Exploring the Effects of an Asynchronous Professional Development with the SAMR Integration Model on High School Teachers’ Technology Integration in the Classroom: An Action Research Study

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Exploring the Effects of an Asynchronous Professional Development with the SAMR Integration Model on High School Teachers’ Technology Integration in the Classroom: An Action Research Study

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DEDICATION

To my wife, Chelsey, who provided me with the support, encouragement, and motivation to achieve my highest potential, to my parents, Bill and Irene who raised me from an inquisitive child to an inquisitive adult, and for all the amazing educators in my life. I am the product of your efforts.
ACKNOWLEDGEMENTS

I would like to begin by thanking the faculty at the University of South Carolina for their support. Throughout the process, members of the staff have been there to guide me, support me, and answer any questions that I had. Dr. Grant was an excellent cohort advisor and mentor, and I am forever grateful for his guidance through this process. I will never look at “stew” the same way again.

I would also like to thank my dissertation committee for helping my dissertation become the best it could be. I would be remiss if I did not offer special thanks to Dr. Ari, my dissertation chair. His expertise helped guide my struggles into productivity, and I can confidently say that my dissertation would not have been completed were it not for his consistent support.
ABSTRACT

The purpose of this action research was to evaluate the effects of an asynchronous PD on teacher technology integration in the classroom as measured by the SAMR integration model. Teacher professional development is one of the most significant factors in student technology use in the classroom (Hall & Martin, 2008; Murthy, Iyer, & Warriem, 2015). Within a school day there are a number of requirements on teachers in addition to teaching their classes, such as attending parent conferences, department meetings, state mandated training, and many other initiatives that supersede teacher technology training (Garthwait & Weller, 2005). When provided with an online model, allowing teachers to work at their leisure has been shown in some cases to increase the amount of professional development teachers willingly take (Paskevicius & Bortolin, 2015; Russell, Carey, Kleiman, & Venable, 2009). This study focused on three questions. The first question sought to explore the ways asynchronous teacher PD on the SAMR model impact the planning process. The second question explored how and in what ways asynchronous teacher professional development on the SAMR model impact teachers’ classroom technology integration. The third sought to determine teachers’ perceptions about the effectiveness of asynchronous teacher professional development.

This study incorporated an online professional development module on classroom technology integration to provide high school teachers with specific technology-related resources, tools, and ideas to use in the classroom. The number of participants is five classroom teachers. Data collection consisted of a pre-survey, gauging teacher’s current
levels of technology integration in the classroom, observations, a mirrored post-survey and individual interviews with selected participants. Data were analyzed through a mixed-methods approach using descriptive statistics for the quantitative measures and literal transcription and inductive analysis for qualitative measures (Mertler, 2017). Results of this six-week study suggest a positive correlation between asynchronous teacher professional development and the thoughtful inclusion of technology when planning, increased levels of teacher technology use in the classroom, as well as a favorable outlook on asynchronous professional development in general. Research highlighted the need for collaboration between participants when participating asynchronously.
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CHAPTER 1
INTRODUCTION

National Context

A 2015 study conducted by the Programme for International Student Assessment rated the United States as “average” or “below average” in science, reading, and math performance (Belfali & Ikeda, 2015). This has caused much concern within the field of education, leading school and district level administrators to look for the next big educational innovation. Concurrently, technology usage in schools continues to grow with implementation of one-to-one student device initiatives as school leaders look to climb back up the international rankings. When new one-to-one initiatives are implemented, educators in classrooms are finding themselves struggling with how to implement the devices in an effective and meaningful way (Donovan, Hartley, & Strudler, 2007; Topper & Lancaster, 2013). Computers in the classroom are not a novel concept. In a 2009 study conducted by the National Center for Education Statistics, it was reported that 96.75% of classrooms had computers in the classroom every day, with an average ratio of 5.3 students per computer (Gray, Thomas, & Lewis, 2010).

Device presence in the classroom, however, is shifting. A survey conducted in 2014 indicated that of districts utilizing mobile devices in the classroom, 19.6% of those classrooms were considered to have a one-to-one ratio of mobile devices to students, with 82.2% of those mobile districts expressing a desire to expand to a one-to-one solution within the next two years (Interactive Educational Systems Design, Inc., 2014).
Increasingly, districts are allowing students to take these devices home (Li & Pow, 2011; Zilka, 2016), further adding to the potential educational reach of one-to-one computing. Adopters of one-to-one programs in their districts report benefits, such as increased student interest, engagement, research skill, and achievement (Bebell & Kay, 2010; Bebell & O’Dwyer, 2010; Edwards, 2012; Ercan, 2015; J. L. Harris, Al-Bataineh, & Al-Bataineh, 2015). There is some disagreement as to whether one-to-one integration is beneficial, as there are those who believe there is a strong correlation with improved student outcomes and others who have noticed either no effect or a negative effect with regard to technology integration in the classroom and student achievement (Arnesen, 2013; Goodwin, 2011; Hu, 2007). With discrepancies in the research, other variables, such as teacher training and implementation, must be considered as potential causes.

One of the methods employed to address issues within a school setting is professional development (PD). Teacher PD regarding technology is often focused around one of two technology integration frameworks: the substitution, augmentation, modification, and redefinition (SAMR) approach (Hilton, 2016; Kihoza, Zlotnikova, Bada, & Kalegele, 2016; Romrell, Kidder, & Wood, 2014) or the technology, pedagogy, and content knowledge (TPACK) approach (Cabero & Barroso, 2016; Liu, Tsai, & Huang, 2015; Retallick & Mithani, 2003; Sarhandi, Khan, Buledi, & Asghar, 2016). The SAMR approach can be applied to teachers or students and portrays technology integration as a continuum, moving from lower levels of technology integration to redefining the educational experience with more advanced levels of technology usage (Puentedura, 2006). TPACK is a framework aligned with a teacher’s pedagogical
abilities, content knowledge, and the combination of these two within a setting that utilizes technology (Mishra & Koehler, 2006).

Regardless of which educational technology framework is integrated, there are best practices for incorporating teacher PD into a district. Many districts struggle with PD due to time constraints, a lack of skilled trainers, budgeting concerns, or other limitations (Dana, Dawson, Wolkenhauer, & Krell, 2013; Tondeur, Forkosh-Baruch, Prestridge, Albion, & Edirisinghe, 2016). In order for PD to be effective, it must generally focus on content knowledge, provide opportunities for active learning, and have coherence with other learning activities (Desimone, Porter, Garet, Yoon, & Birman, 2002; Garet, Porter, Desimone, Birman, & Yoon, 2001; Penuel, Fishman, Yamaguchi, & Gallagher, 2007). Studies report often the largest challenge in employing mobile technology is incorporating PD that supports teachers who lack knowledge or experience (Ilhan & Ilhan, 2013; Interactive Educational Systems Design, Inc., 2014; Li, 2016). When provided with opportunities to utilize devices, teachers often feel uncomfortable and unprepared (Ertmer, 2005). This discomfort can lead to underutilization or complete abandonment of district-purchased one-to-one devices and a regression into other methods of teaching (Ertmer, 1999; Hall & Martin, 2008; Johnson-Martin, 2014; Murthy, Iyer, & Warriem, 2015). With a lack of teacher knowledge and preparedness, a common solution is teacher PD. If teachers are not provided with these opportunities for professional learning and growth, they will be unable to effectively incorporate one-to-one student devices within their classrooms.

In middle schools and high schools around the country, implementation of one-to-one programs is becoming more commonplace. Not all teachers are reporting an ease of
transition from other models to a one-to-one setting noting. There are reported concerns with the formatting of the lesson (Storz & Hoffman, 2013), preparation ahead of the lesson (Donovan et al., 2007), and lack of translation from expert home-use to expert school-use. Ultimately, it is teacher concerns, not student reluctance, administrative hesitation, or parental trepidation that is one of the largest barriers to successful one-to-one implementation within the classroom (Donovan et al., 2007). These problems are not unique to the national scale and have a localized interest within the researcher’s school district.

**Local Context**

District X hired a new superintendent within the last 5 years. One of the priorities for the new superintendent is a one-to-one Chromebook initiative. The goal of this initiative is to provide every student in grades 3-12 a mobile device for them to use in school and to take home with the goal of igniting a passion for “innovation, personal growth, and promot[ing] the pursuit of world class knowledge and skills (Berkeley County School District, 2017a, para. 1). The district is implementing this goal in four separate phases, beginning with 23 elementary and middle schools, followed by the remainder of the district’s schools, including the high schools. One-to-one devices in the form of Chromebooks were provided to students beginning in October 2016. Prior to the deployment of Chromebooks, teachers at the researcher’s school had not received any training in regard to their implementation or use. After their implementation, a course was offered after school for teachers to learn the basics of Chromebook use, and low attendance was reported, with less than 10% of the faculty attending this optional training.
The school’s annual renewal plan has technology as one of the main foci. Specific strategies focus on providing PD and other opportunities for teacher professional growth in the areas of technology implementation, integration of science, technology, engineering, arts, and math into programs and initiatives with specific considerations for training teachers on technology usage. The school renewal plan is linked to the school district’s goals of incorporating a “purposeful infusion of technology in teaching and learning” (Berkeley County School District, 2017b, para. 2). School level data indicates that there is a need for more technology training, as 51% of classrooms observed by administrators, this year, saw no student technology use, and the majority of technology that was used (25%) was utilized by students at the substitution level. For teachers, 26% were not observed to be utilizing any technology at all during their lessons, and of those who were, 46% were utilizing at the substitution level. With such a low level of student utilization of technology in a one-to-one building, there is a clear need for more training on how to utilize and implement devices effectively according to school goals and district expectations.

**Statement of the Problem**

When it comes to appropriate implementation of student technology use in the classroom, teacher training is one of the most significant factors (Hall & Martin, 2008; Murthy et al., 2015). Research suggests training is imperative to teacher implementation of technology within the classroom; however, within the school context, time is at a premium and many other initiatives, especially state mandates, take precedence over teacher technology training (Garthwait & Weller, 2005). Once exposed to an online model, allowing teachers to complete a course at their leisure, they are at least as likely,
and sometimes more likely to take more PD online than in a face-to-face format (Paskevicius & Bortolin, 2015; Russell, Carey, Kleiman, & Venable, 2009). Due to a lack of appropriate asynchronous PD, teachers are underutilizing or failing to utilize one-to-one student Chromebooks in the classroom setting as measured by teacher self-reporting and administrative observations (Bartlett, 2017).

**Purpose Statement**

The purpose of this action research was to evaluate the effects of an asynchronous PD on teacher technology integration in the classroom as measured by the SAMR integration model.

**Research Questions**

This research explores the following: In what way does asynchronous PD impact teachers’ implementation of one-to-one classroom technology? This will be explored with the following specific questions:

1. In what ways does asynchronous teacher professional development on the SAMR model impact the planning process?
2. How does asynchronous teacher professional development on the SAMR model impact teachers’ classroom technology integration?
3. What are teachers’ perceptions about the effectiveness of asynchronous teacher professional development?

**Researcher Subjectivities and Positionality**

I am a white, middle class, 31-year-old male born and raised in New Jersey, currently residing in a southeastern state in the United States. I hold generally liberal worldviews and am not afraid to share them with others. I grew up in a privileged
household where only one parent had to work a white-collar job to support our family and in a town that was made up of other upper-middle class to lower-upper class professionals and their families. As a result of my professional decisions, my socioeconomic class has changed, but I still experience the benefits of my race, gender, and social class. I have a strong interest in education and how technology can improve the school experience for both teachers and students. It is my philosophy that at their core, all students truly want to learn. They want to know that someone is there to support them and care about them. I believe that most teachers have the best interests of their students in mind and will generally operate within their own comfort zones unless provided with training on new skills and pedagogical knowledge.

My experiences with educational technology started at a young age. The home I was raised in was in an affluent district, which enjoyed computers in every classroom in the early 1990s (Manczuk & Pasco, 1994) and a high level of student achievement, which rose to such a level of competition that class rank was abolished (Brockett, 1996). Such a high-stakes environment has left an indelible mark on my work ethic, character, and beliefs about education. I am currently an assistant principal. Among my duties at the school are the implementation of PD as well as the deployment of Chromebooks to our 2100 student population. I dabble in programming, custom computer builds, robotics, and the maker culture in my spare time. All of these items influence my position as a researcher of educational technology. Modern technology in the classroom and one-to-one initiatives are the future, just as smartboards and whiteboards have replaced chalkboards. I also feel as though teachers cannot effectively implement new initiatives, whether they be technological or otherwise, without appropriate training or time to
process. This core concept forms the basis of my research and also connects to my research paradigm of pragmatism. Those who study education may never be able to point to a silver bullet that solves all of the woes of education, but we can certainly weigh the evidence available and make a decision based on this evidence (Omerod, 2006).

Throughout the course of my research, my positionality has changed. Since beginning this program, my employment has changed from a teacher to an assistant principal. This has changed my authority, access, and positionality. In the past I was a teacher researching the implementation of a PD plan and its outcome on other teachers within my building. Now, I am an assistant principal who is researching these same topics. The research participants are now individuals who are considered my employees. I was previously considered an indigenous insider (Buss, Zambo, Zambo, & Williams, 2014). I have worked with the group of people that I researched for 2 years and was accepted as one of their own. Now, in many ways, I am an outsider. The people with whom I conducted research are not my peers, but, rather, they are those I am tasked with supervising. One area where I had to monitor my biases was with my own knowledge of educational technology and what I expected participants to know. I am also the only one, within the group mentioned, who has engaged in the research process before. This knowledge, along with my position as the assistant principal gives me a certain level of authority that may have altered participants’ views while I was conducting my research. Alternatively, as I have only been in this position for a year, it may have altered their views in an entirely different way. Being aware of these potential issues was important throughout the research process.
Definition of Terms

Asynchronous PD - defined as an online PD program, where course participants are “not required to be available at the same time” (Dash, Magidin De Kramer, O’Dwyer, Masters, & Russell, 2012, p. 4).

One-to-One - defined as “programs, in which all the students in a class, grade level, school, or district are provided computers for use throughout the school day and, … at home” (Zheng, Warschauer, Lin, & Chang, 2016, p. 1053).

SAMR - defined as a system of technology integration utilizing the following four classifications for technology learning:

- **Substitution** – The technology acts as a direct tool substitute with no functional change.
- **Augmentation** – The technology acts as a direct tool substitute, with functional improvement
- **Modification** – The technology allows for significant task redesign
- **Redefinition** – The technology allows for the creation of new tasks, previously inconceivable.

Related activities that are classified as substitution and augmentation are considered to be enhancements to learning. Those activities that are classified as modification and redefinition are considered to transform learning (PuenteLura, 2013; Romrell et al., 2014).
CHAPTER 2
LITERATURE REVIEW

In 2016 the Programme for International Student Assessment released the results of the 2015 administration of their triennial survey showing the United States ranked significantly behind other developed countries in education (Belfali & Ikeda, 2015). School and district administrators are implementing a variety of strategies designed to bring students to a competitive score on the international stage. One of the recent trends in education is the shift to one-to-one computing for students. By placing a computing device in every student’s hand, it is thought that student success will improve (Levenson & Boser, 2014). A review of the literature suggests that many schools are finding that simply adding technology to a classroom does not improve student success; rather, the technological and pedagogical knowledge of the instructor has a crucial influence in these outcomes (Johnson-Martin, 2014; Storz & Hoffman, 2013). As technology has many different meanings, first, Information and Communication technologies (ICT) and their use by both students and teachers will be reviewed. Next, different frameworks pertaining to technology integration are compared. Finally, teacher PD relating to both ICT integration and technology frameworks are discussed and different methods reviewed.

