Evaluating the Impact of Personalized Professional Learning on Technology Integration in the Classroom

Angela Bishop Burgess

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EVALUATING THE IMPACT OF PERSONALIZED PROFESSIONAL LEARNING ON TECHNOLOGY INTEGRATION IN THE CLASSROOM

by

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Everyone’s doctoral journey is unique and as my friends and family know, I am all about travel. I could not have imagined when I began that this dissertation would travel to eight countries, to 13 states, 48 cities, on the oldest schooner in the United States, and on at least eight trains across 43 different trips. It has seen Atlanta United win the MLS Cup, the Atlanta Braves win the World Series, and the Georgia Bulldogs win two Football National Championships. Eventually, every journey ends and as I end mine, I must thank those that have helped make this possible.

Most importantly, I have to thank my captain, my husband Brad, the one who when I told him that I was thinking of setting off on this journey, told me he had known that I was undertaking this journey all along. When I doubt myself and my ability, he is my number one cheerleader. Every captain has a co-captain and his is our son, Ryan. I owe Ryan for inspiring me keep going, even when encountering setbacks, because how could I quit when he has overcome so much and kept going? I could not have done this without both of you.

Additional gratitude is owed to Dr. William Morris, my navigator and dissertation advisor. I also want to thank my friends, colleagues, and fellow Cohort YOLO members who never stopped believing in me. Lastly, I want to thank the faculty and staff of my research site, especially the teachers who volunteered to participate in my study. Thank you for your time and dedication, even through the difficult times.
Abstract

Classroom access to technology such as a computer or the Internet does not guarantee a high-level of integration of technology by the teacher or application by the student. Tools that could be used to increase student creation or personalized learning opportunities may instead be used by the teacher at lower levels of use that replace non-technological tools. The purpose of this action research was to implement and evaluate the impact of technology-focused personalized professional learning on participants’ use of and attitudes towards classroom technology. It attempted to show that modeling technology integration in professional learning opportunities for educators could have a positive change on how participants used technology in the classroom. It also sought to demonstrate that a focus on technology integration models through professional learning opportunities for educators could shift participants attitudes and beliefs towards technology in the classroom. A final area of research was to explore how such personalized professional learning opportunities changed the personalized learning opportunities offered by participants in the classroom. It took place at a large public high school in a suburb north of Atlanta.

This action research followed a concurrent mixed-methods study design, collecting both qualitative and quantitative data. Upon completion of a pre-study survey sent to all teachers at a single high school, 10 participants were purposefully selected from across all core content areas. Qualitative data was collected through classroom
observations and focus-group discussion, as well as the pre-study survey. Quantitative data was collected through the same pre-study survey and classroom observations.

Once baseline data was collected, participants learned more about models for evaluating classroom technology use and personalized professional learning, coupled with opportunities for implementing their new knowledge in their classroom or participating in personalized professional learning opportunities. At the end of the study innovation, post-study data was collected through the same pre-study data points.

Quantitative data were analyzed using descriptive and inferential statistics. Quantitative data analysis suggested changes in participant views of five barriers to use of classroom technology, as well as changes in the ways that participants and their students used classroom technology. However, the results of these findings were inconclusive. Qualitative data were analyzed using inductive analysis. The analyses revealed major themes related to classroom technology use, teacher attitudes towards technology, and personalized learning. The data analysis also served to help answer the research questions and guide recommendations for technology-focused professional learning and implications for future research.

Results from the research will be shared with participants and the school, as well as being published when and if possible.
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List of Abbreviations

FHS ................................................................. Focus High School
ISTE .............................................................. International Society for Technology in Education
ITS ................................................................. Instructional Technology Specialist
LMS ................................................................. Learning Management System
PICRAT ............... Passive Interactive Creative/Replacement Amplification Transformation
PL ................................................................. Professional Learning
PLC .............................................................. Professional Learning Community
PLN .............................................................. Professional Learning Network
RAT ............................................................... Replacement Amplification Transformation
SAMR ......................................................... Substitution Amplification Modification Redefinition
CHAPTER 1

INTRODUCTION

National Context

Technology in the classroom is no longer considered an optional tool for teachers to employ at their discretion. As early as 2005, nearly 100% of public classrooms had computer and Internet access (Wells & Lewis, 2006). As technology has become more pervasive in today’s educational realm, the focus has also shifted to ensuring that all students have learning experiences of the highest quality and to personalize the learning experience for students, instead of questioning whether there is room for a computer in the classroom (U.S. Department of Education, 2016).

However, Ruggiero and Mong (2015) found in their study that while teachers say that technology is widely integrated in today’s classrooms, the reality is far from the ideal, with those same teams self-reporting that the most commonly used technology tool in their classroom is PowerPoint, used by the teacher for lecture-style presentations. This popular presentation tool is not inherently bad, but its high use shows that many classrooms are still following a teacher-focused instructional model that centers around lectures. In reality, technology integration is generally at a much lower level than many would like to believe. While technology continues its advancement into the classroom, the expectation that teachers will use it to advance student achievement is not always
realized, nor is it always used to create more personalized learning opportunities (Hilton, 2016).

Ertmer (1999) identified two barriers preventing teachers from using technology in the classroom. In her study entitled "Addressing First- and Second-order Barriers to Change: Strategies for Technology Integration," she described first-order barriers as those that were “extrinsic to teachers” (p. 4). This includes both hardware and software resources, training, and support. These first-order barriers include access to the resources, as well as the knowledge and skills needed to be able to use them. The second-order barriers were those that were “typically rooted in teachers’ underlying beliefs about teaching and learning” (Ertmer, 1999, p. 5), and can include beliefs about how students learn, classroom management, and the perceived value of technology to the teaching and learning process.

If one accepts that nearly 100% of public classrooms have computer and Internet access as seen previously, hardware resources are not the concern they used to be. However, it is also not enough to simply provide resources without the needed training and support for using those tools effectively in the classroom to increase student learning. In 2013, the Pew Research Center’s Internet and America Life Project found in a survey of Advanced Placement and National Writing Project teachers that only 70% of participants in the highest socio-economic areas believed that their schools did a “good job” (Purcell, Heaps, et al., 2013, p. 4) at providing them the resources and support needed to integrate technology in the classroom and only 50% of teachers in the poorest schools.
Hixon and Buckenmeyer (2009) reported that, even once resources, support, and training are all addressed, the focus must continue to shift on eliminating the second-order barriers: teacher confidence in using technology, teacher beliefs about how students learn, and teacher perception of the value of adding technology to the classroom. Eliminating these second-order barriers will guide the path to true purposeful and seamless integration. As Jim Knight (2007) expresses in his book *Instructional Coaching: A Partnership Approach to Improving Instruction*, the vast majority of teachers will not only implement appropriate changes but will also embrace new programs and technologies that will “improve students’ experiences in the classroom” (2007, p. 4) when given the appropriate tools and support. To get there, teachers must be shown how the technology will improve the learning experience in ways that also still value the presence of the teacher in the classroom.

Unfortunately, many efforts towards encouraging technology integration in the classroom tend to focus on shortcomings in teacher behavior and beliefs rather than practical suggestions for improvement (Cuban, 2001). Instead, professional learning opportunities for teachers need to focus first on recognizing their current level of knowledge and skills, followed by working to personalize the learning opportunities offered to them (Hixon & Buckenmeyer, 2009). Ruggiero and Mong (2015) found that teachers most often learn about technology through trainings which were broken into three categories: online, conferences, and workshops. Only 21% of secondary teachers in their study reported learning about technology tools from others in their building. These two figures taken together paint a picture of professional learning that is designed to be standardized rather than personalized.
While technology is not a requirement for personalizing learning for students, purposeful application of technology facilitates an easier personalization for individual students in the classroom (Patrick et al., 2013). Technology can create an opportunity for teachers to engage students at differing levels without calling attention to who is stronger or weaker. This is true for offering personalized learning opportunities for teachers as well. For teachers to understand the full potential of technology to increase personalized learning opportunities, their own professional learning about technology needs to be personalized.

Professional learning can have a profound impact on teaching practices as well as student growth and achievement. However, traditional professional learning experiences often fail to meet teachers’ needs (Rose, 2009). Unlike in the past, there are many opportunities for teachers to personalize their learning experiences today by choosing what they want to learn, when and where they want to learn it, and how they choose to show what they learned. Technology allows them to take ownership of their professional learning through online personal learning networks (Hirschy, 2016), Twitter chats (Caramanico, 2014), and unconference-style events like Edcamps (Carpenter, 2016; Swanson, 2014). Educators who take advantage of the opportunities presented through technology find that they are more “motivated to engage in authentic learning” and are able to focus on “connecting with people with purpose and finding new ways to learn” (Swanson, 2014, p. 39).

**Local Context**

As a former instructional technology specialist (ITS) at Focus High School in the north Atlanta suburb of North Mountain School District, I observed that many teachers
believe they integrate technology because they use an interactive whiteboard to give slides-based notes presentations which are also shared with students using our online learning management system. However, findings from as early as 2013 showed that teachers were using technology to replace traditional, non-digital classroom activities (i.e., PowerPoint notes projected on a whiteboard, digital gradebooks, digital assignment collection, etc.), and not to redefine learning with interactive or creative learning experiences (Bang & Luft, 2013). To achieve this change, teachers need to experience personalized professional learning, modeling and focusing on higher levels of technology integration by teachers and students. It is not enough for students to see technology – in order to gain 21st Century skills, they must interact with it in subject-specific contexts to learn how to use it as a tool rather than a distraction (Ruggiero & Mong, 2015).

Focus High School (FHS) was already a high-achieving school. In 2018-2019, an average of nearly 98% of students performed at “Developing Proficiency” or higher on the Georgia Milestones End of Course exams and in 2019, 84% of students who took an Advanced Placement exam passed with a score of 3 or higher. The teachers also pushed themselves to achieve: 94.5% of teachers who responded \((n = 73)\) to my beginning of the year survey about their educational technology training preferences in August 2016 (shortly before this research began) indicated that they wanted to learn more about at least one educational technology tool, 23.9% \((n = 17)\) responded that they would be interested in helping facilitate or present new tools, and 32.4% \((n = 23)\) said that they were interested in gaining certification as a Google Certified Educator: Level 1 (See Appendix A). As is often the case though, lofty goals do not always lead to implementation and only two of those interested in becoming a Google Certified
Educator achieved that goal by the end of the 2016-2017 school year, while attendance at optional response-driven training opportunities was sparse. This unfortunately places educational technology in the role of an optional addition that serves to entertain or distract rather than facilitate learning.

The desire to effect change in practice is often addressed through professional learning. In the past, professional learning experiences offered to teachers at FHS that focused on technology had been either mandatory for all teachers (in which the training was delivered the same way to all teachers regardless of their experience, ability, or desire to use the tool in their classroom) or optional (in which the training was delivered to only those teachers who chose to attend and attempted to personalize the training based on the expressed needs of attendees). In the same way, other professional learning experiences focused on pedagogy are mandatory and treated all teachers as though they are all at the same place in their educational career or had the same pedagogical philosophies and practices. This was true for both school-based and district-led professional learning.

There had been previous efforts to change both practice and beliefs, however. In the fall of 2015, an elementary school assistant principal in the district formed a Twitter chat specifically targeted to teachers in the district using a district-specific hashtag. In the beginning, there were only a few members who regularly participated, but it quickly became an active weekly chat that grew to include educators at all levels and all ranges of experience, including teachers at FHS. Shortly thereafter, in February 2016, I helped to organize and host the first-ever Edcamp for the district at FHS. Unfortunately, despite all
manner of promotion, only one other teacher from FHS attended among the 100 educators from other district and non-district schools.

But the movement for more personalization was getting noticed by district leaders. In July 2016, the district offered a professional learning opportunity called EdSummit, at which teacher leaders from across the district presented on innovative practices in their classrooms. Word continued to spread about EdCamp North Mountain and at the second event hosted in February 2017, overall attendance grew by 20% and FHS had thirteen teachers attend. All of those who attended relayed through anecdotal conversations that they had positive experiences and felt more in-control of their learning.

**Statement of the Problem**

Teachers at FHS did not design student-centered learning experiences that included technology at higher levels of integration and did not understand how transformative technology integration could create opportunities for personalized learning. Instead, teachers relied on traditional methods and designed lessons that did not recognize the benefits that high levels of technology integration can offer for transforming and personalizing learning. Additionally, although many were dissatisfied with their professional learning experiences, they did not embrace personalized professional learning opportunities, such as unconferences or Twitter chats. It was expected that as educators learned more about models of technology integration and how it can allow teachers to offer more personalized learning opportunities, they would begin to integrate technology in ways purposefully designed to transform the learning experience and would also offer more opportunities for personalized learning.
Purpose Statement

The purpose of this action research was to implement and evaluate the impact of personalized professional learning for teachers intentionally focusing on models of technology integration.

Research Questions

This research explored the following research questions:

1. How does modeling technology integration in professional learning opportunities for educators change technology integration in the classroom?

2. How does a focus on technology integration models through professional learning opportunities for educators change teacher attitudes towards technology integration in the classroom?

3. How does an educator’s participation in personalized professional learning opportunities change personalized learning opportunities offered in the classroom?

Researcher Subjectivities and Positionality

I pursued a doctoral degree in educational technology so that I could become more knowledgeable and be a more valuable resource to the educators I serve. I spent 14 years in the classroom as a high school French teacher and chose to leave the classroom to become an ITS to help more students. I had realized that not all teachers used technology to improve student engagement and achievement and that many chose to ban technology all together. I realized that by leaving the classroom while I was still passionate about teaching and improving the learning experience for students, I would be able to help more students by helping their teachers.
The first year that I spent as an ITS was a learning experience for me as well. I realized that it was not enough to show teachers new technology and ways to use it. I needed to be patient and willing to go to them, working individually or in small groups, and be present to assist them in the classroom as they tried new things. When I discovered that the International Society for Technology in Education (ISTE) has standards for technology coaches in addition to those for students and teachers, I realized that I had found my guidebook as well as my focus. As Williamson (2015) explains, the ISTE Standards for Coaches are important because they encourage technology coaches to be more reflective and evaluate their own performance. This method of encouraged reflection should provide an impetus to try new ideas and allow technology coaches to identify areas of weakness for which they need to search for professional learning opportunities.

ISTE identifies six areas of focus for technology coaches: visionary leadership; teaching, learning, and assessments; digital age learning environments; professional development and program evaluation; digital citizenship; and content knowledge and professional growth. I also believe that the ideal technology coach in education is humble, patient, and personable. When working with adults, it is important to be willing to admit when I do not know the answer even while providing reassurance that I will keep looking for the answer. It is equally important to recognize that not everyone will be as passionate about classroom technology integration as I am just because I share my knowledge and experience with them. Finally, the key to encouraging growth in others is to build a relationship with them first. Being focused on the person and not the
technology creates a bond that can withstand the struggle that can come from trying new things.

As an educator whose background centers around communication and interpretation of meaning, it is clear to me that my paradigm is interpretivist or constructivist. In Research Designs: Qualitative, Quantitative, and Mixed Methods Approaches Creswell says, “Social constructivists believe that individuals seek understanding of the world in which they live and work” (2014, p. 8). He goes on to say that researchers with a constructivist paradigm look for the complexity of meaning instead of narrowing the idea to a few key ideas and that their intent is to understand how others apply meaning to a situation instead of attempting to prove or disprove a theory. My time spent in the classroom as both a language and a literature teacher before becoming an ITS prepared me to seek understanding long before I became a student again. The focus of learning language is to create understandable communication and connections between cultures. As a teacher of literature in both French and English, I helped my students to understand the complexity of meaning of words, both explicitly stated and implied, and then apply that meaning to other situations in the real world outside of our four classroom walls.

The field of personalized learning is still evolving and there are still questions about what it looks like in practice, both in the classroom and when applied to professionals. As a researcher, that was an important idea to remember as I sought understanding, not only of what personalized learning is but also how it relates to technology integration in the classroom and in professional learning. It was also important to try to understand how others apply the meaning of personalized learning to
their specific situations rather than trying to prove or disprove an existing theory within specific contexts.

As an educator who spent eight years at FHS before leaving to go to the North Mountain School District central office immediately preceding the beginning of this research, my positionality was that of an outsider but with insider knowledge. This allowed me the unique experience of being able to build upon previously established relationships to attempt a collaborative action research approach with a more equitable power relationship than the traditional outsider attempting to collaborate with insiders.

On the other hand, my close relationship with the participants also opened opportunities of making it too easy to skew or spin the data, avoid asking difficult questions, or gloss over questionable practices. It was important for me to seek participants who had a wide range of current technology practices and skill, as well as attitudes and beliefs about technology integration, professional learning, and personalized learning, so as to not skew the results of the study. I sought to remember that my relationship to the participants may shift throughout the study (Drew et al., 2007), due to both the nature of the research process and my changing relationship to those with whom I once worked closely.

**Definition of Terms**

**Personalized Learning.** In this study, personalized learning was defined as opportunities that give learners the freedom “to set their own goals for learning, create a reflective process during their journey to attain those goals, and be flexible enough to take their learning outside the confines of the traditional classroom” (Patrick et al., 2013). Additionally, personalized learning should understand learners’ past experiences to meet
them where they are instead of where the educator thinks they are, as well as helping the learner to form communities of learning, to be responsible for both the pace and progress of their learning, and to make “healthy academic decisions” (Patrick et al., 2013, p. 6).

**Professional Learning.** Continued learning experiences for educators have been known by a number of different names, including professional training, continuing education, professional development, and professional learning. For the sake of consistency, this study defined professional learning as opportunities which vary “from formal, structured seminars on in-service days to everyday, informal hallway discussions with other teachers. Professional [learning] activities can come in the form of workshops, local and national conferences, college courses, special institutes, and so on” (Desimone, 2011, p. 68).

**Technology Integration.** The term “technology integration” can have multiple meanings, as can be seen in looking at the research. However, for this study, the definition of technology integration was “the integration of technology into daily classroom protocols…as a way of creating learning, a process, rather than a specific technology tool” (Ruggiero & Mong, 2015, p. 168). The focus of technology integration is that technology tools are selected as part of the process of increasing student learning and engagement, based on the needs of the students, the curriculum, and the pedagogy bolstering the curriculum, rather than choosing a tool and then designing learning experiences around the tool.

**Technology Integration Model.** There are many different evaluation models that exist to measure technology integration. However, this action research focused on the Replacement, Augmentation, Transformation (RAT) model (Hughes, 2005; Kimmons et
al., 2015); the addition made by Kimmons et al. (Kimmons et al., 2015, 2020; Kimmons & Hall, 2018) to add Passive, Interactive, Creative to RAT, creating PICRAT; the Substitution, Augmentation, Modification, and Redefinition (SAMR) model originally proposed by Puentedura (2013); and the Technological, Pedagogical, and Content Knowledge (TPACK) model proposed by Koehler and Mishra (2005).
CHAPTER 2
LITERATURE REVIEW

Introduction

The purpose of this action research was to implement and evaluate the impact of personalized professional learning for teachers intentionally focusing on models of technology integration to change both teacher attitude and classroom practice through the use of modeling. An additional aspect was to explore the impact of teacher participation in personalized professional learning opportunities on technology-enhanced personalized learning opportunities in the secondary classroom.

The first research question attempted to determine how modeling purposeful technology integration at a variety of levels in professional learning opportunities for teachers changed classroom technology integration. Second, the research attempted to determine if purposeful instruction about models designed to evaluate classroom technology integration changed teacher attitudes and beliefs about technology integration in the classroom. The third and last research question attempted to determine if teacher participation in personalized professional learning opportunities such as technology coaching, professional learning communities, and informal learning experiences changed technology-enhanced personalized learning opportunities in the classroom.
Using the research questions as a guide, four main variables were identified to guide the research process: (1) technology integration, (2) technology integration models, (3) professional learning, and (4) personalized learning. Resources for this literature review were collected primarily through educational databases such as *ERIC* and *Education Source*. A small number of resources were also identified through Google Scholar searches and curated reading using the RSS-reader Feedly. Search terms included technology integration, technology integration models, classroom technology use, teacher use of technology, SAMR, TPACK, TPCK, professional learning, professional development, personalized learning, informal professional development, social media, and Edcamps.

The review of literature in this chapter is divided into three sections. The first section will examine how technology is used in the K-12 environment by looking at definitions of technology, models for evaluating classroom technology integration, and the impact that teacher attitudes and beliefs have on classroom technology integration. The second section will focus on professional learning experiences designed for educators by examining types of professional learning offered, worst and best practices associated with professional learning, and the impact of professional learning on teacher practice. The third section will explore forms of personalized professional learning for educators and the impact that these personalized experiences have on classroom practice.

**Technology Integration in the K-12 Environment**

The term *educational technology* is fairly vague and can be used to describe either the study of or process by which technology is used in the classroom (Jenkinson, 2009). Going a step further, definitions of technology integration vary widely, from using any
tool that uses electricity at one end (Ruggiero & Mong, 2015), to technology being used in a single lesson (Hilton, 2016; McKnight et al., 2016; van Thiel, 2018), to technology being integrated as a concept throughout the period of study (Hamilton et al., 2016; Hilton, 2016; Kim et al., 2013) at the other end. These varying views of what constitutes educational technology can result in a wide range of levels of technology integration across various models. Teachers who view technology as any tool that uses electricity would likely have a more positive view of their own classroom technology integration than a teacher who believes that technology integration is a concept to be woven throughout a period of study viewing the same lesson.

**Technology as Any Tool that Uses Electricity**

One hundred years ago, the typical classroom had many of the same tools still seen today. Etherington (2018) points out that five revolutionary additions to the classroom in 1918 were the pen, the chalkboard, the abacus, radio used for instruction, and the magic lantern, a device similar to an early projector. Today, while these exact tools are no longer considered revolutionary or even necessarily as technology, their descendants are still seen by some as being part of educational technology. For the sake of simplicity and understanding the wide range of technology that may be available to classrooms in the K-12 environment, many tools that simply use electricity such as overhead projectors, a classroom flat-screen television, a paper printer, or even music may be classified as technology in the classroom environment (Francom, 2016; Ruggiero & Mong, 2015).
Technology in a Single Lesson

In addition to simply using technology tools in the classroom, teachers may evaluate their use of technology within individual lessons by also examining how the lesson would have been different without the use of technology. Hilton (2016) asked teachers participating in his study to code lessons using the Substitution Augmentation Modification Redefinition (SAMR) model of evaluating technology integration. He found that rather than a progressive shift throughout the year towards their classrooms being redefined through the integration of technology, they instead chose to use technology in ways that met the instructional needs and goals of the activity.

Project Blackboard's (2017) study found similar results, reporting only on how technology was integrated into individual activities instead of throughout entire periods of study. These findings show that many may choose to evaluate technology as it appears within a single lesson rather than taking an overhead view of technology use in the larger classroom environment.

Technology Integrated as a Concept Throughout a Period of Study

When technology is integrated as a concept throughout a period of study, it can help to create student-centered learning experiences (Admiraal et al., 2017; Bang & Luft, 2013). By placing students at the center of the learning experiences, teachers are better able to link content needs and strong pedagogy with technology tools that will help to achieve the associated goals (Harris et al., 2009; Parker et al., 2013; Ruggiero & Mong, 2015). The emphasis of content and pedagogy over, but still connected to, technology is at the forefront of the Technology Pedagogy and Content Knowledge (TPACK) model of evaluating classroom technology integration and may result in a flipped (Admiraal et al.,
2017; Kong & Song, 2015; McKnight et al., 2016) or blended (Gallagher, 2014; Hilton, 2016; Kellerer et al., 2014; U.S. Department of Education, 2016) classroom design.

**Impact of Teacher Attitudes and Beliefs**

Ertmer’s (1999) original study began the conversation about the difference between first-order barriers towards technology adoption, which include external factors such as access to or knowledge of how to use programs or tools, and second-order barriers, which include intrinsic factors such as beliefs about teaching, technology, and change. As technology has become more pervasive in the educational setting and the first-order barriers have been eliminated (P. A. Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012; Ruggiero & Mong, 2015; U.S. Department of Education, 2016), many have begun to focus on when and how to integrate technology into the learning process to best support teaching and learning (Ruggiero & Mong, 2015; U.S. Department of Education, 2016). The shift in focus, from how to gain access to the tools and how to operate them to the deeper exploration of how to use the available technology to improve student learning outcomes, means that the second-order barriers of teacher confidence, teacher beliefs about how students learn, and perceptions of the educational value of technology must be addressed (Ertmer et al., 2012; Kopcha, 2012a; McKnight et al., 2016).

**Original Attitudes and Beliefs**

Teachers’ attitudes and beliefs about how students learn and the role of technology in the classroom can significantly impact their choices about how to use technology. Not only do teachers need to know how to use the technology tools available to them, but they also need to know how to use them instructionally (Kim et al., 2013;
Kopcha, 2012a; Rollins, 2011) and with confidence (Rollins, 2011; Sahin et al., 2016). There are conflicting reports on the comfort levels of teachers using technology in the classroom. Some reports find that newer teachers may struggle to use technology to support student-centered instruction (Francom, 2016; Sahin et al., 2016) while others indicate digital natives may be more likely to adopt instructional technologies into their everyday classroom routine (Bang & Luft, 2013). On the other hand, more experienced teachers may not believe that technology has a role in the classroom, choosing to hold on to the idea that technology is a distraction for students and that the teacher's role as expert is undermined if information is presented to students in a non-traditional fashion (Mama & Hennessy, 2013).

There are other barriers to classroom technology as well. Another problem faced by many teachers is the lack of coursework in teacher preparation programs focusing on concepts central to technology integration in the classroom (Aslan & Zhu, 2016; Carey, 2010; Rollins, 2011). This lack of preparation means that many teachers have little to no prior knowledge that could be useful in forming educated opinions on classroom technology integration. Lastly, a primary complaint of many teachers is their belief that they lack both time and support to learn how to use newer technologies for student-centered instruction and that by the time they do learn a new tool, something new will have replaced it (Hixon & Buckenmeyer, 2009).

**Effect of Educating Teachers about Integration Models**

Leadership support and instructional models must be in place in order for technology to improve learning (McKnight et al., 2016; Thannimalai & Raman, 2018). When leadership at a school emphasizes how technology can be used to support
pedagogy and instructional models, technology becomes another tool used to drive
student learning and engagement (L. Brown, 2014; McKnight et al., 2016; Thannimalai
& Raman, 2018). Similarly, teachers who learn new technology tools from a content-
based perspective are more likely to use it as an integral part of instruction than those
who learn from a tool-based perspective (Frazier, 2011; Hughes, 2005). However,
research has also shown that innate beliefs and attitudes about both technology and
pedagogy can be changed through well-structured professional learning, modeling,
coaching, social pressure, and change agents (Admiraal et al., 2017; Hixon &
Buckenmeyer, 2009; Straub, 2009).

**Technology Integration Models**

When trying to choose a model to evaluate technology usage and integration,
there are almost as many models as there are definitions. While there is likely a model to
suit every teaching style, this research will limit its scope to the Replacement
Amplification Transformation (RAT), SAMR, and TPACK models of evaluating
technology integration, as well as exploring the impact of teacher attitudes and beliefs on
technology integration.

**RAT**

First proposed by Hughes (2005), the RAT model evaluates the degree to which
classroom technology use is innovative. It consists of three levels of technology
integration: Replacement, Amplification, and Transformation. Teachers using technology
at a Replacement level do not change their previous instructional routine, nor does
student learning change. Rather, technology is used instead of a non-technological
practice to achieve the same goal. When technology is used at an Amplification level, the
goals may be achieved more efficiently and/or effectively, but the goals and tasks still do not change. Using technology at the Transformation level will change student learning practices and/or teacher instructional practices. In order to make the transition to using technology to transform the classroom, Hughes suggests that teachers may need to engage in professional learning experiences that focus on their classroom content while also providing ideas for technology use and encouraging reflection.

**Practical application.** Kimmons, Miller, Amador et al. (2015) argue that the RAT model of technology integration and evaluation is teacher-friendly because it views classroom technology as a tool used to achieve certain pedagogical or curricular goals. It is these goals that direct teachers towards certain technological tools. The evaluation model focuses less on specific tools being used and instead looks at the role the technology plays in the specific classroom context when compared to that same classroom without the technological tool. This allows the teacher to focus on choosing to integrate technology in ways that will enhance student learning and achievement through sound pedagogical practices, evaluating what should change or stay the same based upon what already works well in the classroom (Hamilton et al., 2016; Kimmons et al., 2015).

**SAMR**

The SAMR model was originally presented by Puente (2006) as a way to approach the transformative possibilities of technology in education. It consists of four levels of technology integration: Substitution, Augmentation, Modification, and Redefinition. These four levels are further divided between two levels of classroom change: Enhancement and Transformation (Hamilton et al., 2016; Hilton, 2016; Project Tomorrow & Blackboard K-12, 2017; Puente, 2013; van Thiel, 2018). The sole focus
of the SAMR model for evaluating classroom technology use is the function of the technology. This leads it to be both easy to adopt and easy to interpret in vastly different ways, but can also sometimes lead to confusion on the part of the practitioner (Hamilton et al., 2016; Hilton, 2016).

PuenteMura (2006) presents the SAMR model as a ladder for teachers to climb. To progress from one level to the next, he proposes a series of questions. To step onto the ladder and reach the rung of Substitution, teachers should ask what they will gain by replacing the older technology with the newer technology. In this level, a digital tool is used only in place of another physical resource (van Thiel, 2018). However, the task does not change by substituting technology. The next level, Augmentation, still has the same task but now technology allows for the process to be improved. To reach Augmentation from Substitution, teachers should identify how technology has improved the lesson, such as improved communication or improved access (McKnight et al., 2016).

In order to reach Modification, teachers also progress from enhancing traditional classroom practice by integrating technology and begin to transform their classroom in ways that would not be possible without technology. At the Modification level, technology not only significantly improves the process of the task, but the task itself is changed by the addition of technology. Teachers should ask themselves how technology modifies the task, does the modification significantly depend on the new technology, and how the modifications contribute to the overall task design (Hilton, 2016). Finally, reaching the top rung of the ladder demonstrates that the task has been significantly redesigned and would not have been possible without the new technology, resulting in an entirely new task. Teachers need to identify what the new task is, if there are any pieces
of the previous task that remain, how the technology makes the new task possible, and how the new task contributes to the overall classroom design (Puentedura, 2013).

**Practical Application.** Applying SAMR in the classroom to a lesson requires a teacher or technology coach to have knowledge of what the lesson would be without technology and then evaluate how the use of technology has changed the lesson (Hamilton et al., 2016; Hilton, 2016). As such, SAMR is meant to be used to evaluate how individual tasks are changed by incorporating technology and does not take pedagogy, content knowledge, or learning goals into account.

