will impact) their practice or didn't, what questions and/or challenges they had, and how they plan to adjust for future sessions. Follow up questions might probe how teachers thinking about their own learning and professional development overall is changing as a result of the sessions, as well as their overall thinking about how they as teachers learn best, and how/if they see their ability to learn new technology and their ability to use it in the classroom differently. Below are some example Exit Ticket prompts, followed by a few samples from the sessions.

- Red, Yellow, Green – teachers respond to one thing they want/need more clarity about (Red), one thing they are still a little hesitant or feel unsure about (Yellow), and one thing they mastered, learned, or are 100% sure about going forward (Green)

- Question Prompts – teachers respond to sentence stems or questions, such as: one thing I'm ready to move forward with next is…, one thing I'm still going to need to revisit and understand better is…., or an "aha" moment I had at some point today was…

- Connections – teachers respond to prompts asking them if there's a song or movie they could tie to the current session, a comment or question from someone in the group during the current session that was particularly valuable to them, or a connection with what they did during the current session that could be valuable to them in their life outside of teaching?

Appendix H
Researcher Field Notes Template

Session Date	Field Notes

Appendix I
Sample Agenda – Collaborative Tech Session