The review of literature began with information gathering pertaining to the chosen technology integration framework, the Substitution, Augmentation, Modification and Redefinition (SAMR) Model (Puentedura, 2006). A Google search was conducted to determine the origin of the SAMR model and identify major sources of information on
the topic. *Google Scholar* was then utilized to review selected resources specifically pertaining to the SAMR model. Initial search began with the keyword “SAMR”; however, this yielded too many unreliable results. Puentedura was added as a keyword along with SAMR to narrow the search to articles relating to the SAMR methodology in education. Other frameworks began to reveal themselves during this search, and a similar search method was conducted on the Technological and Pedagogical Content Knowledge (TPACK) methodology (Koehler & Mishra, 2005). After resources were gathered on *Google Scholar*, the references for these resources were reviewed for additional sources of information. Some of these sources required paid subscriptions. Additional searches were conducted on *ERIC* and *Education Source* with keywords “SAMR” “TPACK” and “Technology Integration.” Keywords from relevant articles were analyzed for frequency and themes emerged. Many articles relevant to research being conducted contained “ICT integration,” “Teacher PD,” or variants on these two keywords. These became the focus of my next search.

PD is a broad topic that spans multiple disciplines. It was necessary to narrow the search to items specifically pertaining to teacher PD with technology in the classroom. Through searching it was revealed that teacher PD and classroom technology are referred to by myriad terms. This necessitated searches on *ERIC* and *Education Source* using keywords “ICT Integration,” “Teacher PD,” “Teacher Training,” “Technology Training,” “Technology Integration,” “Teacher Development,” and additional modifiers, such as “Effects” and “Outcomes.”
Information and Communication Technologies

Information and Communication Technologies (ICT) can have different meanings to different individuals. To contextualize the definition of ICT, the definition from the UNESCO World Communication and Information Report will be utilized: “Information and communications technologies (ICT) are a diverse set of technological tools and resources used to communicate and to create, disseminate, store and manage information” (Blurton, 1999, p. 46). In the past, ICT has been used to refer to film, radio, telephones, and television in education (Cuban, 1986; De Korte, 1967; Molnar as cited in Blurton, 1999). For the purpose of this research, the focus of ICTs will be on computer usage. First, a history of ICTs will be discussed, including their implementation and use within the educational setting. I will discuss (1) effective student usage of ICTs and (2) effective teacher usage of ICTs. Next, I will address the barriers to ICT usage, followed by benefits to ICT usage in the classroom, and finally controversies regarding ICT usage within the classroom.

The use of ICT within the classroom is not a new concept. Using the definition provided by UNESCO, the use of telephones, televisions, and other such devices would classify as ICTs and usage of these systems dates back to the 1930s (Simonson, 2009). Even the use of laptop computers as an ICT is not a new concept. As early as the 1990s, laptops were incorporated into classroom instruction in Australia and the United States (Johnstone, 2003). Integration of laptops did not offer a seamless experience, and many studies were conducted as to how to classify their effectiveness within a classroom environment. In a meta-analysis, Zheng et al. (2016) conducted a review of 65 different papers tracking laptop usage and their effectiveness from 2001 to 2015. Their research
revealed that, in general, having laptops in a classroom led to improved achievement for students (Zheng et al., 2016). The results of this meta-analysis are supported by researchers who have conducted studies within their classrooms and school settings (Kimmons, Darragh, Haruch, & Clark, 2017).

**History of ICTs in Education**

To effectively evaluate ICT usage within a classroom setting, how technology is used must be at the forefront of the discussion. Effective student usage of ICT relies on technology integration, not technology as a product or outcome. This is the difference between students using technology to create something engaging versus students using technology as the end goal. When students are engaged in a lesson, they are more likely to retain the information (Usher, 2012). For example, researchers found that students engaged in a math lesson that utilized ICT as a part of the interactive experience were more likely to not only participate but also to encourage others to come to the same conclusions on math problems (Arnesen, 2013). This effect was corroborated by researchers finding that laptops can create learning environments that are more stimulating and can enhance the conversation occurring within a classroom (Devasagayam, Stark, & Watroba, 2013). A crucial component of this successful technology integration appears to be a student-centered approach (Johnson-Martin, 2014), where teachers have a strong background in pedagogy prior to incorporating ICT into their lessons (Grant, Ross, Wang, & Potter, 2005). Effective technology usage in the classroom focuses on integration to the lessons, not a focus on the technology as the activity itself.
Technology integration does not begin and end with bringing laptops or other mobile devices into a classroom. Integrating technology within a classroom can be a difficult process for many educators, especially those who lack a strong belief that they can be successful or lack a solid educational foundation (Hall & Martin, 2008; Johnson-Martin, 2014). Often, it is assumed that a teacher’s background knowledge of technology or technology-related skills is enough to effectively incorporate technology into a classroom; however, this is generally a false assumption (Hall & Martin, 2008; Ilhan & Ilhan, 2013). Background knowledge is not sufficient for effective implementation; teacher competency using ICT within the classroom is largely dependent on training (Lawrence, 2018). With training an essential component of ICT use within the classroom, it is essential to employ training methods and procedures that teachers are willing to invest in.

When schools invest money in ICTs without appropriate training, they often find that teachers are hesitant to adopt that ICT into their planning without strong foundations. When planning with ICT does occur, its effectiveness and level of incorporation often varies based on teacher’s technical and pedagogical knowledge (Hall & Martin, 2008; Ilhan & Ilhan, 2013; Zheng et al., 2016). Teacher’s personal feelings are a significant determiner of whether technology will be integrated with a classroom, with many teachers considering how it will impact them personally, before considering the impact on students or the classroom learning (Donovan et al., 2007). Hall and Martin (2008) find that teachers feelings toward their own personal technology ability, exposure to PD related to ICT use, and years of experience all influence whether or not a teacher will incorporate technology into their lessons. When key barriers to technology integration are
removed, such as availability and access to devices, availability of materials, and teachers' beliefs, teachers tend to incorporate technology more meaningfully (Lowther, Inan, Daniel Strahl, & Ross, 2008). Teachers who receive training related to technological knowledge and pedagogical knowledge and how they overlap and intersect plan more student-centered lessons that focus on thoughtful integration of technology (Harris & Hofer, 2011). When training is not provided or prior ability level is not considered and accounted for, ICT usage in a classroom setting can have mixed results, ranging from full implementation to no utilization at all.

**Barriers to ICT Usage**

Not all barriers to ICT usage are related to the instructor; some are related to the course design or the structure. In a Tennessee district, researchers investigated whether or not their implementation program would assist teachers in incorporating technology within their school (Lowther et al., 2008). Researchers reported that as a result of the program, there were significant changes to technology culture, teacher confidence in technology integration, and student technology usage (Lowther et al., 2008). As early as 1999, in the infancy of technology integration in schools, Ertmer (1999) recognized two types of barriers to change for teachers, internal and external. It was noted that much was done to remove these barriers; however, at the time, significant research was not conducted to define the link to these two barriers.

These factors were noted and expanded upon by a multitude of researchers (Agyei & Voogt, 2014; Ahmad et al., 2016; Bettis, 2015; Çetin, 2016; Hew & Brush, 2007; Tallvid, 2016). Through their research it has been determined that there are four main barriers to ICT usage. First, a lack of technical competence, or skill, on the part of the
teachers was showing that they were hesitant to incorporate technology into their classroom (Agyei & Voogt, 2014; Hew & Brush, 2007; Tallvid, 2016). Second, even when technical competence was present, there was often noted a lack of resources or training on how to use the materials provided within a classroom setting, suggesting even when teachers know how to use technology themselves, they may still struggle with effective pedagogical implementation (Ahmad et al., 2016; Hew & Brush, 2007; Tallvid, 2016). For example, teachers with knowledge of business office-style software may struggle with how to implement these programs effectively in an educational setting (Hew & Brush, 2007). The third issue noted was a lack of time for teachers to prepare and implement technology within their classrooms. This lack of time was both classroom time and preparation time, with classroom time simply being the time it takes to distribute, log in, and navigate through devices (Bettis, 2015; Sharma, 2004). The final barrier to integration was a perceived lack of control noted by teachers. There are times when the district or state requirements can seem to be at odds with technology integration. For example, this was noted by a researcher who found that teachers often felt as though curricula were too restrictive to effectively implement technology (Çetin, 2016). If the common barriers to ICT classroom usage can be removed, research suggests that teachers may implement more technology and at more advanced levels within their classrooms (Hew & Brush, 2007).

**Effectiveness of one-to-one ICT usage.** Although teachers have reported significant barriers to ICT integration and utilization within the classroom, research suggests one-to-one ICT usage can be an effective strategy when managed properly. In a quantitative study conducted in Illinois, researchers noted higher test scores for students
using one-to-one technology in the classroom. These same researchers did not notice a change in motivation; however, motivation was measured by student attendance, which is not necessarily a determiner of motivation (Harris & Al-Bataineh, 2015). Results of student success are similarly noted in other studies. In a midwestern United States classroom, a phenomenological qualitative research study was conducted, and through 47 separate interviews, key themes included an improved effect on student learning experience and overly positive effect on student behavior and management (Storz & Hoffman, 2013). In a high school, iPads were utilized for a one-to-one learning pilot program, and noted improvements in engagement, digital literacy, digital citizenship and more class time to work on projects. Researchers concluded with a recommendation for ongoing faculty development related to the effective use of technology within the classroom (Chou, Block, & Jesness, 2012). Implementation of one-to-one devices is a significant step forward for ICT that, with proper training, can provide strong benefits for both teacher and student outcomes, including planning, engagement, and achievement.

**Multi-Year Studies.** The effectiveness of one-to-one implementation has been studied closely not only as a year-to-year implementation but longitudinally as well. A four-year mixed methodology study was conducted at a middle school comparing their implementation of a one-to-one program with the characteristics of effective middle schools. Downes and Bishop (2015) noted a significant relationship between implementation and team climate with team climate suffering as a result of technology integration in the third year of implementation. Through their realization, technology implementation was embraced, rather than restricted and in year four saw a significant increase in student climate. As a result of their technological integration, students
experienced a wider exposure to different types of content, such as podcasts and access to the internet for Web 2.0 tools. Finally, teachers noted an increase in student’s involvement in their own learning. Students were completing assignments outside of school and teaching themselves new technology related skills as a result of their assignments (Downes & Bishop, 2015).

A three-year research initiative conducted by Bebell and Kay (2010) followed a pilot one-to-one integration program in Massachusetts. Through their research, they noted an increased usage of technology by both teachers and students, though technology was readily available before. Teachers saw marked increases in student motivation as measured by a survey, with less than 2% of teachers reporting that the laptop program had led to a decline in class participation. Teachers utilized new and varied methods to communicate with their students. Reports from the study also suggest that there was a significant increase in both teacher and student technological knowledge. Finally, researchers noted a significant impact on student achievement as a result of the implementation of one-to-one devices, with achievement trends on standardized test scores increasing as well as favorable outcomes on a computer-writing study (Bebell & Kay, 2010).

In both of these longitudinal studies, there were reports of increase in student achievement and growth. In Bebell and Kay (2010), the majority of teachers reported that increased curriculum support (80%) and increased technical support (100%) would have made the program even better. This supports the barriers for entry postulated by Hew and Brush (2007) and Hall and Martin (2008). Student achievement, motivation, and participation all noted marked increases. These could potentially have been even more
significant with additional PD provided to teachers on the use and implementation of ICTs.

**Different devices as ICTs.** Every school has different requirements and needs; this is reflected in their choices of ICT. In this section three separate computing ICT solutions will be discussed: first, Chromebooks, followed by iPads and, finally, traditional laptops.

*Chromebooks as an ICT.* Chromebooks are a relatively new technology when compared to the other ICT options available. Chromebooks are designed very similarly to traditional laptops; however, they lack significant on-board storage, and they operate almost entirely within the cloud. Despite the newness of Chromebooks, Google has a significant hold on the educational market with over half the market share (Singer, 2017). Chromebooks offer an advantage in the classroom as Google Suite, formerly Google Apps for Education (GAFE), is fully integrated into the Google System. Chromebooks also provide the benefit of requiring less user interactions on the device to get to programs and search results, with those interactions being more intuitive (Ahlfeld, 2017).

Chromebooks, like other ICT systems, are not perfect. In a study conducted by Sahin, Top, and Delen (2016), they discovered teacher experience did not have as much of an effect on teacher technology integration as the number of devices and teacher’s attitudes toward those devices did. Within the research, proper training and technological problems arose as two of the specific concerns that teachers had. This is in contrast to another study conducted by a University in Ghana where students were provided the opportunity to take a course immediately following the implementation of GAFE within their program. Within this study, over 80% of students noted they felt as though they
were more productive when using GAFE and over 90% stated that they were more satisfied than using a traditional course model. The remaining percentage stated that they were also moderately satisfied (Awuah, 2015). There is a stark contrast between teacher perceptions and student perceptions. In studies focusing on teachers and their satisfaction, generally they are more critical of the devices and voiced concerns (Sahin et al., 2016). For students, the Chromebook platform and the Google Suite are versatile and provide a high range of student satisfaction.

* iPads as an ICT. Apple iPads are another ICT that are commonplace in classrooms. With Google holding most of the market share, Apple is working hard to make their devices competitive as an ICT. iPads have on-board storage and a significant number of apps and programs that can be installed as well as new technologies geared specifically for students (Nicas & Singer, 2018). This technology can offer different experiences than those available on other devices.

A three-year study in New Zealand with over 100 schools explored effectiveness of iPads and found that iPads offer significantly different experiences from other ICTs, specifically offering more collaboration and a shift to learners who are engaging in educational experiences in a more informal fashion (Falloon, 2015). Of note, within this study is the researcher uses Google Suite as a part of their iPad deployment, suggesting that even when the hardware is owned by a different company, Google still maintains a presence in many classrooms. Despite the hardware utilized, there seems to be a strong case for why Google controls so much of the educational market share.

In a 9th grade classroom, a team of researchers evaluated iPads as a learning tool and tracked their effectiveness in a variety of direct and indirect instruction
environments. Researchers noted increased engagement, improved digital literacy and improvements in digital citizenship. Challenges for students included distracting apps and irrelevant websites, while for teachers, it was a lack of teacher-selected apps and need for more PD (Chou et al., 2012). Reports from teachers utilizing iPads are similar to those using Chromebooks—there is noticed improvement; however, more training and support are required.

*Traditional laptops as an ICT.* Laptops are the earliest implemented of the three one-to-one ICT models discussed. Laptops, for the purposes of this research, are differentiated from Chromebooks by their on-board storage and local applications.

In a research study conducted across multiple districts, laptops were utilized in a one-to-one setting and patterns were examined. Research questions centered around the purpose for implementing one-to-one initiatives, the funding and support for said initiatives and the expectations of the stakeholders that are encouraging adoption. Findings from this particular study suggest that teacher PD should play a larger part in technology implementation, as teachers need to learn to shift from a tools-based model to one focused on integration of technology (Topper & Lancaster, 2013).

A meta-analysis of 65 journal articles and 31 dissertations examined the specific impacts of one-to-one laptops on learning in K-12 schools. A common theme that emerged across the analysis within this study, and other studies, was the need for support from school administration and leadership for one-to-one program (Bebell & O’Dwyer, 2010; Silvernail, 2008). Studies reported positive changes with regard to student engagement, and interest level (Bebell & O’Dwyer, 2010). Again, one-to-one devices,
regardless of type, have the capacity to improve student outcomes and provide for better classroom instruction, with appropriate supports in place.

**Controversies within ICT implementation.** ICT is not without its controversies; arguments include better retention with paper and pencil, and ICT serves as a distraction to the learning environment. This controversy extends to all levels of education. In middle school, complaints include students distracted by gaming and chatting (Storz & Hoffman, 2013). In high school, students found certain apps and websites a distraction to the classroom instruction occurring (Chou et al., 2012). In higher education, students who are attempting to multitask struggle staying focused on classroom content (Kay & Lauricella, 2011). Drawbacks should not serve as a reason not to implement certain ICTs within the classroom; rather, to serve as a reminder that one method of implementation, regardless of what that method is, is not as effective as varied strategies.