**TPACK**

Koehler and Mishra (2005) first proposed the TPACK model as a way to provide clarity about what technology integration should look like and how teachers should gain the knowledge needed to effectively integrate technology within their specific content without sacrificing pedagogy (Harris et al., 2009; Koehler & Mishra, 2005). While this view is more encompassing and recognizes that technology alone will not create change in education, it can also be more confusing for teachers to understand as each of the knowledge areas (content knowledge, pedagogical knowledge, and content knowledge) can overlap or exclude other areas, leading to seven different possibilities (Hilton, 2016).

**Technological Knowledge.** In 2005, Koehler and Mishra defined technology as encompassing “modern technologies such as computers, the Internet, digital video, and more commonplace technologies including overhead projectors, blackboards, and books” (p. 133). However, the idea of modern technology is constantly changing and thus resists an exact, fixed definition (Harris et al., 2009). At the core of the knowledge area however is the idea that technological knowledge is about more than just knowing how to use a
specific technology but instead about how to work with technology in a way that can be applied to all technological tools productively (Harris et al., 2009; Hilton, 2016).

**Pedagogical Knowledge.** Pedagogy is described as the “collected practices, processes, strategies, procedures, and methods” (Koehler & Mishra, 2005, p. 133) used in the classroom for both teaching and learning, including the goals for instruction, assessment, and student learning. Teachers with strong pedagogical knowledge understand how students learn, how they acquire new skills, and how they develop both cognitively and socially (Harris et al., 2009). This understanding is perhaps the most important in the real classroom environment as it will shape teacher practices with both technology and content (Aslan & Zhu, 2016).

**Content Knowledge.** The last individual knowledge area is the field of content knowledge. Content knowledge is quite simply the subject matter that teachers teach and students learn (Koehler & Mishra, 2005). Additionally though, it is knowledge of the concepts and ideas as well as the research-based practices towards developing the knowledge needed in a specific content area (Harris et al., 2009). This is traditionally how outsiders view teachers, as the content experts who provide their knowledge to students (Straub, 2009), although this is changing as educators become facilitators of knowledge acquisition (U.S. Department of Education, 2016; van Thiel, 2018).

**Practical application.** TPACK asks teachers to look at more than just how technology is used in a lesson or unit of study. Instead, teachers or technology coaches have to understand how the use of technology interacts with the pedagogy being applied to the lesson and the content (Ahmed & Qasem, 2016; Hilton, 2016; Koehler & Mishra, 2005). When using the TPACK model, the goal is to look at how the different knowledge
areas overlap and interact with each area. When teachers possess and employ pedagogical content knowledge, for example, they show an understanding of the teaching strategies needed to build understanding of their specific content, as well as how to make connections between different ideas within their content (Harris et al., 2009). However, to be truly effective in today’s technology-enhanced classrooms, a teacher must have knowledge of how technology can be used to support both pedagogical and content knowledge (Gallagher, 2014; Harris et al., 2009; Hilton, 2016).

**Professional Learning**

**Forms of Professional Learning**

Teacher professional learning (PL) takes many forms. Frequently, teachers participate in PL that is best described as a series of single, isolated lessons delivered by school or district administrators, or perhaps punctuated by an outside consultant, during the teacher’s planning period during the school day or during a faculty meeting on a professional learning day when students are not in school. PL lessons may also be designed and delivered by other members of the school or district faculty, such as an ITS, an Instructional Coach, or a Content Specialist (Desimone, 2011; Hunzicker, 2011). These one-off lessons, while delivered in the same school and district, are still separate and not interconnected. Other forms that are also widely used include workshops, conferences, graduate courses, and special seminars (Birman et al., 2000; Borko, 2004; Desimone, 2011; Guskey, 2014; Guskey & Yoon, 2009). However, at its most basic, teacher PL is an ongoing practice designed to improve teacher instructional practices, leading to an increase in student learning and achievement (Borko, 2004; Desimone, 2011; Guskey & Yoon, 2009).
**Ineffective practices.** PL experiences that do not improve teacher practice, teacher leadership, or student learning are considered to be ineffective (Guskey, 2017; Mizell, 2010). Adults do not learn in the same way as younger learners and typically do not respond favorably to traditional methods of instruction focused on behavioral pedagogy (Potter & Rockinson-Szapkiw, 2012). PL experiences that contain ineffective practices have been described as “fragmented, intellectually inferior, and do not take into account what we know about how teachers learn” (Borko, 2004, p. 3). Examples of ineffective practices include one-shot PL, one-size-fits-all approaches, and insufficient time to practice, reflect on, and apply what has been learned.

One-shot PL lacking clearly defined goals that offers no follow-up or continued support is all too often the go-to model for many educators (Brooks & Gibson, 2012; Guskey, 2014; Guskey & Yoon, 2009; Knight, 2007). When speaking about technology-focused PL, this may refer to PL that is focused on a single tool without being aligned to curricular goals.

Another facet of ineffective PL is that it is often mandatory for all teachers and uses a one-size-fits-all approach, without taking into account individual learning preferences (such as when, where, or how the teacher chooses to learn the content), readiness, or interest in the topic (Gamrat et al., 2014; Hixon & Buckenmeyer, 2009; Knight, 2007). When speaking about technology-focused PL, this may refer to district initiatives that fail to consider that some teachers may have experience with a tool from a previous district, or that the tool may not be appropriate to their classroom needs.

A final example of ineffective PL practices is not providing ample opportunity for teachers to practice, reflect on, and apply what they have learned during the session.
Without taking the final step from passive to active learning, it is likely that participants will fail to retain and effectively use the new information and skills they were intended to gain from the session. When speaking about technology-focused PL, this is often seen in sessions that are rushed and do not allow for hands-on learning opportunities during the training session.

**Best practices.** In 2001, The National Staff Development Council argued that the best professional learning does not adhere to a strict set of best practices applied across all areas, but instead is carefully planned and applied to specific contents and contexts (as cited in Guskey & Yoon, 2009). However, there are commonalities to be found across varied models and applications, such as being connected to the classroom experience, collaborative, choice-driven, and on-going (Hunzicker, 2011; Stewart, 2014).

As mentioned earlier, a primary complaint about many PL experiences is that they tend to take a one-size-fits-all approach, which approaches PL from the idea that any new tool or approach can be adapted into any classroom in the same way. Regardless of the format of the PL activity, however, effective PL needs to be connected to the classroom experience by allowing a focus on the specific content taught and how students best learn that content (Desimone, 2011; Hunzicker, 2011) or by providing an opportunity to adapt the strategy or tool to their unique classroom situation (Guskey & Yoon, 2009). Workshops and seminars are often the most effective and valuable form of PL when they provide time for content-specific collaboration (Guskey, 2017).

Traditionally, collaboration happens among teachers at the same school, teachers who teach the same content, or teachers who teach the same level of content (Stewart, 2014; van Thiel, 2018). Collaborative PL that is active and engaging provides
opportunities for teachers to problem-solve, to discuss, to role-play, and to apply what they are learning to their specific classroom environments (Hunzicker, 2011).

Collaboration among teachers has been found to be a pivotal factor in effecting teacher change in practice (Parsons et al., 2016; Tam, 2015). However, to be most effective, teachers may need to be taught how to engage in collaborative PL that involves well-structured, meaningful, and sustained interactions going beyond superficial conversations (Makopoulou & Armour, 2014; Stewart, 2014).

It is also important to develop a plan that allows teachers to choose when and how to engage in the PL activities that they need as individuals (Caramanico, 2014). However, in order for that to have the greatest impact on student learning, the teacher must first decide what they hope to achieve and engage in activities that are chosen purposefully and with intent (Guskey, 2017). The K-12 environment can allow for teacher choice by asking for teacher input on the types and focus of PL activities to be offered throughout the year (Phillips, 2017; Rodman, 2018) and providing a structured format for teachers to choose the activities that will best help them to meet the goals previously established.

Finally, a key element to effective PL is that it provides ongoing support after the fact. Almost all of the studies discussed in Guskey and Yoon's (2009) study of effective PL provided significant and sustained well-structured support even after the primary PL activities were concluded. Research from both Hunziker (2011) and Sheffield, Blackley, and Moro (2018) showed that long-term support for changing teacher practice can improve the confidence and preparedness of teachers who are implementing changes in their practice, both to curriculum and to technology integration practices. Knight (2007) and VanThiel (2018) found that on-going support through PL is crucial to the adoption,
implementation, and integration of technology tools in the classroom. Devices and access alone are not enough for teachers to effectively integrate the technology into the daily classroom practice – they must also have the confidence and skills necessary to use them. Finally, it is important to recognize the existing skills and confidence of teachers in the technology integration process and then offer ongoing PL support that helps them to grow (Hixon & Buckenmeyer, 2009).

**Evaluation of impact of professional learning on teacher practice.** The surest way to know that PL is effective is by evaluating the impact it has on teacher practice and student learning. In 2009, Guskey and Yoon observed that there were relatively few research-driven valid studies that explicitly examined the relationship between PL and improvements in student learning. Since that time, a number of studies have been published examining the impact of PL on teacher practice, finding that the desired effects may include increased teacher reflection, greater collaboration among teachers, improved classroom practice, and of course, increased student achievement (Guskey & Yoon, 2009; Kopcha, 2012a; Zehetmeier et al., 2015).

Reflection upon practice is essential for continued growth and changes leading to improved instructional practices (Bleicher, 2014; Krahenbuhl, 2016). When reflection is built into and intertwined with technology-focused PL, teachers are better able to intentionally choose tools that expand or transform the learning experience rather than allowing technology to be the focus of learning (Kimmons et al., 2015; Ruggiero & Mong, 2015). However, reflective practices need to be intentional and focused in order to have a long-term impact on higher teaching practices (Sheffield et al., 2018; Zehetmeier et al., 2015). Additionally, teachers must be willing to engage in reflective practices that
open the door to a change in practice, especially when learning about innovative technologies that may transform traditional teaching practices (Hughes, 2005).

Effective PL can also greatly increase collaboration among teachers when implemented correctly and with due diligence. When organized around common teams of teachers or when forming professional learning communities, a more structured organization of PL can produce a new sense of collaboration that is primarily positive among team members (Tam, 2015). These teams may in fact continue beyond the scope of the original PL intent (Bleicher, 2014). Well-structured collaboration, especially in the vehicle of a professional learning community, has been found to be a very powerful tool for implementing a change in instructional practice among teachers (Mizell, 2010; Woodland & Mazur, 2015). It should be considered though that collaboration should primarily focus on student learning and powerful instructional practices; otherwise, the collaboration is superficial at best (Woodland & Mazur, 2015).

Another key result desired by most PL is that teacher practice improves (Guskey, 2014). It is important for PL to be conducted under appropriate conditions and with best practices in mind in order to increase the likelihood that it will actually achieve the desired result of a change in teacher practice (Stewart, 2014). Importantly, sustained PL activities that are content-focused, led by content-area leaders, and designed to increase teacher knowledge of how to teach the content has been shown to lead to a significant increase in teacher knowledge of their content for teaching (Koellner & Jacobs, 2015). Research has shown that when PL activities are conducted with fidelity to the best practices mentioned previously, there is an increased likelihood of long-term change in teacher practice (Goodnough, 2018; Kopcha, 2012a).
Historically, it has been difficult to scientifically measure the impact of PL on changing teacher practice resulting in improvements to student learning because that data has been self-reported by teachers (Fishman et al., 2013). It is also important to recognize that different stakeholders may have different opinions regarding what data demonstrates an improvement in student learning. Administrators and district personnel may focus on statewide standardized test results, while classroom teachers may focus more on improved classroom behaviors and assessment performance (Guskey, 2014). Learning Forward is a national organization promoting the purpose that “every educator engages in effective professional learning every day so every student achieves” (Mizell, 2010, p. 21). According to Learning Forward, student learning and achievement increase when teachers engage in effective PL that focuses on transformative teaching practices (Mizell, 2010). Similarly, McKnight et al. (2016) found that teachers are more successful at integrating technology for student learning when leadership, instructional technology specialists, and teacher leaders work together with the common goal of providing PL focused on using technology to increase student learning.

**Personalized Learning for Educators**

The term *personalized learning* has quickly gained popularity in education as a way to improve student learning but unfortunately, there seems to be no clear understanding of what it actually is or how to implement it effectively (Basham et al., 2016; Cavanagh, 2014). Patrick, Kennedy, and Powell (2013) define personalized learning as “tailoring learning for each student’s strengths, needs and interests — including enabling student voice and choice in what, how, when and where they learn — to provide flexibility and supports to ensure mastery of the highest standards possible” (p.
4). When applied to PL for educators, personalized learning has the ability to transform PL from a chore and something that they are required to do to meet certification requirements into something that is exciting, fulfilling, and immediately relevant to the personal needs of their individual classrooms (Brooks & Gibson, 2012; Caramanico, 2014; Hirschy, 2016). The following sections will review three types of personalized learning for educators: coaching, professional learning communities, and informal personalized professional learning such as social media and Edcamps. Best practices and the potential impact on classroom technology integration will be explored for each type of personalized professional learning.

**Coaching**

Coaching has existed as a form of individualized learning for professionals for more than 20 years (Knight, 2007). When employed at the school level, instructional coaches work one-on-one or in small groups with teachers with the goal of helping them implement research-based instructional practices that will improve student learning (Ehsanipour & Gomez Zaccarelli, 2017; Knight, 2007; Tanner et al., 2017). Unlike other forms of mandated PL for the entire staff of a school, coaching includes activities in a variety of formats, such as individual coaching, small group coaching, or even large-group activities. The frequent result of teacher participation in coaching activities is an immediate and direct impact on student learning (Rose, 2009). One of the most important aspects of coaching is that the coach works in partnership with the teacher (Ehsanipour & Gomez Zaccarelli, 2017). The role of the coach is to think beyond the role of the teacher but without the constraints of the role of an administrator, due to their evaluator role,
when searching for solutions to whatever problem the teacher is trying to solve (Wolpert-Gawron, 2016).

Using these same ideas, the International Society for Technology in Education first released standards for technology coaches in 2011. The role of a technology coach is defined as an educator who helps “others use technology effectively to improve teaching and learning” (Williamson, 2015). Technology coaches may be full- or part-time coaches or may be full-time educators who simply serve as technology coaches to those around them. Technology coaches are generally employed by a school or school system, but an increasing number are self-employed or employed by a variety of other educational organizations or companies.

The partnership between either an instructional or a technology coach and a teacher has seven underlying principles to which both the coach and the teacher should adhere:

- Equality: both are equal partners in sharing and decision making
- Choice: the teacher has the final say in the decision of which goals or practices to choose, as well as how to interpret data
- Voice: coaching conversations should feel like a safe and candid conversation with a trusted friend
- Dialogue: the conversation is a back-and-forth dialogue in which ideas and inquiries are shared by both parties
- Reflection: conversations with coaches involve reflection on what has been learned and what will be learned
• Praxis: the goal of the coaching experience is that the knowledge and skills being learned can be applied immediately and are helpful to both the teacher and the students

• Reciprocity: the partnership creates shared learning experiences for both the coach and the teacher (Knight, 2007, 2018).

Knight (2018) describes the coaching cycle as one in which the teacher and coach identify a goal, work together to learn how to achieve the goal, and then work together to improve until the goal is met. While he also identifies three different approaches to coaching, all of which could be followed by either instructional or technology coaches, he believes that the best model is dialogical. In the dialogical coaching model, the teacher is a partner in the relationship and has valuable knowledge and skills to share but needs additional knowledge or skills to be able to meet his or her goal. The teacher has the final decision-making power, but the coach is able to share his or her own knowledge and skills as an expert through dialogues with the teacher. The focus of the goal, dialogue, and inquiry is on improving student learning through the teacher’s improved instructional practices.

Professional Learning Communities

Another way of personalizing learning for educators is through the use of professional learning communities (PLCs). In a PLC, groups of teachers work together and decide upon a shared focus for a change in practice with the intent that it will lead to an improvement in student learning (Woodland & Mazur, 2015). As defined by DuFour (2004), PLCs operate around the key principles of ensuring that students learn, that
teachers collaborate, and that all involved focus on the results. Effective implementation of a PLC starts with four pivotal questions that must be answered:

1. What does the student need to know?
2. How does the teacher know that the student has learned it?
3. How will the teacher respond if the student has difficulty in learning it?
4. What will the teacher do if the student already knows it?

The members of the PLC are typically those who have chosen to work together towards a common student-learning goal and may come from the same school or district, or may choose to work together across districts or even nationally (Çolak, 2017). An important difference of a PLC from other forms of PL is that the focus is on student learning, rather than on teaching (Richard DuFour, 2004; Jessie, 2007). It is also important to note that the members of the PLC do not work in isolation, but rather work together as a collaborative group, taking responsibility as a group for improving student learning (B. D. Brown et al., 2018; DuFour, 2004).

PLCs that focus on technology integration must remember to specifically target the focus as technology integration for improved student learning and must be able to tie technology integration into the four essential student learning-focused questions that guide a PLC (Thoma et al., 2017). A failure to keep the focus on those essential questions or to eliminate one of the key principles of collaboration, data-driven results, and student learning may result in an imperfect implementation that not only fails at improving student learning but also may lead to teacher dissatisfaction in the process (Wilson, 2016). Even while working collaboratively in a PLC, teachers who desire autonomy will
have that freedom when PLCs are implemented with fidelity to the key principles (DuFour, 2011).

**Informal Opportunities**

While most discussion around effective PL focuses on formal PL experiences, teachers in the trenches know that a lot of serious learning about learning, teaching, assessing, and reflecting take place during more informal learning experiences. Recently, those involved in education and educational research have begun to place more importance on these informal learning experiences, which are characterized by a lower level of pre-planning and organization in which learning may happen individually or collectively, but without a formal instructor (Kyndt et al., 2016). Two areas of informal learning that continue to gain popularity among educators are unconferences such as Edcamps and Personal Learning Networks (PLNs) organized through social media.

The first recorded Edcamp was held in Philadelphia, PA in 2010, organized by a group of teachers who decided to meet for a computer science-focused unconference (EdCamp Foundation, 2018). In the first four years, more than 400 Edcamp events had been held (Swanson, 2014) and two years later, that total had grown to more than 600 (Jeffrey Paul Carpenter, 2016). Topics for sessions are chosen based on the suggestions, strengths, and interests of those who attend, and frequently revolve around technology tools and integration practices (Carpenter, 2016; Carpenter & Linton, 2016; U.S. Department of Education, 2016). Lastly, Edcamps rely on a principle of Open Space Technology commonly known as "the law of two feet" (Carpenter, 2016; Carpenter & Linton, 2016; Wake & Mills, 2018), meaning that if an attendee is in a session that does not meet their needs or interests, it is expected and incumbent upon them to get up and go
to another session. It is not uncommon at an Edcamp to see attendees in more than one room during the same session, or even engaging in serious exchanges of academic dialogue in the hallway outside of sessions.

According to the Edcamp Foundation (2018), who routinely survey organizers and attendees of local Edcamps, educators who participate in Edcamps say that they feel more supported, that they learn more, and that they leave feeling more satisfied compared to many formal PL experiences. Additionally, almost 70% of attendees report that they learned four or more new ideas that they intend to implement in their classroom. Finally, more than 97% of those responding to surveys sent by the Edcamp Foundation say that they created or developed beneficial contacts while attending an Edcamp event. Similar results were reported in other studies, with attendees providing largely positive feedback on their overall experience, session topics, what they learned, and their intent (or not) to attend future events (Carpenter, 2016; Carpenter & Linton, 2016; Wake & Mills, 2018).

Another form of informal PL that allows educators to take charge of their own learning anywhere, anytime, is the formation of a Personal Learning Network (PLN) through social media sites like Facebook, Twitter, Voxer, and Pinterest. PLNs allow educators from across the globe to connect and collaborate with other educators in similar roles or with similar interests, be they peers or experts (U.S. Department of Education, 2016). Due to the nature of social media, many of the interactions are asynchronous, but synchronous interactions can happen as well, through the use of online chats featured around a certain hashtag or even videoconferencing between educators or classrooms (Caramanico, 2014; Carpenter & Krutka, 2015; Hirschy, 2016; Ross et al., 2013; U.S. Department of Education, 2016). Many educators form their own PLN using social media
due to feelings of isolation in their school or district (Carpenter & Krutka, 2015). Being able to connect with outside peers and even experts is especially beneficial to educators in smaller and/or rural districts who may feel that they are in a silo (Carpenter & Krutka, 2015; Ross et al., 2013) and for those in roles which exist in limited numbers in a school or district, such as the instructional technology specialist, the media specialist, or even the principal or superintendent (Jetter & Coda, 2018). Finally, while exchanges on social media have a reputation for being superficial, many educators who engage in academic dialogue on social media can provide concrete examples of how those exchanges have led to real change in their classroom, in their practice, or in their attitudes and beliefs (Brooks & Gibson, 2012; Carpenter & Krutka, 2015; Jetter & Coda, 2018; Ross et al., 2013).

**Chapter Summary**

The review of literature in this chapter began by identifying differences in the definitions of technology integration in the K-12 environment. An exploration of major models used for evaluating technology use in the classroom followed, and the section concluded with the impact that teacher attitudes and beliefs about technology use have on classroom technology integration. Secondly, the review of current literature continued by exploring the types of professional learning experiences offered for K-12 educators, then examined ineffective professional learning practices, and concluded with the best practices associated with professional learning and the impact of professional learning on teacher practice. Lastly, the review ended by exploring forms of personalized professional learning for educators such as coaching, professional learning communities,
and informal opportunities such as Edcamps and Personal Learning Networks, each of which also explored the impact that these experiences have on classroom practice.
CHAPTER 3

METHODS

The purpose of this action research was to implement and evaluate the impact of personalized professional learning for teachers intentionally focusing on models of technology integration.

This research explored the following research questions:

1. How does modeling technology integration in professional learning opportunities for educators change technology integration in the classroom?
2. How does a focus on technology integration models through professional learning opportunities for educators change teacher attitudes towards technology integration in the classroom?
3. How does an educator’s participation in personalized professional learning opportunities change personalized learning opportunities offered in the classroom?

Research Design

The purpose of this action research was to implement and evaluate the impact of personalized professional learning for teachers intentionally focusing on models of technology integration. Using an action research approach allowed me to explore the solutions to the research questions within a localized context. While other forms of research may focus on generalized applications of the study, a primary focus of action
research is to apply the results of the study directly back into the context in which the
research was done (Herr & Anderson, 2005).

Using the action research cycle allowed the participants to drive the research and
benefit first from the results of the study. This is what Mertler (2017) means when
describing action research as a process which allows teachers to study the practices
taking place in their own classroom to evaluate the effectiveness of those practices and
implement changes that will improve outcomes. Participants in the study were also
participant researchers instead of passive objects of study. Moreover, it was important to
remember that the very process of action research is to construct meaning by exploring
“the real-life experiences of real-life people” (McNiff, 2013, p. 24) and learning from
their success as well as their struggles.

Mills (2017) defines action research as any process of systematic inquiry that
educators may conduct in their educational environment with the purpose of learning
more about “how their particular schools operate, how they teach, and how well their
students learn” (p. 10). The action research cycle is typically represented with four steps:

1. Selection of a research focus
2. Data collection
3. Analysis and interpretation of data
4. Development of an action plan

In many action research environments, this may be a spiraled, ongoing process in
which classroom teachers or other educators return to the first step after implementing the
action plan as a way of determining the effectiveness of the changes made, as seen in
Figure 3.1.
Study Design

This study employed a concurrent mixed-methods research design, collecting both qualitative and quantitative data. Creswell (2014) defines qualitative research as “an approach for exploring and understanding the meaning individuals or groups ascribe to a social or human problem” (p. 12). Quantitative research is defined as a way of “examining the relationship between variables” (Creswell, 2014, p. 13). The qualitative data provided the opportunity to explore teacher attitudes towards technology integration, perception of levels of technology integration and personalized learning, and beliefs about the impact that professional learning can have on classroom practice. The accompanying quantitative data provided numerical data that helped to create a more complete and in-depth picture of how teachers felt and what they believed about the role of technology in the classroom. This method of concurrent triangulation allowed each
type of data collected to validate the evidence produced by the other (Kroll & Neri, 2009).

Before beginning Phase 3 of the study (the Innovation phase), I collected quantitative data from teachers regarding the school vision for technology use, their access to technology, their beliefs about classroom technology use, technology-related professional learning, and time spent integrating technology into classroom practices. Qualitative data collected included questions designed to elucidate their opinions about technology integration in professional learning and their efforts towards personalizing their own professional learning, as well as classroom observations focusing on technology integration and personalization of learning.

Quantitative and qualitative data were collected through an online survey during Phase 1 of the research. Following completion of the online survey and selection of participants, follow-up data were collected through classroom observations and focus-group discussions. The combined data collected during Phase 1 and Phase 2 provided information about what participants knew and believed about classroom technology integration, as well as how they currently used technology in their classroom. This data served to drive the development of the instructional modules of Phase 3, which was designed to inform teachers of models to evaluate how technology can be purposefully integrated into their classes while also personalizing instruction for their level of knowledge and ability. Further, I was able to seek out additional practical classroom applications based on the collected data.
Setting and Participants

Setting

The research took place at Focus High School (FHS), a public high school with grades 9-12, in the fall of 2019. FHS is located in an affluent suburb north of Atlanta, Georgia and is part of a Bring Your Own Technology (BYOT) district. In BYOT or BYOD (Bring Your Own Device) schools and districts across the country, students are permitted to bring their own devices for use in the classroom as one way to increase student access to technology in the classroom without also increasing budgets (U.S. Department of Education, 2016; Woodside, 2014). The site was selected because I already had a relationship with both the administration and many of the teachers in the building since I worked at the school for eight years as both a French teacher and an Instructional Technology Specialist (ITS).

The district has a history of being technologically rich, but with low levels of technological innovation. The school opened in 2009 with all teachers having a laptop and an interactive Promethean board paired with the ActivInspire software on teacher laptops, in addition to four desktop computers in every classroom for student use. In 2017, the desktop computers were removed and replaced with ten Chromebooks in every classroom for students to use. In Spring 2019, the outdated Promethean boards and software were replaced with new interactive ClearTouch panels. Additionally, there were two computer labs with desktop computers, one computer lab with Chromebooks, and four digital language labs, as well as carts of Chromebooks or laptop computers that could be checked out through the Media Center for classroom use.
At the time the study was conducted, the school had only one ITS for approximately 200 staff members. However additional, non-instructional responsibilities took time away from his ability to create and deliver professional learning opportunities for teachers about best practices for technology integration. Therefore, this study was designed to help to fill a gap in learning for the participating teachers.

**Participants**

The research site had approximately 160 teachers on staff in Fall 2019. The teachers ranged in age from 23 years old to 65 years old, with 59% being female and 41% being male. The number of years of experience ranged from first-year teachers to 35 years of experience. The average number of teachers per department was 15, with the smallest department (English for Speakers of Languages) having only 2 teachers and the largest department (Mathematics) having 26 teachers.

The study was originally designed to have eight to twelve participants and the final study, conducted in Fall 2019, had 10 participants, consisting of teachers across all core content areas, including English Literature, Mathematics, Science, Social Studies, and World Languages. I first contacted all teachers at the school with an invitation to apply to be part of the study via email at the end of July in 2019 and 28 teachers responded.

The average age of respondents was 42.64 years old. Only one respondent was in the age range of 20-29 and they did not agree to participate in the study. There were 10 respondents between the ages of 30-39 and 10 between the ages of 40-49. While there were seven teachers who responded in the age range of 50-59, only one agreed to participate in the study. 57.1% \((n = 16)\) respondents identified as female, while 42.9% \((n \)
identified as male. The average number of years teaching by those who responded to the study was 16.11 years and the average number of years at FHS was 6.39 years. 35.7% \((n = 10)\) of those who responded were Social Studies teachers, 25.0% \((n = 7)\) of those who responded were Science teachers, 14.3% \((n = 4)\) of those who responded were English Literature teachers, 14.3% \((n = 4)\) of those who responded were World Language teachers, and 10.7% \((n = 3)\) of those who responded were Mathematics teachers.

From the 28 teachers who responded to the survey, I purposefully selected 10 participants with an aim to have a representative sample of content areas, years of teaching experience, and gender amongst those teachers who participated. These 10 participants formed a Professional Learning Community (PLC) as part of the yearly teacher evaluation system for the state of Georgia, which has a component of teacher professional growth. Therefore, participants were not asked to take on an additional task but were rather able to participate in the study as part of their normal duties and responsibilities. Table 3.1 provides an overview of the 10 participants, while longer descriptions are provided below.

Table 3.1
Participant Descriptions

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Age</th>
<th>Gender</th>
<th>Years Teaching</th>
<th>Years at FHS</th>
<th>Subject Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andrew</td>
<td>42</td>
<td>Male</td>
<td>17</td>
<td>6</td>
<td>Social Studies</td>
</tr>
<tr>
<td>Deborah</td>
<td>48</td>
<td>Female</td>
<td>17</td>
<td>2</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Diana</td>
<td>51</td>
<td>Female</td>
<td>28</td>
<td>9</td>
<td>English Literature</td>
</tr>
<tr>
<td>Edward</td>
<td>36</td>
<td>Male</td>
<td>13</td>
<td>2</td>
<td>Science</td>
</tr>
<tr>
<td>Heather</td>
<td>38</td>
<td>Female</td>
<td>13</td>
<td>10</td>
<td>Science</td>
</tr>
<tr>
<td>Jane</td>
<td>33</td>
<td>Female</td>
<td>9</td>
<td>6</td>
<td>Social Studies</td>
</tr>
<tr>
<td>Jennifer</td>
<td>31</td>
<td>Female</td>
<td>8</td>
<td>8</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Josh</td>
<td>43</td>
<td>Male</td>
<td>21</td>
<td>6</td>
<td>Science</td>
</tr>
<tr>
<td>Melody</td>
<td>41</td>
<td>Female</td>
<td>18</td>
<td>6</td>
<td>World Languages</td>
</tr>
<tr>
<td>Robyn</td>
<td>45</td>
<td>Female</td>
<td>16</td>
<td>2</td>
<td>World Languages</td>
</tr>
</tbody>
</table>
At the time of the study, Andrew was 42 years old with 17 years of teaching experience, six of which were at FHS. He taught Social Studies, both on-level and honors World History. He was also a coach, which had an influence on his teaching style and his approach to new ideas. Additionally, he held an advanced degree in Instructional Technology and was known to me for being open to a higher use of technology in the classroom, as I had worked with him as he completed his previously mentioned degree.

Deborah was 48 years old with 17 years of teaching experience, only two of which had been at FHS. She taught Mathematics, including on-level Statistics, and Advanced Placement Statistics. She had come to FHS from a district where all students were issued the same stylus-enabled touchscreen tablet. This was a something that she missed and struggled with not having in our district. But she was excited to continue using technology in her teaching and looked forward to exploring new ways to incorporate it.

Diana was 51 years old at the time of the study with 28 years of teaching experience, nine of which were at FHS. She taught English Literature, both on-level 12th-grade literature and Advanced Placement English Literature. She was not afraid of new experiences but described herself as a "dinosaur" teacher, especially when it came to using technology. Despite this, she was happy to participate in the study and was interested in learning more about how technology could enhance her teaching.