Research indicates that students perform taking notes using long-form handwriting versus laptop note-taking. Researchers suggest that handwriting notes is superior to typing them (Goodwin, 2018; van Wyk & van Ryneveld, 2018). This is mainly due to the levels of thought process conducted while using a device versus those writing longform. The noted discrepancy derives from the tendency for laptop note-takers to take notes verbatim, whereas those who are taking handwritten notes often paraphrase and process information reframing it into their own words (Mueller & Oppenheimer, 2014). Teachers utilizing one-to-one ICT in their classroom should consider the effects of processing information internally before having students resort to paper, or screen as their primary note-taking device.
Not all writing is created equal, with one researcher suggesting that students write better compositions when using a Chromebook versus handwriting an essay. Within this research, Kimmons et al. (2017) compared 8th grade students’ essays based on whether they were composed by Chromebooks or by hand and the composition of those essays. Chromebook essays showed a significantly higher grade-level of writing and greater reading difficulty. Researchers claim this suggests greater complexity in both word usage and sentence composition, in comparison to those essays written by hand. It is hypothesized that the medium may have an effect on student writing (Kimmons et al., 2017). In Maine, after a 5-year implementation of a laptop program, the average student score on writing in state standardized testing increased by approximately two-thirds (Peckham, 2008). Clearly, the type of writing conducted by students is an important consideration when determining the appropriate use of ICTs within the classroom.

Laptops pose distractions not only to students using the devices outside of their educational purposes but to those around them attempting to use them properly. In a higher education study, Kay and Lauricella (2011) reported despite almost 75% of participants saying laptops were beneficial, there were still issues. Specifically, even those students not engaging in distracting behaviors on their devices were distracted by those around them who chose to. Distracting behaviors included watching movies, playing games, and instant messaging during class time. In a one-to-one classroom, it is important for teachers to monitor student device usage and make sure that devices are being used for the appropriate task.
Technology Integration Frameworks

To facilitate promoting and tracking teacher technology integration, various frameworks were developed. Many of the frameworks are similar with some specifically borrowing parts from others or seeking to improve on previous iterations. Four frameworks will be discussed, starting with the Substitution, Augmentation, Modification and Redefinition (SAMR) framework created by Puente dura (2006). Next Mishra and Koehler’s (2006) Technological and Pedagogical Content Knowledge (TPACK) framework will be discussed. Then, Hughes’ (2006) interpretation and simplification of the SAMR strategy, known as Replacement, Amplification, and Transformation (RAT) will be covered. Finally, the University of South Florida (2011) developed the Technology Integration Matrix. I will discuss each of these models as well as compare and contrast them against each other.

SAMR

The SAMR model is a framework for technology integration and should be treated as a continuum with teachers employing all ranges of the SAMR strategy, as seen in Figure 1 below (Puente dura, 2006, 2013). The SAMR model emphasizes a method of technology integration that moves in a linear path from substitution, where an instructor substitutes a digital task for a previously non-technological one, to redefinition, where tasks are designed that could previously not be accomplished without the use of technology (Puente dura, 2006). The SAMR model has been used by a variety of researchers, educators, and administrators to evaluate the level of technology integration within their contexts.
The SAMR model has been implemented in a variety of ICT contexts. Romrell, Kidder, and Wood (2014) utilized it specifically as an evaluation tool for mobile learning. They found that for mobile learning, using technology at the substitution and augmentation levels provided too many barriers for entry for technology to be worth implementation. At the modification and redefinition stages, there was a benefit to using technology that outweighed the costs. There were multiple issues noted within this study, mainly those related to technical, pedagogical, and management concerns. Researchers noted a need for training for teachers prior to implementing the SAMR model to promote effectiveness (Romrell et al., 2014).

One common issue with the SAMR model is that it is often noted as hierarchical by those who are using it on a day-to-day basis (Hilton, 2016). Those who see it as hierarchical attempt to consistently reach to the redefinition stage, which can cause struggles in the classroom. Hilton (2016) challenged this notion by having the participants chart their technology usage and see how it was distributed, rather than moving toward more complex levels. It is important that any training provided to teachers...
on the SAMR framework provides clear direction for teacher expectations of technology use.

Another area of note was in that of content acquisition. Teachers reported that they found themselves using substitution/augmentation with content acquisition and modification/redefinition with understanding activities (Hilton, 2016). The versatility of SAMR as a framework makes it a worthy choice for technology integration efforts.

**TPACK**

TPACK is a way for teachers to assess their knowledge of ICT competencies as it relates to multiple domains. Mishra and Koehler (2006) suggested that a master of implementing ICT in the classroom has control over each of the TPACK areas as noted in Figure 2.2. In contrast to the SAMR model, the TPACK model looks at the interrelatedness among different fields of knowledge and posits that knowledge within all three areas together will lead to the most well equipped technological integrators. The three fields that are compared are technical knowledge, content knowledge, and pedagogical knowledge, for example, a teacher’s knowledge of classroom technology, their knowledge of their classroom content, and their knowledge of what it is to be an educator. These fields are combined together in a Venn diagram to create various overlapping skill sets, with the overall goal being the intersection of all three abilities together.
Figure 2.2. The TPACK model (Mishra & Koehler, 2006).

TPACK can be more useful in looking at the big picture of technological integration. In a social studies classroom, the TPACK strategy was employed alongside the SAMR model (Hilton, 2016). Researchers found that the TPACK strategy was more useful when modifying existing content and deciding how to incorporate that content with technology (Hilton, 2016). For teachers struggling with other models that appear to be ladders or hierarchies, the TPACK model may be an appropriate solution, as it emphasizes a blend of knowledge rather than a series of actions.

The TPACK strategy is widespread and sees use among a variety of contexts. One research model involved 12 schools where they were asked how they utilized the TPACK strategy within their local context. One of the themes included TPACK as a connector, combining many of the school’s initiatives under one unified plan, linking technology integration with other non-technologically related school goals. Others saw TPACK as a grass-roots initiative, where early adopters of TPACK had adopted its strategies into their professional learning experiences. Yet others utilized TPACK as a check and balance, as a mechanism to allow the technology and learning specialists to work together. Finally,
there were those who saw TPACK as an instructional planning tool, focusing on learning activity types as a method to bridge the learning with application (Harris & Hofer, 2017). One of the issues with the implementation process is that the different knowledge bases, technological, content, and pedagogical are interpreted differently by different teachers (Cabero & Barroso, 2016). Since TPACK is a highly descriptive framework, those with more experience tend to describe their abilities differently than new teachers (Cabero & Barroso, 2016). In general, TPACK is a varied strategy that has a variety of different implementation implications based on the context in which it is implemented.

**RAT Model**

The replacement, amplification, transformation (RAT) model introduced by Hughes, Thomas, and Schamber (2006) is seen by some as a simpler version of SAMR. The RAT model aims to remove some of the confusion between substitution and amplification. This framework was introduced shortly after the SAMR framework, as there was a noted discrepancy between how the SAMR model was being applied, with significant concerns between the semantics of the substitution and augmentation as well as the augmentation and modification stages (Hughes et al., 2006). Instead of the bottom-up approach of the SAMR model, the RAT model takes a top-down approach, as seen in Figure 2.3. The model places replacement as the entry method to technology integration with the outcome of the instruction the same as it was prior to the use of technology. Amplification is next, where technology increases the ability of the user, specifically with benefits to productivity and efficiency but does not change the overall nature of the lesson or activity. Finally, at the transformational stage technology offers instruction that
was previously unthinkable, with the description being extremely close to the redefinition stage of the SAMR model.

![RAT Model](image)

*Figure 2.3. The RAT model (Hughes et al., 2006).*

RAT and SAMR were released within months of each other, and SAMR has become the more popular strategy. As such, there is significantly less research conducted using the RAT model. One study (Kimmons, Miller, Amador, Desjardins, & Hall, 2015) utilizing the model found that it provided a positive framework to determine whether or not preservice teachers were utilizing technology effectively. Through the utilization of RAT, the researchers were able to monitor practice and assign codes based on teacher reflections. The RAT model removes some of the confusion between the substitution and augmentation stages of SAMR and provides a clearer transition between sections.

**TIM**

The Technology Integration Matrix (TIM) was developed by the Florida Center for Instructional Technology located at the University of South Florida and focuses on how the teacher implements technology in the classroom in 5 steps. First released in
2011, the TIM model, as seen in Figure 4, provides information for teachers on how to use technology in the K-12 classroom. The matrix is broken down into “five interdependent characteristics of meaningful learning environments—active, constructive, goal directed, and collaborative” (Welsh, Harmes, & Winkelman, 2011, p. 69). The TIM model provides concrete examples of what each of the stages looks like through the use of videos. Unlike the other models provided, there are concrete descriptors provided that explain in detail what the differences are between the categories. For example, one can navigate to the TIM online and click on any of the categories and see what the action looks like for the teachers, the students, and in what setting it takes place. Another benefit to the TIM model is the inclusion of two tools for teachers and administrators, the TIM-O observation instrument and the technology comfort measure (TCM) (Welsh et al., 2011). These instruments give a clear evaluative tool for teachers to monitor their own practice as well as one for administrators to incorporate into observations. The TIM model has built on the models of technology integration that have come before it and sought to solve some of the most common issues.
A teacher using the TIM model and making efforts to incorporate technology along the five categories can expect to see significant changes in learning, compared to a traditional model. Teachers can utilize the TIM model as a method of self-reflection, comparing themselves to the definitions provided by the matrix (Keller-Kyriakides, 2016). The TIM model is one that can be employed in a school that is fully one-to-one or a school with limited technology access and is adaptable based on the local context (Ruman, 2017). The TIM model offers a wide range of flexibility and provides specific, concrete, and clear expectations for those using it.
School-based PD

A common theme that emerged throughout a review of related literature was the need for additional training and support for teachers who are attempting to implement technology in the classroom (Chou et al., 2012; Ertmer, 1999; Sahin et al., 2016; Zheng et al., 2016). Support and training requested by teachers included information specifically related to how to integrate technology (Hall & Martin, 2008) and how to appropriately incorporate technology into planning (Bettis, 2015; Donovan et al., 2007). This section will review research related to PD. First, effective PD methods will be discussed, followed by the types of PD available, and finally, the potential effects of PD will be discussed.

Effective PD

Effective technological PD for teachers centers around agreed upon central themes. These themes have emerged in numerous studies from a number of researchers. One of the most common themes is a sustained model, eschewing the normal idea of a one-off PD session. Researchers suggest that training should be continuous to support teacher needs (Curwood, 2011; Garet et al., 2001; Penuel et al., 2007). Continuous training offers the ability to ask questions and for training to shift as needed when teachers encounter obstacles in their classrooms. The second common theme related to PD is that it should be specific and relevant to teacher needs. For example, PD should relate to the issues teachers are dealing with at the moment that the PD is being offered. PD that is specific and relevant has more meaning to the teachers undergoing the PD and contributes to greater outcomes (Garet et al., 2001; Hunzicker, 2010; Penuel et al., 2007). The final common theme for PD is that it is timely, offering the opportunity for teachers
when they are most likely to need it. PD that is timely can offer opportunities for teachers to improve practices (Curwood, 2011). Timely PD can also improve a teacher’s abilities more than if they had the PD at a time that was not relevant (Garet et al., 2001; Hunzicker, 2010; Penuel et al., 2007).

**Types of Educational PD**

There are multiple types of educational PD that are utilized with teachers. Studies suggest that when training teachers in ICT, PD that models what the desired outcome for the teachers is may be most successful (Desimone et al., 2002; Fusco, Haavind, Remold, & Schank, 2011; Garet et al., 2001; Jaipal-jamani, Figg, Gallagher, Scott, & Ciampa, 2015). PD is an important tool to support teachers with technology integration in the classroom. Teachers are professionals who are expected to constantly grow and hone their craft. To be effective for their students, teachers must always be updating their knowledge and be provided with opportunities to do so (Sarhandi et al., 2016).

Incorporating PD that is appropriate and increasing the amount of PD that is available can improve student learning and their integration of ICT (Lehiste, 2015). Increasing the frequency of PD may not be the only solution, rather the PD should be targeted to ICT and how it can be applied within classroom teaching (Çetin, 2016). In implementing a successful and cohesive PD plan, teacher and students can improve their ICT skills and utilization.

**Face-to-face PD.** Face-to-face PD ranges in effectiveness, based on the strategy employed in the PD but is usually ranked unfavorably by teachers due to factors, such as time, relevance, and perceived lack of differentiation (MacDonald, 2008; Russell et al., 2009; Simmons, 2015). Coaching as a PD tool may be the most effective of the face-to-
face PD strategies, providing targeted one-on-one support for teachers. Depending on school population, it can be difficult for the coach to service everyone (Beglau et al., 2011).

Two types of models typically employed are the sit-and-get model and professional learning communities. Sit-and-get, or the traditional lecture format of PD is an outdated model that does not differentiate or reach the needs of teachers (Dana et al., 2013; Hunzicker, 2010). Professional learning communities are often seen as an effective method of PD, as teachers are able to learn from their peers; however, there is a significant time commitment associated with these meetings (Curwood, 2011; Easton, 2008).

Blended or flipped PD allows for face-to-face interaction as well as online completion of activities or assignments. Teachers engaging in blended PD generally rate it more favorably than face-to-face alone. They suggest that it allows for practice and allows the group to come together to discuss issues and concerns related to shared experiences (Alebrahim, 2016; Gunter & Reeves, 2017). Blended PD can also provide an opportunity for teachers to practice some of the same skills that are being requested they utilize with their students in the classroom, with this hands-on approach leading to even more meaningful learning (Curwood, 2011). Blended meetings have the opportunity to increase the effectiveness of an overall PD plan. In a blended situation, face to face meetings can actually help encourage online participation (Paskevicius & Bortolin, 2015). Seemingly, one way to augment the typically undesired full face to face meeting is to offer a blended solution which increases popularity and may bridge the gap with those who are less tech savvy and willing to participate in a full online session.
Online PD is a strategy that allows for flexibility and teachers to complete tasks and learning on their own schedule but collaboration and interaction with others can be difficult (Russell et al., 2009). Teachers who enrolled in online PD courses to improve their pedagogical knowledge noted marked improvements over a six-week span in one particular study; however, this learning did not necessarily translate to a specific increase in student achievement (Dash et al., 2012). Improved pedagogical knowledge seems to be just one of a few benefits related to online PD, participants noted changes in their teaching methodology as a result of the online courses (Scruggs, 2009). Online PD offers many of the same benefits of other PD styles without requiring participants to meet in a set location at a set time.

**Benefits of Educational PD**

PD often exhibits strong results on teacher performance. PD has improved teachers’ self-efficacy and increased their use of technology in the classroom (Johnson-Martin, 2014). Teacher development has led to increased teacher proficiency, preparedness, and ability to incorporate technology into planning (Doherty, 2011; Uslu & Bümen, 2012).

One of the most frequent complaints of teachers that they experience when implementing a one-to-one laptop system is the lack of training or support surrounding the implementation (Ertmer, 1999; Johnstone, 2003; Sahin et al., 2016). It was found that when these barriers are removed and training is provided, the students perform better and teachers incorporate more technology into their classrooms (Desimone et al., 2002; Kimmons et al., 2017). When districts are investing money and time into ICT, it is important that teachers learn how to implement the ICT appropriately.
The effects of PD on teacher planning are generally positive as well. Teachers who receive training on ICT are more likely to incorporate ICT into their planning and ultimately their lesson. Even teachers with low pedagogical knowledge of ICTs improved their planning when exposed to training related to technology integration (Kihoza et al., 2016). In some cases, it was enough just to increase teachers’ perception that they were more trained in ICT for improvements to be made (Hall & Martin, 2008). Appropriate PD can improve teacher implementation of technology from the planning stage to integration within the classroom.

**Chapter Summary**

Using ICTs in a classroom is not a new concept; however, there are new ICTs being used that teachers need to be prepared for. It is known that ICTs can improve student engagement, and when student engagement is high, so is retention of information (Usher, 2012). There are a variety of devices being used in classrooms from Chromebooks to iPads to traditional laptops. All of these devices present significant benefits (Capra, 2014; Chou et al., 2012; Kay & Lauricella, 2011). Benefits to utilizing devices include improved writing skills (Peckham, 2008; Sharma, 2004) and increased student engagement (Bebell & Kay, 2010; Bebell & O’Dwyer, 2010; Harris & Al-Bataineh, 2015).

There are also some noted drawbacks to device use. Students may become too reliant on devices, diminishing skills, such as recall and note-taking ability (Goodwin, 2011; Mueller & Oppenheimer, 2014). Students may also struggle with staying on task and multitasking at inappropriate times (Kraushaar & Novak, 2006). Many frameworks have been developed to support teacher and administrative implementation of ICTs.
Different frameworks can be applied to different situations with differing results. Frameworks can sometimes cause confusion as to how they should be applied (Hamilton, Rosenberg, & Akcaoglu, 2016; Hilton, 2016). Integrating more ICTs in a classroom does not guarantee high engagement, and it may be difficult to get ICT into a classroom without teachers feeling comfortable with that technology (Ertmer, 1999; Grant et al., 2005). PD is a way to encourage teachers to change their practices and offer them support. When appropriate PD is applied, there are significant growths in both student achievement and teacher integration of technology (Curwood, 2011; Harris et al., 2015; Kihoza et al., 2016; Sahin, Top, & Delen, 2016).
CHAPTER 3

METHOD

The purpose of this action research was to evaluate the effects of an asynchronous PD on teacher technology integration in the classroom as measured by the SAMR integration model. This research explored the following: In what way does asynchronous teacher professional development impact teacher implementation of one-to-one classroom technology? This study focused on three questions. The first question seeks to explore in what ways does asynchronous teacher professional development on the SAMR model impact the planning process. The second question explores in what ways does asynchronous teacher professional development on the SAMR model impact teachers classroom technology integration. The third seeks to determine what teachers’ perceptions are about the effectiveness of asynchronous teacher professional development.

Research Design

A concurrent mixed-methods design was selected for the purposes of my research, which evaluates the impact of asynchronous PD on teachers’ understanding of a technology integration model and their technology integration practices within the boundaries of this model. As an assistant principal and the lead member of the technology team at my school, it is of particular interest to me how other teachers in my building are integrating technology and if there are possibilities for improvement or advancement of their craft. Action research fits well with this inquiry-based approach, as:
[It is] any systematic inquiry conducted by teachers, administrators, counselors, or others with a vested interest in the teaching and learning processes or environment for the purpose of gathering information about how their particular schools operate, how they teach, and how their students learn. (Mills, 2000, p. 4)

In line with the definition offered by Mills, I, as an administrator, conducted a systematic inquiry of teachers about how teachers at my school integrate technology into their classrooms.

Although action research can take many forms (Bradbury-Huang, 2010), in general, action research is conducted by educators within their local settings (Mertler, 2017). This action research is focused on “cycles of action and reflection…[and] strengthening a skill set” (Bradbury-Huang, 2010, p. 98) Typically, action research tends to be less formal and lacking the ability to generalize to wider contexts and implications, as it is generally used to guide practitioners in a specific context; that is not to say, however, that action research cannot contribute in meaningful ways to a larger understanding of a situation (Mertler, 2017; Mills, 2000). Educators engaging in action research have the ability to study a setting they are a part of and guide their actions based on the outcome of their research.

My action research incorporated both qualitative and quantitative methods, making my research a mixed-methods approach. Mixed methodology is considered to be “in the middle of this continuum because it incorporates elements of both qualitative and quantitative approaches” (Creswell, 2008, p. 32).

Multiple and varied methods of data collection will serve to provide the most detailed information to address my research questions. When measuring qualitative items,
there were a variety of methods utilized to gather data to ensure the validity of data collected, known as triangulation (Bloomberg & Volpie, 2008). Specifically, observations of classrooms as well as interviews with teacher participants will be utilized to gather data sources. Observations of classrooms provided the researcher with information about the teachers’ integration of technology with their practice in an objective format. Teacher interviews were semi-structured in nature. A semi-structured method was chosen as I am the administrator to the teachers who will be involved in this study. In addition to the qualitative measures, teachers were provided with a list of Likert-scale questions for a pre- and post-assessment regarding their level of one-to-one technology integration in the classroom. Selecting these methods of data collection provided an opportunity to triangulate my sources.

**Setting**

The site selected for this study is a suburban school serving grades 9-12 in a mixed rural-suburban district in a southeastern state in the United States. The school has an approximate enrollment of 2,100 students. The site has been selected because it is my home school, and the area where I have identified the need for my action research population. The high school has just undergone its first year of one-to-one student Chromebook implementation, in which every student was given a Chromebook device. The classrooms being observed include grades 9-12 English, Spanish, social studies, and career and technical education classes (CTE).

In addition to teachers asking for PD opportunities, administrators have identified a need, where 51% of classrooms observed by administrators in the 2016-2017 school year noted no technology usage in their classroom. When technology was being used, it
was noted on the SAMR (Hilton, 2016; Kihoza et al., 2016; Puantedura, 2006; Romrell et al., 2014) scale as being strictly at the substitution level. To make progress on the school renewal plan and state report card data, in addition to other school initiatives, the school has decided to make purposeful and meaningful technology integration a priority.

**Participants**

Prospective participants were selected among the full-time certified classroom teachers. The classrooms being observed all follow the state standards for their content areas. The teachers participating in this action research study ranged in levels of experience from first-year teachers to veterans with 35 years of experience. Their level of personal technology usage ranges as well, from those who do not own their own personal computer to those who spend multiple hours a day outside of school using them for personal purposes. There are 107 certified teachers at the school. The study is restricted to classroom teachers. Teachers who cover subjects, such as physical education and JROTC, will not be observed; however, they were not excluded from partaking in the intervention, should they desire. Long-term substitutes, student teachers, and those teachers who work in a support role, rather than as the main instructor in the classroom, are all be excluded for the purposes of this study. Participation in the study was on a voluntary basis. Prospective participants were provided with an overview of the intervention and had an opportunity to choose to participate in the PD modules being offered. A total of five teachers agreed to participate in this research study.

**Participant Profiles**

Five teachers agreed to participate in the asynchronous professional development, and each had a unique experience. Prior research suggests teachers can have varying
results based on years of experience, technology self-efficacy and prior participation in professional development (Hall & Martin, 2008; Ilhan & Ilhan, 2013). Each participant experienced the professional development in a different way, making their background especially relevant to the study. Each participant’s background information, as well as generalized demographic information are provided, along with a pseudonym. Care has been taken to anonymize this information as best as possible to preserve the identity of the participants while still providing the reader with a clear idea of their individuality.

Participant One. Albert teaches more than one subject at the high school, however, the course that he was observed for was a computer related course in the math field. Albert is between 30 and 40 years old. Albert’s highest level of education is a master’s degree. He has been teaching for the entirety of his career, between 10 and 20 years, and has described himself as a digital native, growing up using computers, video game systems, and generally being comfortable around technology. When conducting the observation prior to introducing teachers to the asynchronous professional development he was teaching from the front of the room, utilizing the smartboard to teach subject-specific concepts to his students, no student technology use was observed.

Albert’s experience with the professional development was mostly positive. He described his experience with the professional development using the phrase “Loved it”. He was particularly interested in applying the course content stating that he “integrates more” now than he had in the past. Albert, like other participants, expressed concern about the discussions stating he wished they could have been “deeper” and had more “back and forth”. Generally, he stated his knowledge of SAMR had “grown”, which was evident in the post classroom observation. Students were applying mathematical concepts
by using coding software. Based on the SAMR (Puentedura, 2006) model, this would be considered an example of redefinition, as technology allowed for something that was previously inconceivable without the technology, in this case, tying mathematics with coding on a computer.

Participant Two. Brittany is one of two foreign language teachers to participate in the study. Brittany is between 35 and 45 years old. Brittany has been teaching between 5 and 10 years, she holds a master’s degree in her content area. She considers herself knowledgeable about technology but acknowledges there is room to grow when it comes to technologies and strategies specifically related to educational technology. When conducting an initial observation, teacher technology use was observed, with the teacher presenting videos from native speakers on the Smartboard and students discussing them. No student technology use was observed.

Brittany’s experience in the professional development seemed to differ from the other participants. She was more influenced by what her peers had done than other participants stating that their discussion board posts “helped” her with technology integration. She stated after participating in the course she is now “more aware” of technology integration and its benefits. She also responded positively overall to the intervention stating “it was great” and she appreciated being able to go back and forth to review information presented. In the post observation of her classroom, no student technology use was observed, however the teacher was using the Smartboard for instruction.

Participant Three. Catherine is a social studies teacher with over 20 years of experience. She has had many roles in education and was, at one point, a technology
facilitator for a district, offering training to other teachers on educational technology, before returning to the classroom. Although not a digital native, she considers herself to be an advanced user when it comes to incorporating technologies into the classroom. She has previously taught courses on technology integration. When observing Catherine’s class, she had students using their individual devices in conjunction with an online textbook, which was followed by an online quiz that graded itself and provided immediate feedback.

Catherine approached the professional development course with a different mindset than the other participants. Catherine is a former technology facilitator who was “already familiar” with many of the technological applications covered in the professional development. Despite this different perspective she was also able to derive benefit from the professional development, stating it gave her a “deeper understanding” of some of the programs she was already using with students. She, too, had suggestions for change. Catherine wished there were deeper discussions as “nobody responded” to her discussion board posts. She also said she wished there was “more choice” provided in the opportunities within the professional development. Overall, Catherine said she “enjoyed” the professional development and would participate in something like it in the future. In the post observation of Catherine’s classroom students were creating a digital book, with a variety of platform options, the book had links to other resources, moving images, and some of them even had opportunities for the story to change depending on what the reader clicked. This is a transformative lesson that would have been considered modification or redefinition depending on which student was completing the assignment.
Participant Four. Deborah is a social studies teacher, who has worked both outside of and within the educational field. Deborah has been teaching for between five and ten years. Deborah’s highest level of education is a terminal degree in a field related to what she teaches. Deborah has always been comfortable using technology, though she was more familiar with using it in a business setting than an academic setting. When observing Deborah’s classroom, she was seen using the Smartboard to show students videos related to their content which they then discussed as a class. No student technology use was observed.

Deborah’s experience in the professional development appeared to be defined by her perception of prior knowledge. Deborah had knowledge of technology prior to entering the professional development, and thought she was doing well. She had “heard of” different applications discussed in the program but had “never thought” of integrating them in the ways suggested in the professional development. She described her experience as “invaluable” and stated that the professional development provided her with a “wealth of knowledge” that she was able to draw from when constructing her lessons and teaching. She stated that she believed her knowledge of SAMR increased and she felt as though she “was doing well” before, however she understands that she is “better” at integrating technology now. In a post observation of Deborah’s class, students were answering questions on their computers based on a video on the Smartboard. Although this can be seen as substitution or augmentation, in the pre observation of Deborah’s class, no student technology use was observed, suggesting there was some growth.
Participant Five. Emily is a foreign language teacher who has between 5 and 10 years of experience in the classroom, this experience has been split over the last 15 years. Emily has previously worked within schools as an interpreter for her language. She is not well versed in technology but expressed interest in learning more to benefit her students. During an initial observation of her classroom, students were watching a video on the Smartboard as an entire class, and responding. No student technology use was observed.

Emily was the most bubbly and cheerful when describing her experiences with the professional development, claiming that it “changed her life”. Emily had previously taught in the early 2000’s, prior to the widespread incorporation of educational technology in the classroom. She felt the professional development was “helpful” and that there were items covered that she used “right away”, making changes to her instruction prior to the conclusion of the professional development. Emily felt as though everything covered was “applicable” to her situation, including the SAMR model which was “brand new” to her. Overall she expressed great joy in being included in the program, her only “downside” was there was so much information that she wouldn’t be able to process it all right now and she would have to “save some for next year”. In a post observation of Emily’s classroom, students were watching videos from a native speaker of the language, and then translating these videos onto a document on the computer.

Intervention

The intervention enacted within the school was an asynchronous PD model, where teachers watched a series of videos regarding various educational programs and applications pertaining to one-to-one classroom technology integration. Participants were provided with literature regarding these programs and applications. Training covered the
SAMR integration model. Participants were given time to engage in discussions with their peers and with me to review any questions that may have arisen during the training. Alternative PD models, including a flipped classroom model have been successful in engaging student learning and promoting positive outcomes for the participants (Dash et al., 2012; Russell et al., 2009). Teachers engaged in these lessons to promote a familiarity and understanding of the Google applications suite available on Chromebooks as well as other applications that can be useful for classroom technology integration. These videos included multiple examples from different levels of the SAMR integration framework (Puenteleda, 2013) and how to incorporate them into lessons. The videos, documents, and discussion followed best practices for PD: being timely, appropriate, relevant, and giving teachers time to plan (Penuel et al., 2007). It is through this PD model that teachers gained the additional skills required to increase the level of technology integration in the classroom and to do so at more meaningful levels.

The PD consisted of five total modules. Each module, except for the first, was based on a standard, non-technological based classroom activity. The first module is different to make sure teachers are starting with the same baseline of knowledge. Teachers were given a beginner and advanced option for each activity to further their understanding. Items covered include: (1) Google Chromebook, Google Applications, and SAMR Introduction, (2) creating a presentation, (3) quizzes and tests, (4) formative assessment, and (5) field study. Each lesson consisted of two-leveled lessons, a beginner lesson, and an advanced lesson. This choice was made to make the PD as relevant as possible to participants. Each lesson consisted of the following steps: (1) Teacher read an introduction about the topic, including a suggestion for how to apply each level of SAMR
to the lesson, (2) teacher watched a video about a tool or tools that can be used to integrate technology into the lesson, (3) the teacher took the information from the video and introduction and used this information to develop lesson ideas, (4) the teacher took one of their lesson ideas and built it into a lesson plan for their class. An optional step was for a teacher who has completed the beginner lesson to also complete the advanced lesson. Teachers were encouraged to post their finished lessons in a collaborative space so that other participants in the PD may benefit from their ideas.

Data Collection

This action research employed a mixed methodology utilizing both quantitative and qualitative sources for data collection. Quantitative data collection focused on technology used by teachers, including frequency, type of technology, teacher comfort, whether the use was teacher-centered or student-centered, and ratings based on the SAMR model. Qualitative data explored teachers’ perceptions of the asynchronous PD program as well as perceived changes, if any, to technology implementation. These data sources were compared and triangulated for trends and to answer the research questions shown in Table 3.1.
Table 3.1 Research Questions and Data Sources

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Data Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ1: In what ways does asynchronous teacher PD on the SAMR model impact the planning process?</td>
<td>TTQ Teacher Interviews</td>
</tr>
<tr>
<td>RQ2: In what ways does asynchronous teacher PD on the SAMR model impact teachers’ technology integration in the classroom?</td>
<td>TTQ Teacher Interviews Classroom Observations Weekly PD Questionnaire</td>
</tr>
<tr>
<td>RQ3: What are teachers’ perceptions about the effectiveness of asynchronous teacher PD?</td>
<td>TTQ Teacher Interviews</td>
</tr>
</tbody>
</table>

Classroom Observations

Classroom observations were conducted using the SAMR framework (Hilton, 2016; Kihoza et al., 2016; Puentedura, 2013; Romrell et al., 2014). Throughout the course of the research period, I conducted the classroom observations with the intent of recording teachers’ technology integration in the classroom in the boundaries of the SAMR framework. Each teacher was observed for a 45-minute block of time, a total of two times, once before PD was provided and once after the PD has been concluded. The observation form was used to record whether technology usage was seen in the classroom, whether this usage was student-centered (e.g., students completing an activity as a group on a Chromebook) or teacher-centered (e.g., the teacher using the smartboard while students watch). Observations are necessary to note the changes in teachers’ practices (Hall & Martin, 2008; Johnson-Martin, 2014; Orrill, 2001), as teachers may not be aware of specific practices they employ in their classrooms. This helped inform research question two, specifically addressing how teacher technology integration changes after implementation of the asynchronous PD module.
**Teacher Interview**

The teacher interview was a semi-structured interview conducted after teachers received the asynchronous PD, and the data collected from the other sections helped guide the questions for this interview. Interviews are an important method of data collection when tracking response to PD and technology integration, as teachers can reveal information and opinions that can inform further research questions (Çetin, 2016; Downes & Bishop, 2015; Hall & Martin, 2008; Johnson-Martin, 2014; Orrill, 2001; Tondeur et al., 2016; Zheng et al., 2016). The interview subjects were teachers at the researcher’s home school. Interviews were conducted at the conclusion of the administration of the asynchronous PD, giving the interview subjects time to incorporate practices from the PD into their classrooms. Interviews were audio-recorded and transcribed in intelligent transcript format. Questions focused on all three research questions, exploring whether PD impacted planning or practice and the overall perceptions of the PD. The initial questions (see Appendix C) asked of the respondents were slight modifications of the research questions referenced in Table 3.1 to ensure alignment.