Edward was 36 years old at the time of the study with 13 years of teaching experience, only two of which were at FHS. He taught Advanced Placement Biology and did not have anyone else in the building with whom to collaborate. He was a strong user of technology even before participating in the study and was hoping that through his
participation in the study, he would find new connections and learn more about how technology was used in the district.

Heather was 38 years old with 13 years of teaching experience, 10 of which were at FHS. She taught Honors Biology and was also the department chair. She was additionally very interested in professional learning and involved in leading the school’s PL initiatives but was not sure how technology could be used in her classroom by students because she saw science as fieldwork. However, she was open to exploring new ideas during the study.

At the time of the study, Jane was 33 years old with only nine years of teaching experience, six of which were at FHS. She taught Advanced Placement Human Geography and was very against the use of technology by students in the classroom, describing herself as an “old school” teacher who felt that she should be “center stage”. She expressed through her pre-study survey and later through the pre-study focus-group discussions that she was scared personally that students, especially her daughter, would spend all day on a screen and was scared professionally of being replaced by technology. Despite her reservations, she still volunteered to participate in the study.

Jennifer was 31 years old with eight years of teaching experience, all of which had been at FHS. She taught Advanced Placement Calculus AB/BC and was also one of the Mathematics department chairs. As part of completing an advanced degree in mathematics through a local university program, she was also completing additional coursework for an online teaching endorsement and was a strong, if new, user of technology in her teaching.
Josh was 43 years old at the time of the study with 21 years of teaching experience, six of which had been spent at FHS. He taught Forensics and was also a coach. Like Andrew, with whom he coached and was close friends, this had an influence on how he approached new ideas in his classroom. Josh also held an advanced degree in Instructional Technology, which he had completed with Andrew, and was a strong technology user prior to participating in the program. However, he sometimes became lax and was excited to use the study to re-energize his use of technology in the classroom.

Melody was 41 years old at the time of the study with 18 years of teaching experience, only six of which had been at FHS. She taught Spanish 2 and Spanish 3, and also held an advanced degree in Instructional Technology, through which I had mentored her. Melody had been against technology use by students in the classroom prior to her degree. However, as a result of her degree program, she became a strong believer in its use, which was she had hoped for. She was excited to continue exploring new ways to incorporate technology into her teaching.

Lastly, Robyn was 45 years old at the time of the study with 16 years of teaching experience, only two of which had been at FHS. She taught Spanish 3. While the study was taking place, she was also participating in a district-provided endorsement program to obtain her Online Teaching Endorsement, similar to what Jennifer was completing, but led by leaders of the district’s online academy.

Action / Innovation

The innovation in this research consisted of targeted professional learning opportunities that aimed to instruct and inform teachers of the various models of technology integration that exist, including best practices for the appropriateness of using
technological resources in classroom instruction. The independent learning experience focused on the pedagogy behind the integration models and the purposeful choice behind educational tools being used as part of classroom instruction. In addition to this independent learning experience, there were also personalized learning opportunities offered for participants to choose what they wanted to explore and how they wanted to attempt implementation in their classroom. This can be seen as a graphic in Figure 3.2 below.

**Figure 3.2. Phases of research**

**Collecting Data to Drive Instruction**

When examined appropriately and in-depth, performance and assessment data should be used to modify instruction beyond surface-level changes, with the goal of improving performance and achievement outcomes (Marsh et al., 2015). This corresponds with the instructional design model promoted by Gustafson and Branch (2002b), which encourages instructional designers to conduct a needs analysis before beginning to plan and design instructional content and materials. As a result, prior to
beginning the innovation phase of the research (Phase 3), I collected data from the participants that was used to design targeted and personalized learning experiences to meet their individual and collective needs and expectations. This data came from an online survey, as well as classroom observations and focus-group discussions.

During Phase 1 of the research, all invited participants completed an online survey using Kopcha’s 2012 *Technology Integration Survey* (see Appendix B). In addition to the 15 Likert-scale questions (grouped by theme), respondents were asked to clarify and explain their answers to each thematic grouping of questions. After completion of the survey, participants were purposefully selected with an aim at achieving a representative sample of content areas, years of teaching experience, and gender. The combined data collected from Phase 1 and Phase 2 was used to design a choice board with an independent learning experience and application activities.

**Independent Learning Experience**

By including an independent learning experience that still included opportunities for personal interaction, this action research innovation took a blended learning approach to professional learning, which allowed teachers to build strong networks, improve their own leadership capacity, and have access to ongoing support (Project Tomorrow & Blackboard K-12, 2017; WestEd, 2015). Additionally, Project Tomorrow (2017) found that teachers who had participated in an online or blended learning course as a student were more likely to use technology at higher levels and to support self-directed learning in their own classrooms.

Allowing participants control over what they learn, when they learn it, and how they demonstrate their learning mirrors best practices for personalized learning as well.
Students who actively participate and own their learning are more engaged in the learning process and understand how to apply what they learn in the real world (Foote, 2013; Headden, 2013). Similarly, teachers who participate in differentiated professional learning are more likely to apply what they learn to the context of their actual classroom practice (Caramanico, 2014; Hunzicker, 2011; Wolpert-Gawrom, 2018), which will lead to improved student engagement and achievement.

All instruction and application were designed based on participant responses to the survey, as well as their needs and desires as expressed or observed during the classroom observations and the focus-group discussion. Nine options were provided via a tic-tac-toe choice board that encouraged participants to learn more about the topics that they wanted and that they felt would help to improve their classroom instructional practices. The middle square was required for all participants and was an interactive hyperdoc providing interactive instruction central to the research focus. Three topics were included on the hyperdoc: technology integration models (SAMR, PICRAT, and TPACK), informal learning, and personalized learning. Upon completion of the middle square, participants were able to choose how they wished to form their tic-tac-toe based upon the application activities provided.

The activities were designed based upon participant responses to the online survey and data collected through classroom observations, and focus-group discussions. The follow-up lessons and classroom application modeled best practices for both blended and personalized learning by offering participants choice of what they learned, choice of when they learned, and choice of how they demonstrated their learning (Caramanico, 2014; Rose, 2009; Wolpert-Gawrom, 2018). Participants were asked to choose one
activity focused on classroom technology integration and one activity focused on personalized learning, in addition to the required middle square hyperdoc.

The additional eight activities included:

**Personalized Learning:**

1. Observe a teacher in another department for at least 20 minutes. Pay close attention to how they manage classroom technology use.
2. Find and participate in a Twitter chat specific to your educational interests (with a presentation on how to get started with Twitter chats and a curated list of chats provided).
3. Attend and participate in an Edcamp or CoffeeEDU (with an offer to organize one if one could not be found).
4. Design a lesson that allows students choice in how they complete an assignment.

**Technology Integration:**

5. Find a new digital tool to use in your class and learn how to use it. If there is a "certification" for it, what are the requirements?
6. Redesign a lesson to more purposefully integrate technology. Teach and evaluate it (using both SAMR and PICRAT).
7. Redesign a lesson without technology to hit all four levels of SAMR. Teach the lesson at least one of the ways.
8. Redesign an in-class lesson to be an in-class blended-learning experience.

As participants completed their chosen tic-tac-toe activities, there were spaces in the instructional hyperdoc for them to reflect on their experience with each activity. This
allowed them to record their thoughts and remember the experience during later conversations and the post-study focus group discussions.

After the innovation phase was complete, data were again collected by follow-up classroom observations and focus-group discussions. These were further supplemented by an online survey of the selected participants.

**Data Collection**

In order to answer the research questions, both qualitative and quantitative data were collected from the study participants via action research methods. Prior to beginning the innovation, participants completed Kopcha’s 2012 Technology Integration Survey through a Google Form (see Appendix B). In addition to the Likert-scale questions included in the survey, participants provided demographic data about themselves and were given the opportunity to elaborate upon their responses through open-ended questions to provide both qualitative and quantitative data. Upon receipt of the responses and selection of participants, participants were observed during one of their class periods to obtain observational data about how technology was integrated in their classroom prior to the study beginning and how it does or does not contribute to personalized learning opportunities offered in their classroom. The classroom observations were followed by focus-group discussions about technology integration, personalized learning, and informal learning, both in the classroom and their own professional experiences.

The qualitative data collected from these methods also served as the basis for the professional learning innovation that was designed. After participants took part in the professional learning experiences designed to increase knowledge of and facility with technology integration and personalized learning, further data was collected via a post-
study classroom observation and focus-group discussion, as well as a post-study survey sent just to participants.

Each form of data collected throughout the study was used to answer the research questions, as seen in Table 3.2 below. Data from the different methods was triangulated to gain a more in-depth understanding of how the research questions are interrelated, as recommended by Bloomberg and Volpe (2015).

Table 3.2

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Data Collection Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ1: How does modeling technology integration in professional learning opportunities for educators improve technology integration in the classroom?</td>
<td>Observations, Focus-group discussion</td>
</tr>
<tr>
<td>RQ2: How does a focus on technology integration models through professional learning opportunities for educators improve teacher attitudes towards technology integration in the classroom?</td>
<td>Online survey, Focus-group discussion</td>
</tr>
<tr>
<td>RQ3: How does an educator’s participation in personalized professional learning opportunities improve personalized learning opportunities offered in the classroom?</td>
<td>Observations, Focus-group discussion</td>
</tr>
</tbody>
</table>

Online Survey

The preliminary online survey was delivered to all teachers at the school via Google Forms and asked basic identifying information that was used for descriptive purposes only (see Appendix B). This part of the survey asked teachers to identify their age, gender, content area, years of teaching experience, years teaching at FHS, and level of students taught that year (on-level, remediate, or advanced). Koppa’s 2012 Technology Integration Survey consists of 15 Likert-scale questions using the standard range of strongly agree (4) to strongly disagree (0). Statements in the survey were broken
into five barriers for classroom technology integration: Vision, Access, Beliefs, Professional Development, and Time. Each barrier consisted of three statements to which participants responded using the Likert scale.

Statements were worded such that higher scores corresponded to conditions that increased the likelihood of classroom technology integration, whereas lower scores indicated that classroom technology integration was less likely due to more challenging conditions. While the full survey can be seen in Appendix B, as an example, the statements for the Beliefs sub-scale are as follows:

- I believe using computers with students increases their learning.
- It is easy to design learning activities that incorporate computers.
- I believe that technology makes my job as a teacher easier.

Kopcha (2012a, 2012b) found that the Cronbach alpha for the survey is 0.93 or more, while the rating within each grouping is also above the acceptable level for the published survey.

In addition to this quantitative data, qualitative data was collected by asking participants to elaborate upon their choice through open-ended questions. This information was used to help “contribute to [an] understanding and resolution of [the] given problem” (Mills, 2017, p. 109). All questions are aligned with the research questions and helped to guide the instruction provided through the innovation. At the conclusion of the study, all 10 participants completed the same survey as a way of comparing pre- and post-study attitudes and beliefs.
Observations

Participants in the study were observed during their teaching periods two times, once at the beginning of the study and again at the end of the study. Each observation was scheduled in advance with the participant and lasted 20-45 minutes. The purpose of the observations was to collect observational data about how technology was integrated into the classroom and how personalized learning opportunities were presented for students.

The Looking for Technology Integration (LoFTI) survey designed by the North Carolina State University College of Education and The William and Ida Friday Institute for Educational Innovation (2010) consists of 19 items to be used in classroom observations to determine how, to what extent, and by whom technology is being used in the classroom. This instrument was used to collect data through a Google Form (see Appendix C). The first 13 items are indicators of the class itself: date, teacher, grade, subject, level, and descriptors of classroom setup. The remaining items focus on what type of technology is being used, how it is used, and who is using it (teacher, student, or both). The final item asks the observer to indicate the percentage of students showing positive engagement in five separate ways.

During the observation, I recorded actions and behaviors that related to teacher use of technology, student use of technology, and instances where personalized learning opportunities were offered to students. After each observation, the results were discussed individually with the teacher as part of the process of member checking, as recommended by Frankel and Wallen (as cited by Mertler, 2017, p. 41).
Focus-group discussions

Participants also took part in focus-group discussions two times during the study. Each focus-group discussion lasted 20-45 minutes. The first discussion focused on the overall findings from the online survey and initial attitudes, as well as to include participants in the design of the innovation. The final discussion was intended to assess what was learned by participants and how the innovation affected their teaching practice.

The purpose of the focus-group discussion was to allow teachers to hear and discuss differences in opinions, attitudes, and experiences with technology integration, personalized learning in the classroom, professional learning, and personalized professional learning with other participants. This technique is supported by Mills (2017) and permitted participants to come to a shared understanding of the questions. Each small group consisted of 2-4 participants chosen based on convenience of scheduled availability.

Each focus-group discussion was semi-structured with questions that provided qualitative data to answer all three research questions. Guiding questions attempted to assess participant attitudes towards and experience with the impact of professional learning, technology integration in the classroom, and personalized learning (see Table 3.3). Other discussion prompts were pulled from common themes observed during classroom observations as related to the participants unique to the focus group, such as how technology can help to improve the teacher experience in addition to the student experience, or arose organically through the discussion, such as conversations about the role of the teacher in the classroom.
Table 3.3

Research Question and Discussion Questions Alignment

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Discussion Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ1: How does modeling technology integration in professional learning opportunities for educators improve technology integration in the classroom?</td>
<td>1. What does technology integration look like in your classroom?</td>
</tr>
<tr>
<td></td>
<td>2. How do you feel about observing other teachers to improve your own teaching?</td>
</tr>
<tr>
<td>RQ2: How does a focus on technology integration models through professional learning opportunities for educators improve teacher attitudes towards technology integration in the classroom?</td>
<td>1. How do you feel about technology’s role in the classroom?</td>
</tr>
<tr>
<td></td>
<td>2. How much do you know about how to evaluate classroom technology integration?</td>
</tr>
<tr>
<td>RQ3: How does an educator’s participation in personalized professional learning opportunities improve personalized learning opportunities offered in the classroom?</td>
<td>1. What does personalized professional learning mean to you?</td>
</tr>
<tr>
<td></td>
<td>2. How do you feel about personalized learning in the classroom?</td>
</tr>
</tbody>
</table>

Data Analysis

Mixed-methods data analysis is a complex process in which the researcher examines the data as a whole, then in individual pieces, and finally reconstructs it again after making new connections between the ideas expressed. As Creswell (2014) says, “It involves segmenting and taking apart the data (like peeling back the layers of an onion) as well as putting it back together” (p. 195). In this study, both qualitative and quantitative data was collected via the pre- and post-study surveys, classroom observations and focus-group discussions. Descriptive demographic data about the participants was also collected through the pre-study survey and served to describe participants while maintaining their anonymity. Qualitative data was collected from all data sources, as seen in Table 3.4 below, while quantitative data was collected from the
online surveys and classroom observations. This section will include descriptions of (a) the quantitative data analysis process and (b) the qualitative data analysis process.

Table 3.4

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Data Collection Methods</th>
<th>Analysis Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ1: How does modeling technology integration in professional learning opportunities for educators improve technology integration in the classroom?</td>
<td>Observations</td>
<td>• Descriptive statistics of quantitative data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Inductive analysis of qualitative data</td>
</tr>
<tr>
<td>RQ2: How does a focus on technology integration models through professional learning opportunities for educators improve teacher attitudes towards technology integration in the classroom?</td>
<td>Online survey</td>
<td>• Descriptive and inferential statistics for quantitative data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Inductive analysis of qualitative data</td>
</tr>
<tr>
<td>RQ3: How does an educator’s participation in personalized professional learning opportunities improve personalized learning opportunities offered in the classroom?</td>
<td>Observations</td>
<td>• Descriptive statistics for quantitative data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Inductive analysis of qualitative data</td>
</tr>
</tbody>
</table>

Quantitative Data Analysis Process

The analysis of quantitative data can help to show the depth and variety of data collected far more transparently than qualitative data sometimes allows and when paired with qualitative data, can complement and expand on what was found through the qualitative analysis (Connolly, 2014). Because quantitative data can be measured and quantified, as well as being objective, its findings can be analyzed using statistical methods.
analysis and then provide evidence for what is shown anecdotally (Goertzen, 2017; Kroll & Neri, 2009).

Quantitative data was collected through the online survey and classroom observations both before and after the innovation phase of the research. This section will detail (a) the descriptive statistical analysis and (b) the inferential statistical analysis.

**Descriptive statistical analysis.** The median and standard deviation were calculated for each item in the online survey for both pre- and post-responses. Statements were worded such that higher scores corresponded to conditions that increased the likelihood of classroom technology integration, whereas lower scores indicated that classroom technology integration was less likely due to more challenging conditions. Therefore, the numerical response to each item represents the likelihood of technology integration occurring according to the individual respondent. The mean scores represent the likelihood of technology integration occurring according to the study participants as a group and the standard deviation represents the distribution of scores.

For classroom observations, the data analysis included the number of students in class during the observations, the number of students using technology, and the types of technology being used in the room. Some questions were described with a frequency count (n) and others were described using a combination of lowest value (min), highest value (max), and range of values (R). Other questions were described by the type of technology being used by students in the classroom, including students’ use of their own technology through the Bring Your Own Technology (BYOT) policy in place in the district. The final questions on the observation tool were described with a frequency
count of the level at which technology was being used by both the participant and their students.

**Inferential statistical analysis.** Due to the small number of participants, the use of parametric statistics such as a t-test for the online survey was deemed inappropriate based upon a Shapiro-Wilk test for assumption of normality. I conducted a non-parametric Wilcoxon signed-rank test for each pair of pre- and post-study barrier (Vision, Access, Belief, etc.). Two subscales showed statistical significance (Vision and Time), however since there is a higher Type I error rate when multiple comparisons are being made the Bonferroni adjustment was used to avoid reporting a false positive (Streiner & Norman, 2011).

**Qualitative Data Analysis Process**

Qualitative data were collected through pre- and post-surveys, classroom observations, and focus-group discussions. These three data sources went through three cycles of coding using inductive analysis. Mertler (2017) and Saldaña (2016) explain that this is a bottom-up approach to data analysis, meaning that it is data-driven and starts with the specific details of the data and then moves towards a more general understanding.

The first cycle involved multiple rounds of reviewing the data to develop codes. This was done by uploading the data sources to the coding application Delve (Ho & Limpaecher, n.d.), reading the transcripts multiple times, and applying codes using a combination of coding techniques that are common to inductive analysis.

The second cycle of coding took the codes through two rounds of grouping and regrouping before the codes were grouped by commonalities to produce categories. In
this second cycle, I worked with participants to verify that the categories matched their participant experience in the focus-group discussions. This process entailed a preliminary cycle where I refined the structural codes that were the final result of the first cycle into categories, shared the information with participants, received feedback, and then completed a second cycle to determine the final categories.

There was a large gap of time between the end of the second cycle of coding and the beginning of the third cycle due to the effects of the COVID-19 pandemic on my research process. However, once I returned and reviewed the data with my dissertation chair, I was able to begin again. Finally, the categories from the second cycle were regrouped and reviewed three times to produce the final themes.

**Procedures and Timeline**

This research study was divided into five phases involving participants: Phase 1, invite and select participants; Phase 2, pre-innovation data collection; Phase 3, innovation; Phase 4, post-innovation data collection; and Phase 5, data checking. Most data analysis and reporting occurred after active participation by participants was complete. Some phases overlapped throughout the study. Each phase is explained more fully in the following paragraphs and is detailed in Table 3.4 below.

**Phase 1: Invite and select participants**

During this first phase, I invited teachers to participate in the research study by sending an email to the staff at FHS. The email explained the goal of the research, the expected time commitment, that participation was voluntary, and included a link to the pre-survey which was used to express interest. Participants were purposefully selected from those who respond based upon the goal of obtaining a representative sample across
content areas, years of experience, and gender. Participants were then asked to provide their informed consent upon final selection. This phase lasted approximately one week at the end of July in 2019.

**Phase 2: Pre-innovation data collection**

During the second phase of the research study, lasting approximately three weeks in August through early September 2019, I collected observational data through classroom observations and focus-group discussions. Classroom observations were noted using a Google Form and focus-group discussions were audio recorded. Discussions were transcribed electronically using Otter.ai (Liang & Fu, 2016). They were then checked manually and corrected for accuracy. Transcripts were made available to participants to view, listen to, and correct for accuracy.

During this phase, I reviewed the collected data from observations and focus-group discussions to discover recurring themes and attempted to discover the relationships between them, resulting in a causal model built from the bottom-up (M. Miles et al., 2013). The information provided by the classroom observations and focus-group discussions was used to design the innovation for Phase 3.

**Phase 3: Innovation**

During the third phase of the research study, participants were part of a collective Professional Learning Community to explore models for evaluating technology integration and best practices for classroom technology integration. Instruction and application opportunities were provided virtually through a tic-tac-toe choice board and included a mixture of blended, hybrid, and fully online formats. During this stage, I also delivered an in-person, whole-group professional learning session focused on the
technology integration model PICRAT (Kimmons et al., 2015, 2020; Kimmons & Hall, 2018). This phase was the longest part of the research and lasted approximately eight weeks, beginning in mid-September 2019 and lasting through mid-November of the same year.

**Phase 4: Post-innovation data collection**

During the fourth phase of the research study, lasting approximately three weeks, I again collected post-innovation observational data through a post-study survey, classroom observation, and focus-group discussions. The information collected from the follow-up survey was used to measure how participant attitudes and beliefs towards classroom technology integration changed as a result of the innovation. The data provided by the classroom observations and focus-group discussions was used to measure change of classroom technology integration following participation in the study.

Focus-group discussions were again audio recorded using Otter.ai (Liang & Fu, 2016). Discussions were once again transcribed electronically, checked manually, and corrected for accuracy. For the purpose of this study and to improve conciseness, partial transcripts were created that included researcher-condensed grammar (Carlson, 2010). This helped to eliminate the uncomfortable situation that may result from participants seeing their verbal speech in written form (Birt et al., 2016). However, all transcripts were made available to participants to view, listen to, and correct for accuracy throughout all parts of the study.

**Phase 5: Data checking**

Once Phase 2 and Phase 4 transcription, analysis, and synthesis were complete, the final transcriptions were shared with participants for member checking and review.
When sharing the final report, it was important to share what to expect when reading the report as well as precise instructions for checking the transcripts to avoid setting traps for me or the participants (Carlson, 2010) and to include specific consent for any follow-up needed (Thomas, 2017).

Table 3.5

Phases of Research

<table>
<thead>
<tr>
<th>Phase 1: Invite and select participants</th>
<th>Participant’s Role</th>
<th>Researcher’s Role</th>
</tr>
</thead>
</table>
| 1 week                                 | • Complete pre-survey to indicate interest  
• Learn study details  
• Provide consent | • Send email with link to pre-survey  
• Collect and review responses  
• Inform participants of the study details  
• Obtain consent |

<table>
<thead>
<tr>
<th>Phase 2: Pre-innovation data</th>
<th>Participant’s Role</th>
<th>Researcher’s Role</th>
</tr>
</thead>
</table>
| 3 weeks                     | • Schedule initial classroom observation  
• Schedule and participate in initial small-group interview | • Schedule and conduct initial individual classroom observations  
• Schedule and conduct initial focus-group interviews  
• Check focus-group transcriptions for accuracy |

<table>
<thead>
<tr>
<th>Phase 3: Innovation</th>
<th>Participant’s Role</th>
<th>Researcher’s Role</th>
</tr>
</thead>
</table>
| 8 weeks             | • Participate in guided instruction designed based on expressed needs and preferences to learn about best practices for technology integration and technology integration evaluation models  
• Participate in informal learning experiences | • Create and deliver instruction on technology integration evaluation models and classroom best practices for technology integration  
• Personalize instruction for participants  
• Provide opportunities for informal learning experiences  
• Provide check-point opportunities throughout the study  
• Use data from check-points to modify instruction as needed |

<table>
<thead>
<tr>
<th>Phase 4: Post-innovation data</th>
<th>Participant’s Role</th>
<th>Researcher’s Role</th>
</tr>
</thead>
</table>
| 3 weeks                       | • Schedule follow-up classroom observation  
• Schedule and participate in follow-up small-group interview | • Schedule and conduct follow-up individual classroom observations  
• Schedule and conduct follow-up small-group interviews  
• Check focus-group transcriptions for accuracy |
Phase 5: Data checking

3 weeks

- Review collected data for accuracy
- Work with researcher to make corrections as needed
- Provide transcriptions to participants for member checking and review
- Work with participants to make corrections as needed

Rigor and Trustworthiness

This concurrent mixed-methods action research study collected both quantitative and qualitative data as complementary data points. Quantitative data were collected with qualitative data serving to further explain and situate the quantitative findings.

Qualitative data is often seen as less trustworthy than quantitative data, perhaps because its data is less quantifiable and therefore unable to address the quantitative constructs of validity and reliability (Birt et al., 2016; Shenton, 2004). An additional danger to the validity of qualitative data is researcher bias, wherein the researcher simply finds what they want to find. However, Creswell (2014) indicates that validity is one of the strengths of qualitative research and recommends the use of several strategies to enhance the ability to “assess the accuracy of findings as well as convince readers of that accuracy” (pp. 200-201). There are numerous strategies that can be employed to maximize validity, such as the researcher as a detective; low interference descriptors; extended fieldwork; triangulation of data, method, or investigator; participant feedback; reflexivity; and peer review (Johnson, 1997). As recommended by Creswell (2014), this study used the following strategies for ensuring the rigor and trustworthiness of qualitative data: (1) triangulation of data; (2) member checking; (3) rich, thick description; (4) presentation of discrepant findings; (5) prolonged time in the field; and (6) peer debriefing and external audits.
Triangulation of Data

The use of multiple sources and multiple methods of data collection, known as triangulation, contribute to the trustworthiness of an action research study by showing that corroborating evidence was collected via different means (Bloomberg & Volpe, 2015). When information collected through the online survey is evidenced through classroom observations and then explained in detail during the focus-group discussion, the researcher is more confident that participants are being truthful about their practice, rather than acting a certain way or saying certain things for the benefit of the study.

One example of triangulation is through the lens of the study as a whole, as seen when findings from the quantitative data support the themes derived from the qualitative data. Another example of this is triangulation of individual participants through data points both pre- and post-study.

To illustrate the first example (quantitative data supporting the themes derived from the qualitative data), in her pre-study online survey, Robyn self-reported a score of 3 out of 4 on the statement “I believe that technology makes my job as a teacher easier.” In her classroom observations, this could be seen in evidence as she did use technology at a higher level, Amplification, but still not the highest level of Transformation, and her students used technology at a lower level of Passive. In the pre-study focus group, Robyn discussed a variety of digital tools that she uses in her classroom, concluding with “I guess I feel like I’m using a lot of technology, but it’s spotty, and I don’t know how much easier it is. But I feel like if I don’t incorporate it, I will lose their interest eventually.”

However, on the post-study TIS, she self-reported a score of 4 and explained her score, saying “I still think that tech helps students learn more, because it opens them up to
new opportunities. It's easy to design good activities but takes time. However, I've realized how much more I can do with technology to make my life easier.” Her classroom observation also evidenced these higher levels of use, with both her use of technology and her students’ use of technology showing growth, reaching the Transformation and Creative levels of use. In the post-study focus group discussion, she talked about how using the online gamified assessment platform GimKit allowed her to more easily create multiple practice assessments for her students by involving her students. In this way, the quantitative data was supported by the qualitative data, as what Robyn said in her in focus-discussions was evidenced through her classroom observations and her self-reported growth the TIS.

**Member Checking**

The process of member checking “involves taking data, analyses, interpretations, and conclusions back to the participants so that they can judge the accuracy and credibility of the account” (Creswell & Poth, 2017, p. 261). Participants had access to their personal collected data and were asked to review findings, interpretations, and conclusions electronically throughout the study and again at the end of the study. Before final submission, participants were also asked to electronically review the findings and clarify any misinterpretations, as well as to judge the accuracy and credibility of the result. This process of member checking helped to equalize the researcher and the participants, therefore empowering participants as fellow researchers (Thomas, 2017).

**Rich, thick description**

Detailed description of the research setting, participants, process, and findings are an important piece of establishing credibility because it enables the reader to gain a
deeper perspective and to be able to “determine the extent to which the overall findings ‘ring true’” (Shenton, 2004, p. 269). It is also important to take the audience into account and to draft a representation that will best speak to those who will read and make decisions based upon their understanding of the setting and findings (Herr & Anderson, 2005). Taking that into consideration, this final report was written in a narrative format that hopefully speaks to the reality of the daily experience of the classroom teacher. Additionally, the final report of the study includes direct quotations from the participants in order to hear and understand the findings in a more personal way.

Presentation of Discrepant Findings

Mills (2017) explains that researchers tend to avoid recording events and data that do not fall in line with the other findings in a quest to wrap up the research questions with neat answers and solutions. However, he goes on to say that rather than being fearful of finding data that does not follow other collected data in answering the research questions, the non-conforming findings are equally important as all data is grist for the research mill and helps lead to a complete understanding of the reality of the daily classroom experience. Therefore, this study seeks to represent all findings, even those that are outliers and do not line up with others, in a way that fully explores the reality of technology integration in the classroom.

Prolonged Time in the Field

It is recommended that a researcher spend as much time as feasible in the research site prior to beginning data collection to gain an easy familiarity with the setting and participants (Bloomberg & Volpe, 2015; Creswell & Poth, 2017; Shenton, 2004). Due to my previous experience at the selected site as both a French teacher and ITS, I believe
that I had an easier time establishing myself as a collaborative researcher working with the participants for a deeper understanding of the impact that personalized professional learning can have on technology integration in the classroom than a traditional outsider would. However, because I am no longer at the school itself but rather at the district office, it was important to make a concerted effort to spend extended periods of time productively observing, as well as interacting and engaging with participants in order to maintain their trust, as recommended by Mertler (2017).

**Peer Debriefing**

As defined by Mertler (2017), peer debriefing is a method of reflecting on the research by both reviewing and critiquing the research process with the assistance of another professional such as a colleague or fellow research student throughout the research study. This study made use of peer debriefing through the assistance of colleagues at the research site who are familiar with both the research process as former or current doctoral researchers and the culture of the site. Another source of peer debriefing has been fellow research students pursuing similar research studies who served to question and critique the study. As recommended by Shenton (2004), these frequent debriefing sessions were used to discuss alternative approaches, to determine if there were flaws in the method or analysis, and to provide a sounding board to test developing ideas and interpretations.

**External Audits**

Similar to the peer debriefing process, an external auditor in one who is uninvolved in the research process and who will review and evaluate the final research study (Mertler, 2017). Creswell and Poth (2017) recommend that an external auditor
examine the final report and help determine whether or not the data collected supports the findings and conclusions. Upon conclusion of the study, an external audit process occurred through conversations with my program advisor who has spent considerable time interrogating my analysis, findings, and report.

Plan for Sharing

When conducting action research, it is important to maintain open communication throughout the process between the researcher, participants, and other stakeholders. During the course of the research cycle, all information collected was available for review by participants and local administration.

At the conclusion of the research, all findings were made available to participants and local administrators through a written report and a multimedia presentation. When sharing the findings, it was important to protect the identity of all participants. All information about participants has been kept confidential throughout the study and was anonymized for this report. Pseudonyms were assigned and used for the district, school, and participants to protect their identities. Therefore, while there are plans for publishing and sharing the presentation with a wider audience, it is also important to balance to the need for anonymity and privacy with how the findings from this study may inform future research.
CHAPTER 4
ANALYSIS AND FINDINGS

The purpose of this action research was to explore how modeling higher levels of technology integration while introducing ways to evaluate classroom technology integration changes both technology use in the classroom and participant attitude towards using technology in the classroom. A secondary aspect of the study sought to explore how personalized professional learning changes student-based personalized learning. This study focused on the following research questions:

1. How does modeling technology integration in professional learning opportunities for educators change technology integration in the classroom?

2. How does a focus on technology integration models through professional learning opportunities for educators change teacher attitudes towards technology integration in the classroom?

3. How does an educator’s participation in personalized professional learning opportunities change personalized learning opportunities offered in the classroom?

Before the study began, teachers at Focus High School were given the opportunity to complete a survey with both Likert-scale questions and open-answer questions. Ten participants were selected from those who agreed to participate in the study. Small-group discussions and classroom observations were held with the ten selected participants. The
results of the survey and classroom observations produced quantitative data for analysis. Further qualitative data was produced through the open-answer portion of the survey, the small-group discussions, and the classroom observations, which was additionally analyzed. Data from all sources were used to design the innovation. After the study, all data points were repeated to provide a method of comparison. Transcripts from all open-answer survey responses, small-group discussions, and classroom observations were coded for qualitative analysis. The findings from both (a) quantitative and (b) qualitative analyses are cataloged below.

Quantitative Findings

Quantitative data were collected for this study using Kopcha's (2012) Technology Integration Survey (TIS) and the Looking for Technology Integration (LoFTI) survey designed by the North Carolina State University College of Education and The William and Ida Friday Institute for Educational Innovation (2010). Both tools were used to collect pre- and post-data. Quantitative data collected through pre- and post-survey results, as well as pre- and post-classroom observations, were analyzed using descriptive statistics and non-parametric tests. Results from the calculations were used to describe what changes, if any, resulted from the innovation. The following sections include (a) a presentation of participant demographics, (b) a presentation of both instruments used, (c) the process used to analyze and compare the data per instrument, and (d) the resulting findings per instrument.

Participant Demographics

From the 28 teachers who responded to the survey, I purposefully selected 10 participants with an aim to have a representative sample of content areas, years of
teaching experience, and gender amongst those teachers who participated. Of the 10
participants, three were male and seven were female. Three participants were Science
teachers, two taught in the Social Studies department, two taught in the Mathematics
department, two taught in the World Languages department, and one taught English
Literature. Table 4.1, shared previously in Chapter 3 but shared here again for reference,
provides an overview of descriptive statistics of the participants.

Table 4.1

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Age</th>
<th>Gender</th>
<th>Years Teaching</th>
<th>Years at FHS</th>
<th>Subject Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andrew</td>
<td>42</td>
<td>Male</td>
<td>17</td>
<td>6</td>
<td>Social Studies</td>
</tr>
<tr>
<td>Deborah</td>
<td>48</td>
<td>Female</td>
<td>17</td>
<td>2</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Diana</td>
<td>51</td>
<td>Female</td>
<td>28</td>
<td>9</td>
<td>English Literature</td>
</tr>
<tr>
<td>Edward</td>
<td>36</td>
<td>Male</td>
<td>13</td>
<td>2</td>
<td>Science</td>
</tr>
<tr>
<td>Heather</td>
<td>38</td>
<td>Female</td>
<td>13</td>
<td>10</td>
<td>Science</td>
</tr>
<tr>
<td>Jane</td>
<td>33</td>
<td>Female</td>
<td>9</td>
<td>6</td>
<td>Social Studies</td>
</tr>
<tr>
<td>Jennifer</td>
<td>31</td>
<td>Female</td>
<td>8</td>
<td>8</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Josh</td>
<td>43</td>
<td>Male</td>
<td>21</td>
<td>6</td>
<td>Science</td>
</tr>
<tr>
<td>Melody</td>
<td>41</td>
<td>Female</td>
<td>18</td>
<td>6</td>
<td>World Languages</td>
</tr>
<tr>
<td>Robyn</td>
<td>45</td>
<td>Female</td>
<td>16</td>
<td>2</td>
<td>World Languages</td>
</tr>
</tbody>
</table>

TIS

The TIS was developed by Kopcha in 2012 as part of his study presented in
"Teachers' perceptions of the barriers to technology integration and practices with
technology under situated professional development." The instrument consists of 15
Likert-scale questions using the standard range of strongly agree (4) to strongly disagree
(0). Statements in the survey were broken into five barriers for classroom technology
integration: Vision, Access, Beliefs, Professional Development, and Time. Each barrier
consisted of three statements to which participants responded using the Likert scale.
Statements were worded such that higher scores corresponded to conditions that
increased the likelihood of classroom technology integration, whereas lower scores
indicated that classroom technology integration was less likely due to more challenging conditions. This section will include (a) a presentation of the tests conducted on the data, (b) descriptive statistics from the survey results, and (c) inferential statistics from the survey results.

Tests Conducted on the TIS Data. Kopcha (2012) found that Cronbach’s alpha "for the final version of the survey was 0.93 or more for each year" (p. 1113) of his study. However, when I determined Cronbach's alpha for internal consistency (see Table 4.2 below), results ranged from 0.53 (Access) to 0.83 (Time). According to Manerikar and Manerikar (2015), acceptable internal consistency is indicated by Cronbach’s alpha values between 0.6 and 0.7. Therefore, while the subscale of Access ($\alpha = 0.53$) will be discussed, conclusions should be considered as tentative.

Table 4.2
Quantitative Results from TIS Subdivided by Section

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Item Numbers</th>
<th>Cronbach's alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vision</td>
<td>1, 2, 3</td>
<td>0.68</td>
</tr>
<tr>
<td>Access</td>
<td>4, 5, 6</td>
<td>0.53</td>
</tr>
<tr>
<td>Beliefs</td>
<td>7, 8, 9</td>
<td>0.82</td>
</tr>
<tr>
<td>Professional Development</td>
<td>10, 11, 12</td>
<td>0.80</td>
</tr>
<tr>
<td>Time</td>
<td>13, 14, 15</td>
<td>0.83</td>
</tr>
</tbody>
</table>

Due to the small number of participants, the use of inferential statistics was deemed inappropriate based upon a Shapiro-Wilk test for assumption of normality. This test showed that the data suggested a deviation from normality. Instead, the data determined that a nonparametric test be used, and I conducted a Wilcoxon signed-rank test for each pair of pre- and post-study barrier (Vision, Access, Belief, etc.). Two subscales showed statistical significance (Vision and Time), however there is a higher
Type I error rate when multiple comparisons are being made, as attitudes about Professional Development could be affected by attitudes about Time. The Bonferroni adjustment can help avoid reporting a false positive (Streiner & Norman, 2011). These tests and the Bonferroni adjustment showed that there was no significant difference between pre- and post-study responses (see Table 4.3). Median values for the pre-study responses ranged from 2.67 for Time to 3.67 for Access. Median values for the post-study responses ranged from 3.00 for Time to 4.00 Access. Median values for each pre- and post-study barrier are reported in Table 4.4.

Table 4.3

<table>
<thead>
<tr>
<th>Barrier</th>
<th>W</th>
<th>z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vision</td>
<td>1.50</td>
<td>-2.113</td>
<td>.041*</td>
</tr>
<tr>
<td>Access</td>
<td>7.00</td>
<td>-1.836</td>
<td>.066</td>
</tr>
<tr>
<td>Beliefs</td>
<td>8.00</td>
<td>-1.400</td>
<td>.182</td>
</tr>
<tr>
<td>PD</td>
<td>8.00</td>
<td>-1.718</td>
<td>.096</td>
</tr>
<tr>
<td>Time</td>
<td>2.00</td>
<td>-2.240</td>
<td>.030*</td>
</tr>
</tbody>
</table>

Note. The asterisk indicates that the Bonferroni adjustment was applied to determine if there was significant statistical difference.

The survey was completed by 28 faculty members of FHS prior to the beginning of the study. Teachers were allowed to respond anonymously and given the opportunity to provide their names at the end only if they consented to participate in the study. By doing so, the responses of the participants were able to be identified. Participants completed the survey again upon its conclusion to determine what changes, if any, resulted from the innovation. The mean and standard deviation were calculated for each item in the TIS for both pre- and post-response for participants. The technology-related responses of non-
participants were discarded and only used to provide descriptive demographic information regarding how participants were selected.

Table 4.4

Mean, Median, and Standard Deviation by Barrier and Survey Item (n = 10)

<table>
<thead>
<tr>
<th>Barrier and survey item description</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>Mdn</td>
</tr>
<tr>
<td>Vision</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I was expected to use technology to</td>
<td>3.33</td>
<td>3.00</td>
</tr>
<tr>
<td>support content objectives.</td>
<td>3.20</td>
<td>3.00</td>
</tr>
<tr>
<td>There was strong administrative</td>
<td>3.10</td>
<td>3.00</td>
</tr>
<tr>
<td>backing for using technology.</td>
<td>3.70</td>
<td>4.00</td>
</tr>
<tr>
<td>The demands / goals placed on me for</td>
<td></td>
<td></td>
</tr>
<tr>
<td>using technology were reasonable.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access</td>
<td>3.50</td>
<td>3.00</td>
</tr>
<tr>
<td>The technology available was, for</td>
<td>3.60</td>
<td>4.00</td>
</tr>
</tbody>
</table>
| the most part, useful for teaching.
| I received help fixing technology   | 3.50| 3.50 | .53 | 4.00| 4.00 | .00 |
| problems in a timely manner.       |     |      |     |     |      |     |
| The technology available was, for   | 3.40| 3.00 | .52 | 3.80| 4.00 | .42 |
| the most part, reliable.           |     |      |     |     |      |     |
| Beliefs                            | 3.17| 3.00 | .70 | 3.43| 3.00 | .86 |
| I believe using computers with      | 3.20| 3.50 | 1.03| 3.50| 4.00 | .97 |
| students increases their learning. |     |      |     |     |      |     |
| It is easy to design learning      | 3.20| 3.00 | .42 | 3.20| 4.00 | .92 |
| activities that incorporate        |     |      |     |     |      |     |
| computers.                         |     |      |     |     |      |     |
| I believe that technology makes my  | 3.10| 3.00 | .57 | 3.60| 4.00 | .70 |
| job as a teacher easier.           |     |      |     |     |      |     |
| Professional Development           | 2.97| 3.00 | .89 | 3.57| 3.00 | .57 |
| The training I received could be    | 3.20| 3.00 | .63 | 3.60| 4.00 | .52 |
| easily applied in my classroom.    |     |      |     |     |      |     |
| I felt adequately trained on the    | 3.60| 3.00 | .52 | 3.80| 4.00 | .42 |
| skills needed to use technology.   |     |      |     |     |      |     |
| I had enough opportunity to share   | 2.80| 3.00 | .79 | 3.30| 3.00 | .67 |
| technology lessons with other       |     |      |     |     |      |     |
| teachers.                          |     |      |     |     |      |     |
| Time                               | 2.47| 3.00 | .86 | 3.29| 3.00 | .58 |
| Integrating technology took less    | 2.40| 2.50 | .97 | 3.10| 3.00 | .74 |
| time than I thought it would.      |     |      |     |     |      |     |
| I was given time to learn to        | 2.60| 3.00 | .84 | 3.40| 3.00 | .52 |
| integrate technology into my        |     |      |     |     |      |     |
| lessons.                           |     |      |     |     |      |     |
| I had enough time to plan and       | 2.40| 3.00 | .84 | 3.30| 3.00 | .48 |
| prepare lessons that use technology. |     |      |     |     |      |     |
Descriptive Statistics. The TIS consists of five barriers, each of which consists of three survey items. Participants responded to the survey both pre- and post-study. In this section, each barrier will be addressed individually in three sub-sections: (a) descriptive statistics of the participant responses to the pre-study survey, (b) descriptive statistics of the participant responses to the post-study survey, and (c) discussion of the findings.

Vision. The first subscale of the TIS is Vision and consisted of three survey items:

- Item 1: I was expected to use technology to support content objectives.
- Item 2: There was strong administrative backing for using technology.
- Item 3: The demands / goals placed on me for using technology were reasonable.

This subscale asked participants to indicate on a scale of 0 (Strongly Disagree) to 4 (Highly Agree) the school's vision for classroom technology integration.

Participant responses to the pre-study survey. Among the three Vision statements, Item 3 received the highest level of agreement \((M = 3.70, \text{Mdn} = 4.00, SD = 0.48)\). Item 2 had the lowest level of agreement \((M = 3.10, \text{Mdn} =3.00, SD = 0.74)\). Item 1 fell into the middle of the three statements for participant responses in the pre-study survey \((M = 3.20, \text{Mdn} =3.00, SD = 0.63)\). The responses from the 10 participants showed greater variability with lower levels of agreement, but their selected responses had greater variability than the total of the 28 respondents.

Participant responses to the post-study survey. Post-study responses indicated that the item with the greatest agreement was Item 1, which read "I was expected to use technology to support content objectives" \((M = 4.00, \text{Mdn} =4.00, SD = 0.00)\). The other
two statements both had a Mean response of 3.60 ($Mdn = 4.00$), but Item 3 showed a Standard Deviation of 0.70.

**Discussion.** While the subscale of Vision was not specifically aligned to the study, the statements contained within were useful for understanding how participants viewed the expectation of their use of technology. Ideally, this could have also measured if a positive change was created specific to Item 3 (“The demands / goals placed on me for using technology were reasonable”) as a result of participation in the study. However, many participants responded to the post-survey February 2020 through April 2020, at the beginning of the COVID-19 crisis while schools were shutting down. This situation may have influenced their responses while being unrelated to the study. As a result, unfortunately, it is difficult to know if the fact that the level of agreement for Item 3 went down and variability increased is a result of participation in the study or due to the events happening in the world at the time of their response.

Research shows that the transactional model of stress and coping proposed by Lazarus and Folkman (1984) is relevant for understanding how people might have responded to the events at the beginning of the COVID-19 pandemic. According to this model, stress is not just a response to external events, but is also influenced by the individual's appraisal of the situation and their ability to cope with it. This may be one reason that helps to explain why agreement decreased and variability increased, as teachers were asked to move their classrooms entirely online. While that was not within the scope of the study, participants may have been unable to separate their current situation from the time of the study and the demands being asked of them at that time.
Access. The second subscale of the TIS is Access and consisted of three survey items:

- Item 4: The technology available was, for the most part, useful for teaching.
- Item 5: I received help fixing technology problems in a timely manner.
- Item 6: The technology available was, for the most part, reliable.

The Access subscale asked respondents to rate their access to technology which can be used in the classroom, including access to assistance in resolving technical issues.

Participant responses to the pre-study survey. In the pre-study survey responses, Item 4 showed the highest level of agreement ($M = 3.60$, $Mdn = 4.00$, $SD = 0.70$) in the pre-study survey. Item 5 fell in the middle, with a Mean of 3.50 ($Mdn = 3.50$) and a standard deviation of 0.53. Item 6 showed the lowest level of agreement ($M = 3.40$, $Mdn = 3.00$, $SD = 0.52$). In the barrier, as levels of agreement decreased, variability decreased amongst responses from participants.

Participant responses to the post-study survey. In the post-survey, Item 4 showed the lowest level of agreement with a Mean of 3.70 ($Mdn = 4.00$) and a standard deviation of 0.67. Conversely, while Item 5 ("I received help fixing technology problems in a timely manner") received the lowest level of agreement in the pre-survey among participants, it showed the highest level of agreement in the post-survey ($M = 4.00$, $Mdn = 4.00$, $SD = 0.00$). Item 6 fell in the middle in the post-survey, with a standard deviation of 0.42, a Mean of 3.80, and a Median of 4.00.

Discussion. It should be remembered that the Cronbach’s alpha for this subscale was 0.53, so conclusions should be considered tentative. For each statement, overall, the participants did show positive change in their self-reported scores regarding access to
technology and their access to help resolving technology-related problems, as the Mean score was higher for each statement. Additionally, there was less variety in their responses in the post-survey responses than in the pre-survey responses, as the standard deviation was lower for each statement. This could be attributed to the support that participants received as a result of participating in the study, especially those who selected to reach out for one-on-one assistance and coaching with individual experiences.

Item 4 showed the lowest level of positive change from pre- to post-survey. However, only two participants did not self-report a score of 4 in response to the statement “The technology available was, for the most part, useful for teaching.” One of those participants, Edward, reported a lower score than his pre-study response, while Jane self-reported the same score of a 2 on both surveys. All other participants self-reported scores at the highest levels on both surveys, or increased from a 3 to a 4 on the post-survey. This could be attributed to their participation in their study, leading to an increase in their understanding of the tools that are available to them and their students.

Beliefs. The third subscale of the TIS is Beliefs and consisted of three survey items:

- Item 7: I believe using computers with students increases their learning.
- Item 8: It is easy to design learning activities that incorporate computers.
- Item 9: I believe that technology makes my job as a teacher easier.

The Beliefs subscale asked respondents to self-report their beliefs about using technology in the classroom for the purposes of learning.

Participant responses to the pre-study survey. Items 7 and 8 in the pre-study survey received the same level of agreement among participants, with a Mean response of
However, the Standard Deviation was different across the two items, with Item 7 showing the highest deviation of both pre- and post-study survey results at 1.03 (Mdn = 3.50) and Item 8 showing the lowest deviation of the pre-study survey results at 0.42 (Mdn =3.00). Item 9 showed the lowest level of agreement for this subscale for participants in the pre-study survey (M = 3.10, Mdn =3.00, SD = 0.57).

Participant responses to the post-study survey. By the post-study survey, there were many changes. Item 9 showed the highest level of agreement for participants (M = 3.60, Mdn =4.00, SD = 0.70), while Item 8 showed the lowest level of agreement, staying at the pre-survey Mean of 3.20 (Mdn =4.00). By contrast, Item 8 showed a Standard Deviation of 0.92 in post-study survey. Item 7 fell in the middle of the post-study survey results for this subscale, with a Mean response of 3.50 (Mdn =4.00) and a Standard Deviation of 0.97.

Discussion. As a group, participants did show evidence of positive change on two of the three items for this subscale. Item 9 ("I believe that technology makes my job as a teacher easier") showed the greatest change from pre- to post-study survey responses. Half (n = 5) of the participants increased their self-reported score to this item from 3 to 4, while two other participants could not increase their scores because they had previously self-reported a score of 4 on the pre-study survey and continued to self-report that same score. The remaining participants also self-reported the same score on both surveys.

This positive change in the belief that technology made their job as a teacher easier, or at least the lack of negative change, could be attributed to the one-on-one assistance and coaching provided through their participation in the study. Research from both Hunziker (2011) and Sheffield, Blackley, and Moro (2018) showed that long-term
support for changing teacher practice can improve the confidence and preparedness of teachers who are implementing changes in their practice, both to curriculum and to technology integration practice, which supports this finding.

Item 7 also indicated positive change for the group as a whole, with the pre-study Mean for participants resulting in a Mean of 3.20 and a post-study Mean of 3.50. However, there was still a great variety of responses pre- and post-study, which could again be attributed to those participants who completed the post-study survey later than originally requested and who waited until they were nearing or in lockdown due to the COVID-19 pandemic.

**Professional Development.** The fourth subscale of the TIS is Professional Development and consisted of three survey items:

- Item 10: The training I received could be easily applied in my classroom.
- Item 11: I felt adequately trained on the skills needed to use technology.
- Item 12: I had enough opportunity to share technology lessons with other teachers.

The Professional Development subscale asked respondents to evaluate their experience with technology-focused professional development.

**Participant responses to the pre-study survey.** In the pre-study survey, Item 10 had the highest level of agreement ($M = 3.20$, $Mdn = 3.00$, $SD = 0.63$). Item 12 had the lowest level of agreement ($M = 2.80$, $Mdn = 3.00$, $SD = 0.79$). The remaining item in the subscale, Item 11, fell in the middle of the responses for the participants, with a Mean response of 2.90 ($Mdn = 3.00$) and the highest variety of responses of the study, with a Standard Deviation of 1.20.
Participant responses to the post-study survey. Compared to the pre-study survey, participant responses changed. Item 11 had the highest Mean response and the lowest variety of responses among participants for the Professional Development subscale ($M = 3.80$, $Mdn = 4.00$, $SD = 0.42$). Item 10 came second for this subscale with a Mean response of $3.60$ ($Mdn = 4.00$) and a Standard Deviation of 0.52. Item 12 showed the lowest level of agreement for this subscale in the post-study survey ($M = 3.30$, $Mdn = 3.00$, $SD = 0.67$).

Discussion. When looking for evidence of positive change per item from pre- to post-study, Item 11 showed the most change for the group of participants as a whole, increasing the Mean response from 2.90 for the pre-study survey to 3.80 for the post-study survey. Additionally, the variety of responses to this item decreased significantly, from a Standard Deviation of 1.20 to a Standard Deviation of 0.42. Reviewing individual responses to this item can show even greater evidence of positive change, as 80% of participants ($n = 8$) self-reported an increased score to this statement, with one participant remaining at the same level and only one decreasing their score by one.

One participant in particular, Heather, increased her score on this item from a 0 (the lowest possible) on the pre-study survey, to a 4 (the highest possible) on the post-study survey. This is especially significant when one looks at other statements made by Heather throughout the study about her interest in the field of Professional Development. Research shows that one of the most important aspects of coaching is that the coach works in partnership with the teacher (Ehsanipour & Gomez Zaccarelli, 2017) and to assist the teacher in searching for solutions to whatever problem the teacher is trying to solve (Wolpert-Gawron, 2016). This research shows that participation in the study,
especially considering the one-on-one coaching, may have led to Heather’s positive change in her self-reported score, as well as those of other participants.

The other items in the subscale, Items 10 and 12, both showed positive change for participants, although not as significant as that as Item 11. Both items also showed a decrease in the Standard Deviation from pre- to post-study survey results, indicating that participation the study may have brought participants closer together in their responses. The increase in Mean responses may also indicate that their participation in the study made them more comfortable sharing what they learned and helped them more easily apply what they learned in their classroom.

**Time.** The final subscale of the TIS was Time and consisted of three survey items:

- Item 13: Integrating technology took less time than I thought it would.
- Item 14: I was given time to learn to integrate technology into my lessons.
- Item 15: I had enough time to plan and prepare lessons that use technology.

The Time subscale asked respondents to consider how time affected their use of technology.

**Participant responses to the pre-study survey.** In this barrier, Items 13 and 15 were tied for the lowest responses in the entire survey, with a Mean response of 2.40. Item 13 had a Standard Deviation of 0.97 (\(Mdn =2.50\)) and Item 15 had a Standard Deviation of 0.84 (\(Mdn =3.00\)). While receiving a slightly higher score than the other items in this subscale among participants (\(M = 2.60, Mdn =3.00, SD = 0.84\)), Item 14’s score was still lower than many of the other items on the survey.

**Participant responses to the post-study survey.** In the post-study survey, the items showed evidence of positive change and some items showed less variation in their
response rate. Item 14 received the highest levels of agreement from participants ($M = 3.40$, $Mdn = 3.00$, $SD = 0.52$), Item 13 showed the lowest level of agreement ($M = 3.10$, $Mdn = 3.00$, $SD = 0.74$). Item 15 fell again in the middle ($M = 3.30$, $Mdn = 3.00$, $SD = 0.48$).

*Discussion.* When looking for evidence of positive change per item from pre- to post-study, Item 15 showed the most change for the group of participants as a whole, increasing the Mean response from 2.40 for the pre-study survey to 3.30 for the post-study survey. Additionally, the variety of responses to this item decreased, from a Standard Deviation of 0.84 to a Standard Deviation of 0.48. Reviewing individual responses to this item can also show evidence of individual positive change, as 60% of participants ($n = 6$) self-reported an increased score to this statement, with all other participants remaining at the same level and none decreasing their score.

Two participants had initially reported a score of 1 for Item 15 on the pre-study survey. However, Robyn self-reported a score of 3 on the post-study survey and Edward increased his score to 4. Teachers who feel rushed or overwhelmed have been shown through research to be less likely to use technology (Ascione, 2018; Ertmer & Ottenbreit-Leftwich, 2010). However, when given ample support through time to collaborate, plan, and participate in professional learning that supports their technology goals, teachers are more comfortable and confident using technology in the classroom as well as becoming more likely to integrate to support student learning and engagement (Ertmer & Ottenbreit-Leftwich, 2010; Patterson et al., 2016).

**Inferential statistics pre- and post-study.** A Wilcoxon Signed-Rank test was conducted to determine the impact of the study on participant attitudes. The results of the
test indicated that there may have been a significant difference between participant pre- and post-study attitude toward Vision, \( W=1.500, z = -2.113, p = 0.041 \). However, an adjustment was made using the Bonferroni correction due to the presence of multiple paired tests. Applying the Bonferroni adjustment (\( p = 0.008 \)) showed that there was no significant difference.

The results of the Wilcoxon Signed-Rank test indicated that there may have also been a statistical significance between participant pre- and post-study attitude in the barrier of Time (\( W=2.000, z = -2.240, p = 0.030, \alpha = <0.050 \)). However, applying the Bonferroni adjustment (\( p = 0.006, \alpha = >0.100 \)) showed that there was no significant difference.

However, the results of the test indicated that there was no statistical significance between participant pre- and post-study attitude toward Access (\( W=7.000, z = -1.836, p = 0.066 \)), even though overall scores did show a positive change pre- and post-study. Additionally, the results indicated there was no statistical significance between participant pre- and post-study attitude toward Beliefs (\( W=8.000, z = -1.400, p = 0.182 \)). For the barrier of Professional Development, the results of the test indicated that there was no statistical significance between participant pre- and post-study attitude (\( W=8.000, z = -1.718, p = 0.096 \)), even though most participants (\( n = 7 \)) did self-report scores that showed a positive change pre- and post-study.

**LoFTI**

The LoFTI is an observation protocol instrument developed by the Friday Institute for Educational Evaluation as part of the spring 2010 evaluation of the North Carolina Learning Technology Initiative. As stated by the Friday Institute:
LoFTI is a tool to aid in the observation of technology integration into teaching and learning. The data gathered through the use of this instrument should be helpful in building-level staff members as they plan and/or provide professional development in instructional technology. (William & Ida Friday Institute for Educational Innovation, 2010)

The instrument consisted of 19 items to be used in classroom observations to determine how, to what extent, and by whom technology is being used in the classroom. The first 13 items are indicators of the class itself: date, teacher, grade, subject, level, and descriptors of classroom setup. The remaining items focus on what type of technology is being used, how it is used, and who is using it (teacher, student, or both). The final item asked the observer to indicate the percentage of students showing positive engagement in five separate ways.

While useful for building administration, the items specific to grade level, track, core subject, student arrangement, student grouping, learning environment, and instructional collaborators were discarded as part of the final data analysis, as they were deemed not relevant to the research questions of this study. Additional items discarded were the North Carolina-specific Web Resources, as the study did not take place in North Carolina.

The instrument was used in classroom observations of the selected participants prior to the study beginning as one way to gain insight into what types of experiences would be best suited to include in the research innovation. Observations lasted approximately 30-45 minutes. At the conclusion of the innovation, observations were
conducted again in an effort to determine what changes, if any, resulted from the innovation.

Information about what type of technology was used, for what purpose, and by whom was also collected via the LoFTI classroom observation protocol. This quantitative data was analyzed using descriptive statistics to inform both the innovation design and to determine what changes, if any, resulted from the innovation. The ten participants were observed before and after the innovation was implemented.

**Classroom Observation Data.** Data derived from the classroom observations was important to the findings of the study as had the potential to show how participation in the study impacted actual classroom technology integration. Additionally, the data from the observations includes details about who was using technology, what types of technology were being used, and the purpose of the technology use.

Table 4.5 provides descriptive statistics for the number of students in class during the observations, the number of students using technology, and the types of technology being used in the room. Some questions are described with a frequency count (n) and others are described using a combination of lowest value (min), highest value (max), and range of values (R). Other questions are described by the type of technology being used by students in the classroom, including students’ use of their own technology through the Bring Your Own Technology (BYOT) policy in place in the district. These data are significant because they show an overall increase in the number of students using technology as well as an overall decrease in passive use of technology.
Table 4.5

Pre- and Post-Study Classroom Observation Data \((n = 10)\)

<table>
<thead>
<tr>
<th>LoFTI Observations Class and Technology Counts Usage by Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>How many students are in class?</td>
</tr>
<tr>
<td>min</td>
</tr>
<tr>
<td>Pre</td>
</tr>
<tr>
<td>Post</td>
</tr>
<tr>
<td>How many students are using technology?</td>
</tr>
<tr>
<td>min</td>
</tr>
<tr>
<td>Pre</td>
</tr>
<tr>
<td>Post</td>
</tr>
<tr>
<td>What type of technology is used in the room?</td>
</tr>
<tr>
<td>Chrome-books</td>
</tr>
<tr>
<td>Pre</td>
</tr>
<tr>
<td>Post</td>
</tr>
</tbody>
</table>

Table 4.6 provides details about how technology is used in the classroom and by whom. The numbers represent the number of classrooms in which technology is being used by students and/or the teacher as a tool for a variety of scenarios. Some data included in the original study (such as “Generating and testing hypotheses”) are not included in the table below because they were not observed in pre- or post-study observations and thus discarded as part of the final data analysis, as they were deemed not relevant to the research questions of this study.

These data are significant because they illustrate the trend of teachers primarily using technology for administrative and productive purposes, such as email and attendance, while students typically use technology for assessment and research purposes. However, this data also shows an increase in the number of classrooms with students
actively using technology to learn and/or show what they have learned as well as an increase in the number of classrooms where participants used technology for instructional purposes instead of administrative purposes.