**Teacher Technology Questionnaire**

Teacher Technology Questionnaire (TTQ) by Lowther et al. (2008) was used to collect teachers’ perceptions of computers and technology. The survey rated teachers’ level of agreement using Likert-type items ranging from (1) strongly disagree to (5) strongly agree with 20 statements regarding five technology-related areas: impact on classroom instruction, impact on students, teacher readiness to integrate technology, overall support for technology in the school, and technical support. The TTQ was
administered both before and after asynchronous PD so responses may be compared. As referenced in Table 3.1, the TTQ helped answer each research question.

**Weekly Professional Development Questionnaire**

Weekly Professional Development Questionnaire was created to gauge participants’ weekly growth as they complete different modules of the asynchronous PD and to evaluate the effectiveness of the professional development course. Aligned with the sections of the SAMR model, the weekly professional development questionnaire provided teachers with Likert-type items about technology implementation and planning for that implementation using a scale ranging from (1) strongly disagree to (5) strongly agree. The goal of the weekly professional development questionnaire was not only to understand whether participants were more likely to use specific course technologies in the classroom after participating the PD but also gauge the effectiveness of the PD as a whole. This questionnaire served as a feedback mechanism informing the researcher about the success of the professional development course as well as helped answer the research question three.

**Data Analysis**

Quantitative data was analyzed by comparing pre- and post-intervention TTQ (Lowther et al., 2008) as well as the weekly questionnaire about technology usage in the classroom as shown in Table 3.2. Data were analyzed descriptively. The data were compared to see whether teacher implementation of technology has changed in five technology-related areas on the TTQ and whether teacher utilization of technology has improved in its frequency and scope on the SAMR scale. As referenced in Table 3.2, qualitative data were collected in the form of teacher interviews and observations. The
interviews were transcribed through literal transcription, including pause words. This method of transcription was utilized, as “missing data” can emerge from omissions, and “transitions and pauses” can also provide valuable insight into the interview (Bernard & Ryan, 2010). I then utilized inductive analysis (Strauss & Corbin, 1994; Thomas, 2006) to analyze the data. Data were analyzed inductively, using Delve, an online qualitative data analysis software. Codes, categories and eventually themes developed. These themes explained and informed the qualitative data using narrative text describing individual themes as well as tables with quotes that relate to specific sections of the qualitative assessments. Detailed description of quantitative and qualitative analyses is provided in Chapter 4.

Table 3.2 Research Questions and Data Sources

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Data Sources</th>
<th>Data Analysis</th>
</tr>
</thead>
</table>
| RQ1: In what ways does asynchronous teacher PD on the SAMR model impact the planning process? | • TTQ  
• Teacher Interviews | • Descriptive Statistics  
• Literal Transcription, Inductive analysis |
| RQ2: In what ways does asynchronous teacher PD on the SAMR model impact teachers’ technology integration in the classroom? | • TTQ  
• Teacher Interviews  
• Classroom Observations  
• Weekly PD Questionnaire | • Descriptive Statistics  
• Literal Transcription, Inductive analysis |
| RQ3: What are teachers’ perceptions about the effectiveness of asynchronous teacher PD? | • TTQ  
• Teacher Interviews | • Descriptive Statistics  
• Literal Transcription, Inductive analysis |
Procedures

The procedures for this study are comprised of three parts. Table 3.3 summarizes the data collection procedures for this study.

In Section I, consent and assent forms were provided to participants. Teacher participants completed the TTQ (Lowther et al., 2008) as well as a weekly professional development questionnaire. Participants were selected using convenience sampling. The intervention was made available to the faculty and an invitation to participate in the research was provided to all participating in the intervention. Of this group, a simple random sample was selected by assigning each participant a number and then selecting numbers at random.

In Section II the participants engaged in the intervention, the online PD course. Participants watched videos and pertained educational apps and strategies that are supported by the researcher’s district. While participants were completing the online PD modules, the researcher addressed any concerns or difficulties related to the online PD course and facilitated participants navigation through the module. Participants began incorporating the strategies they have learned during this time.
Table 3.3 *Data Collection Procedures*

<table>
<thead>
<tr>
<th></th>
<th><strong>Section I</strong> (1 Week)</th>
<th><strong>Section II</strong> (6 Weeks)</th>
<th><strong>Section III</strong> (4 Weeks)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Participant's Role</strong></td>
<td>• Complete consent &amp; assent forms</td>
<td>• Complete Online PD Course</td>
<td>• Complete Post TTQ and Weekly professional development questionnaire</td>
</tr>
<tr>
<td></td>
<td>• Complete Pre-TTQ and Weekly professional development questionnaire</td>
<td>• Begin implementing learned strategies in classroom</td>
<td>• Participate in post-intervention interview</td>
</tr>
<tr>
<td></td>
<td>• Register for Online PD</td>
<td></td>
<td>• Continue to implement learned strategies in the classroom</td>
</tr>
<tr>
<td><strong>Researcher's Role</strong></td>
<td>• Distribute consent &amp; assent forms</td>
<td>• Facilitate online PD</td>
<td>• Conduct Pre-TTQ and Weekly professional development questionnaire</td>
</tr>
<tr>
<td></td>
<td>• Conduct Pre-TTQ and Weekly professional development questionnaire</td>
<td></td>
<td>• Observe Classes</td>
</tr>
<tr>
<td></td>
<td>• Select participants</td>
<td></td>
<td>• Conduct post-intervention interview</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Transcribe, Code Interviews</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Member check interviews</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Analyze TTQ and Weekly professional development questionnaire</td>
</tr>
</tbody>
</table>

In Section III, once participants had completed the online PD course, they completed a post-TTQ and Weekly professional development questionnaire to determine
how knowledge and implementation of technology may have changed over the course of the research. Observations were conducted by the researcher to determine whether or not there were changes to the level of technology use as rated on the SAMR scale by the participants. Observations noted both the frequency of technology use and the level of usage as rated on the SAMR scale. The researcher conducted a post-intervention interview with each participant to ask questions related to teacher planning and teacher implementation of technology in the classroom. The interviews were coded and transcribed. After coding and transcription, member checking occurred to verify that the participants’ thoughts were accurately conveyed.

**Rigor and Trustworthiness**

Through my research, I was using a mixed methodology with a triangulation of both quantitative and qualitative sources. Since I conducted observations of teachers in the classroom, conducted interviews, and conducted a pre- and post-surveys, these methods seem most appropriate for my research. Although action research is not focused on transferability or generalizability, it is still my responsibility to ensure that there is significant information available to allow the reader to make a transfer should they desire (Creswell, 2014; Shenton, 2004). To ensure that my research and findings is of a high standard, I employed thick, rich descriptions, triangulation, member checking, and peer debriefing (Mertler, 2017).

**Quantitative Methods**

The TTQ has been validated (Lowther & Ross, 2000; Sterbvinsky & Burke, 2004) and is frequently used in research and evaluation studies (Corbeil & Valdes-Corbeil, 2007; Grant, 2005; Lowther et al., 2008). The reliability of the TTQ has been tested on
4,863 teacher participants, who had previously completed the instrument as a part of research projects for Center for Research in Educational Policy at the University of Memphis. Reliability coefficients were determined to be high for each subscale of the instrument, ranging from .75 to .89. (Adapted from Inan & Lowther, 2010).

**Qualitative Methods**

Qualitative methods of research were utilized to gather information beyond the numbers provided in the quantitative section. The foci of my qualitative data collection and analysis were semi-structured interviews and classroom observations. Semi-structured interviews took place with the research participants following the implementation of the PD plan. Observations occurred throughout the intervention period.

**Thick rich descriptions.** Through my observations, I gathered data on teacher practices and their implementation of specific programs related to my research. Thick, rich descriptions of the observations and information I recorded provided insight into my mindset as I was conducting the observation and can prove invaluable to the reader in understanding the research at a deeper level (Creswell, 2014). How information and data are collected as well as how my interviews and observations are structured will be described at length and in detail to provide the maximum amount of information to the reader. The reader has been provided with a description of how the data were analyzed and how the interviews and observations were recorded and coded to better understand the process.

**Triangulation.** Triangulation refers to utilizing multiple data sources, including interviews and observations, to gather data for qualitative research (Creswell, 2014;
Shenton, 2004). Searching for themes within the qualitative research and identifying those themes across multiple research methods helped to ensure validity within my research. To this end, my observations and interviews were compared to corroborate the two data sets.

**Member checking.** Member checking was used to finalize accuracy by bringing the results, or themes, of the research to the participants to determine whether the participants feel the results have captured their feelings and if the study is accurate (Creswell, 2014). Member checking is often considered one of the most important segments of qualitative research; however, it can offer significant barriers to researchers, including having to redo entire sections of the research (Shenton, 2004). Participants in the research were asked to engage in member checking at two separate points during the study. Initially, they were asked to review the interview transcripts to see if their comments have been accurately captured. When the interviews were reviewed and coded and themes emerged, the participants again were asked to verify whether or not these themes captured the essence of their interview. Their confirmation or rejection of the themes have been included as a part of the overall qualitative data analysis and discussion.

**Peer debriefing.** Peer debriefing, or scrutiny, is a way to allow other academics to provide feedback and insight on the research prior to publication (Shenton, 2004). Peer feedback can offer new perspectives and challenge my assumptions and biases. This input from others can help take the researcher deeper into their research as well as add validity to the study (Creswell, 2014).
Plan for Sharing and Communicating Findings

Findings will be shared with multiple stakeholders within the school, district, and local community as well as outside vendors who are engaged in contracts with the school. Within the school context, the results of the research will be shared with the research participants (teachers) as well as the school administration. Regardless of the results of the research, those within the community where the research was conducted deserve access to the information collected. Findings will be shared with the school administration in a meeting with recommendations to shift some school PD, where appropriate to an asynchronous model. If a neutral or negative outcome is observed, findings will be shared with administration to brainstorm additional solutions to the problem. Feedback was collected from the participants in the study to gather more information about what could be changed, added to, or removed from the asynchronous PD model to make it more effective moving forward. Due to the nature of my district’s research approval process, I have informed the Chief Academic Officer of the district of my findings. Other interested parties at the district level would include the Executive Director of Secondary Programs, and the Director of the Office of Technology as well as the technology coaches within the district.

The district hosts’ monthly technology coach meetings that are attended by all of the above parties and I presented my paper and findings at one of these meetings, as I have done with other technology initiatives in the past. This allowed the research to disseminate both vertically up the chain of command and horizontally, across other technology coaches within the district. A district-wide technology conference is hosted at the end of the year. I have previously presented topics at this presentation and would
enter my findings as a presentation for this conference as well. Through the sharing of the
data and the findings, participants’ information will be held in strict confidence.
References to individuals will be removed and replaced with corresponding participant
numbers. Any quotes from interviews or statements will be assessed for personal
identifying information and removed prior to publication as well.
CHAPTER 4

FINDINGS AND INTERPRETATIONS

The purpose of this action research was to evaluate the effects of an asynchronous PD on teacher technology integration in a high school in a southeastern state in the United States as measured by the SAMR integration model. The expectation is that the findings of this study will provide insights into teachers’ integration of technology in their classrooms as well as into their planning process for effective technology integration. This chapter presents findings from both quantitative (i.e., surveys, TTQ [Lowther & Ross, 2000] as well as pre- and post-tests) and qualitative measures (i.e., teacher interviews, classroom observations). Data collection was guided by three questions:

1. In what ways does asynchronous teacher professional development on the SAMR model impact the planning process?
2. In what ways does asynchronous teacher professional development on the SAMR model impact teachers’ technology integration in the classroom?
3. What are teachers’ perceptions about the effectiveness of asynchronous teacher professional development?

Part one of this chapter reports the quantitative results and findings obtained from the TTQ as well as the teacher pre- and post-tests. Part two of this chapter identifies common themes that emerged from qualitative sources.
Quantitative Results

To explore in what ways asynchronous PD affected teachers’ planning process and their perceptions about technology integration, several quantitative measures were implemented. Five teachers of varying subjects and grade levels at a suburban high school in South Carolina completed both the asynchronous PD course and the surveys. Respondents’ ages ranged from the mid-30s to the late-50s. Two participants were male and three were female. The TTQ (Lowther & Ross, 2000) was implemented as a pre- and post-test to gauge teachers’ perceptions of technology in five categories. Participants were also provided with a questionnaire before and after each PD module completed to gauge their perceived knowledge of specific tools and their intention to implement lessons using these tools.

Teacher Technology Questionnaire

The Teacher Technology Questionnaire (TTQ), a two-part instrument, was utilized to gather teacher’s perceptions of computers and technology integration (Lowther & Ross, 2000). Teachers were asked to rate their level of agreement with statements related to five main technology-related areas: (1) teachers’ perception of technology’s influence on student learning and achievement, and impact on classroom instruction and learning activities (Teachers’ Beliefs), (2) teachers’ feeling and perception of their capabilities and skills required for technology integration (Teacher Readiness), (3) teachers’ perception of administrative, peer, and community support for their technology integration in their classroom instruction (Overall Support), (4) teachers’ perception of the adequacy of technical support, availability of resources, and assistance with computer software and troubleshooting (Technical Support), and (5) teachers’ perception of the
frequency of technology integration in their instruction (Technology Integration). There was a total of 24 items on a 5-point Likert scale from (1) Strongly Disagree to (5) Strongly Agree.

As previously discussed, the TTQ has been validated and is used in research and evaluation studies (Lowther et al., 2008; Corbeil & Valdes-Corbeil, 2007; Grant et al., 2005). Due to the small sample size, reliability scores were not calculated in this study.

**Descriptive statistics.** Due to the small sample size, parametric testing was not conducted. Instead, descriptive statistics were used to explore the changes in participants’ TTQ scores from pre-test to post-test. Table 4.1 provides descriptive statistics for the pre- and post-TTQ subscales. The quantitative results indicated that TTQ scores changed the most for Impact on Classroom Instruction and Impact on Students subscales from pre- to post-test. For the Impact on Classroom Instruction subscale, participants’ scores increased 1.05 on average from pre-test ($M=3.55, SD=0.10$) to post-test ($M=4.6, SD=0.16$). Similarly, for the Impact on Students subscale, participants’ scores increased 1.0 on average from pre-test ($M=3.50, SD=0.26$) to post-test ($M=4.5, SD=0.12$).

Table 4.1 *Descriptive Statistics for the Teacher Technology Questionnaire* (n=5)

<table>
<thead>
<tr>
<th>TTQ categories</th>
<th>Pretest</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact on Classroom Instruction</td>
<td>3.55</td>
<td>4.6</td>
</tr>
<tr>
<td>Impact on Students</td>
<td>3.5</td>
<td>4.5</td>
</tr>
<tr>
<td>Teacher Readiness to Integrate Technology</td>
<td>4.3</td>
<td>4.5</td>
</tr>
<tr>
<td>Overall Support for Technology in the School</td>
<td>3.7</td>
<td>4.4</td>
</tr>
<tr>
<td>Technical support</td>
<td>3.75</td>
<td>4.5</td>
</tr>
</tbody>
</table>
**Impact on classroom instruction.** In Table 4.2, individual responses on the “Impact on classroom instruction” section can be seen. This area had the second-lowest mean score compared to other subcategories. The lowest scoring question item 20, “My teaching is more interactive when technology is integrated into the lessons” with a mean score of 3.4. Item 18, “Technology integration efforts have changed classroom learning activities in a very positive way” saw the highest increase from a mean score of 3.6 to 4.8 within any subcategory. This subcategory was volatile in response with high standard deviations in some areas, notably item 18, “Technology integration efforts have changed classroom learning activities in a very positive way.”