Table 4.6

Quantitative Data Regarding How Teachers and Students Use Technology According to LoFTI Observations (n = 10)

<table>
<thead>
<tr>
<th>Technology is being used as a tool for…</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Students</td>
<td>Teacher</td>
</tr>
<tr>
<td>Problem Solving (e.g., graphing, decision support, design)</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Communication (e.g., document preparation, email, presentation, web development)</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Information Processing (e.g., data manipulation, writing, data tables)</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Research (e.g., collecting information or data)</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Personal Development (e.g., e-learning, time management, calendar)</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Group Productivity/Cooperative Learning (e.g., collaboration, planning, document sharing)</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Formative Assessment</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Summative Assessment</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Brainstorming</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Computer-assisted instruction</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Face to face classroom discussion</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Face to face group discussion</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Asynchronous discussion</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Drill and practice</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Identifying similarities and differences</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Project-based activities</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Summarizing and note-taking</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Technology software is in use by…</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrative (e.g., grading, record-keeping)</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Assessment / Testing</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Computer-Assisted Instruction / Integrated Learning System</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>
Table 4.7 outlines the rigor levels of technology usage in classroom observations using the PIC-RAT Integration Model, which measures how technology is being used in a lesson by the student and separately being used by the teacher. Student usage is measured as Passive (low), Interactive (middle), and Creative (high), while teacher usage is measured as being at a level of Replacement (low), Amplification (middle), and Transformation (high). While there were 10 participants in the study, the number of observed levels may be ±1, due to the possibility of more than one type of activity occurring in a classroom during the observation period or no technology being used. This table also includes researcher notes regarding the instructional practices that fit into each rigor rating. This information is significant because it measures the depth of technology integration for the previously discussed LoFTI data features.
Table 4.7

LoFTI Observations Technology Rigor \((n = 10)\)

<table>
<thead>
<tr>
<th>How was technology used by the teacher in the classroom?</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replacement</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td><strong>Observer Notes (examples):</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Instructions displayed on panel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Panel used by teacher as a whiteboard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Teacher displays timer on panel while students take quiz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amplification</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td><strong>Observer Notes (examples):</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Teacher provides pre-recorded flipped lecture notes, allowing him to be virtually present whenever students need.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Scaffolded Q&amp;A in Spanish using Language Lab</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Assignment prepared digitally for distribution and collection on LMS, as well as digital resources students use to complete the assignment.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Teacher plays a passage on the ClearTouch panel pre-recorded by a native speaker.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Teacher has prepared a midterm review packet for Stats Reasoning that has QR codes that take students to online lessons and activities for a variety of topics to help prepare them for the midterm.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transformation</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td><strong>Observer Notes (examples):</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Teacher uses Flipgrid and installed language lab for students to interview other students then share a recorded summary for other students to view.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Students go to Gimkit and create a collaborative Kit by entering a vocab test question and four answer choices, focusing on circumlocution, fill-in-the-blank, or simple translations. Teacher provides feedback to the students as they create their questions. Students then play the GimKit review that they just created as a class. At end of day, teacher will have five student-created reviews available to students.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How was technology used by students in the classroom?</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passive</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td><strong>Observer Notes (examples):</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
• Students listen to a short passage in Spanish played on the panel
• Students watch teacher-presented slideshow and take notes on paper (or simply listen and answer the questions posed by the teacher)

**Interactive**

| 6 | 5 |

Observer Notes (examples):
• Students complete an interactive midterm review on the LMS using Chromebooks or personal devices
• Students are working on practice problems to prepare for the midterm exam and then scanning their responses in SchoolCity to get instant feedback on their performance.

**Creative**

| 0 | 4 |

Observer Notes (examples):
• Students create video summaries showing similarities & differences of how they celebrate holidays.
• Students created presentations that summed up parts of world history that had been previously studied as a way to review for the midterm exam, trying to argue and prove that their chosen time period was the best one studied.

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**Qualitative Findings & Interpretations**

Qualitative data were collected for this study in three separate ways. Free response questions on the TIS allowed respondents to clarify their opinions for each of the five sections. Small focus group discussions were conducted both before and after the innovation was implemented. Lastly, observational data were collected through classroom observations conducted both before and after the innovation. This section includes (a) a description of each type of qualitative data collected, (b) the process used to analyze the data, and (c) the emerging themes and interpretations.

**Types of Qualitative Data Collected**

The first type of qualitative data collected was through free-response questions on the TIS distributed to collect information about the teachers at FHS and to select study participants. The TIS was developed by Kopcha in 2012 as part of his study presented in "Teachers' perceptions of the barriers to technology integration and practices with
technology under situated professional development." The instrument consists of 15 Likert-scale questions using the standard range of strongly agree (4) to strongly disagree (0). Statements in the survey were broken into five barriers for classroom technology integration: Vision, Access, Beliefs, Professional Development, and Time. Each barrier consisted of three statements to which participants responded using the Likert scale. Qualitative data from the survey comes from a free-response question at the end of each section asking respondents to explain their responses to the statements in each barrier section. There was one additional question at the end of the survey that allowed participants to openly share their thoughts. Participants completed the survey prior to the study and again once the study was completed.

The second type of qualitative data was collected through four small focus group discussions held before and after the implementation of the innovation, for a total of eight discussions. There were six questions designed prior to the discussions taking place:

1. What does technology integration look like in your classroom?
2. How do you feel about observing others to improve your own teaching?
3. How do you feel about technology's role in the classroom?
4. How much do you know about how to evaluate classroom technology integration?
5. What does personalized professional learning mean to you?
6. How do you feel about personalized learning in the classroom?

Each focus-group was semi-structured, with additional questions for clarification occurring organically throughout the discussion. Participants were scheduled into groups based on their availability at the time of the discussion, meaning that Group A in the first
round of discussions contained different participants than Group A in the second round of discussions. All focus-group discussions were recorded using an online tool called Otter.ai that both records and transcribes audio in real-time (Liang & Fu, 2016). After each discussion was complete, I was able to listen to the recordings and edit the transcripts as needed, including the ability to name each speaker and conduct voice matching so that the AI program could better identify each participant based on their voiceprint.

The third type of qualitative data collected came through classroom observations conducted both before and after the study. Each participant was observed prior to the pre-study focus-group discussions and again at the conclusion of the study, for a total of 20 classroom observations. The Looking for Technology Integration (LoFTI) is an observation protocol instrument developed by the Friday Institute for Educational Evaluation that consists of both quantitative and qualitative data. Quantitative data in the form of checklists was described previously. Qualitative data were also collected through field note descriptions of what was observed throughout the observation period regarding how technology was used and by whom.

Qualitative Data Analysis

These three data sources went through three cycles of coding using inductive analysis. Mertler (2017) and Saldaña (2016) explain that this is a bottom-up approach to data analysis, meaning that it is data-driven and starts with the specific details of the data and then moves towards a more general understanding.

The first cycle involved multiple rounds of reviewing the data to develop a final number of 160 codes. The second cycle of coding took the codes through two rounds of
grouping and regrouping before the codes were grouped by commonalities to produce ten categories. Finally, those categories were regrouped and reviewed three times to produce four themes. Table 4.8 presents the quantity of qualitative data by source to highlight the original data source of the unique codes.

**Table 4.8**

**Summary of Qualitative Data Sources**

<table>
<thead>
<tr>
<th>Type of qualitative data source</th>
<th>Number</th>
<th>Number of unique codes applied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre- and post-study surveys</td>
<td>38</td>
<td>25</td>
</tr>
<tr>
<td>Pre- and post-study observations</td>
<td>20</td>
<td>12</td>
</tr>
<tr>
<td>Pre- and post-study focus groups</td>
<td>8</td>
<td>123</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>66</strong></td>
<td><strong>160</strong></td>
</tr>
</tbody>
</table>

To begin, qualitative data from all three sources were uploaded to the coding application Delve (Ho & Limpaecher, n.d.) in order for me to begin the coding process. While I had originally intended to begin coding when I collected each type of data, instead all qualitative data were added at the same time once it was ready for coding. I created two projects in Delve (see figure 4.1 below). The first project consisted of transcripts of data collected before the study began. The second project consisted of data transcripts collected upon conclusion of the study. Once each data source was uploaded, I was able begin the coding process.

<table>
<thead>
<tr>
<th>Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-Study Data</td>
</tr>
<tr>
<td>Pre-Study Data</td>
</tr>
</tbody>
</table>

*Figure 4.1 Coding projects in Delve*
First-round coding consisted of three techniques: in vivo and open coding, pattern coding, and finally structural coding, all using inductive analysis. I began by applying a combination of in vivo and open coding techniques to the transcripts that were uploaded to Delve. Saldaña (2016) states that open coding (also known as initial coding) allows the researcher to study the data while remaining open to all interpretations of the data. Using open coding allowed me as a researcher to begin to reflect on what the participants had shared throughout the study and begin to take ownership of the survey data, the classroom observations, and the focus group discussions. I alternately applied open coding techniques, in which I used my own words to derive codes, with in vivo coding, in which I used the words of the participants. The choice to apply in vivo coding was made when the voice of the participants needed to be prioritized and honored, or to emphasize that the words came from the participants and not from me as the researcher. In vivo codes were differentiated from open codes by using quotation marks (see Figure 4.2 below).

![staff meeting vs professional learning (2)](image)

![standardization (1)](image)

"stuck in their ways" (2)

Figure 4.2 Quotation marks used to differentiate between in vivo and open codes

After the first cycle of in vivo and open coding, I exported the codes from Delve into a spreadsheet, printed them as labels (see Figure 4.3 below), and applied the labels to
index cards. Working with both the index cards and Delve, I was able to use pattern coding to combine similar codes based on their wording and meaning. I also looked at codes with a low number of attributed quotes to determine if the code was needed as is or should be combined with another code even if the original wording was dissimilar.

Pattern coding was selected for this round of coding because it encourages the researcher to use iterative rounds to condense a large number of codes into a smaller number of more focused codes (Saldaña, 2016). This process allowed me as the researcher to examine the quality of data highlighted from the focus group discussions, the classroom observations, and the survey. Consequently, the use of pattern coding in my second round of coding allowed me to narrow my total codes to 160 active codes.

Figure 4.3 First five rows of codes as labels

The last cycle of first-round coding consisted of structural coding. Structural coding is a useful way to code interview transcripts and open-ended survey responses by categorizing codes based on similarities and differences. Codes can be additionally
categorized using the relationships that exist among codes (Saldaña, 2016). In this final cycle, I added a column to the spreadsheet I had previously created in the first cycle and then modified in the second cycle by combining and narrowing my codes. I sorted the codes alphabetically, read them, and began by applying terms as a form of initial categorization.

When this was finished, I shared the spreadsheet with a participant who had volunteered to assist with data analysis as a part of member checking. We reviewed the codes and initial groupings together, then re-sorted the spreadsheet by the number of instances a code was applied to a quote. We worked together to apply structural codes, refining and narrowing the initial iteration to what was determined to be suitable for the next round of coding (see Figure 4.4).

<table>
<thead>
<tr>
<th>Code Name</th>
<th>Number of Snippets</th>
<th>Structural Coding 1</th>
<th>Structural Coding 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>access</td>
<td>8</td>
<td>availability of technology resources</td>
<td>availability</td>
</tr>
<tr>
<td>active student use of technology</td>
<td>16</td>
<td>student use of technology</td>
<td>use of technology</td>
</tr>
<tr>
<td>adapt use based on student needs</td>
<td>3</td>
<td>personalized learning</td>
<td>use of technology</td>
</tr>
<tr>
<td>appropriateness</td>
<td>1</td>
<td>teacher use of technology</td>
<td>teacher attitude toward technology</td>
</tr>
<tr>
<td>augmentation</td>
<td>7</td>
<td>teacher use of technology</td>
<td>use of technology</td>
</tr>
<tr>
<td>availability of devices</td>
<td>7</td>
<td>availability of technology resources</td>
<td>availability</td>
</tr>
<tr>
<td>balance</td>
<td>3</td>
<td>teacher use of technology</td>
<td>teacher attitude toward technology</td>
</tr>
<tr>
<td>benefits of technology</td>
<td>41</td>
<td>teacher attitude</td>
<td>teacher attitude towards technology</td>
</tr>
<tr>
<td>blended</td>
<td>5</td>
<td>teacher use of technology</td>
<td>use of technology</td>
</tr>
<tr>
<td>BYOT</td>
<td>5</td>
<td>availability of technology resources</td>
<td>availability</td>
</tr>
<tr>
<td>challenges</td>
<td>35</td>
<td>teacher attitude</td>
<td>teacher attitude towards technology</td>
</tr>
<tr>
<td>change</td>
<td>10</td>
<td>teacher attitude</td>
<td></td>
</tr>
<tr>
<td>Chromebooks</td>
<td>6</td>
<td>availability of technology resources</td>
<td>availability</td>
</tr>
<tr>
<td>classroom management</td>
<td>1</td>
<td>teacher use of technology</td>
<td>use of technology</td>
</tr>
<tr>
<td>comfort level</td>
<td>9</td>
<td>teacher attitude</td>
<td>teacher attitude toward technology</td>
</tr>
<tr>
<td>consistent technology use</td>
<td>5</td>
<td>teacher use of technology</td>
<td>use of technology</td>
</tr>
</tbody>
</table>

*Figure 4.4 Spreadsheet with Structural Coding 1 and Structural Coding 2*
Using structural coding in the last cycle of the first round of coding led seamlessly to the second round of coding which is creating categories. During the second round of coding, I worked with participants to verify that the categories matched their participant experience in the focus-group discussions. This process entailed a preliminary cycle where I refined the structural codes into categories, shared the information with participants via email (see Figure 4.5 below), received feedback individually from six of the ten participants, and then completed a second cycle to determine the final categories. This resulted in a total of five categories: availability, personalization, support, teacher attitude towards technology, and use of technology.

As the second round of coding was concluding, the arrival of the COVID-19 global pandemic resulted in an interruption of both face-to-face school and my final round of coding. This resulted in a large gap between the initial research and the final round of coding to develop themes. I returned to the process of data analysis with new experiences and a new lens through which I view the data collected during my study. I met with my dissertation chair Dr. Morris in Fall 2021 after an extended time away and we re-began the process of creating themes from the categories that had been initially
created in February 2020. This involved reviewing my research and data collection with him, as well as talking through the codes I had assigned to the data and how I created categories from the codes.

After refreshing myself and my dissertation chair on my data, I was able to begin developing the categories into themes. The first cycle of third-round coding resulted in four working themes. A further two meetings with Dr. Morris finally resulted in the final themes, as presented below:

1. The levels at which teachers and students use technology depends on its availability.
2. Teachers and students need support in the form of training and troubleshooting in order to use technology effectively in the classroom.
3. Teacher attitudes and beliefs towards technology in the classroom can change with support.
4. Personalization of instruction and support impacts student performance and attitude, as well as teacher adoption and attitude.

Figure 4.6, shown below, shows how the themes developed over time through the meetings with Dr. Morris.
Figure 4.6 Three cycles of third-round coding to create final themes

Presentation of Findings

Findings from qualitative data were derived from focus-group discussions and open-ended survey responses. Focus-group discussions were held both before and after the study, and participants responded to the survey both before and after the study. Pseudonyms are used to protect the identity of all participants. Quotes are shared with minor grammatical adjustments made by the researcher for the purpose of conciseness, as recommended by Carlson (2010) and Birt et al. (2016). Four primary themes resulted from the analysis of qualitative data (see Table 4.7). These themes describe how teachers and students use technology in the classroom, the support needed for both teachers and students to use technology effectively in the classroom, how teacher beliefs about the role of technology in the classroom can evolve with support, and how personalized instruction and support can influence both attitude and performance.
Table 4.7

Themes that Evolved from Qualitative Data Analysis

<table>
<thead>
<tr>
<th>Themes</th>
<th>Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The levels at which teachers and students use technology depends on its availability.</td>
<td>• Consistent &amp; reliable access to technology</td>
</tr>
<tr>
<td></td>
<td>• Availability of devices</td>
</tr>
<tr>
<td></td>
<td>• BYOT network</td>
</tr>
<tr>
<td></td>
<td>• Chromebooks</td>
</tr>
<tr>
<td></td>
<td>• Levels of technology use</td>
</tr>
<tr>
<td></td>
<td>• Student use</td>
</tr>
<tr>
<td></td>
<td>• Teacher use</td>
</tr>
<tr>
<td>2. Teachers and students need support in the form of training and troubleshooting to use technology in the classroom.</td>
<td>• Support</td>
</tr>
<tr>
<td></td>
<td>• Modeling</td>
</tr>
<tr>
<td></td>
<td>• Professional learning needs</td>
</tr>
<tr>
<td>3. Teacher attitudes and beliefs about technology in the classroom change with support.</td>
<td>• Teacher attitude and beliefs towards technology</td>
</tr>
<tr>
<td></td>
<td>• Benefits of technology</td>
</tr>
<tr>
<td></td>
<td>• Challenges and disadvantages</td>
</tr>
<tr>
<td></td>
<td>• Evaluating technology integration</td>
</tr>
<tr>
<td>4. Personalization of instruction and support impacts student performance and attitude, as well as teacher adoption and attitude.</td>
<td>• Personalization</td>
</tr>
<tr>
<td></td>
<td>• Classroom personalization</td>
</tr>
<tr>
<td></td>
<td>• Personalized professional learning</td>
</tr>
</tbody>
</table>

Theme: The levels at which teachers and students use technology depends on its availability.

A theme that emerged from this study is that participants and their students used technology based on its availability being consistent and reliable. Ertmer (1999) classified availability as a first-order barrier to technology integration, one that is extrinsic to the teacher. Other first-order barriers include time, training, and support (Ascione, 2018; Francom, 2016; Kopcha, 2012a). Early efforts at technology integration focused heavily on eliminating these external barriers (Ertmer, 1999; Fisher et al., 1996;
Means & Olson, 1997). However, more than two decades later, participants confirmed that having technology that was consistently and reliably available was still a common barrier to the use of technology in the classroom and that this impacted the levels to which both participants and students were able to use it. This theme will be addressed in two sections: (a) consistent and reliable access to technology and (b) levels of technology use by teachers and by students.

**Consistent and reliable access to technology.** When classroom technology is neither consistent nor reliable, teachers may face challenges to integrating it in the classroom. As Karen Cator was quoted as saying in 2015, “Access to technology and the ability to use it consistently and reliably in the classroom is no longer a luxury, but a necessity. It has the potential to transform teaching and learning” (Schwartz, 2015). However, from the very beginning of the study, consistent access to technology was mentioned as a barrier to its use in the classroom. This category will be presented in two sections: (a) the challenges faced when access is inconsistent and unreliable and (b) the benefits participants expressed when access has been consistent and reliable.

**Challenges** Inconsistent and unreliable technology, leading to technical issues such as software glitches or Internet outages, can disrupt the flow of learning and cause lost instructional time (Duncan, 2011; Holland, 2021; Molnar, 2014). One respondent replied to an open-ended question that the district-provided Bring Your Own Technology (BYOT) Internet access for students was inconsistent and unreliable, going down "at least 20 times in the 2018-2019 school year" (anonymous response). In another example, Melody responded on the pre-survey that the language labs are not always reliable, and because technology services technicians are not always available to make repairs as
quickly as needed, she did not always feel that the technology available was useful for teaching, which made it challenging for her to use at as high a degree as she wanted in her classroom.

In the post-study focus group discussion, Diana brought up a similar complaint when asked about the role of technology in the classroom, referring to a lesson she had planned as part of the study to complete the technology integration square that relied on using the BYOT Internet for students to use Chromebooks and personal devices to create digital projects. Unfortunately, on the day that the worktime was planned, the BYOT network was unavailable. When discussing how that affected her lesson, she complained, "Another thing I've noticed is that when technology goes down, oh my, everything comes to a halt." Unfortunately, when technical issues occur frequently, teachers may choose to abandon technology altogether and resort to more traditional methods of instruction (Holland, 2017).

This was similarly echoed by Deborah and Melody during pre-study focus-group discussions. They were in the same small group and had an exchange about the struggle of not having a consistent device that performs desired tasks across all students.

Deborah: I do miss, with BYOT, I miss them not having all the same thing. And the Chromebooks are nice, but we don't have the writing capabilities that I wish we had. We borrow, we have ten, and we have been good about sharing with other teachers.

Melody: We are too. It's just not as easy as like, take your device and everybody has the same and they know what we're talking about.
Deborah: Exactly! And I just find in math, I really miss them having the ability to write.

Deborah, a math teacher who was new to the district from a district that had been one-to-one with tablets that had styluses and writing capabilities, was expressing a common frustration. That is, that even with ample access to technology, there are still challenges to be faced when not all students have the same device or have devices that do not offer the capabilities that the teacher or subject area needs (Duncan, 2011; Holland, 2017; Sullivan, 2021)

**Benefits** Consistent and reliable access to technology can also help educators be more efficient and productive in their work. With access to reliable technology tools and resources, teachers can streamline administrative tasks, such as grading and providing feedback, and focus more time on lesson planning and instruction (Cator, 2019; U.S. Department of Education, 2017). In addition to sharing the challenges they faced when technology did not work as expected, participants shared the benefits they saw when their access to technology resources was consistent and reliable.

Edward, already a strong proponent of using technology in the classroom, noted that he appreciates being able to use the district’s technology resources and policies, such as the BYOT student Internet, BYOT policy, and district Chromebooks, for in-class projects and assessments. Access to these resources allowed him to focus his efforts on using technology to be more efficient, “serve the kids better,” and “deliver assessment feedback to them quicker.” This supports previous research that shows that teacher use of technology often relies on the technology to amplify existing practices and make them

When asked about the role of technology in their classroom or what technology integration looks like in their classroom, other participants mentioned benefits of having consistent and reliable access to resources as well. Josh spoke highly of the benefits of having consistent and reliable access to technology resources for students as a science teacher, especially when conducting labs. “Technology for the data collection, the analysis, the collaboration part of it, and then trying to get it all in there.” He went on to talk about the benefits for himself as a teacher once students turned in their lab reports, saying, “then like, you know, you can assess it, to me easier, it's more organized than getting a bunch of papers.” For Andrew, a benefit to using the district LMS with digital assignments and assessments was that he was able to use “the Chromebooks, the ten that we're allotted, any outside digital device that students may have, to kind of bring all that together.” Jane appreciated being able to refer students to the LMS planner feature: “if students miss something in class, they go to [the district LMS] for the planner aspect, and for all the resources. So, if they lose something, they can go there and get it.”

For most of these teachers, while they also spoke of the frustration that they experienced when the Internet went down, when Chromebooks went missing, or when students did not bring devices or when devices did not function as expected, the benefits of having consistent and reliable access to technology resources in their classrooms outweighed the challenges. They understood that these technologies improved their own practices to be more efficient and effective (Lewin et al., 2019; McKnight et al., 2016)
and were a step towards teaching their students skills that they would need outside the classroom (Duncan, 2011; Hoffman & Ramirez, 2018).

**Levels of technology use.** Another part of the discussion is who uses technology, when they use it, and how they use it. This too is influenced by consistent and reliable access to technology, but it is about more than just access to the devices and Internet (Holland, 2021). Students and teachers use technology differently in the classroom (Hoffman & Ramirez, 2018; Kimmons et al., 2020). This category will be presented in two sections: (a) participant uses of technology and (b) how their students used technology.

**Participant use** Participants in the study reported using technology for primarily administrative tasks, such as taking attendance, maintaining an accurate record of grades, and adding materials to the school LMS. In responding to the pre-study survey question about the vision for technology use at FHS, Josh explained his responses by saying that "while [the district LMS] and Infinite Campus (the district gradebook and attendance program) are required, there is very little other emphasis or requirements for technology in the classroom." This supports previous research by Project Tomorrow (2007, 2013, 2017), Ertmer et al (2012), and Ottenbreit-Leftwich et al (2012) that while teachers are using technology, the types of digital activities being implemented are teacher-focused and not yet transforming the classroom experience.

Multiple responses to the pre-study survey indicated that teachers also choose to use technology for the sake of efficiency: "technology really helps me manage workflow," "technology makes me more efficient," and "digital grading makes getting feedback easier." This type of use still helps to amplify existing practices but falls short of
transforming the classroom experience as defined by Hughes (2005), Puente du r a (2013), and Kimmons and Hall (2018).

Anonymous pre-study TIS responses showed evidence that efficiency is a driving factor for many other teachers at the school as well: "Once you get them figured out, computer technologies can certainly increase the speed, scope, and power of learning activities," "I'm agnostic with students and computers, but tech really helps me manage workflow and data analysis to better inform my teaching," and "online assignments makes it easier to give feedback faster." Edward, a strong believer in education technology agreed when he said:

Oftentimes, the technology I'm using is just trying to cut time for me, to make things more efficient, so that I can work with students more, which is what I want to do. So yeah, I use technology a lot, but it's always in the service of helping me work better with the kids.

These responses show that efficiency has the potential to benefit more than the teacher. Students can also benefit from teacher efficiency when the teacher uses that time to work more closely with students or to provide faster, better feedback.

Although all who participated in the study used technology in their personal life, some thought it might be better to eschew its use in the classroom altogether. An anonymous response to the pre-study TIS stated "we are engaged in a vast experiment with smartphones and BYOT which can have serious, negative consequences which I don't think are yet fully realized and must be tamped down by keeping it out of the classroom." A participant in the study, Jane, expressed that while she understood why technology might be good for other classes, she did not ever see herself asking students to
use it "in the actual classroom" or to change her lecture-based class experience to a flipped classroom:

    I use technology. I show videos basically every single day or clips of videos. I just don't think the whole flipped classroom and things like that…it's just too much to me. Students can use technology to study, just not in the actual classroom.

This supports research done by the Pew Research Center showing that while many teachers use technology in their own personal lives, and even for their own professional purposes such as lesson planning, research, and networking, they are not confident in students’ abilities to use it effectively (Purcell, Buchanan, et al., 2013).

    Even for someone like Jane who was strongly opposed to using technology for educational purposes, being more efficient was an enticing proposition. As part of the study, she chose to take a traditional classroom activity and make it digital in the district’s LMS as part of her participation in the study because:

        [students] see what the answers are right after, and it was much quicker. While I still don't want to use any more technology than I am, I can see this having a place when we're getting ready for the AP exam. It just takes something that can us an entire week to complete and lets us do it in one day. Plus, they can always go back and retake it for extra practice whenever they want.

For Jane, this a was a major step forward in her approach to using technology. She realized that the time she spent once to add the test to the LMS was given back to her in each class period because she was able to use that time to engage in deeper conversations about the content and provide feedback to students when that time would have otherwise been spent simply providing the correct answers.
**Student use.** Student use of technology in the classroom often varies widely and can be heavily driven by the tools available for use as decided by the teacher (Hoffman & Ramirez, 2018; Rehmat & Bailey, 2014). During classroom observations prior to the innovation, student technology use was limited to mostly passive or somewhat interactive uses, such as watching lectures that had been pre-recorded by the teacher or reviewing key concepts and terms with the interactive flashcard website Quizlet. This was done using personal phones or laptops as well as district-provided Chromebooks.

In our post-study focus group discussions, Andrew mentioned that many students used technology for "just teaching stuff. [The teacher] digitizes the worksheet and the kid answers in complete sentences they developed, and it's not plagiarized, that's more powerful than a [paper] worksheet that they completed by copying from websites because I can see that is their original thought. I can't see that when it's on paper." For Andrew, this was a positive student use of technology. The student was using technology to learn and he, as the teacher, had evidence that what was provided was the student’s own understanding of the material.

During the second round of observations though, there were instances of students using or having used technology actively and creatively. For example, Heather worked with students who built a toehold switch to detect the presence of helminth eggs in soil samples as a way of diagnosing and preventing the transmission of helminthiasis, a parasitic worm infection that infects 1.5 billion people globally (FHS iGEM, 2019). While this is an extreme case example, it showed the power of putting technology in the hands of students. "They literally built an entire infrastructure from scratch. That didn't exist - they made it. Like, they birthed that, which is just insane, you see the significance
and then you wonder, is that the same impact on the average or below-average student?"

This is what researchers seek when looking for students creating with technology (Kimmons et al., 2020) and solving real-world problems (Project Tomorrow & Blackboard K-12, 2017), although it does not always have to be that dramatic.

In a less extreme example, Robyn asked students to create review questions for an upcoming test using the online quiz website GimKit.

Now I have 27 student-created questions that I can take and assign to them. At the end of the day, I have five study guides for my five classes with different points of view and different perspectives on what was important. And the students like it too! The ones who used them told me that it was good, and they were glad they did.

Another anonymous respondent said in response to the TIS, "Technology provides an equitable amount of distraction, complementary to their learning." Edward shared this point of view, saying "It depends on how kids use technology, right? So, it's not the technology's problem, but the technology is there like a multiplier." He went on to discuss that the way students choose to use technology in the classroom, as much as how the teacher chooses to integrate technology in the classroom, can have a major impact on student learning and engagement, supporting research that encourages purposeful integration of technology in the hands of students (Gibson et al., 2014; Hoffman & Ramirez, 2018; U.S. Department of Education, 2017).

Each of these examples illustrates that when the technology is available, reliable, and integrated in a meaningful way in the classroom, student use of technology can be
strong and powerful, motivating them to do more than distract themselves from the learning experience.

**Theme: Teachers and students need support in the form of training and troubleshooting to use technology in the classroom.**

While access to technology tools and resources is considered a first-order barrier to its use in the classroom (Ertmer, 1999), access to training and support is just as important. Professional learning for teachers, including learning focused on technology tools, is a vital part of the process and should be adapted to the needs of the teachers, both as professionals and with regards to what they will then do in the classroom (Desimone, 2011; Guskey & Yoon, 2009; Hunzicker, 2011). Participants expressed that they often felt under-supported by traditional methods of professional learning, divided into formal training sessions and separate troubleshooting once they attempted to use a technology tool in the classroom. Research shows that newer models of professional learning combining modeling technology situated in actual classroom environments with immediate troubleshooting assistance allows teachers to take more risks (Ehsanipour & Gomez Zaccarelli, 2017; Hunzicker, 2011; Juarez & Goyette, 2020; Williamson, 2015). Participants expressed that their students also occasionally needed support using the technology, as well as understanding that these are tools and skills they will continue to use once they leave the classroom.

This theme will be presented in three categories: (a) drawbacks expressed by participants to traditional training and troubleshooting methods, (b) benefits expressed by participants to newer models of training and troubleshooting, such as modeling and coaching, and (c) the student need for support as expressed by participants.
**Drawbacks to traditional training and troubleshooting.** Research shows that teachers may fall back on what they know and what is easy, even if it takes more time to do so without technology, if they do not feel confident when using technology (Ertmer & Ottenbreit-Leftwich, 2010). In her post-study focus group, Diana shared that even though she had realized that she used more technology than she had previously thought, she still felt frustrated at times.

Good teaching is good teaching whether you use technology or not. Sometimes you don't need to do it because it's just noise, it's just extra work to do all this stuff for no purpose if I haven't been trained on how to use it. I mean, I'll stick to Substitution just to say, shut up, leave me alone, I'm doing it.

As the oldest participant in the study, it might be expected that Diana is resistant to technology-use in her classroom. However, in this quote, she directly expressed a key pillar of andragogy, the need for immediate application of PL (Stewart, 2014; Zepeda et al., 2014). Without additional support to show how technology can be immediately implemented, Diana and other teachers like her may feel pressure to implement technology just for the sake of change and fear that it is “extra work for no purpose.”

Deborah echoed this in her post-study focus group, asking "How can you know how to use it in new and innovative ways unless you first know what it does and have some base comfort level?" This supports research showing that teachers need to know how to use the technology tool itself, as well as how to use it for instructional purposes, in order to build both self-confidence and to facilitate student learning (Admiraal et al., 2017; Ertmer & Ottenbreit-Leftwich, 2010; Harris et al., 2009; Orlando, 2014).
Unfortunately, anonymous responses and participants expressed that traditional professional learning methods sometimes left them feeling frustrated. Anonymous pre-study TIS responses included "Sometimes we learn something cool and new, but it's so much and so fast, I know that I will still need someone to walk me through it a couple more times," and "There are times when it is overwhelming and could have been better planned." While none of these responses called out technology-focused professional learning specifically, Edward left no room for doubt, saying during his pre-study focus group discussion, "My girlfriend also teaches, and we laugh a lot about tech PD. I mean, it's almost universally awful."

These responses show that participants felt a need for change in the way that are supported in their professional learning in general, and more specifically in the way that they are supported when learning about how to integrate technology in their classroom.

**Benefits to newer models of training and troubleshooting.** Research also shows that teachers become willing to try new things when they know that, in addition to professional learning time, they also have the necessary support available (Crompton, 2020; Frazier, 2011; Williamson, 2015). Pre-study TIS responses showed this with anonymous responses including, "I can always count on timely help from my technology peeps, which makes me more comfortable trying something new," "I've been really impressed with the responsiveness and willingness to help me implement a personal program that is essential to my increased technology use," and "It is so easy to get any additional help when required, especially when implementing something new."

Discussing one of the experiences she chose as part of the study, Heather talked about how much she appreciated being able to get personalized support for her project,
which allowed her to do something she had traditionally done without technology and take it to higher levels using technology because of the access to support and troubleshooting. "It was great to have you come down, give us perspective on what this would look like, show us where to click, brainstorm what we could do differently, and then let us run with it." As a science teacher who has always strongly believed in the value of keeping a paper and pencil field journal, this response shows the value of having a technology coach and personalizing the professional learning experience to encourage teachers to take risks with the technology they use in their lessons. Heather ended by saying, “I don't know that we would have got there without knowing that we could just call you.” Without the personalized support offered through the study, it is possible that Heather would have gotten frustrated and quit, choosing instead to revert to a non-technological project that she had done in the past. Instead, she was able to take the project to a level she had not before imagined.

Robyn brought up an experience that she and Melody had during the study that showed the importance of modeling.

We worked together to team-teach and have students use Canva for a presentation they were working on. I had never used Canva before, and this was a good way to have Melody model it for me and my students while I walked around and kind of made sure they're all doing it. It just took the stress off, because I didn't have to plan that as a separate part of the lesson, or as something else for me to do before the lesson.

This scenario allowed participants to learn a new technology tool in the exact context it was meant to be used without taking any additional time or putting either
teacher in the position of using a tool that they have not yet mastered. Melody emphasized that another benefit was that "we get to practice that way together. We're both accomplishing more by working together." This type of co-teaching and modeling of technology in the classroom supports research showing that situated professional learning and technology coaching within the context of the classroom improves adoption and change (Czajka & McConnell, 2016; Ertmer et al., 2012; Ertmer & Ottenbreit-Leftwich, 2010; Kopcha, 2012a; Sugar, 2005).

**Student need for support.** Participants also discussed the need for students to have the same support and training when using recent technologies and to understand how it may relate to their world once they leave the classroom. They also discussed that while students are comfortable using technology for personal purposes, they may not necessarily have the skills or knowledge to use it in a productive and meaningful way for academic purposes. During his post-study focus group discussion, Josh mentioned that "students need more support sometimes using tech than we think they do; they don't just automatically get it just because they're younger." Edward responded with "Yeah, that's something that we have to think about when choosing to do something online. Do I know the product well enough to not just use it, but to answer questions about how to use it?"

These quotes show the challenges that participants faced when deciding whether or not to take a previously non-digital task and move it online. In addition to choosing the proper tool for the task, teachers must feel comfortable enough with a tool to guide students in troubleshooting problems that may arise as they use it, as well as teaching them how to troubleshoot for future problems. This is supported by guidance from the

Participants also expressed a need for students to understand that these technological skills are important to their success in their eventual jobs. Jennifer pointed out that teaching with technology does not mean teaching the technology but is rather teaching and using technology to do it. During her pre-study focus group discussion, she said:

I look at my kids that are juniors and seniors and are about to go off to college and then off to a job. They're going to have access to technology in their workplace more often than not and so they need to understand how to interact with it, like knowing how to use certain types of software. Teaching them a skill, teaching them things that aren't necessarily curriculum.

In other words, teachers need to be sure that the technology they are using in their classrooms is an integral part of the learning process, not a supplement or reward. This is supported by research showing that the integration of technology should be aligned with the pedagogical approach and the content being taught (Ahmed & Qasem, 2016; Anderson et al., 2013; Harris et al., 2009; Hilton, 2016; Koehler & Mishra, 2005). Furthermore, research shows that technology can be used to facilitate learning, encourage collaboration, and provide access to resources and information that might not be otherwise available (Crompton, 2020; Hilton, 2016; Kimmons et al., 2020; Puentedura, 2013).
Theme: Teacher attitudes and beliefs about technology in the classroom change with support.

While teachers may be confident in their content knowledge, the constantly changing field of educational technology can create fear and anxiety when faced with more recent technology tools for their classroom (Couros, 2015; Dowd & Green, 2016). Despite that, it is important to move beyond the past and embrace the future role of educational technology. In addition to increasing the levels of technology use in the classroom, data from this study showed that timely support has the potential to change teacher attitudes and beliefs about the challenges and benefits of classroom technology integration, as well as a clearer understanding of how to evaluate levels of technology integration. This theme will be addressed in three categories: (a) overcoming challenges, (b) seeing benefits, and (c) evaluating levels of technology integration.

Overcoming challenges. Participant experiences showed that timely support can change perceptions of the challenges that attempting to design seamless classroom technology integration can present. Research also emphasizes the importance of providing teachers with timely and effective support to help them overcome the challenges they may face when integrating technology in the classroom. Puentedura (2006, 2013) and Holland (2017, 2018) argue, for example, that providing timely and effective support can help teachers overcome these challenges and may ultimately change their perceptions of these challenges.

As part of his participation in the study, Andrew chose to have his students create an end-of-semester review in which they chose a time period of history and presented an argumentative presentation to argue that their chosen time period was the best studied so
far in class. When asked why he chose to design this particular project as part of the study, he replied that recent changes in his district department (Social Studies) and increased support from both school and district instructional technology departments convinced him that it "would be prudent to take the opportunity to integrate the course with [the district’s LMS] and create an in-class blended-learning experience" as part of a shift to a more thematic approach to teaching World History. With the support of his district-level content specialist and both the school and district instructional technology specialists working with him, he stated:

I finally felt I had the support needed to make this shift to engage more students and increase student enthusiasm for the course. This is something I've always wanted to do, but never felt that I had the needed support to overcome the challenges of trying to do it with ten devices and 150 students.

Similarly, Jennifer expressed that she sometimes "gets overwhelmed with the amount of technology that is out there and available to be used in a classroom. It's hard to focus on just one or two and then I end up not trying anything at all." During her participation in the study, Jennifer requested to meet one-on-one to help design a blended learning experience to incorporate into her traditional classroom environment. She redesigned an entire unit of study to be more blended and moved many elements completely online. "While I can say I see many different improvements that could be made, I'm pleased with how my first attempt went. Thanks to your support, I can see beyond the challenges and start to see the benefits of changing up the structure of the classroom and assignments."
Other participants shared examples of how their participation in the study gave them the push they had been looking for to try something new because they knew there would be support if they struggled (Josh). Robyn shared that she used her participation to “up my game a little bit because I really feel like that’s the best way to engage them.” When asked by Melody what she meant, Robyn clarified that she trusted in the support she had been given and realized that even if an experience “doesn’t go to plan, that’s okay. It can still be a learning experience.” Instead, because of the support they received through participating in the study, these participants were able to see their way to using technology in ways that they had not previously imagined.

The experiences shared by these participants support research that shows that providing teachers with access to a variety of support resources for technology integration helps to build their confidence as they learn to overcome challenges (Bowman et al., 2022; Hall & Trespalacios, 2019). They also show the value of including ongoing professional development, coaching, and collaboration opportunities, also supported by research (Crompton, 2020; Ehsanipour & Gomez Zaccarelli, 2017; Frazier, 2011; Juarez & Goyette, 2020; Wolpert-Gawron, 2016) in helping teachers learn self-efficacy to overcome challenges on their own.

**Seeing benefits.** As previously mentioned, Jane was strongly opposed to students using technology in the classroom and even limited her own use to tools that allowed her to remain the primary focus of the classroom experience. During her pre-study focus group discussion, she described her classroom technology integration as:

More just the traditional classroom, but with using the tools that helped me do that. So instead of writing on a chalkboard, I use a PowerPoint. I use [the district
LMS], but only in terms of putting what we do in class in the planner. In terms of assignments, I am a strong believer in pencil-paper as I prepare students for the AP exam, since the AP exam is still paper-pencil.

However, despite her resistance, she volunteered to be part of the study and as a result of her participation, she chose to create digital tests in the district's LMS for students to take practice multiple choice tests online in preparation for her subject's Advanced Placement test. At the end of the study, during her post-study focus group discussion, she shared that her feelings had shifted just slightly towards a less negative opinion:

Doing the test online gave me more time in class. Yes, it took time to create the tests because I had never done that before, and no, I didn't like it (laughs). But when I called you to talk it over, you pointed out that I won't have to do that ever again. When I did it on paper, I had to go wait for the copy machine every time, every year. So not only am I getting some time in class back, I'm also getting time outside of class back. I also liked during our conversation that you pointed out things I can do to make it more secure and more challenging, like randomizing the answers or selecting questions randomly from a category. When I did it on paper, everyone had the exact same thing. But this way, it's way different and gives kids a more unique experience. I don't think I would have made the decision to do it again in the future without you taking the time to talk me through the plusses and minuses, and that's how I'm going to do all of my practices going forward!

While her shift in beliefs and attitudes about the role of technology in the classroom was not extreme and she could not be classified as a strong proponent of classroom
technology, even a slight shift away from the negative shows the power of support when working with teachers.

After her experience of creating a blended learning lesson lasting three weeks for her students, Jennifer shared that she had realized “it (blended and personalized learning in a math class) is a little bit more feasible than I thought it was to begin with.” Deborah explained that her students enjoyed the variety of resources she had shared with them because of her participation. “They do like that! It’s very helpful. I’ve just been giving them more resources that they can go back to, they can access at any time, and I see them going back!” Being able to see that her students were using the resources she had created or curated also helped to encourage her to keep going and continue her efforts after the study ended:

But what I want, I want to do something where they have to, like, make a video of them working out the math problem because then I can see them working it out.

And I think that’s one of my things that I’m going to do next semester.

These examples from participants show that support can have a lasting impact on teacher’s beliefs and attitudes about the role of technology in the classroom. This is supported by research as well (Bowman et al., 2022; Ertmer et al., 2012; Ertmer & Ottenbreit-Leftwich, 2010; Kim et al., 2013; Tam, 2015).

**Evaluating levels of technology integration.** Lastly, support in understanding how to evaluate classroom technology use can also have an impact on teacher attitudes and beliefs about the role of technology in the classroom. Since beginning my work as an ITS, teachers at the school who have been resistant to change expressed views that equated technology use as a checkbox on teacher evaluations. Anonymous responses to
the pre-study survey included "more apps doesn't always mean better learning" and "just because it's computerized doesn't make it better." But when asked what they knew about how to evaluate classroom technology use, most participants had no prior knowledge.

Diana, a teacher with more than 25 years of classroom teaching experience at the time of the study and who said in her pre-study TIS response that she is often overwhelmed by new technology, said at the beginning of the study that she had "no idea that was even a way to measure that. It's just there or it's not, right?" During the post-study focus group discussion, however, she had a much different feeling:

I've heard other presentations about things, and they always make it sound like you suck if you're on this end of the model, it's like you're either great and use "all the technology" (uses hands to make air quotes) or you are awful and don't use it at all, or don't use it in "the right way" (uses hands to make air quotes). But I think you did a really nice job of showing that we're not always going to be this revolutionary teacher with technology each and every day with each and every student. I've always called myself a dinosaur but learning about PICRAT made me realize, no, I'm not. I use a lot more technology than I thought I did and while I may be at a Replacement or Substitution level, now I'm finding myself more reflective, and thinking more about how to take it up a notch, both my own use and my students' use.

Melody also found that by learning more about how to evaluate how technology is used in the classroom, she had a more positive attitude about its daily integration. In her post-study focus group discussion, she explained "Learning the purpose was a big mind shift for me! Replacement isn't always bad, it's not always the teacher disengaging
from with the kids, it can still be good teaching." Robyn agreed with this, adding that she "started to look for a way to up my game, just to make sure that I was reflecting. What could I change? What would be better for students?"

Support is often viewed as troubleshooting assistance or training on new tools and is often discounted as a way to shift attitudes and beliefs. However, when participants knew that support was available to them when trying new things and when they were presented with ways to evaluate classroom technology use beyond its presence or absence, they were able to see more ways to overcome challenges to its use in addition to seeing more benefits. Kimmons (2018) also found that when teachers are provided support in understanding technology integration models such as PICRAT that were “contextually valuable in the teacher’s unique classroom setting” (p. 34), beliefs about technology integration are able to be influenced and changed. Research shows that other models are effective as well, such as SAMR or TPACK, as long as the teacher has clarity and understanding about how to apply the model to their use of technology in the classroom (Consoli et al., 2023; Hall & Trespalacios, 2019; Hamilton et al., 2016; Hilton, 2016; McKnight et al., 2016).

**Theme: Personalization of instruction and support impacts student performance and attitude, as well as teacher adoption and attitude.**

Support can take many forms, such as training or troubleshooting, as well as modeling or coteaching in the classroom. However, support can also take the form of an instructor personalizing the actual instruction that an individual receives, whether that individual is a student in the classroom or a teacher participating in technology training. While personalizing instruction can provide many challenges (Basham et al., 2016;
Cavanagh, 2014; Schaffhauser, 2013), when the support provided to students and teachers is personalized to their current level of knowledge and their expected future needs, both their performance (or adoption, in the case of teachers) and attitude have the potential to show great improvement (edWeb, 2018; Foote, 2013; Hall & Trespalacios, 2019; Phillips, 2017). This section will address (a) student results as shared by participants and (b) participant results.

**Student results.** Personalizing instruction in the classroom, especially in a high school classroom, can be extremely challenging. Jennifer argued in her pre-study focus group discussion that while important, it is also often impractical. "I'm all for it! I mean, who would say 'that's a horrible idea'? (laughs) But it's hard with 35 kids. And with math, while I can explain it several different ways, there's only one answer." Josh agreed, saying "It's a management nightmare. People just throw their hands up and say, 'we're all doing the same thing!!" Andrew added that "without the use of technology, I think it's probably not going to happen. I think people will go through the motions if forced, but's there's just not time with so many students." Melody expressed another frustration, this time with students themselves, saying "They just want the bottom line, 'How can I get the grade?' Everything is so grades-based and I wish we could be more organic, a more fluid kind of learning, where every student shows what they can do."

Heather demonstrated that support is one piece missing to make such personalization possible.

I love the idea of that as much as possible! And I know it's an area where technology can really help. All kids learn very differently and being able to push those kids who are already so far and get them to the next level but also at the
same time, not losing the kids who are really just trying to figure out, like, where am I today? But in practicality, it becomes a matter of how you manage it. And that's where having a good grasp of technology, how to integrate it appropriately, and having someone to support you comes into play.

Andrew agreed, pointing out that having strong connections between curriculum and technology would be one of the best ways to improve classroom personalization of learning. "I think through technology, if you have standard curriculum that can assist one student while the teacher works with another, that's where we're really going to get student and teacher buy-in of personalized learning."

While Jennifer had argued that personalizing instruction would be too challenging to implement during her pre-study focus group discussion, she found that it was the key to making her online learning unit work for students. While some students enjoyed the freedom of being able to work at their own pace and reach challenge markers, others struggled and expressed intense dissatisfaction. "After the first week, I shifted some and for those who wanted a mini-lesson, I worked with them individually and gave them a mini-lesson. It was like an individual check-in." By giving students this level of individual support and instruction, personalizing and adapting the unit to meet both their academic and social needs, not only did student performance improve, but their opinion of the unit also improved, and for Jennifer, "it definitely shifted my mind-set on how this can work."

Heather and Andrew also appreciated the ability to use technology to help personalize support and instruction in the classroom. Heather chose an activity that allowed students choice in how to show mastery of a concept. "The assignment was the
same, but the way they approached it looked different depending on their strengths, which was great to see! It allowed me to offer personalized support during and feedback after, something I don't normally get to do." Andrew focused on the ability to support students who may be struggling. "The integration allowed me to identify students that are truly attempting to learn the material but may be struggling and need help. Being able to give a real-time intervention and help is a game-changer!"

Deborah also shared an experience that she had as a result of the study that changed her students' approach to personalized instruction in the classroom. When she first introduced a personalized unit to her class, they were resistant.

They normally do a lot more group work than a typical class because they are a block class and I have them for twice as long as a regular class every single day. They worried that it would be all online and take away from the group cohesiveness if everyone in the room was in a different place.

She patiently answered their questions and explained that while all instruction and activities would be provided online, students would be able to move freely throughout the unit, revisit concepts as needed, and lastly, the most important to changing student attitude, they were encouraged to work together in partners and groups.

Once I explained that, well, they really enjoy that! And being able to help each other and explain where the answer came from. It wasn't just their attitude that improved, their overall performance improved, because they really had the opportunity to go back and do things as many times as they needed to be able to really understand it.
These student experiences shared by participants show that while there are challenges to overcome, such as having the knowledge and skills to implement personalized learning effectively, when participants had the support they needed, they were able to improve the quality of the personalized learning experience for their students. As a result, participants shared that their students had increased engagement and improved achievement, which is also supported by research on the use of personalized learning in the classroom (Basham et al., 2016; “Effects of Personalized Learning,” 2016; Patrick et al., 2013)

**Teacher results.** Personalizing instruction for teachers during professional learning can be equally challenging (edWeb, 2018; Foote, 2013; Gamrat et al., 2014), although participants did not need convincing of the need for personalization of their own professional learning. Robyn mentioned during her pre-study discussion that one of the problems with traditional professional learning is that teachers "get taught something, and then it's like, okay, go back to your room and rush, rush, rush with what you were already planning, and there's no time to practice, play, implement it." Diana also had strong opinions on traditional professional learning. "As a veteran teacher, who leads mentoring programs, I don't feel I need help with pedagogy or classroom management. But I do maybe need more time than someone else with technology or implementing it." Josh seemed to summarize the thoughts of everyone across the study when he said, "Generally speaking, I think we all need really specific professional growth, but yet when there's professional learning as a group, we're brought back to the middle."

These thoughts from participants show the need for personalizing instruction for teachers as well as students. Technology is constantly evolving, and educators need
ongoing professional learning opportunities to keep up with this constantly moving target (Ertmer & Ottenbreit-Leftwich, 2010). Additionally, technology-focused training often requires specific skills, and this can vary widely among teachers. Providing personalized professional learning opportunities for them can help to ensure that all are successful with the tools they need to use in the classroom (Guskey, 2014; Hunzicker, 2011; Phillips, 2017).

Heather was particularly interested in this topic. In her pre-study TIS, she responded at length to the open-response question about Professional Learning, mentioning that she had begun to seek out articles to read about how to use technology to personalize her own professional learning because she was personally interested in the topic. "Too often, teachers are asked to sit through trainings that do not apply or are not in their wheelhouse of ability yet. Technology-based professional learning allows teachers to create or curate a plan that meets their unique needs."

Edward also hoped that one of the challenges to be addressed in education soon would be personalizing professional learning. "It's a struggle, but just like we're trying to do with students, we're trying to recognize that we're not just a factory and everyone has different skills, different needs." Jane and Robyn agreed, adding that for professional learning to be truly personalized, "it is content specific to my course" (Jane) and "someone has asked me what I need or want to learn and that is what I receive" (Robyn).

While these opportunities might not be the everyday experience, when available, they do have the ability to change teacher perception about adopting new pedagogies and technologies in their classroom. In her post-study focus group discussion, Heather said "It's coming. Having the support in place to do better. The project we did was really cool
and it's because I was able to take advantage of this really unique opportunity where I asked and got what I asked for." Robyn shared in her post-study TIS that she appreciated being given materials and resources that were designed to be applied the next day. "It was really helpful, knowing that I had been able to really personalize my experience, once I realized that there are different ways to look at things, instead of just this is how you have to do it."

The biggest hurdle to overcome teacher attitude and adoption is ultimately out of the scope of control of the study and that is time (Hanson, 2017; Smith & LeCompte, 2018; Tu, Bianco, & Breslav, 2020). Until teachers are given more time, or compensation for their time, to truly personalize their own professional learning, events such as EdCamps and Twitter Chats will remain largely unexplored by many educators (Carpenter & Krutka, 2015; EdCamp Foundation, 2018) even as they continue to exist as a free and open means to continued personalized professional learning (Carpenter, 2016; Carpenter & Krutka, 2015; Carpenter & Linton, 2016; Ross et al., 2013; Swanson, 2014).

As part of their participation in the study, participants were given three options to actively participate in their own personalized professional learning. They could choose to observe another teacher while focusing on how that teacher manages classroom technology use, participate in a Twitter chat that is specific to their educational interests, or attend and participate in an EdCamp or CoffeeEDU. Not one participant chose an option that would have taken place outside of the school day. Edward summed up this experience best, saying in his post-study TIS response:
Probably the biggest request I have is to have time during the school day to work with colleagues who want to change their practices with some of this theory. I do not want to spend more of my own personal time to do this.

**Chapter Summary**

This chapter reported quantitative findings resulting from Likert-scale questions on the Technology Integration Survey (TIS) administered both before and after the study, as well as classroom observations conducted using the Looking for Technology Integration (LoFTI) observation instrument, developed by the Friday Institute, both before and after the study. Qualitative findings were also reported, resulting from pre- and post-study focus-group discussions and open-ended responses added as clarification or explanation to each section of the TIS. Quantitative findings were organized by topic and described using descriptive statistics. Four relevant themes emerged from qualitative findings and were presented using direct quotations from participants. These findings, both quantitative and qualitative, will drive the discussion, implications, and limitations of the next chapter.
CHAPTER 5
DISCUSSION, IMPLICATIONS, AND LIMITATIONS

The purpose of this action research was to implement and evaluate the impact of personalized professional learning for teachers intentionally focusing on models of technology integration. As a former Instructional Technology Specialist at Focus High School, the original intent of the study was to design and recommend technology-focused professional learning that was more personalized to the needs of teachers and resulted in higher levels of classroom implementation. Quantitative and qualitative data were collected through the Technology Integration Survey (TIS), Looking for Technology Integration (LoFTI) classroom observation protocol, and focus group discussions. Four primary themes evolved from analysis of the qualitative data (see Table 4.6). These data points were used to answer three research questions:

1. How does modeling technology integration in professional learning opportunities for educators change technology integration in the classroom?
2. How does a focus on technology integration models through professional learning opportunities for educators change teacher attitudes towards technology integration in the classroom?
3. How does an educator's participation in personalized professional learning opportunities change personalized learning opportunities offered in the classroom?
This chapter will synthesize the data presented in the previous chapter while situating it within the literature to answer the research questions, explore the implications, and discuss the limitations of the study.

Discussion

The findings of this action research study are discussed in this section within the context of prior research on technology-focused professional learning in education. Both the quantitative and qualitative data are used to answer the research questions.

Research Question 1: How does modeling technology integration in professional learning opportunities for educators change technology integration in the classroom?

This research question originated from a desire to improve classroom technology integration as a result of educators participating in technology-focused professional learning. In order to do that, I needed to better understand best practices around professional learning, modeling, and technology integration. Additionally, it was important to understand how to measure a change in classroom technology integration.

In this study, modeling was defined as a peer or coach, or in this case, me as the researcher, integrating technology into professional learning in lieu of teaching the technology tool out of the context of the learning environment, thereby teaching with technology instead of teaching technology, as Jennifer discussed in her focus-group discussion. Additionally, technology integration has been defined as integrating technology into daily classroom routines for the purpose of increasing student learning and engagement, based on the needs of the students, the curriculum, and the pedagogy
that bolsters the curriculum rather than the use of an individual tool (Ertmer & Ottenbreit-Leftwich, 2010; Ruggiero & Mong, 2015).

While it is recognized that educators need to know how to use a tool to be able to use it effectively in the classroom, they often need to understand first how it will be useful to their students and the learning goals of their content (Kim et al., 2013; Kopcha, 2012a; Rollins, 2011). Seeing technology integrated at higher levels in professional learning allows teachers the opportunity to see what a tool can do before deciding if it is something that they want to learn how to use in their classroom. This research question will be addressed in three sections: (a) improvements in teacher-use of technology in the classroom, (b) improvements in student-use of technology in the classroom, and (c) discrepant findings.

**Improvements in teacher use of technology in the classroom.** Research suggests that strong teacher use of technology can have a positive impact on the classroom experience, including increased student engagement, improved learning outcomes, and positive attitudes toward technology use (Scherer et al., 2019). Further, when teachers are able to observe others using technology frequently and effectively in the classroom, they are more likely to have positive attitudes toward technology use and to integrate technology at higher levels in their own teaching (Chen et al., 2017). It is also important that teachers participate in professional learning opportunities that allow them to both observe and practice using technology at higher levels (Darling-Hammond et al., 2020).

The LoFTI classroom observation protocol instrument, developed by the Friday Institute for Educational Evaluation in 2010, was used to determine how, to what extent,
and by whom technology was being used in the classrooms of participants \((n = 10)\) both before and after the study took place. As intended by the William & Ida Friday Institute Educational Innovation (2010), the data that was collected during pre-study observations was used to develop the professional learning opportunities that were provided to participants.

During the pre-study observations, participants were observed at the lower levels, with four participants being observed at a Replacement level and six participants being observed at an Amplification level. During the pre-study observation, no participant reached the Transformation level. However, post-study observations showed positive change, with participants being observed at the Replacement level only twice. Participants were observed at the Amplification level seven times and at the Transformation level three times.

Across the study, participants shared in the responses to the TIS that both Time and Professional Development played leading roles in improving their use of technology in the classroom. Pre-study responses to Item 14 on the TIS indicated that participants felt that they had some time provided to integrate technology into their lesson, but the lower level of agreement \((M = 2.60)\) and further explanation indicated that they would like more time and more assistance. Upon completion of the study, this statement showed the most positive change amongst participants, with a mean response of 3.40 post-study although the Wilcoxon Signed-Rank test revealed that neither barrier showed a statistically significant difference.

This positive change could also be seen in responses on the TIS regarding statements about Professional Development. Post-study responses to the TIS showed that
participants felt that the training received could be easily applied in the classroom ($M = 3.60$) and that they felt adequately trained on the skills needed to use technology ($M = 3.80$). In the open-response portion of the TIS, Robyn clarified her responses saying, "Everything was modeled either in-person or in the HyperDoc and designed to be applied the next day, but also we could reach out for help, which let me use my time better." The positive changes resulting from participating in the study can be seen in three ways: (a) Replacement to Amplification, (b) Amplification to Transformation, and (c) Replacement to Transformation.

**Replacement to Amplification.** Of the four participants observed at the Replacement level during pre-study observations, three of them improved their use and were observed at the Amplification level during post-study observations. One of those participants, Jennifer, mentioned in her pre-study focus group discussion that while she believed she had "the knowledge and the wherewithal to make [my class] more integrated, I haven't taken the time to do it. I would love to, it's just not as integrated and interactive as I would like it to be."

As a result of her participation in the study, she did take the time and created a three-week blended learning experience for students that was mostly online but also allowed the opportunity for her to work individually with students who wanted individual mini-lessons. In describing her design process, she said, "I looked first at the HyperDoc you designed because I liked the way it was step-by-step. Then I looked at some of the online lessons you have in the Resource Course. Those were all great models to get me started!" During her post-study focus-group discussion, she said, "I've always liked incorporating technology in my classroom. As this experience pointed out, it takes the
teacher to make it work. Tech isn't going to replace good teaching practices, but used right, can help to improve what's already working."

Another participant who improved her use from Replacement to Amplification from pre- to post-study observations was Jane. A self-described "old-school teacher" who feared that technology will replace traditional classrooms and "put teachers out of a job," she was a "strong believer in paper-pencil for writing especially, but also for multiple-choice as the AP exam is still paper-pencil." Thus, it came as somewhat of a surprise to her when her post-study classroom observation revealed that her use of technology as a teacher had increased from Replacement to Amplification. While still leaning heavily on the same instructional goals of teacher-focused lecture style of instruction, she had added memes to break up the lecture with moments of humor and added points to quickly check for understanding as the class reviewed for the midterm exam. These quick checks were accomplished by referring to online tests that students had previously taken on the district LMS. When asked why she chose to make these small, but still important changes, she explained, "I don't think I would have made the decision to do it without you taking the time to talk me through the plusses and minuses."

While an Amplification use of technology by the teacher does not change instructional goals or tasks, it does allow the teacher to work more effectively and efficiently (Kimmons et al., 2020; Puentedura, 2013). More importantly to the goals of the study and this research question however, when a teacher has positive experiences using technology in the classroom, they are more likely to continue using technology and may attempt higher levels in the future (Darling-Hammond et al., 2020; Ertmer et al., 2012; Ertmer & Ottenbreit-Leftwich, 2010).
**Amplification to Transformation.** Of the six participants who were observed using technology at the Amplification level during pre-study observations, two improved their own use of technology during post-study observations and were observed at the Transformation level.

One of those participants, Robyn, shared during her pre-study focus group discussion that she felt that was using a lot of technology, but that "it's spotty and I struggle with knowing how to evaluate it [the use of technology]. There's no rubric, it's just random technology assignments." As part of her participation in the study, she chose to learn how to use a new tool in her class and design a lesson that allowed students choice in how they completed the assignment. The result of these could be seen in her post-study observation. As a world language teacher, she used a combination of multiple tools to direct students to listen to a short passage in the target language, then create a collaborative review set writing their own questions focusing on circumlocutions. While students submitted their questions, Robyn was able to provide immediate feedback to students and either approve the question to be added to the set or suggest changes. At the end of each class period, these digital reviews were shared to the district LMS so that every class could play all five review sets.

When asked what prompted her to make these changes to her routine, and specifically the presentation tool that tied the lesson together, she replied, "I was intrigued when I saw how you used it to present because it seemed like so much more than a presentation tool! I used it in class one day and time flew by! The students were more engaged than ever and I'm able to quickly get in informal assessments."
Asked about the review sets, she was even more enthusiastic, "I have 27 student-created questions that I can take and assign to them. At the end of the day, I have five study guides for my five classes with different points of view and different perspectives on what was important. And the students like it too! The ones who used them told me that it was good, and they were glad they did."