Table 4.2 *Descriptive Statistics for Impact on Classroom Instruction* (n=5)

<table>
<thead>
<tr>
<th>Impact on Classroom Questions</th>
<th>Pretest</th>
<th></th>
<th>Posttest</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>14. My teaching is more student-centered when technology is integrated into the lessons</td>
<td>3.6</td>
<td>1.14</td>
<td>4.6</td>
<td>0.55</td>
</tr>
<tr>
<td>16. I routinely integrate the use of technology into my instruction</td>
<td>3.6</td>
<td>0.89</td>
<td>4.4</td>
<td>0.55</td>
</tr>
<tr>
<td>18. Technology integration efforts have changed classroom learning activities in a very positive way.</td>
<td>3.6</td>
<td>1.67</td>
<td>4.8</td>
<td>0.45</td>
</tr>
<tr>
<td>20. My teaching is more interactive when technology is integrated into the lessons.</td>
<td>3.4</td>
<td>1.52</td>
<td>4.6</td>
<td>0.55</td>
</tr>
</tbody>
</table>

**Impact on students.** As noted in Table 4.1, the lowest rating was Impact on students with a mean score of 3.5, and within that subgroup, located in Table 4.3, item 8, “the integration of technology has positively impacted student learning and achievement” scored the lowest at a mean score of 3.2. This was another area of high volatility in
answer confidence, with high standard deviation ratings. The post-test had a 1.2-point increase from the pre-test, one of the highest in the TTQ.

Table 4.3 Descriptive Statistics for Impact on students (n=5)

<table>
<thead>
<tr>
<th>Impact on Students Questions</th>
<th>Pretest</th>
<th></th>
<th>Posttest</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3. The use of computers has increased the level of student interaction and/or collaboration</td>
<td>M 3.6</td>
<td>SD 1.52</td>
<td>M 4.6</td>
<td>SD 0.55</td>
</tr>
<tr>
<td>8. The integration of technology has positively impacted student learning and achievement</td>
<td>M 3.2</td>
<td>SD 1.48</td>
<td>M 4.4</td>
<td>SD 0.55</td>
</tr>
<tr>
<td>10. Most of my students can capably use computers at an age-appropriate level</td>
<td>M 3.8</td>
<td>SD 1.64</td>
<td>M 4.4</td>
<td>SD 0.55</td>
</tr>
<tr>
<td>19. The use of technology has improved the quality of student work</td>
<td>M 3.4</td>
<td>SD 1.52</td>
<td>M 4.6</td>
<td>SD 0.55</td>
</tr>
</tbody>
</table>

Teacher readiness to integrate technology. As seen in Table 4.1, “Teacher readiness to integrate technology” had the highest initial mean scores and the lowest standard deviations among all pre-tests. In Table 4.4, teachers rated themselves either agree or higher in all four areas. The area with the most growth in this category is item 11, “I have received adequate training to incorporate technology into my instruction” with a change from 4 to 4.4 from pre- to post-tests. One of the only items in the pre- and post-tests not to change was item 9, “I am able to align technology use with my district’s standards-based curriculum with a mean score of 4.4 for both pre- and post-tests.
Table 4.4 Descriptive Statistics for Teacher Readiness to Integrate Technology (n=5)

<table>
<thead>
<tr>
<th>Readiness to integrate technology questions</th>
<th>Pretest</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. I know how to meaningfully integrate technology into lessons.</td>
<td>4.4 0.55</td>
<td>4.6 0.55</td>
</tr>
<tr>
<td>9. I am able to align technology use with my district’s standards-based curriculum.</td>
<td>4.4 0.55</td>
<td>4.4 0.55</td>
</tr>
<tr>
<td>11. I have received adequate training to incorporate technology into my instruction.</td>
<td>4 0.71</td>
<td>4.4 0.89</td>
</tr>
<tr>
<td>12. My computer skills are adequate to conduct classes that have students using technology.</td>
<td>4.4 0.89</td>
<td>4.6 0.55</td>
</tr>
</tbody>
</table>

Overall support for technology in the school. Support for technology in the school as a category has an overall mean score of 3.7 in the pre-test, which is the third-highest average out of the five categories scored. In the post-test, it has the lowest combined mean score of 4.4. On table 4.5 we can observe the lowest scoring question is regarding the technology plan, item 15, with a 3.6 mean response in the pre-test, and a significant amount of variability (SD=1.14), which increases to a 4.6 mean in the post-test.
Table 4.5 *Descriptive Statistics for Overall Support for Technology in the School* (n=5)

<table>
<thead>
<tr>
<th>Overall Support for Technology Questions</th>
<th>Pretest</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Parents and community members support our school’s emphasis on technology.</td>
<td>3.8</td>
<td>4.0</td>
</tr>
<tr>
<td>13. Teachers receive adequate administrative support to integrate technology into classroom practices.</td>
<td>3.6</td>
<td>4.4</td>
</tr>
<tr>
<td>15. Our school has a well-developed technology plan that guides all technology integration efforts.</td>
<td>3.6</td>
<td>4.6</td>
</tr>
<tr>
<td>17. Teachers in this school are generally supportive of technology integration efforts.</td>
<td>3.8</td>
<td>4.6</td>
</tr>
</tbody>
</table>

**Technical support.** Technical support had the second highest mean score out of the five areas ranked (*M*=3.75). In Table 4.6, item 7, “Materials (e.g., software, printer supplies) for classroom use of computers are readily available.” scored the highest in the pre-test with a mean score of 4 and a comparatively low standard deviation of 0.71. The lowest scoring question in this area is item 6, “students have adequate access to up-to-date technology resources” with a mean score of 3.4 in the pre-test and a 4.0 in the post-test, a mean score of 3.4 in the pre-test was the lowest mean score for any individual question in the TTQ. There was a 0.6 increase from the pre-test to the post-test in this area; it was the lowest scoring question in the post-test (*M*=4.0).
Table 4.6 *Descriptive Statistics for Technical Support* (n=5)

<table>
<thead>
<tr>
<th>Technical Support Questions</th>
<th>Pretest</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Most of our school computers are kept in good working condition.</td>
<td>3.8</td>
<td>4.6</td>
</tr>
<tr>
<td>2. I can readily obtain answers to technology-related questions.</td>
<td>3.8</td>
<td>4.8</td>
</tr>
<tr>
<td>6. My students have adequate access to up-to-date technology resources.</td>
<td>3.4</td>
<td>4.0</td>
</tr>
<tr>
<td>7. Materials (e.g., software, printer supplies) for classroom use of computers are readily available.</td>
<td>4</td>
<td>4.6</td>
</tr>
</tbody>
</table>

**Perceived Knowledge of and Intention to Use Applications Pre-Post Test**

Participants completed an asynchronous PD course that consisted of five units. Prior to completing each of the PD modules, participants were asked to rate their knowledge of specific applications with a 5-point Likert-type scale from (1) Not Very Knowledgeable to (5) Extremely Knowledgeable in a weekly professional development questionnaire. After completing each unit, teachers were asked to rate their knowledge of the applications that were associated with each unit. For each unit, teachers were also asked to rate their intention to implement a lesson using an application with a 5-point Likert-type scale from (1) Not Very Likely to (5) Extremely Likely.

**Descriptive statistics.** Table 4.7 presents teachers’ perceived knowledge of applications before and after the PD based on information collected from the weekly professional development questionnaire. For each unit, there was an increase in participants’ perceived knowledge from pre-test to post-test. The smallest change was observed in Unit 3, Quizzes and Test, from pre-test ($M=3.25$) to post-test ($M=4.25$). On
the other hand, the highest increase was observed in Unit 5, Field Study, from pre-test 
\((M=0.64)\) to post-test \((M=3.57)\).

Table 4.7 *Teachers’ Perceived Knowledge of Applications (n=5)*

<table>
<thead>
<tr>
<th>Application Categories</th>
<th>(M_{\text{Pretest}})</th>
<th>(M_{\text{Posttest}})</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAMR Model</td>
<td>1.43</td>
<td>3.71</td>
<td>2.29</td>
</tr>
<tr>
<td>Creating a Presentation</td>
<td>2.67</td>
<td>4.08</td>
<td>1.42</td>
</tr>
<tr>
<td>Quizzes and Tests</td>
<td>3.25</td>
<td>4.25</td>
<td>1.00</td>
</tr>
<tr>
<td>Formative Assessment</td>
<td>0.92</td>
<td>3.75</td>
<td>2.83</td>
</tr>
<tr>
<td>Field Study</td>
<td>0.64</td>
<td>3.57</td>
<td>2.93</td>
</tr>
</tbody>
</table>

Table 4.8 presents teachers’ self-report of the intention to implement a lesson 
using different applications. Among these categories of applications, field study \((M=4.36,\)
\(SD=0.74)\), formative assessment \((M=4.33, SD=0.78)\), and quizzes and tests \((M=4.33,\)
\(SD=0.98)\) were the areas in which teachers are most likely to implement a lesson using 
different applications.

Table 4.8 *Likelihood of Application Usage (n=5)*

<table>
<thead>
<tr>
<th>Application Categories</th>
<th>(M)</th>
<th>(SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAMR Model</td>
<td>3.57</td>
<td>1.27</td>
</tr>
<tr>
<td>Creating a Presentation</td>
<td>3.91</td>
<td>1.24</td>
</tr>
<tr>
<td>Quizzes and Tests</td>
<td>4.33</td>
<td>0.98</td>
</tr>
<tr>
<td>Formative Assessment</td>
<td>4.33</td>
<td>0.78</td>
</tr>
<tr>
<td>Field Study</td>
<td>4.36</td>
<td>0.74</td>
</tr>
</tbody>
</table>
Qualitative Data Themes

Qualitative data were obtained through teacher interviews as well as classroom observations. Observations were used to gather data to triangulate data from other quantitative and qualitative sources (Bloomberg & Volpie, 2008). Observations were conducted twice, once prior to the implementation of the PD and once after completion. Observations were a snapshot of classroom instruction and used to compare teachers’ perceptions to observable changes. Interviews were utilized to gain insight into teachers’ perceptions of the asynchronous PD, including any changes to planning and practice. The interviews were transcribed using literal transcription to capture a full record of each teacher’s response. As data were coded literally, the first form of coding used was informal pattern coding. As the interviews were transcribed, it was inevitable that certain ideas would repeat themselves and the researcher would recognize this repetition. This is seen in Figure 4.1. Formally, the first coding cycle was a combination of descriptive and in-vivo coding. For the purposes of this research, descriptive coding is defined as summarizing a topic in a word or short phrase, and in-vivo coding is a code developed using a word or short phrase from the language found in the interview transcript (Saldana, 2016). Second cycle coding, as seen in Figure 4.2, was completed using pattern coding, or coding for data that are repetitive or occur more than twice (Saldana, 2016). After coding was completed, codes were themed or grouped into phrases or sentences that explain what the data was about (Saldana, 2016). To ensure trustworthiness, peer debriefing was utilized during the coding process. Initial codes were discussed and analyzed, suggestions were made, and revisions to initial coding were conducted. A second round of peer debriefing followed in which themes were reviewed and discussed.
for clarity and relevance. Through this process, two main themes emerged through the conversations with teachers regarding the PD. Teachers’ thoughts on the PD module centered on (a) their opinions of the course and (b) transfer of learning experience from participation in the PD.

![Figure 4.1 Pre-coding.](image)
Figure 4.2 Pattern coding.
Table 4.9 Themes and Examples

<table>
<thead>
<tr>
<th>Themes</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Opinions of the Course</td>
<td>• Approach to the course</td>
</tr>
<tr>
<td></td>
<td>• Positive outcomes</td>
</tr>
<tr>
<td></td>
<td>• Suggestions for change</td>
</tr>
<tr>
<td>2. Transfer of learning experience from</td>
<td>• Self-reported increase of knowledge</td>
</tr>
<tr>
<td>participation in the PD</td>
<td>• Increase in confidence</td>
</tr>
<tr>
<td></td>
<td>• Perceived benefits to planning</td>
</tr>
<tr>
<td></td>
<td>• Teachers using applications discussed in training</td>
</tr>
<tr>
<td></td>
<td>• Changing lessons as a result of PD</td>
</tr>
<tr>
<td></td>
<td>• Increased technology use in lessons</td>
</tr>
</tbody>
</table>

**Theme 1: Opinions of the Course**

Opinions of the course are defined as any stated thoughts or beliefs that participants shared as a part of their interview after the course has completed. This theme emerged as participants described their participation in the course and their overall thoughts regarding the material presented. Essentially, the theme emerged as participants described the fundamentals of their week-to-week experience. In their opinions, participants articulated their knowledge of course material, their emerging understanding of the SAMR model of technology integration, and thoughts on current and future course development. The opinions of the course varied in scope, with three major categories emerging: 1) approach to the course, 2) positive opinions of the course, and 3) suggestions for change. The following section offers more detail into these categories and their subsequent subcategories.
**Approach to the course.** This subcategory for theme one emerged as a result of participants describing their approach to the asynchronous PD course. One of the benefits of an online course is the flexibility of time, space, and location that are provided through an online platform (Capra, 2014). In this study, approach to the course references the articulated method in which the participants used to describe how they completed the online PD module. Participants were asked questions specifically about how they consumed course content from week to week. From this point, many of the participants elaborated into discussions on how they scheduled the course and what their motivations were for their specific scheduling choices. The approaches that were mentioned varied, however, they were split between two main categories, the self-paced and the structured groups, each of the five participants shared a clear opinion for how they set their time to be most efficient in completing the course.

**Self-paced.** Of the five participants in the course, three reported as completing the course on their own, flexible schedule, without regard for stated weekly suggestions provided by the researcher. Participant #4 mentioned the flexibility of the course as a benefit during coaching, stating, “Coaching [sport], it was a little difficult to find the time. Once I finished coaching, I was able to get the last few done. I didn’t have any set pattern. I just did it in my free time.” Flexibility is a major draw to professionals looking to further their knowledge in a field (Capra, 2014; Doherty, 2011) and was recognized by Brittany, who stated, “It allowed me to go back and forward when I have time to look at the information and look at the notes, and it was available 24/7.” Those who mentioned taking a self-paced approach used terms, such as “Completed the work in my free time” (Deborah), “set a time for myself” (Brittany) and “training was self-paced” (Albert).
Those who completed work on their own schedule were free to approach the course as they saw fit, in line with the aforementioned flexibility.

**Structured with schedule.** The remaining two participants, of five in the course, mentioned using a more structured approach, either due to their own personal schedules or due to the need to provide rigidity themselves. Although the structure of the PD was stated as open-ended, some participants used the outline of each week as a guideline, with Emily stating they “appreciated the outline every week [...] so I knew how to budget the week. I usually started with the reading, I prefer the reading first, and then the videos […] and then the responses.” Those who completed their work with the suggested structure and order of completion used phrases, such as “Set deadlines,” and “set a time specifically.” With the PD being asynchronous, participants were able to implement the methodology that fit them best.

**Positive outcomes.** The second subcategory for theme one emerged as teachers explained the perceived usefulness of the PD course and, in some cases, their desire to have more training or recommend it to others. For this study, a positive outcome is defined as any stated opinion regarding the PD that was spoken about in positive terms by the participants. Many of the participants spoke with great enthusiasm about their participation in the course and their thoughts about how they could continue to benefit from the course. After the conclusion of the research, some of the participants became evangelists for the course, attempting to enlist others in participating in the PD.

**Recommend to others.** For the purpose of this research, this subcode specifically relates to comments made by participants who indicated they would share or encourage others to take the PD course. Participants in the PD were quick to suggest that others may
benefit from the course. When asked about their participation in the PD, Brittany indicated that they wanted to bring others in their department into the course so that “maybe we can all help each other create a really good lesson.” Albert stated that they “found myself ahead of my peers” in their technology use and their participation in the course would help advance their knowledge and skill base to improve their professional learning community (PLC) planning process. Overall, three of the five respondents made comments directly related to encouraging others to participate in the PD or to take the PD course.