Robyn’s experience and change in the ways she used technology from pre- to post-study observations connects to the value of technology coaching and modeling. While not resistant to technology-use in her classroom, she needed to see how the new tool could be used for teaching before being able to implement it in her own classroom. If the tool had been introduced in a traditional technology-focused PL session that focused on the tool, she may not have made the connection between a presentation tool and using it for assessment purposes. This demonstrated the importance of situating the technology in a classroom context rather than teaching a technology tool out of context and how doing so can effect positive change in classroom practice (Czajka & McConnell, 2016; Kopcha, 2012a; Sugar, 2005).

**Replacement to Transformation.** Only one participant throughout the study improved their own use of technology from the Replacement level during pre-study observations to the Transformation level during post-study observations. While not as resistant to the use of technology in the classroom as Jane, Heather used technology in a similar way during her pre-study observation, with the classroom interactive panel being used as a projector to display review lecture notes and then a timer as students took an assessment.
However, her interest in improving professional learning led her to choose as part of her participation in the study to learn more about what it means to intentionally integrate technology into those lessons. As part of that process, she found that she also began to reflect more on how she was using technology in her own classroom practices. "In the same way that I was thinking about designing PL for teachers, I started thinking about, is this really making that much of a difference? Or can I take it up a notch? How can I make it even better?"

That thought process led her to working with another teacher who was not part of the study to completely redesign a project using technology to take it to levels that were previously not possible, including personalized support during the design process and individual feedback afterwards. "This was something that I never imagined myself doing. I've always said before that scientists have to know how to take notes in a field manual, but this really brought things into the modern day." Instead of a traditional research project, Heather tasked students with creating a website containing multimedia content. Throughout the process, she was able to work individually with students, helping with the design process and the content being included in the website.

I know this is where I grew the most. All kids learn very differently and being able to push those kids who are already so far and get them to the next level but also at the same time, not losing the kids who are really just trying to figure [it] out. That's where having a good grasp of technology, how to integrate it appropriately, and having someone to support you comes into play.

This level of positive change was extreme but encouraging. It showed that collaboration with coaches and peers, as well as having the right blend of professional
learning, modeling, and support can have a positive impact on teacher technology use (Bofill, 2013; Juarez & Goyette, 2020; WestEd, 2015; Williamson, 2015). It also emphasized the importance of helping make connections between classroom practice and professional practice, since Heather realized that what she was trying to achieve for professional learning could also be applied to her classroom.

**Improvements in student use of technology in the classroom.** The LoFTI classroom observation protocol instrument was modified in this study to additionally measure student use of technology in participants’ classrooms during observations. Student use of technology was measured using Kimmons and Hall's 2018 addition to Hughes et al.’s RAT model of Passive (low), Interactive (medium), and Creative (high) uses of technology. In pre-study observations, students were observed passively receiving digital content in four of the participating classrooms while six of the classrooms contained students who were interacting with digital content. Post-study observations showed improvements, with students passively receiving digital content in only two of the classrooms and students actively creating digital content themselves in four of the participating classrooms.

**Passive to Interactive.** In order for student learning to become lasting and impactful, studies have shown that students need to be able to interact with the learning process (Kennewell, Tanner, Jones, & Beauchamp, 2008). During pre-study observations using the LoFTI classroom observation instrument, students were observed in four classrooms as passively receiving digital content. During post-study observations, two of the participants had improved student use of technology in their classrooms to be at the
Interactive level; that is, students were interacting with digital content as part of the learning process thereby increasing the possibility of student learning.

One of those participants was Josh, a Forensic Science teacher who was completely at ease with technology being used in his classroom. On the pre-study TIS, he stated that he "loves technology in the classroom and tries to integrate it every opportunity [he] can." During his pre-study classroom observation however, while Josh was using technology at an Amplification level, his students were passively receiving digital content by watching YouTube video on search and seizure procedures and then a pre-prepared presentation delivered by Josh. During this time, students took notes and completed an accompanying questionnaire on paper.

However, during his post-study classroom observations, student technology use had improved to the Interactive level. During that observation, Josh began by showing a brief clip from a holiday film featuring the Grinch. Students then logged in to the district LMS to complete a digital assignment in which they evaluated the case against the Grinch, including his motive and opportunity, the evidence against him, and crafted both the defense and prosecuting arguments. Students were also able to do their own further research regarding Georgia state law as they answered these questions and could choose to work independently or with a partner.

When asked about his shift from Passive to Interactive student use of technology in his post-study focus group discussion, he was quite forthright: "I thought the October PL meeting when you showed the PICRAT model was effective because it made teachers think about how they use technology in the classroom and more importantly, how students use technology in the classroom." He paused to reflect, then said, "I know that I
could do more, but I also think that the more students use technology even for relatively mundane tasks the better off they will be." I asked him to expand on this and he continued, "I don't think my views changed, necessarily. I was already trying to integrate technology as much as I can, but I don't feel like I do enough. You just gave me the push I needed and the reminder to do it."

This feedback from Josh emphasized to me the importance of continuing to work with teachers to encourage student use of technology. Teachers who have more positive beliefs about technology use tend to use technology more frequently and effectively in the classroom, which can lead to increased student engagement and learning outcomes (Ertmer et al., 2012), but busy teachers need reminders from time to time to focus on student-centered learning that incorporates active technology use (Eaton, 2020).

**Interactive to Creative.** The shift from Interactive to Creative in student use of technology is one of the most difficult to conceive for many educators because of a pre-conceived notion that the student use of technology must be artistic (Kimmons et al., 2020). Instead, achieving this level of student technology use is accomplished when students "use the technology as a platform to construct learning artifacts that instantiate learning mastery" (Kimmons et al., 2020). While this could be conceived through high-end artistic endeavors, it can also be accomplished through more traditional classroom projects such as digital storytelling or student-driven assessment prompts.

During pre-study classroom observations, six participants had designed lessons in which their students were interacting with digital content as part of the learning process. When post-study classroom observations were conducted, three of those participants had improved their students’ use of technology to the Creative level, which is the highest
level of technology use in this model. One of those participants, Heather, was previously discussed at length in the *Replacement to Transformation* section of Improvements in Participant Use of Technology.

As part of her participation in the study, she chose to learn more about what it means to intentionally integrate technology into lessons, specifically related to using technology to personalize professional learning. Through that process, she found that she also began to reflect more on how she was using technology in her own classroom practices. "In the same way that I was thinking about designing PL for teachers, I started thinking about, is this really making that much of a difference? Or can I take it up a notch? How can I make it even better?"

This led her to working with another teacher who was not part of the study to completely redesign a project using technology to take it to levels that were previously not possible. "This was something that I never imagined myself doing. I've always said before that scientists have to know how to take notes in a field manual, but this really brought things into the modern day." Instead of a traditional research project, Heather asked students to create a website containing multimedia content. This was a distinct change for her, as she had previously asked students to all submit the same research project and instead, she allowed students the opportunity to design something that fit their own comfort level with technology:

Everything was across the board, just like their level of comfort with technology. You know, what they created was fantastic! But it was, you know, it was more than the assignment itself wasn’t the same, it was that the execution of it looked different for different kids. It was (*pause*) it was great!
Melody was a Spanish teacher whose lesson engaged students interactively with digital content during pre-study classroom observations. During that observation, students engaged with digital flashcards both independently and with partners to review vocabulary related to interpersonal speaking skills. Students who worked with a partner took turns asking questions and answering them using the digital flashcards, while students who worked independently simply tested their own knowledge of the vocabulary using the digital flashcards or one of the games offered through the online flashcard platform. After a short period of time, students used the digital language lab to record scaffolded conversations that used some of the same language they had just practiced in the time prior.

During focus-group discussions after the initial observation, Melody said that she thought of her class as being semi-blended. "I definitely use technology every day to some extent, even if it's just a replacement, but I dream of a flipped classroom. But that's a lot of work on the front end that I haven't wrapped my brain around yet doing." As conversation continued, she later added, "I'm not saying I should doubt what they can do with it. But my challenge is, how does it fit the curriculum? How can I accomplish what we need to do curriculum wise and let them create stuff?"

As part of her participation in the study, she watched "Reimagining Classrooms," a TEDxTalk by Kayla Delzer (2015). We discussed her thoughts after watching it and she said the idea that schools and classrooms have looked much the same for seventy years or more has been troubling her.

Why? Teachers no longer have to be the gatekeepers. Students can teach each other, and us! I want to use this time to bring in new experiences that allow
students to create and provide access to learning that might not happen in such a traditional setting.

When I came back to observe her classroom after the study was complete, she had accomplished her goal and improved student use of technology to the Creative level. Students first used the digital language lab to partner with five other students throughout the class. Each time they partnered with a different student, they asked a series of questions crafted by the individual student to find out how they celebrated holidays in their family. After interviews were completed, students had a short period of time to synthesize the information and then create a short video presentation on Flipgrid showing both the similarities and differences of how holidays are celebrated. Finally, while I was not able to observe the last part of the activity, students were instructed to watch at least five other classmates' presentations, post video feedback with one thing each video had in common with their video and one thing each video did differently, and be prepared to discuss what they learned the next day in class.

During the post-study focus group discussion, we discussed her students' use of technology during the lesson. "One way I've worked on improving their use of it this semester is remembering to coach them on the process and the product, because I think I took it for granted." Throughout the study, Melody had expressed concern that while she was trying to improve student use of technology, they were struggling to follow instructions. "I just assumed that they knew what to do if I posted instructions. I mean, I thought it was very clear, I made a screencast and everything!"

But prior to the lesson I observed, she had left a practice assignment similar to what I observed while she attended a conference and many students did not complete the
assignment correctly, even after the assignment was returned to them with feedback to review the instructions and rewatch the screencast. "You and I talked about it, and you pointed out that they [the students] need coaching too, just like teachers. So, I pulled it up on the panel and I could see the light bulbs going off!"

These experiences from Heather and Melody show the impact that the professional learning can have on the student experience through changing teacher practices (Ehsanipour & Gomez Zaccarelli, 2017; Kimmons et al., 2015; Wolpert-Gawron, 2016). When teachers use technology more frequently and effectively, they may also have students who have higher academic achievement, increased engagement, and improved attitudes toward learning (Scherer et al., 2019).

**Discrepant Findings.** Discrepant findings are not uncommon in research studies, and this can be especially true in action research. Even though most participants showed improvement in both their use of technology and their students’ use of technology, there were some who did not show improvement despite participating in the research study. These discrepant findings can be challenging to reconcile with the overall results of the study and can raise questions about the effectiveness of the innovation. Nonetheless, it is important to carefully consider these findings and explore potential explanations for why some participants did not show improvement, whether in their own use of technology in their classroom or in students’ use of technology.

**Participants who showed no or negative improvement in their use of technology.** There were no participants in the study who remained at a Replacement level of technology use across both observations. However, three participants in the study were observed at an Amplification level in their pre-study classroom observations and
remained at that same level when observed during the post-study classroom observation. Andrew, Edward, and Josh all showed evidence of using technology to amplify their practice as classroom teachers when initially observed as part of the study. Though their post-study classroom observations did not show a Transformation level of use, that does not necessarily mean that growth did not occur, or they did not learn from the experience. It is simply a demonstration that based upon the technologies available to them, at the time observed in the curriculum, this use of technology was what they deemed best for that moment. This actually supports the model used in this study, and adds to the research surrounding it, as Kimmons’ (2020) encourages technology as just one of many factors being considered by the teacher, with pedagogy and improved learning being the driving force that guides educators to use, or not use, technology in a lesson.

Teachers often find themselves in a world pushed to succeed by outside criteria, including their use of technology (Guskey & Bailey, 2001; Hunzicker, 2011). Kimmons, Hall, and West (2020) emphasize that educators must avoid technocentric thinking and instead focus on the “what, how, and why, of technology integration (p. 180).” In a world driven by the academic calendar of midterm and final exams that is common in American high schools, classroom teachers in early December are at the mercy of the academic calendar.

There was also one participant who demonstrated a negative change in their use of technology from the pre-study classroom observation to the post-study observation. In the pre-study observation, Diana demonstrated an Amplification level of her own use of technology. Unfortunately, the academic schedule being what it is at that time of year, the only time available to schedule the observation for the post-study
observation led to a Replacement level of technology use. Rather than deny these findings, it is important to recognize that this is a daily occurrence for teachers across the country and that while educators may strive to use technology at higher levels, a single observation does not define them.

**Participants who showed no or negative improvement in their students’ use of technology.** Only one of the participants whose students were observed at the Passive level and only two of the teachers whose students were observed at the Interactive level of classroom technology use during the pre-study classroom observations remained at those levels when observed post-study. Diana’s students remained at a Passive level in both observations, despite adding elements of intentional technology integration into her classroom and including students’ viewpoints when considering the potential uses of technology. However, as was mentioned previously, classroom teachers in early December are at the mercy of the academic calendar and the only time available to schedule the observation for the post-study observation led to the same observed Passive level of technology use for her students.

Additionally, both Edward and Jennifer’s students remained at the Interactive level of technology use across both observations. It should again be noted though that one observation of a classroom does not define the entire student learning experience, and that “lasting and impactful learning” (Kimmons et al., 2020, p. 185) can occur even when students are not creating with technology. In their post-study focus group discussions, both Edward and Jennifer noted that the experience of participating in the study gave them a lens to purposefully evaluate the technology they were including in their lessons for students to use, which could be viewed as an important measure of growth, even
though it was not demonstrated through a positive change in student technology use at the
time of the observations.

Ultimately, there was also one participant whose classroom observations recorded
student technology use that went from an Interactive level during the pre-study
observation to a Passive level of use during the post-study observation. Jane was chosen
as a participant in the study specifically because her pre-study TIS responses indicated
that she might be an outlier and might have the potential for greater growth than other
teachers in the study, if she could be convinced of the benefits of having students use
technology in the classroom. While her own use of technology did show positive
changes, on the day of the post-study classroom observation, she did not choose to have
students interact with technology as part of their learning experience. While
disappointing, it was also not unexpected as it followed research showing that teacher
beliefs, attitudes, and confidence about technology are important predictors of their
willingness to adopt and use technology in the classroom (Ertmer & Ottenbreit-Leftwich,
2010; Harris et al., 2009). Effective professional development programs and support can
help teachers overcome resistance to change (Ertmer & Ottenbreit-Leftwich, 2010;
Frazier, 2011; Juarez & Goyette, 2020; Williamson, 2015), but there is no guarantee that
this will always happen or be demonstrated at the time of an observation.

**Summary.** Prior to participating in the study, participants were using technology
at a Replacement and Amplification level only, with no participants reaching the
Transformation level. At the same time, student use of technology in the classroom was
low as well, with students receiving digital content at a Passive level or using digital
content at an Interactive level, but no students producing digital content at a Creative
level. However, after participating in the study and seeing technology modeled at higher levels of integration during professional learning, participants overall improved their own uses of technology in the classroom as well as student uses of technology.

These findings contribute to the body of work surrounding Kimmons’ PICRAT model of technology integration. It is a newer model and possibly lesser-known than other models, such as SAMR or TPACK, so adding additional studies that incorporate the model into teacher practice in addition to the author’s own study and research may help to increase its reach. Additionally, the methodology of the study contributes to research on technology coaching and modeling as a form of professional learning.

**Research Question 2: How does a focus on technology integration models through professional learning opportunities for educators change teacher attitudes towards technology integration in the classroom?**

A common misconception is that classroom technology use is either good or bad, but few know why that might be the case, or even how to evaluate classroom technology use (Hixon & Buckenmeyer, 2009). This question originated from a desire to help teachers at FHS and in the district have a better understanding of how to evaluate technology integration in the classroom with the hope that clarity would lead to improved attitudes towards its use.

This action research study focused on two primary technology integration models: the PICRAT matrix developed by Kimmons (2018), which expanded upon the RAT model he had helped to develop with Miller, Amador, Desjardins, and Hall (2015), and the SAMR model, developed by Puentedura (2012). This study attempted to show that a focus on technology integration models through professional learning opportunities for
educators improved teacher attitudes towards technology integration in the classroom. This research question will be presented in two sections: (a) teacher attitude and beliefs and (b) discrepant findings.

**Teacher attitude and beliefs.** Research shows that teachers who have a better understanding of how to evaluate technology integration are more likely to see technology as a tool that can enhance student learning and engagement, whereas those who have a more limited understanding of technology integration tend to view technology as an add-on or distraction that does not significantly contribute to student learning (Ertmer, 1999; Ertmer et al., 2012). Additionally, when teachers participate in well-designed professional learning on how to evaluate technology integration, they tend to demonstrate more positive attitudes towards using technology in the classroom (Bowman et al., 2022; Chen et al., 2017; Ertmer & Ottenbreit-Leftwich, 2010; Kim et al., 2013). This suggested to me that providing teachers with opportunities to develop their understanding of technology integration could have a positive impact on their attitudes towards its use in the classroom.

The Technology Integration Survey (TIS) was developed by Kopcha in 2012 as part of his study presented in "Teachers' perceptions of the barriers to technology integration and practices with technology under situated professional development." The instrument consists of 15 Likert-scale questions using the standard range of strongly agree (4) to strongly disagree (0). Statements in the survey were broken into five barriers for classroom technology integration: Vision, Access, Beliefs, Professional Development, and Time. Each barrier consisted of three statements to which participants responded using the Likert scale. The survey was described in greater detail in Chapter 3 and
Chapter 4. The data from the survey was useful for answering this question due to the Beliefs subscale and three statements about their beliefs surrounding classroom technology that participants answered.

By nature of volunteering to be part of the study, most of the participants already had a strong belief about the role of technology in the classroom. Therefore, it is understandable that there was not a lot of room for improvement even through participation in the study. The additional challenge presented by the beginnings of the COVID-19 crisis and the anticipated or recent move to fully-digital education meant that participants who were far more positive during post-study focus group discussions (conducted in December 2019) had a more tempered response when they completed the post-study TIS (completed February – April 2020). This falls in line with research showing that the shift to fully online learning created stress that had a negative impact on teacher attitudes towards educational technology (DeCoito & Estaiteye, 2022).

Melody self-reported at the highest level on each of the subscales on both the pre- and post-study survey, therefore she was unable to demonstrate any positive change. But importantly, she also did not demonstrate negative change in her attitude and beliefs. Despite the challenges mentioned above, three of the 10 participants, Andrew, Deborah, and Edward, self-reported higher scores in each of the survey areas on the post-study survey, and two additional participants, Diana and Robyn, showed positive change on the last item, "I believe that technology makes my job as a teacher easier."

The three participants who showed positive change with this statement after participating in the study had a mean pre-study response of 2.67 and a mean post-study response of 4.0. Edward initially said that he was "agonistic with students and
computers" on the open-response section of the TIS. He later went on to say that he is someone who uses "technology a lot, but it's always in service in helping me work better." During his pre-study focus group discussion, he also mentioned that teachers are constantly being asked to take on additional responsibilities and that trying to constantly monitor student-use of technology can feel overwhelming at times, even for someone who is mostly positive towards technology-use in the classroom. “I think it’s not something I'm failing at but something I'm growing in as I discover new ways to make things happen. So, I kind of see it as an ideal that I'm trying to work my way towards.”

After participating in the study, Edward showed positive change in his attitude regarding students using technology for learning. As part of his participation in the study, he watched Jason Brown's TEDxTalk (2016), which advocated for a fuller use of creative student use of technology in the classroom. In reflecting on the video, he said that he cautiously agreed but drew a distinction between using the Internet to know facts and to understand concepts. "Usually I promote technology-based activities after they have built an initial understanding to prevent distractions from technology." In discussing the professional learning presentation he attended to learn about the PICRAT model of technology integration, he attributed an even greater shift in attitude:

I've heard other presentations where it always made it sound like you are an awful teacher if you're on the low end of the model, right? So even if not directly stated it’s still there. But I think you did a really nice job of saying, you know we're not always going to be this revolutionary teacher with technology each and every day with each and every student, right? I think that that's kind of ridiculous and I appreciate your kind of attempt to make that clear, like a summary. I remember
when your metaphors, like there might just be times where it's like, look, you
know all you're looking to do is this. So why do you need to, you know,
necessarily go crazy and all that kind of thing. So yeah, I appreciated the, the
theory, the basis for continuing to think about, you know, what am I doing and
why am I doing it, but ultimately, it’s about what is getting the most out of my
students, and if technology does that, great!

When Andrew initially completed the TIS, he rated his attitude in all Belief sub-
scales as a 3 out of 4 and did not explain his responses. However, in his pre-study focus
group discussion, he explained that he feels that student use of technology for learning is
“necessary at this point” in the classroom because it is going to “probably feed into
whatever they’re going to do within their occupation.” He went on to explain that he
thought it should be “completely integrated to be more relevant to where they're at, sort
of meeting the students where they are just keeping things up to date.”

As part of his participation in the study, he decided to “create an in-class blended
learning experience for my students that would integrate the curriculum with [the district
LMS].” Part of this involved converting traditional research papers into digital group
presentation projects using Google Docs, Google Slides, and the school system’s learning
management system. Reflecting on the project afterwards, he said, “the activities
transferred well, and I noticed an improvement towards my organization and how much I
enjoyed watching the presentations, compared to reading the papers.”

During the post-study focus group discussion, he was asked which part of the
study he found most influential in his shift in attitude and replied that he found the
presentation on the PICRAT technology integration model to be the most beneficial.
“That’s what I liked about it – a lot of models are too high-minded and can actually turn people off of technology. Like sometimes digitizing a worksheet is exactly what you need, and PICRAT shows that’s OK.” Later on, he expanded on how that applies specifically to when students are using technology to learn, the role of technology in the classroom, and how technology makes his job as a teacher easier:

If you take a worksheet, and you digitize it and the kid answers in complete sentences they developed and it's not plagiarized, I think it's more powerful than a worksheet because you can actually see if it has been plagiarized, is that original thought and did they put the effort into, and that's going to be far more powerful than a worksheet that they potentially copied…Realizing that was a big shift. It helps me be better, makes my job easier because I’m not spending hours tracking down kids who cheat, but also gives kids the info and the tools they need today.

On the pre-study TIS, Deborah self-reported all three Belief subscales at a score of 3 of 4. She did not clarify any of her responses on the pre- or post-study TIS, but her responses during the focus-group discussions can give insight to how her beliefs towards technology integration in the classroom improved as a result of her participation in the study. In the pre-study focus group discussion, she discussed using technology to let students “remediate if they need more help with a concept, or if they’re advanced, and they can go on and do something new” when the group discussed the role of technology in their classrooms, while lamenting the loss of previously available technology and the fact that not all students have the same device. “Well, I’m still mourning ActivInspire, and I miss, in my old district, all the kids had a Surface and that was nice. It just made my job easier because we write in math.” She then went on to say that she also wanted
technology to help students “be actively involved in their learning and kind of monitoring their progress along the way, being able to assess whether they got it or they don’t got it.”

However, on the post-study TIS, Deborah self-reported all three Belief subscales at a score of 4 of 4. During her post-study focus group discussion, she was reserved, but had this to say when asked about how her beliefs about technology’s role in the classroom had changed as a result of her participation in the study:

There are still challenges because we still don’t all have the same devices, but I did some Desmos activities, and the kids like them. I can pull them up and see what each one is doing, then we can discuss it as a class. And through some of what we’ve done (motions around the circle), I’ve found other resources that I can give them that they can access any time, and I can see them doing that. That definitely makes my job easier (laughs)! And next semester, I think I want them to start using something with video, to explain how they are working out the problem or maybe, like, test corrections? I don’t know exactly yet, but I’m excited to play around with some new ideas that I hadn’t thought about before.

Two of the teachers who participated in the study reported positive change in only the last Belief sub-scale statement, “I believe that technology makes my job as a teacher easier.” Diana and Robyn originally self-reported a score of 3 out of 4 on this statement. During her pre-study focus group discussion, Robyn discussed a variety of digital tools that she uses in her classroom, concluding with “I guess I feel like I’m using a lot of technology, but it’s spotty, and I don’t know how much easier it is. But I feel like if I don’t incorporate it, I will lose their interest eventually.” However, on the post-study TIS, she self-reported a score of 4 and explained her score, saying “I still think that tech helps
students learn more, because it opens them up to new opportunities. It's easy to design
good activities but takes time. However, I've realized how much more I can do with
technology to make my life easier.”

In the open-answer portion of the TIS, Diana explained her response by saying
“I'm sometimes overwhelmed by all the new websites presented and prefer seeing
something first before deciding whether or not I want to create an account (& remember
passwords) and utilize it.” Diana also describes herself as a “dinosaur teacher” and during
her pre-study focus group discussion, she expressed frustration with tools that are
introduced and then are replaced a short time later. “You spend all this time and then it
just goes away. But I could just stick with good old PowerPoint, and I would still have
everything I need.”

As part of her participation in the study, Diana watched Kieran Miles’s (2016)
TEDxTalk “Googled It” and later reflected that something she took away from watching
the talk is to think about the potential that technology can bring into the classroom,
including asking students about the potential use of technology. She decided to add online
quizzing to her face-to-face teaching as a way of saving time. “I got really proficient, and
it all goes back to, I feel really comfortable with it! It cut down on papers and the grading
is done! So, I’m happy, I’m proud of myself!” When she completed the TIS upon
completion of the study, she self-reported an improved score of 4 on this statement,
explaining in her post-study focus group, “It's really getting at the learning, I'm gonna say
it's things that you did, like your presentation. It made me think about the different ways I
do things.”
Towards the end of the discussion, she said that the PICRAT presentation helped her feel validated:

I think for me it validated what I guess I'd been struggling with as a person. I guess I call myself a dinosaur. I'm not that bad, I've always said that I like technology. And I'm like, y'all, good teaching is good teaching whether you use technology or not.

She went on to say that she felt pressured to use technology sometimes, saying that it is a “bandwagon we all gotta jump on.” As the oldest participant in the study, she felt that sometimes adding technology into her lessons was “just extra work” and if she could not see a purpose for using it, then she did not “need to do it because it’s just noise.” But she did not want to use technology to “just for the sake of doing it” and so she enjoyed learning more about the PICRAT model. She worried that “maybe I personally have been stuck doing a lot of replacement with technology just for the sake of doing it, like okay here. Look, I'm doing it folks. Shut up. Leave me alone.”

She ended by saying that she realized she was using more technology than she thought and that she appreciated the different levels presented by the PICRAT model for assessing classroom technology use.

Like is it modifying it, is it you know redefining it or is it really, you know, are we using that to transform what we're doing in the classroom. And you know, sometimes I am but probably most of the time I’m not. But I'm trying to, and I'm more aware of that, so I did appreciate it, it validated me.

This understanding, and subsequent change in attitude as expressed during our post-study focus group discussion, connects to a goal of the PICRAT model, which was
to provide clarity for teachers in understanding how to evaluate classroom technology use (Kimmons, 2020). It additionally adds to the body of research using PICRAT as an evaluation tool and the value of providing professional learning opportunities focused on how to evaluate technology integration.

The 2013 Kim et al. study suggested that providing teachers with professional development opportunities that focus on the potential benefits of technology for enhancing student learning and providing support for improving technology skills can lead to positive changes in teacher beliefs and increased technology use in the classroom. Prior to that, Palak and Walls (2009) published their study that found a positive relationship between teachers' participation in technology-focused professional development and their use of technology in the classroom, suggesting that effective professional development can lead to changes in teachers' technology practices. The study also found that teachers who held positive beliefs about technology were more likely to use technology in their teaching, indicating that teachers' beliefs and professional development may be important factors in promoting technology use in the classroom.

These studies are not unique and while the data from this research may be inconclusive, it does corroborate their findings and add to an ever-growing body of research on the importance of well-designed professional learning (Guskey, 2017; Hunzicker, 2011) in changing teacher attitudes and beliefs (Bowman et al., 2022; Ertmer & Ottenbreit-Leftwich, 2010; Tam, 2015).

**Discrepant Findings.** The discussion above focuses entirely on those participants who showed through their responses on the post-study TIS that they had an increased
belief in the importance of technology in the classroom. However, it failed to take into account two groups of participants: those who did not show positive change as a result of their participation and those who, for one reason or another, responded in such a way showing that they had negative change in the importance or usefulness of technology in the classroom.

While there were five participants whose TIS self-reported Belief scores demonstrated positive change towards technology use in the classroom, there were participants who responded the same way to individual statements or the entire Belief section both pre- and post-study. For some participants, such as Melody, this can be easily explained: Melody responded to all statements in the Belief section both pre- and post-study with the highest response possible. Therefore, while she showed no change, the study was not designed in such a way for her to quantitatively show positive change, only negative change, which she did not do.

For other teachers, such as Robyn, the answer may be more complex and in need of deeper investigation using qualitative measures. In both responses, Robyn self-reported a score of 3 out of 4 on the statement, “It is easy to design learning activities that incorporate computers.” She completed the post-study survey after the beginning of the COVID-19 lockdown, while teaching all of her classes entirely online. This certainly could have influenced her response, as evidenced by the open answer explanation she provided, saying “It's easy to design activities I think are good (and they seem to enjoy!), but it still takes MUCHO time.”

Three other participants self-reported scores that showed negative change in one aspect of the importance or usefulness of technology in the classroom. In response to the
statement “I believe using computers with students increases their learning.” Heather’s response decreased by a score of -1 on her post-study responses. However, as she completed the survey as the 2019-2020 school year was drawing to a close after having spent 2.5 months in a lockdown situation, her response to the open answer explanation makes clear that she was not thinking about just her time in the study. “While I know the school closings were unexpected and not what online school looks like, it does impact my thoughts about online learning and students.” It is my belief that this statement applies to the other participants as well, even though they did not clarify their responses, since their previous discussion in post-study focus groups showed a positive change in their attitude towards technology in the classroom.

This negative change, or lack of change, being attributed to the stress of the COVID-19 crisis is supported by research. Studies have found that after the school closures, teachers reported spending more time on administrative tasks and communication with students and families, giving them less time to spend on instruction and planning (Jones et al., 2022; Li & Lalani, 2020; Marshall et al., 2020). This would explain experiencing higher levels of stress and lower levels of job satisfaction, leading to a negative change in the belief about the role of technology in education.

Summary By learning more about how to evaluate the way technology is used in their classrooms, some participants in this study demonstrated positive change in their beliefs and attitude towards technology use in the classroom. However, it cannot be said that there is enough evidence from the TIS to prove that this question showed general improvement and some participants reported no change or even a decrease in attitude. In addition, even for those participants who did show positive change, the results of the
Wilcoxon Signed-Rank test indicate that there is no statistical significance to the change. While there are several factors that could influence the negative change, the one most likely is the fact that participants completed the post-study survey just prior to or after moving to fully-online classes at the beginning of the COVID-19 pandemic and lockdowns.

**Research Question 3: How does an educator's participation in personalized professional learning opportunities change the personalized learning opportunities offered in the classroom?**

I realized when I left the classroom that many of the teachers with whom I worked did not participate in any professional learning outside of what was required by our school or district, nor did they offer many personalized learning experiences in their classrooms. As I began to offer technology-focused professional learning opportunities to the school, it was important to me to offer them choice and to personalize the sessions I offered to their expressed needs and wants. During this time, I also began to explore more of my own personalized professional learning, through Twitter chats and Edcamps, which in turn led to me increasing the number of personalized professional learning opportunities offered to the teachers I served. This research question originated from a curiosity to explore if there was a similar relationship between the professional learning experiences that teachers chose to participate in on their own or chose for themselves and the personalized learning opportunities that they offered in their classrooms.

A 2018 study also investigated the impact of personalized professional learning on teacher practice and student learning. In it, researchers found that personalized professional learning can have a positive impact on teachers' attitudes and beliefs about
teaching and learning and were more likely to implement personalized learning strategies in their classrooms (O’Dwyer et al., 2018). Foote (2013) suggested that personalized learning can better meet the diverse needs and interests of individual educators and help to foster a culture of continuous learning and growth, which in turn, can enhance student learning outcomes when the same strategies are applied in the classroom. The 2018 guide published by EdWeb, "A Guide to New Models for Personalized Professional Learning: Research & Practice," emphasized the value of personalized professional learning as a means of improving teacher practice and enhancing student learning outcomes.

In this study, personalized professional learning was defined as educators having the opportunity to set their own goals for learning, as well as having the freedom to be responsible for the pace, place, and progress of their learning (Basham et al., 2016; Cavanagh, 2014; Headden, 2013). While there has been much discussion about personalized learning in the classroom, little is done to intentionally personalize professional learning for educators (Cavanagh, 2014; Patrick et al., 2013; U.S. Department of Education, 2016). In fact, most personalized professional learning is undertaken by the educator at their own expense and/or on their own time through informal opportunities such as Twitter Chats, EdCamps, and CoffeeEDUs (Caramanico, 2014; Rodman, 2018; Ross et al., 2013; Swanson, 2014; Wolpert-Gawrom, 2018).

This study attempted to show that an educator's participation in personalized professional learning led to positive change in the quality of the personalized learning opportunities offered to students in their classroom. However, as previously mentioned, no participant chose to participate in personalized professional opportunities that would take place outside of their normal workday. Consequently, this research question will
solely address the positive change observed in opportunities offered by participants for personalized learning in the classroom. There are no discrepant findings to discuss for this research question.

Of the 10 participants that participated in the study, only one, Jane, was fully against the idea of personalized learning in her classroom at the beginning of the study. The other nine participants fell along a spectrum from being open to the idea with some hesitation or reservations to already implementing personalized learning opportunities in their classroom. One of those participants, Diana, was additionally confused about the difference between personalization and differentiation, saying “wait – while you (pointing at someone else) were talking, I was thinking, is that personalization or differentiation? So maybe I don’t know, maybe I’m growing as I discover, like an ideal that I’m trying to work my way towards.” During the pre-study focus group, Melody responded that she was already consistently offering personalized learning opportunities for students in her classroom, although she also indicated an interest in learning more, saying that she was “always wanting to learn more, to challenge myself! If I ask my students to do it, why shouldn’t I? This is a chance for me to keep growing! (laughs)”

When the study was complete, all participants in the study showed some evidence of positive change in the idea of offering personalized learning opportunities in the classroom. In her post-study focus group discussion, Jane, the participant who was fully against personalized learning in her classroom, admitted that while she would not be implementing any personalized learning opportunities in her Advanced Placement course, “If I taught on-level, I would use that a lot more. Because when you teach on-level, there’s such a huge variance of ability. But AP, my philosophy, I guess, is here’s the bar
and everyone needs to be at it.” Diana, the participant who was confused about the difference between personalization and differentiation, showed during her post-study discussion that she now understood the difference and had begun to offer students some choice in the way they completed and submitted assignments, saying in her post-study focus group discussion:

I realized that could give different parameters with the big project with my on-level kids, and I could give better, personalized feedback, and that was good! I also gave choice in the assignment, which yeah, I normally do, but yeah, I liked it, I thought about it more which, as an older teacher (laughs), I don’t always.

Melody, the teacher who was already offering personalized learning opportunities in her classroom, found that her participation in the study energized her. “I thought it was fantastic! I was trying new things, I never want my kids to walk out and tell their teacher the next year, ‘My teacher last year was scared to try xyz.’”

Three participants in particular showed great improvement through their participation in the study. Heather, Jennifer, and Deborah all expressed positive beliefs towards personalized learning in the classroom during pre-study focus group discussions, but their pre-study classroom observations showed no evidence of this in practice and all three also expressed hesitation about the practicality of implementing personalized learning opportunities.

In Heather’s pre-study discussion, she said “I love the idea of being able to offer that. But in practicality, it becomes a matter of, how do you manage it?” Jennifer was concerned that her advanced-level mathematics course with large class sizes precluded offering true personalized learning opportunities. “I mean, I’m all for it. But I also don’t
think with 35 kids in the room, when the answer is what it is, I just don’t know.” Deborah was worried that personalizing the learning experiences would take away from the group experience in her classroom, as she spends a lot of time to build a class-wide relationship.

“They’re not all going to be able to interact with the activity and each other and is that really a good thing?”

However, when the study concluded, all three participants showed improved attitudes towards personalized learning in their post-study focus group discussions and their classroom observations backed this up with evidence. During Heather’s post-study classroom observation, students were working on a research project that she redesigned as part of her participation in the study.

With their actual assignment, it was the same, but the way they approached it looked different depending on different kids which was great for them! Some did websites and some used a structure that already existed, everything across the board, like with their level of comfort with technology, but you know, what they created was fantastic, and then you think the individualized feedback based on what they produced, what a great idea here! I just loved everything about it!

While Jennifer was participating in the study, she was also taking a graduate-level class that asked her to design a three-week online learning unit, so she combined the two experiences into one plan. Although she had argued that personalizing instruction would be too challenging to implement during her pre-study focus group discussion, she found that it was the key to making this online learning unit work for students. While some students enjoyed the freedom of being able to work at their own pace and reach challenge markers, others struggled and expressed intense dissatisfaction. "After the first week, I
shifted some and for those who wanted a mini-lesson, I worked with them individually and gave them a mini-lesson. It was like an individual check-in." By giving students this level of individual support and instruction, personalizing and adapting the unit to meet both their academic and social needs, not only did student performance improve, but their opinion of the unit also improved, and for Jennifer, "it definitely shifted my mind-set on how this can work."

Finally, Deborah also redesigned one unit of her course as part of her participation in the study. She was initially hesitant to do this because they did not want to diminish the community that she had worked to establish. But she found that once students understood that they would still be able to interact with each other and work together as a class, both she and they were much more positive about the experience.

Once I explained that, well, they really enjoy that! And being able to help each other and explain where the answer came from. It wasn't just their attitude that improved, their overall performance improved, because they really had the opportunity to go back and do things as many times as they needed to be able to really understand it.

These findings connect to research on both classroom personalized learning and personalized professional learning. It additionally makes connections between the two, adding to research supporting the idea that when educators participate in personalized professional learning, they are more likely to incorporate similar strategies in their own classrooms.

**Summary** This study attempted to show that an educator's participation in personalized professional learning can lead to positive change on the personalized
learning opportunities offered to students in their classroom. However, as previously mentioned, no study participants chose to participate in personalized professional opportunities that would take place outside of their normal workday. Despite that, their participation in personalized professional learning opportunities, such as choosing another teacher to learn from through observation or having choices about when, where, and how to complete the instructional hyperdoc, led to positive changes in the personalized learning opportunities offered in their classrooms.

The findings from this research question, while not statistically significant, still speak to the power of personalized learning at all ages. While there is much research on the impact of personalized learning for students (Basham et al., 2016; “Effects of Personalized Learning,” 2016; Headden, 2013; Johnsen, 2016; Patrick et al., 2013; Schaffhauser, 2013) and for educators (edWeb, 2018; Foote, 2013; Gamrat et al., 2014; Hall & Trespalacios, 2019; Hirschy, 2016), this study adds to research that connects them both.

Implications

After having collected and analyzed data, presented findings, and answered the research questions using thick and rich descriptions, I have attempted to show here how personalized professional learning focused on technology integration can change both classroom technology integration and personalized learning. Now, it is important to explore the implications of the research findings through the lens of the researcher’s realm of influence. In this section, implications are addressed in three phases: (a) personal implications, (b) recommendations for technology-focused professional learning, and (c) implications for future research.
**Personal Implications**

The time I have spent researching, designing, implementing, analyzing, and describing this study have led to growth in the way that I serve others and in the way that search for my own professional learning. Personal implications include (a) technology coaching practices and (b) personal professional learning practices.

**Technology Coaching Practices.** In the proposal stage of this study, my researcher positionality was that of an outsider but with insider knowledge. That background allowed me the unique experience of being able to build upon previously established relationships to create a collaborative action research approach with a more equitable power relationship than the traditional outsider attempting to collaborate with insiders.

This research showed that teachers are more willing to let an insider work with them in their classroom than an outsider and so it is important to build and maintain strong relationships with the teachers at all of the schools I serve, to be in the buildings as much as possible in an informal way, and to follow up in person after leading professional learning whenever possible so that teachers feel supported. Current research about instructional coaching supports this belief (Juarez & Goyette, 2020; Knight, 2018) and guides me in making decisions about how to approach my work with schools, ITSs, and individual teachers.

As a result of this research, I will endeavor to offer technology-focused professional learning experiences that both incorporate research-based best practices and feedback from teachers in the classroom. Currently, this means that professional learning experiences that I lead are tailored as much as possible to the needs of the school with
additional opportunities for individual teachers to either show teacher-leadership by mentoring others or to be able to exempt required learning experiences. Additionally, technology-focused professional learning will be designed to be quickly applied to the classroom environment and to be delivered in a blended-learning model, so that teachers can easily access content both before and after the learning experience.

**Personal Professional Learning Practices.** From this positionality, I also discovered personal implications in this process that are helpful in driving my own personal professional learning, something that becomes more difficult to find when you are the one providing professional learning experiences. As I decide what conferences to attend, books to read, or future research to follow, I realize that I must consider my own strengths and weaknesses as they relate to the technology coaching that I provide in addition to the needs of those I coach.

Through this study, I conducted a needs assessment with participants to determine their needs before designing the learning experience for them. In professional learning, especially when attending conferences, it is easy to choose learning experiences that are personal strengths. Instead, I have realized through this research that it is equally important for me to conduct my own needs assessment and choose learning experiences that will allow me to grow.

**Recommendations for Technology-Focused Professional Learning**

In its most simplistic form, educator professional learning is an ongoing practice designed to improve instructional practices, leading to an increase in student learning and achievement (Borko, 2004; Desimone, 2011; Guskey & Yoon, 2009). However, respondents and participants in this study voiced complaints about the professional
learning opportunities offered to them, including technology-focused professional learning. Anonymous pre-study TIS responses included "Sometimes we learn something cool and new, but it's so much and so fast, I know that I will still need someone to walk me through it a couple more times," and "There are times when it is overwhelming and could have been better planned."

While neither of those responses called out technology-focused professional learning specifically, Edward left no room for doubt, saying during his pre-study focus group discussion, "My girlfriend also teaches, and we laugh a lot about tech PD. I mean, it's almost universally awful." It is often noted in research that technology-focused professional learning is mandatory for all teachers and uses a one-size-fits-all approach, without taking into account individual learning preferences (such as when, where, or how the teacher chooses to learn the content), readiness, or interest in the technology (Gamrat et al., 2014; Hixon & Buckenmeyer, 2009; Knight, 2007).

At its core, technology-focused professional learning is designed to improve classroom technology integration practices for the purposes of teaching and learning (Crompton, 2020). Based on my study and current research, I will discuss three recommendations for technology-focused professional learning opportunities offered to educators:

1. Technology-focused professional learning should have personalized delivery options available.
2. Technology-focused professional learning should be targeted instruction.
3. Technology-focused professional learning should focus on the purposeful integration of technology into daily classroom routines.
**Recommendation #1: Technology-focused professional learning should have personalized delivery options available.** Personalizing instruction for teachers during professional learning can be challenging. Participants in this study brought up concerns such as a lack of time to “practice, play, implement” (Robyn) and the need for teachers to be able to “curate a plan that meets their unique needs” (Heather). Offering technology-focused professional learning in a variety of delivery options can help to eliminate these concerns.

This research offered instruction to participants in a variety of formats, taking a blended approach. Technology-focused professional learning should be designed to be delivered in a variety of formats, whenever possible, including online, blended, and classroom coaching models in addition to the traditional face-to-face instruction favored. These choices allow educators to personalize their own learning by developing a plan that allows them to choose when and how to engage in the PL activities that they need (Caramanico, 2014).

Online learning provides just-in-time learning and are often focused on a specific tool (Juarez & Goyette, 2020) but can also be designed as entire lessons, units, or courses of instruction, and should follow best practices for instructional design principles. When technology-focused professional learning is designed as online learning, it helps to model those best practices so classroom teachers additionally can see what online instruction could look like in their own classroom, as Jennifer did when looking at this research’s design and a district Online Resource Course before redesigning a unit of study to be a fully-online three-week unit in her course.
Blended learning provides technology-focused professional learning instruction in both face-to-face and online formats. This is one of the primary shifts I have made in my own practice, offering technology-focused professional learning across my district face-to-face with additional online elements of instruction, hands-on practice, and classroom application. However, it is important to understand that there is no exact definition or perfect blend of how much of each type of instruction must be included for instruction to be considered blended (Eaton, 2020) and that the focus should be on why certain elements of instruction are delivered online or face-to-face (Tucker, 2019).

Coaching offers an opportunity to provide personalized technology-focused professional learning in the classroom environment. It further allows the coach to help the teacher take the lesson to higher levels of technology usage because of the immediate access to support and troubleshooting. Coaching can be one-on-one, as experienced during this study with Jennifer and Jane, both of whom requested times to meet to discuss lesson design, or can happen with a small team of teachers, as experienced with Heather and a non-participating teacher. Most important, coaching should be at the request of the teacher and help to build a relationship between the teacher and the coach (Juarez & Goyette, 2020; Knight, 2007, 2018). When that occurs, shifts in attitude and instruction can occur, as was seen with Jane.

**Recommendation #2: Technology-focused professional learning should be targeted instruction.** Instructional designers are encouraged to conduct a needs analysis before beginning to design instruction (Gustafson & Branch, 2002a). Similarly, professional learning designers should conduct a needs analysis to determine the needs of the school, and the teachers and students within it, before beginning to design
technology-focused professional learning (Crompton, 2020). Instead of one-shot professional learning that lacks a clearly defined goal and offers no follow-up or continued support, instruction should be focused and sustained, with alternate opportunities for teachers to show mastery of topics in lieu of attendance or participation (Brooks & Gibson, 2012; Guskey, 2014; Guskey & Yoon, 2009; Knight, 2007).

When possible, these opportunities for targeted instruction can change teacher perception about adopting new pedagogies and technologies in their classroom. In this study, participants appreciated “this really unique opportunity where I asked and got what I asked for” (Heather) and being “able to really personalize my experience, once I realized that there are different ways to look at things, instead of just this is how you have to do it” (Robyn).

**Recommendation #3: Technology-focused professional learning should focus on the purposeful integration of technology into daily classroom routines.**

Professional learning that focuses on improving instructional practices and includes the purposeful integration of technology into daily classroom routines, rather than separating professional learning about pedagogical practices and technology tools, has the power to shift both practice and attitude about the place of technology in the classroom (Juarez & Goyette, 2020; Kimmons & Hall, 2018; Koehler & Mishra, 2005). Similarly, teachers who learn new technology tools from a content-based perspective are more likely to use it as an integral part of instruction than those who learn from a tool-based perspective (Frazier, 2011; Hughes, 2005). Robyn, a World Language teacher who participated in the study, backed this up when she chose to learn a new presentation tool as part of participation. "I was intrigued when you used it to present because it seemed like so
much more than a presentation tool! I used it in class one day and time flew by! The students were more engaged than ever and I'm able to quickly get in informal assessments.” Later on, she added additional context. “As a Spanish teacher, it’s hard, you know? I want my students to be able to speak and write and listen, not just read words on a screen. PearDeck did all that, so seeing it in real-life helped.”

Research also shows that innate beliefs and attitudes about both technology and pedagogy can be changed through well-structured professional learning, modeling, coaching, social pressure, and change agents (Admiraal et al., 2017; Hixon & Buckenmeyer, 2009; Straub, 2009). For example, this research found that encouraging teachers to purposefully integrate technology into their daily classroom routines and lessons improved their attitude about how and why technology is integrated. Diana and Robyn both found that by learning more about the PICRAT model, they are more positive and reflective. This reflection has the added benefit that they think more about how to “take it up a notch both my own use and my students’ use” (Diana) and to “up my game, for my students’ benefit” (Robyn) when integrating technology in the classroom.

**Implications for Future Research**

This study has implications for instructional technology specialists and coaches at the school and district level who are responsible for designing technology-focused professional learning. Professional learning leaders may be interested in future research related to how findings would change if this study were to be (a) replicated in a post-COVID-19 world or (b) replicated on a larger scale for the purposes of generalization or comparison.
**Replication Post COVID-19.** Most data collection in this research study took place in the semester immediately prior to the COVID-19 global pandemic. Once the world entered the virtual education reality of lockdown that began in March 2020, many practices and attitudes shifted and continue to shift even today. Replicating this study in a post-COVID-19 world could provide future researchers with a view to how teacher attitudes towards technology integration in the classroom have shifted since the global pandemic began and life settled into a new normal.

**Replication at a Larger Scale.** This study originally intended to perform inferential statistics to show statistical evidence of improvement. However, due to the small number of participants, it was determined that the use of a parametric test was not possible. Instead, only the nonparametric Wilcoxon Signed-Rank test and Shapiro-Wilk test of normality were conducted. Replicating the study on a larger scale with a greater number of participants, such as at an entire school or at multiple sites, would provide future researchers the opportunity to have a large enough sample size to be able to perform parametric tests. The analysis of quantitative data can help to show the depth and variety of data collected far more transparently than qualitative data sometimes allows and when paired with qualitative data, can complement and expand on what was found through the qualitative analysis (Connolly, 2014). Because quantitative data can be measured and quantified, as well as being objective, its findings can be analyzed using statistical analysis and then provide evidence for what is shown anecdotally (Goertzen, 2017; Kroll & Neri, 2009).
Limitations

As with any research study, this research had limitations that reduce the ability to generalize the findings to a wider audience and can also lead to uncertainty of its outcomes. The limitations that will be discussed below include (a) study design, (b) researcher bias, and (c) the COVID-19 pandemic.

**Study Design.** The primary limitation of the study was the study design. This included the use of single study site, purposefully chosen participants, and a small number of study participants. The use of a single study site prevents comparisons between two sites receiving similar professional learning experiences. The small number of purposefully chosen study participants created further limitations because the findings of the study cannot be generalized. This small number of participants also meant that parametric tests were not used during the data analysis process, meaning that data analysis relied on the more subjective descriptive qualitative data instead of the objectivity of quantitative data.

**Researcher Bias.** A second limitation of the study is researcher bias, which also includes positionality. Despite the fact that my role at the district level comes with no supervisory or administrative roles, the potential still exists to influence survey and focus group discussions because participants may see me and my role at the district level as being someone they want to impress. Similarly, qualitative data analysis lends itself to a more subjective interpretation and is considered a limitation compared to the objective nature of quantitative data analysis, which can be influenced yet again through my own researcher bias and positionality.
COVID-19. A final limitation to note is the effect of the global COVID-19 pandemic on the final post-study TIS responses, as well as my own data analysis and writing process. While the post-study TIS was sent to participants to complete prior to COVID-19 lockdowns starting to take place around the world, many of the participants completed the survey while preparing to move to an extended period of online learning or after realizing that school would not be returning to normal for the rest of the 2019-2020 school year. It is therefore possible that this led to skewed responses that were not reflective of participants true feelings. The COVID-19 pandemic also caused me to put my doctoral journey on hold and created several large time gaps as I struggled to regain my footing.
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Appendix A: 2016-2017 EdTech Training Preferences

The original survey can be seen here: https://forms.gle/dL7aTnH84RcuJEy7

1. Which is your preferred WAY to participate in edtech training?
   a. Face-to-face
   b. Online
   c. Blended (online with F2F practice)

2. When is your preferred TIME to participate in edtech training?
   a. During planning periods
   b. Before school
   c. After school
   d. Online on my own time

3. Which of the following would you like to learn more about? Check as many as apply.
   o ActivInspire
   o Blendspace
   o Designing tests in the district LMS
   o Digital assessment tools like Quizziz, GoFormative, etc.
   o Digital Scavenger Hunts
   o Finding your PLN tribe
   o Google Docs
Google Forms
Google Sheets
Google Sites (after redesign is unveiled)
Learning Station Basics
Periscope
Sharing files in Google
Twitter 101 for Educators
Weebly

4. What have we missed in edtech that you want to learn more about?

5. We’re designing a TechPD Challenge, with point values of 1-6 and rewards based on how much you challenge yourself. What type of challenge tasks would like to see and what point value would you assign?

6. Would you be interested in helping facilitate or present new tools during training sessions?

7. Would you be interested in gaining certification as a Google Certified Educator: Level 1?

8. Please share your name if you’d be interested in either of the two above (facilitating or Google).
Appendix B: Pre-Study Technology Integration Survey

This link provides access to the original Google Form used to collect participant demographic information and data on technology integration:

https://goo.gl/forms/KVZluJUHXJJkmmAD3

**Pre-Study Data Collection:** Completion of this survey alone does NOT indicate a desire to participate in the study, "Evaluating the Impact of Personalized Professional Learning on Technology Integration in the Classroom." All teachers are encouraged to complete the first two parts (Demographic Information and Technology Integration Survey) regardless of their desire to participate in the study itself.

All information will be kept confidential. Data provided by those not wishing to participate will be used for descriptive purposes only. Data collected from chosen participants will be reported anonymously.

Upon completion of the demographic information and technology integration information, you will be presented with an opportunity to indicate your willingness to participate in the study. Participants will be chosen with a goal towards equal representation across content areas.

1. Do you agree to provide demographic information and information about technology integration for the purposes of data collection?

**Demographic Information**

2. Age
3. Gender
   a. Female
   b. Male
   c. Prefer not to say

4. Content Area
   a. Career / Technical Education
   b. English Literature
   c. Fine Arts
   d. Mathematics
   e. Science
   f. Social Studies
   g. World Languages

5. Years of teaching experience

6. Years at Focus High School

7. Level of students taught this year (2019-2020) Select all that apply:
   a. Remediate
   b. Onlevel
   c. Advanced

Technology Integration Survey

When answering these questions, please refer to previous experience using technology in
the classroom. Reply to each statement using a score of 0 (Strongly disagree) to 4
(Strongly agree). For each area, you may explain your response if you choose.

8. Vision:
a. I was expected to use technology to support content objectives.
b. There was strong administrative backing for using technology.
c. The demands / goals placed on me for using technology were reasonable.
d. Please explain your response.

9. Access:
a. The technology available was, for the most part, useful for teaching.
b. I received help fixing technology problems in a timely manner.
c. The technology available was, for the most part, reliable.
d. Please explain your response.

10. Beliefs:
a. I believe using computers with students increases their learning.
b. It is easy to design learning activities that incorporate computers.
c. I believe that technology makes my job as a teacher easier.
d. Please explain your response.

11. Professional Development:
a. The training I received could be easily applied in my classroom.
b. I felt adequately trained on the skills needed to use technology.
c. I had enough opportunity to share technology lessons with other teachers.
d. Please explain your response.

12. Time:
a. Integrating technology took less time than I thought it would.
b. I was given time to learn to integrate technology into my lessons.
c. I had enough time to plan and prepare lessons that use technology.
d. Please explain your response.

**Participant Request to Participate**

13. Having provided information concerning demographics and technology integration, do you wish to be considered for participation in the study, "Evaluating the Impact of Personalized Professional Learning on Technology Integration in the Classroom"?

   a. Yes (Continues to potential participant information)

   b. No (Submits form)

**Potential Participant Information**

14. Last Name

15. First Name

16. Email Address
Appendix C: LoFTI Classroom Observation Protocol

This link provides digital access to the Classroom Observation protocol as used by the observer: https://goo.gl/forms/cS3SIN13GD8gtQN82

1. Date
2. Time
3. Teacher Name
4. Is technology in use? Yes No
5. How many students are in the class?
6. How many students are using technology?
7. Comments?
8. Why type of technology is used in the room?
   - Student desktops
   - Chromebooks / student laptops
   - Student use of ClearTouch panel
   - Teacher active use of ClearTouch panel
   - ClearTouch panel as overhead projector
   - BYOT
   - Calculator
9. How is technology being used by the teacher?
   - Activating prior knowledge
○ Assessments

○ Cues, questions, and advance organizers

○ Demonstration

○ Differentiated instruction

○ Facilitation

○ Lecture

○ Providing feedback

○ Questioning

○ Reinforcing / recognition

○ Scaffolding

○ Setting objectives

○ Summarizing

○ Other:

10. How is technology being used with assessment?

○ Oral response

○ Product (e.g., product with rubric)

○ Performance (e.g., presentation, demonstration)

○ Selected response

○ Written response

○ Other:

11. Technology is being used as a tool for… (Select Teacher, Students, or both):

○ Problem Solving (e.g., graphing, decision support, design)
o Communication (e.g., document preparation, email, presentation, web development)

o Information Processing (e.g., data manipulation, writing, data tables)

o Research (e.g., collecting information or data)

o Personal Development (e.g., e-learning, time management, calendar)

o Group Productivity / Cooperative Learning (e.g., collaboration, planning, document sharing)

o Formative Assessment

o Summative Assessment

o Brainstorming

o Computer-assisted instruction

o Face to face classroom discussion

o Face to face group discussion

o Asynchronous discussion

o Drill and practice

o Generating and testing hypotheses

o Identifying similarities and differences

o Project-based activities

o Recitation

o Summarizing and note-taking

12. Technology software is in use by… (Select Teacher, Students, or both):

o Administrative (e.g., grading, record keeping)

o Assessment / Testing
- Assistive (e.g., screen reader)
- Computer-Assisted Instruction / Integrated Learning System
- Thinking Tools (e.g., visual organizer, simulation, modeling, problem solving)
- Hardware-Embedded (e.g., digital white board, GPS/GIS, digital interactive response system)
- Multimedia (e.g., digital video editing)
- Productivity Software (e.g., database, presentation, spreadsheet, word processing)
- Programming or web scripting (e.g., Javascript, PHP, Visual Basic)
- Graphics / Publishing (e.g., page layout, drawing / painting, CAD, photo editing, web publishing)
- Subject-specific software
- Web browser (e.g., MS Internet Explorer, Netscape, Firefox)
- Course management software (DyKnow, etc.)
- Database systems
- Discussion boards
- Libraries, E-publications
- Search engine
- Video, voice, or real-time text conference
- Web logs, blogs
- Web mail
- Wiki
- Other:
13. Student engagement is shown by…(Choose the best estimate of the percentage of students showing each positive indicator of engagement, with 0 = 0% and 5 = 100%):
   o 0 = Tendency to give up easily in the face of challenges, 5 = Sustained behavioral involvement
   o 0 = Negative emotional tone (boredom, depression, anxiety, anger, withdrawal, or rebellion), 5 = Positive emotional tone (cheerful, calm, communicative)
   o 0 = Selection of tasks well within their comfort zone, 5 = Selection of tasks at the border of their competencies
   o 0 = Passivity, lack of initiative, 5 = Initiation of action when given the opportunity
   o 0 = Laziness, distraction, 5 = Exertion of effort and concentration

14. How was technology used in this classroom?
   o Passive (student)
   o Interactive (student)
   o Creative (student)
   o Replacement (teacher)
   o Amplification (teacher)
   o Transformation

15. Brief explanation of above response.

16. Classroom agenda.

17. Other comments regarding teacher?
18. Other comments regarding students?

19. Other comments regarding learning environment?
Appendix D: Focus Group Introduction Statement

Hello! First, let me thank you for agreeing to participate in this research study. Before we begin, I would like to remind you of the purpose of the research. The purpose of this action research will be to implement and evaluate the impact of personalized professional learning for teachers that is intentionally focused on models of technology integration. The study seeks to determine how modeling effective technology integration in professional learning experiences focused on models of technology integration improves classroom technology integration, as well as how teacher participation in personalized professional learning opportunities improves personalized learning opportunities offered in the classroom.

I will record our conversation to ensure the data is accurate, but I may also take notes throughout the discussion.

Do you have any questions before we start? (Clarify for the participant as needed). Ok! Let’s begin.

1. How much effect does observing others teach influence your own teaching practice?
2. What effect does learning more about a topic have on how you use it in the classroom?
3. What effect does professional learning have on your classroom practice?
4. What types of personalized professional learning activities, if any, do you participate in?
5. What do you know about models for evaluating technology integration in the classroom?

6. Can you describe what technology integration looks like in your classroom?

7. Describe your typical experience in technology-related professional learning.

8. How does the style of your professional learning activities influence your classroom practice?

9. What types of personalized learning activities, if any, do you offer in your classroom?

Thank you so much for your time and for agreeing to participate in my research study.

Before you go, I want you to know that I will be working to transcribe our interview. Before moving forward with my research, I will send you the completed transcript for you to review and evaluate. Please be sure to take a few minutes to review the transcription upon receipt and send me any discrepancies or send me a confirmation that all was transcribed appropriately. You should know that the transcription will not be verbatim but will be cleaned up grammatically for conciseness. Thank you again for your time and participation!
Appendix E: IRB Approval Letter

INSTITUTIONAL REVIEW BOARD FOR HUMAN RESEARCH
DECLARATION OF NOT RESEARCH

Angela Burgess
3609 Ridge Towne Dr.
Duluth, GA 30096

Re: Pro00089106

Dear Mrs. Angela Burgess:

This is to certify that research study entitled EVALUATING THE IMPACT OF PERSONALIZED PROFESSIONAL LEARNING ON TECHNOLOGY INTEGRATION IN THE CLASSROOM was reviewed on 5/7/2019 by the Office of Research Compliance, which is an administrative office that supports the University of South Carolina Institutional Review Board (USC IRB). The Office of Research Compliance, on behalf of the Institutional Review Board, has determined that the referenced research study is not subject to the Protection of Human Subject Regulations in accordance with the Code of Federal Regulations 45 CFR 46 et. seq.

No further oversight by the USC IRB is required. However, the investigator should inform the Office of Research Compliance prior to making any substantive changes in the research methods, as this may alter the status of the project and require another review.

If you have questions, contact Lisa M. Johnson at lisaj@mailbox.sc.edu or (803) 777-6670.

Sincerely,

Lisa M. Johnson
ORC Assistant Director and IRB Manager