**Collaboration with others.** When referencing collaboration with others, it is a direct reference to comments made by participants regarding their desire to work with others, and since it is within the positive outcomes subtheme, it will only encompass positive outlooks. Below, you will find those who found collaboration with others to be lacking in the context of the PD, with possible reasons for this apparent disparity discussed in the results section. Two participants out of five referenced collaboration with others as being a strength. One of the participants who viewed collaboration as a net benefit to the PD actively engaged others involved in the program and sought them out, outside of the channels provided. Brittany “asked one of the teachers from the PD board and we looked into how to incorporate the idea of […] google tours in different projects.” This teacher utilized the message board as a way to see who else was participating in the course and sought them out directly, as opposed to collaborating in the space provided. Of note, one of these collaborations was done asynchronously, using the message board as a springboard for ideas without directly talking to the other participants. Catherine stated, “I went in and read other people’s responses, and I was like ‘Oh, I never thought
about doing it like that’ and that was beneficial to me, and I enjoyed that.” With a positive outlook on the PD and the opportunity to collaborate with others, participants are more likely to benefit from the course (Liu et al., 2015; Paskevicius & Bortolin, 2015).

**Suggestions for change.** The third and final subtheme for opinions of the course were suggestions for change. When evaluating the effectiveness of the program, teachers were quick to offer their ideas for how the PD could have been improved. Both suggestions for change offered ideas that are consistent with other researcher’s findings on best practices for PD, including collaboration and time to discuss and debrief with peers (Chen, 2010; Curwood, 2011; Fenton, 2017; MacDonald, 2008). For the purposes of this study, suggestions for change references ideas participants submitted during their interviews regarding modifications that could or should be made to the PD course. Suggestions for change were not solicited directly from the researcher; rather, they emerged dynamically as participants discussed their own participation and the participation of others in the PD course. It is possible that suggestions for change were influenced by the researcher’s positionality, which will be discussed in more depth within Chapter 5.

**More opportunities for collaboration.** While some saw collaboration as a strength, others saw it as an opportunity for improvement. Studies have shown that collaboration between teachers can be more important to positive outcomes in PD than large scale PD, or one-size-fits-all models (Chen, 2010; Curwood, 2011; Fenton, 2017). Because of this idea, a collaborative piece was included in the asynchronous PD, in which respondents were encouraged, after participating in a lesson, to share their experiences, thoughts, and ideas. Although this was made available, after initial posts,
there was rarely follow-up conversation. Three of the five participants reported a desire for more collaboration with fellow teachers. Catherine was particularly dismayed that there was no back-and-forth conversation on the provided discussion boards.

I noticed that when we responded to your discussion questions, nobody made, I noticed that if I made a comment, nobody made a comment back, so there was a lack of ‘back and forth’ collaboration with my co-teachers that I’ve had in other online PD classes… but I liked the way you structured the questions, because I went in and read other people’s responses.

Part of the PD course was the suggestion to post in the discussion boards; however, it was not a requirement, much like responding to others on the board. In their conversation about the lack of collaboration Albert stated, “I think if you could have a more scheduled deadline on [the discussions], I think we could have bounced ideas off each other,” alluding to the possibility that the lack of collaboration was, in part, due to the asynchronous nature of the course.

**Deeper discussions.** Although the PD course was voluntary, participants stated that they hoped for more requirements regarding the PD, specifically in the area of discussions. Suggestions were made to the participants to make posts on a discussion board and to reply to others’ posts; however, due to the asynchronous nature of the program, there were significant disparities between when people posted on the same topics. Albert, who felt that the PD was worthy of providing to others, also critiqued the level of discussion, stating, “I would offer it again because I thought it was relevant and the, uh, discussions could have been deeper, but I think overall the topics were perfect.” When asked to elaborate on his thoughts on the discussions, he continued:
I felt that because it was self-paced, there were not a lot of one-on-one discussions with each other. With other grad classes, I had taken that’s kind of a requirement of how we had to discuss it with each other. If we had that requirement it would have been better. Obviously, if it was self-paced that’s harder to do.

The participant likened his completion of the PD module to an online graduate course and then stated that discussion is often a requirement in these courses. Although suggestions for the discussion board collaboration and back-and-forth discussion were encouraged, no part of the course was required, as it was entirely voluntary.

**Theme 2: Transfer of Learning Experience from Participation in PD**

The second theme that emerged through qualitative methods regards the transfer of learning. For the purposes of this research, transfer of learning refers to any statement made by a participant regarding the utilization of knowledge gained as a result of participating in the PD course. Transfer of learning was discussed both overtly through questions and also mentioned by participants as they described their classrooms, lessons, and activities in a post-PD setting. This theme is a combination of two distinct subthemes: 1) current transfer of the learning experience and 2) future transfer of the learning experience. The following section offers more detail on these categories and their subsequent subcategories.

**Current transfer of learning experience from participation in PD.** The first subtheme within the transfer of learning experience theme was current transfer of the learning experience. For the purposes of this research, a current transfer of learning experience describes any statement made by participants that referenced an action they had currently or already taken as a result of participation within the PD course. Transfer
of learning is of crucial importance when determining whether a one-to-one program will be successful, with a lack of technical competence being one of the barriers to technology integration (Brush, Glazewski, & Hew, 2008; Tallvid, 2016). Within this subtheme are three categories: 1) teachers’ utilization of applications discussed in training, 2) changing lessons, and 3) increased technology use in lessons.

**Teachers’ utilization of applications discussed in training.** When conducting precoding, one of the items that stood out most to the researcher was the depth and frequency in which participants discussed different applications that were referenced in the course training materials. All of the participants referred to applications discussed in the course despite there being no specific question asking about individual applications. Ironically, the SAMR model preaches a process over product model in which the applications used are not as important as the outcome of their usage (Hamilton et al., 2016; Puente, 2006). The design of the course was such that specific applications were provided to address gaps in participants’ knowledge when considering incorporating technology along the SAMR framework. Comments about applications or programs were specific in nature, referencing their usage and, often, their perceived benefit. Emily, who had not previously used an app discussed in the PD became so enamored with it that they cannot envision a class without it, “Google forms, I love it, my new best friend. Like I can’t believe you’re taking my Chromebook before finals.” Deborah used specific examples of current use to explain their usage of certain programs:

> Just last week, I used the Quizziz for preparation of my […] classes, they had their final [class] on Saturday, and so to prepare, I used Quizziz, and I used
EdPuzzle too, I quizzed them on objection, amendments, case law, things like that, just kinda prepping them beyond their cases.

To this teacher, the preparation and the knowledge was what was important; the application discussed was simply the means to an end; however, she put a heavy emphasis in the applications used to deliver her content. In all, there were 29 separate references across 5 interviews to different applications discussed by participants. These references are seen in the Table 4.10.

Table 4.10 References to Applications

<table>
<thead>
<tr>
<th>Names of Applications</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Google Touring</td>
<td>9</td>
</tr>
<tr>
<td>EdPuzzle</td>
<td>8</td>
</tr>
<tr>
<td>Google Forms</td>
<td>3</td>
</tr>
<tr>
<td>Quizziz</td>
<td>3</td>
</tr>
<tr>
<td>Prezi</td>
<td>2</td>
</tr>
<tr>
<td>Google Apps</td>
<td>2</td>
</tr>
<tr>
<td>Google Earth</td>
<td>1</td>
</tr>
<tr>
<td>Sketchup</td>
<td>1</td>
</tr>
</tbody>
</table>
Changing lessons. Changing lessons refers to an adjustment made to a lesson to incorporate technology based on training received as a result of the PD. All of the participants (n=5) referred to changing a lesson in some way to incorporate technology more meaningfully in their assignments. When discussing changing their lessons, some teachers went into extensive detail about how they had made adjustments, referencing terminology from the SAMR framework (Puentedura, 2006) at the same time. Catherine reflected on how they have modified a budget project to reflect their learning in the PD module:

Typically, a simple budget project is a kid comes up, you tell them to pick a career and then you have to go find an apartment. I mean, very basic. I have transformed it over into making them really work for it. I tell them “How much are your utilities”, instead of giving them a number, I have them use an online utility calculator and they have to sit down and they have to think “how many hours am I going to use an Air conditioner” how many hours are they going to use a washing machine”? So that they can get a more realistic view of their electricity usage.

In this sense the teacher has taken an existing project and made it more interactive by providing the use of online resources, which in turn also makes the experience more relevant. The same teacher described how the tools used provide additional real-world experience:

I’m using the tools that they have on the internet so that students have a more realistic budget when they’re done and really have an understanding that “I can’t live on this salary, not with what I want” and I think, I see other teachers do
budget projects, and it’s very simplistic, it’s just like, “Well you’re just making up
the numbers.”

In this section, the teacher reflected on the students’ involvement and the students’
takeaways from the project. She concludes, stating that, by using technology, students are
held accountable at every step in the process:

I’m not allowing the kids, the children have a google spreadsheet where they have
to prove everything they put in their budget and I’ve given them links to various
websites and tools that they can use to help them develop it. So I think that
helped, I think that would be more on the augmentation, maybe modification side,
definitely not substitution.

The teacher explained, specifically, how the lesson has been changed, turning a formerly
paper and pencil activity into a dynamic web quest with opportunities for student
technology use that far surpass what she had previously done. Others noted more nuanced
changes, specifically with using technology to free up additional time in class, Deborah
commented: “Instead of doing what I typically would have done, I used EdPuzzle to have
them watch videos, have them answer questions instead of taking up class time watching
those videos.” By using what they had learned in the PD module, they were able to
change the lesson and streamline classroom processes at the same time. Emily described
their use of EdPuzzle, stating:

EdPuzzle is genius […] previously I liked to expose them to different native
[speakers], not just me, because they learn [my accent]. So previously I’d shown
videos in class and we’d talk about it, or maybe they’d have to write a summary
or whatever, but embedding it, like physically in the video and having them break it down, I think was a really good example.

By using technology to change a lesson the participant had previously used, they were able to go into more depth and craft a more meaningful lesson for their students.

**Increased technology use in lessons.** Increased technology use in lessons refers to any mention by a respondent referencing a usage of technology that is elevated compared to prior to participating in the PD. Each participant mentioned an increase in overall technology usage in their lessons, compared to prior to the PD course. Albert reflected on how their technology use had changed:

I definitely [integrate technology] more now than I did before the course. I teach a [technology focused course] class and a lot of my stuff is done on my computer anyway, but that kind of stuff is now at the forefront of my thought process for kids turning in their assignments, kids taking their assessments, even taking little formal assessments.

In addition to a technology-focused course, there were classes that were not technology-centered that also experienced changes in technology integration as a result of the PD course. In four of five teacher observations, student technology use increased from the pre-observation to post-observation. In each observation not only did the level of time spent on technology increase but the level of SAMR utilization increased as well. Deborah had 27 total student technology minutes observed in the pre-observation while there was 45 minutes in the post-observation. Of those observable minutes, 10 were students using technology for substitution and 17 were modification; in the post-observation, all 45 minutes were spent on modification of the lesson. Technology
implementation in the classroom can also influence student participation and help students learn (J. Harris & Al-Bataineh, 2015; Storz & Hoffman, 2013). Catherine stated that they changed the methodology for student input into the classroom experience and noticed increased engagement:

I use a backchannel now for their responses […] and they like using that, it gets them engaged. If I have a question about something and I want to see their responses, they use that. It just makes for better engagement, more different types of technology they use in the classroom.

The participants noticed changes in their own practice leading to increased technology use in the classroom after participating in an online PD.

**Future Transfer of Learning Experiences from Participation in the PD**

Future transfer of learning experiences refers to statements made by respondents referencing effects of the PD that are not immediate in nature. Statements regarding future transfer may have been direct comments about plans teachers had for the future, suppositions of how they may implement technology or skills in the future, or long-term benefits of the PD that have effects beyond the last day of the online PD course. These benefits may have been benefits derived by the researcher or benefits specifically stated as positive outcomes by the participants themselves. There were three emerging subthemes: 1) self-reported knowledge increase, 2) increase in confidence, and 3) benefits to planning.

**Self-reported knowledge increase.** The participants in the PD course ranged in subject areas as well as disciplines taught from former technology facilitators to teachers with less than five years of teaching experience. Despite previous knowledge,
consistent subtheme that emerged within this group was a reported increase in knowledge. Four of the five teachers made statements referencing an increase of knowledge as a result of the PD. A teacher who teaches a technology-focused course, Albert, reported that they were knowledgeable about integrating technology and the SAMR model prior to taking the course, however they saw an increase as well:

[My technology knowledge] has definitely grown, I did use some of the concepts prior to [the PD], but having seen the videos and taking the course I think I will be using more. I like the idea of using technology for the purpose of it.

Within self-reported knowledge increase there were two subcategories: 1) an increased awareness of technology and 2) taking lessons deeper.

*More aware of technology.* With noted knowledge increases came increases in awareness, as teachers were more knowledgeable about meaningful technology integration as it relates to the SAMR model. Brittany discussed this awakening framing her knowledge increase as an increase of awareness during her daily routines:

I am more aware of technology now. I am more aware of the benefits, now I use technology in my classes. During my planning I look for ways to incorporate technology into my classes. It’s more of an inner motivation really, it’s more of a self-efficacy thing to improve your lessons, but I think the program that you used kind of made me aware of the influence of technology.

Some awareness came as a realization, when Deborah who was exposed to more of the Google Applications suite realized they had a lot more to learn:
I felt like I was doing well because I really embraced Google Classroom and I love that aspect of what we were doing here, but when I did this, I felt like maybe I wasn’t using it to its full capacity, and that was a big revelation for me.

Of the five participants, two noted a specific increase in awareness related to technology integration within the classroom.

**Taking lessons deeper.** Those who reported increased knowledge also reported an increase in the depth in which they were taking their lessons, specifically, their knowledge of technology was allowing them to do more in the classroom, Catherine reflected:

Well, a lot of the material I already was familiar with, but it gave me a little bit of an in depth, more deeper understanding of the material that was used and I turned around and used that information with my students.

This description reveals the thought process behind a participant who already had extensive knowledge of the material covered in the PD but was still able to benefit from the information provided.

**Increase in confidence.** Self-confidence in technology implementation has been ranked as one of the important traits in teacher technology implementation (Ahmad et al., 2016; Grant et al., 2005; Y. Li, 2016). For the purposes of this study, increases in confidences refers to statements made by participants that reference a positive outlook on technology usage or integration as a result of the PD course. Respondents stated they felt as though they were reaffirmed that they were integrating technology correctly, or “doing it right.” This type of response can be seen as an affirmation that the PD course provided them with confidence or skills needed to feel comfortable about their own technology.
use. Deborah, when referencing their knowledge of technology remarked on this increased confidence:

    I understand more how it should function and how I can implement it effectively instead of just thinking you’re doing something, but now I know I’m doing it right, so I’m more confident.

Another participant, Catherine, had a similar thought, reflecting: “A lot of the things I already knew about, I felt like I have a deeper understanding and I’m more confident in using it with my students.” These descriptions of increased confidence revealed how participants can benefit from the PD, even with prior knowledge of technology integration, through affirmation.

**Benefits to planning.** Benefits to planning refers to statements by teachers suggesting a perceived positive outcome related to their preparation process for their classes. All of the five participants stated that their planning would be affected in some way by the PD course. Benefits to planning included those who were perceived as organizational in nature, helping Catherine find structure: “It’s helped me streamline my planning and I’m getting a lot more done now and that I’m incorporating even more technology into my lessons.”

    Alternatively, Emily reflected on their long-term prospects considering how their planning for the following year may be affected by the increase in knowledge:

    Long-term planning, I think is going to be most affected, I tried to use bits and pieces, coming mid-year, mid-stream, I tried to add to what I’m doing, it still affected the way I plan.
Within the benefits to planning category, there were two subcategories that emerged: 1) the ease of technology integration in planning and 2) ideas for future use.

**Ease of technology integration in planning.** Technology integration in the planning process can be intimidating to those without proper training, and this prospect can even be a barrier for entry for those otherwise interested in integrating technology (Inan & Lowther, 2010; Lowther et al., 2008; Sharma, 2004). For Brittany, it is simply a matter of knowing what technology is available and being able to have the tools to plan effectively:

> It has affected me a lot, every time I’m doing a lesson I’m thinking, we have to cover listening, reading, speaking and writing, and I’m thinking, “How can I incorporate technology in this?” because nowadays that’s what they want. They want technology.

This participant understands that students want technology, and due to their knowledge, they are thinking about how to incorporate it effectively, rather than shying away from the possibility. Others, such as Catherine, who finds technology integration easier, have found that technology helped to provide an organizational structure that may not have been present previously. “I find that my planning is a lot more organized, because I find that the tools I learned about in the course [helped].” It was most simply summarized by Deborah who stated, “It’s almost made planning great, everything’s just easier.” Planning with technology is easier when technology is a known variable.

**Ideas for future use.** The final subcategory in the benefits to planning category is ideas for future use. Two of the participants directly stated that they felt as though they had so much information in the course that they simply could not implement it all
immediately and would have to put it off for later use. Albert recalled: “I also bookmarked a lot of stuff in the course because I thought it was very good and I thought I might use it in the future.” Bookmarking is a deliberate action showing that the participant intends to utilize the information at a later date for their benefit. Emily stated, “I was going to use google tours for my international unit, but then I looked at it and I was like ‘I can’t, that’s too much work, I’ll save that for next year.” In this case, the idea required too much preparation to incorporate mid-way through a semester, which is when the PD course was provided; rather, they would save the idea for the future and implement it with a new group of students.

**Chapter Summary**

Participants reflected on two main themes throughout the structured interviews following the PD: 1) opinions of the course and 2) transfer of learning experience from participation in the PD. Although each participant approached the PD in their own way, there were two general approaches, a structured and a self-paced approach. Opinions of the PD course were relatively positive, with a distinct lack of negative comments. Some participants offered their suggestions for change in the course, centering on opportunities for collaboration and deeper discussions when collaboration did take place. Transfer of the learning experience was prevalent through a variety of discussions. Participants reported an increase in knowledge, becoming more aware of technology integration, and taking lessons deeper. Those who engaged in the course also noted marked increases in confidence with integrating technology in the classroom. There were also other perceived benefits to planning, including the ease at which technology is integrated and the ease of
planning, with the now-established knowledge of technology. Finally, teachers reported saving parts of the PD for future use based on course schedules or perceived ability to integrate technology in the middle of an academic year.
CHAPTER 5
DISCUSSION, IMPLICATIONS, AND LIMITATIONS

Chapter 5 situates the findings of the research with what is known of PD and technology integration. The purpose of this research was to determine the effects of an asynchronous PD on teachers’ use of the SAMR technology integration framework through one-to-one student Chromebook implementation in a suburban high school in the Southeastern United States. Two major themes emerged as a result of data analysis (see Table 4.4). Effects of asynchronous PD on teachers’ use of the SAMR technology integration framework were evident through their discussions of their opinions of the course as well as their stated transfer of the learning experience from participation in the PD. Both quantitative (i.e., TTQ and pre- and post-tests) and qualitative (i.e., teacher interviews) were utilized for data collection and analysis. The discussion, implications, and limitations of this research are examined in the following sections.

Discussion

Much research has been conducted regarding one-to-one device integration in the classroom, PD regarding technology integration, and limitations on teacher technology integration. PD, as a method of providing educators skills or information on new trends in education, is the source of much discussion and research. Successful PD related to ICT usage is often broken down into three common themes. The first theme is a sustained model, where PD is ongoing, rather than a one-off approach, that continuously supports teacher needs (Curwood, 2011; Garet et al., 2001; Penuel et al., 2007). Continuous
training has the benefit of providing participants with an ability to develop their skills within the PD environment, ask questions, and solicit feedback from their peers as well as the instructor. The second theme that emerges when researching PD is that it should be specific and relevant to teacher needs. Specificity and relevance led to more successful outcomes when implementing ICT (Curwood, 2011; Garet et al., 2001; Hunzicker, 2010). The third theme is timeliness. PD should provide information for participants as close to when it is needed as possible. (Curwood, 2011; Garet et al., 2001; Hunzicker, 2010; Penuel et al., 2007). This research sought to expand on the ideas of successful PD and its effects, combining them in a way that was appropriate for the researcher’s setting. The discussion will be framed in the context of the three research questions.

**Research Question One**

*In what ways does asynchronous teacher PD on the SAMR model impact the planning process?*

There are many PD models in use; however, the one that appears the most successful based on research is one that models desired outcomes for teachers (Desimone et al., 2002; Fusco, Haavind, Remold, & Schank, 2011; Garet et al., 2001; Jaipal-jamani Figg, Gallagher, Scott, & Ciampa, 2015). Specific PD following the three themes provided above has been shown to lead to increases in teacher skill, preparedness, and the ability for teachers to incorporate ICT into their planning process (Doherty, 2011; Uslu & Bümen, 2012). By participating in this asynchronous PD, findings suggest that teachers were able to modify, create, and plan lessons that had increased levels of ICT usage and at more meaningful levels. These effects can be seen in a) the benefits to planning as
observed by the participants and b) participants’ application of technology while participating in the PD.

**Benefits to planning.** Technological and content knowledge can benefit a teacher’s planning process and make it more effective, leading to increased thought in the selection of materials and activities (Harris & Hofer, 2011). This supposition is reflected in the results of the TTQ (Lowther & Ross, 2000) in which participants noted an increase in the mean response from 3.6 to 4.4 in the statement, “I routinely integrate the use of technology into my instruction.” Brittany noted that having new tools to plan and knowing how to plan was going to dramatically change how the planning process took place:

> It has affected me a lot, every time I’m doing a lesson I’m thinking, we have to cover listening, reading, speaking and writing, and I’m thinking how can I incorporate technology in this because nowadays that’s what they want, they want technology.

Easing teachers’ minds about how to incorporate technology in the classroom is a significant step in ensuring appropriate implementation (Donovan et al., 2007; Ertmer, 1999). Catherine noted that their planning is simply easier as a result of the PD training:

> “I find that my planning is a lot more organized because I find that the tools I learned about in the course [helped].” This is consistent with the findings of Hall and Martin (2008) who noted teachers’ personal feelings are a significant contributor to whether technology will be integrated in the classroom. The effects of planning can be seen in quantitative data as well, with impacts on classroom instruction. In the “Impacts on classroom instruction” domain, there was a mean increase from 3.6 to 4.6 in the
statement, “My teaching is more student-centered when technology is integrated into the lessons.” This increase, as a result of training, is consistent with Harris and Hofer (2011) who suggested that teachers with more technological and pedagogical knowledge plan more student-centered lessons focusing on the integration of technology.

Impacts to planning were also seen during teacher observations. Four of the five participants increased their total technology usage from pre-observations to post-observations. Of those, all four also increased the level of SAMR utilization they were implementing in the classroom. Changes were significant, in Albert’s classroom, there were 0 minutes of student technology use in the pre-observation; in the post-observation, there were 35 of 45 minutes of student technology usage with all 35 minutes at the redefinition level as defined by Puentedura’s (2006) SAMR model. Deborah had 27 total minutes of student technology with 17 at the modification level; in the post-observation, there were a total of 45 minutes of student technology usage, all at the modification level. These findings are consistent with research that suggests changes based on PD can occur rapidly; however, they may be inconsistent in long-term studies (Sahin et al., 2016; Swallow, 2015).

In addition to short-term planning, effects from the PD were evident in long-term planning as well. Long-term change based on PD can be a struggle with participants quick to try new things but losing sustainable change over time (Curwood, 2011; Johnson-Martin, 2014). One consistent theme from participants was a future transfer of learning experiences from participation in the PD. Emily reflected on how the PD was going to influence future behavior:
Long-term planning, I think is going to be most affected, I tried to use bits and pieces, coming mid-year, mid-stream, I tried to add to what I’m doing, it still affected the way I plan.

Although there was a large amount of information presented in the course, participants were still eager to implement parts of it immediately, as stated above, as well as later.

Albert also had his own plans for the future of the course content: “I also bookmarked a lot of stuff in the course because I thought it was very good and I thought I might use it in the future.” Bookmarking items is a deliberate step taken to ensure future access to materials when planning and developing lessons. When evaluating the statement, “I routinely integrate the use of technology into my instruction” from the TTQ (Lowther & Ross, 2000), there was a pre-test mean score of 3.6, and a post-test mean score of 4.4. This suggests that teachers were planning to, and more readily applying ICTs in their classrooms after the PD.

**Participants' application of technology.** When evaluating the effects of the PD, it is valuable to look at a teachers’ instruction, as they will inevitably convert their planning to practice. In their interviews, participants referenced the immediate incorporation of technology discussed in the PD into their practice. This finding is consistent with the quantitative data that saw a high favorability of teachers’ likelihood of utilizing applications, with responses falling between 3.91 and 4.36 on a 5-point scale.

There was also an increase in teachers’ reported readiness to integrate technology with teachers stating they are more knowledgeable about how to meaningfully integrate technology into lessons ($M_{pre} = 4.4$, $M_{post} = 4.6$) and are better trained to incorporate technology into their instruction ($M_{pre} = 4$, $M_{post} = 4.4$). These findings are consistent with
Hall and Martin (2008) who noted that self-efficacy and PD are factors that can influence teacher technology integration in the classroom.

The influence of the PD on the planning process appears to be so profound that each participant interviewed indicated changing a current lesson. Some of the changes referenced took place prior to the PD concluding. Deborah explained how they changed their lesson plans to have students complete work that would normally take class time outside of class: “instead of doing what I typically would have done, I used EdPuzzle to have them watch videos, have them answer questions instead of taking up class time watching those videos.” This sort of purposeful change provided a direct benefit to the teacher but also shows a shift in the teachers’ planning process as they saw technology as a tool to extend the classroom. Changes in planning and lesson presentation were seen by teachers from all subject areas. Albert, a teacher who teaches a technology-focused course discussed how their lesson plans have changed as a result of the PD:

I definitely [integrate technology] more now than I did before the course. I teach a [technology focused course] class and a lot of my stuff is done on my computer anyway but that kind of stuff is now at the forefront of my thought process for kids turning in their assignments, kids taking their assessments, even taking little formal assessments.

The teacher described a sweeping change to his plans based on technology, including classroom procedures and assessments, activities that typically have well defined and engrained procedures attached to them.
Research Question Two

*In what ways does asynchronous teacher PD on the SAMR model impact teachers’ perceptions of technology integration in the classroom?*

Teachers' perceptions about technology integration in the classroom can be the most significant influence as to whether or not ICTs are actually deployed in the classroom (Ertmer, 1999, 2005; Tondeur, van Braak, Ertmer, & Ottenbreit-Leftwich, 2017). When concerns are addressed, there is a noted increase in not only technology usage but also in confidence integrating the ICTs (Hall & Martin, 2008; Johnson-Martin, 2014). Interviews and the TTQ provided a great deal of information on teachers’ perceptions of technology. Findings suggest that changes in perception could be observed through quantitative and qualitative measures related to teachers’ perceptions of increased technology use in lessons.

**Increased technology use in lessons.** Teacher interviews provided information related to teachers’ increased technology usage in lessons. Every participant involved in the study made comments during their interview regarding an increase of overall technology use when compared to prior to their participation in the PD. Teachers who were likely to use technology on a frequent basis prior to the PD noted their increase as well, such as Catherine, who teaches a course with a strong technology component:

I use a backchannel now for their responses [...] and they like using that, it gets them engaged. If I have a question about something and I want to see their responses, they use that. It just makes for better engagement, more different types of technology they use in the classroom.
The teacher observed that students appreciate the new use of technology in the classroom and feels as though it increases engagement among his students. This viewpoint is reflected in teachers’ responses to the TTQ, in which the response to the question, “My teaching is more interactive when technology is integrated into the lessons” increased by 1.2 points from the pre-test to the post-test \((M_{Pre} = 3.4, M_{Post} = 4.6)\), a result that is consistent with Bebell and O’Dwyer (2010) who found that students participating in 1:1 programs see increased engagement and interest from students. Another area in which an increase in student engagement is seen is in the statement, “The integration of technology has positively impacted student learning and achievement” for which there was a 1.2 point growth from the pretest to the posttest \((M_{Pre} = 3.2, M_{Post} = 4.4)\), indicating that teachers’ perceptions of technology integration have changed since beginning the PD. Findings are consistent with research, which suggests that opinions of ICT usage can change after successful PD (Çetin, 2016).

During the interview process, participants’ reliance on technology became evident. Emily was so attached to an application they were introduced to during the PD that they expressed dismay at its loss: “Google forms, I love it, my new best friend. Like I can’t believe you’re taking my Chromebook before finals.” This level of attachment was not noted by one teacher; rather, all of the participants listed their favorite applications from the course, or apps that they now felt like they could not go without. These are all applications that they were either introduced to during the PD or were provided more information about. In all, applications were discussed on 29 separate occasions throughout the interview of the five participants, almost 6 mentions per participant. This
level of adoption points to a significant shift in thinking among participants regarding their technology integration in the classroom setting.

Not all of the data were clear, when discussing integration of technology in the classroom. An important observation is despite training having no student interaction, and there being no formal offered technology training for students during the course of this study, teachers noted a change in students’ capability in using computers age appropriately ($M_{Pre} = 3.8, M_{Post} = 4.4$). This change could be the result of a shift in teacher perceptions regarding the use of technology in the classroom based on the training provided or based on other external events.

**Research Question Three**

*What are teacher’s perceptions about the effectiveness of asynchronous teacher PD?*

Much research has been conducted regarding the effectiveness of PD. When designing PD, collaboration is one area of suggested focus, with others being relevance and situational to the learner’s context (Fenton, 2017; Paskevicius & Bortolin, 2015; Polly & Hannafin, 2010). Participants in PD who experience these traits are more likely to respond to the PD in a way that promotes long-term retention and use of the skills learned. The research suggests that individuals engaging in the PD had overall positive perceptions; however, they also had suggestions related to ways the PD could be improved in future iterations.

**Positive perceptions.** Participation in PD is an expectation of many teachers in the profession. In my setting, the expectation for PD is typically at least one a month. Providing the PD opportunity online was met with praise from a number of participants, which is consistent with what other researchers have found on the subject of alternative
PD delivery methods (Alebrahim, 2016; Devasagayam et al., 2013; Scruggs, 2009). Noted responses on the TTQ (Lowther & Ross, 2000) referencing training include, “I can readily obtain answers to technology-related questions” ($M_{pre} = 3.8$, $M_{post} = 4.8$), “Teachers receive adequate administrative support to integrate technology into classroom practices” ($M_{pre} = 3.6$, $M_{post} = 4.4$), and “Our school has a well-developed technology plan that guides all technology integration efforts” ($M_{pre} = 3.6$, $M_{post} = 4.6$). In each of these three scenarios the teachers’ feelings toward technology support increased drastically from pre-test to post-test. Shifts in thinking, including understanding a shared technology vision, can remove barriers to ICT usage and increase overall positive attitudes and beliefs (Hew & Brush, 2007).

Participants in the course spoke in almost exclusively positive terms regarding the PD, suggesting that they held optimistic opinions of the course as well. During interviews, one of the perceptions shared was a desire to share the course with others. Brittany wanted to recruit more individuals to partake in the PD so they could all work together to create better lessons. Soliciting others in a department to participate in a PD points to a favorable opinion regarding the course and the overall experience.

**Desire for collaboration.** Another area in which teachers appeared to feel strongly was in their desire for collaboration. This feeling manifested in different ways. In some instances, teachers stated that they appreciated the collaboration that was offered; others expressed a desire for more collaboration. This collaborative approach to PD has been shown to be successful in other studies (Liu et al., 2015). The general idea of a collaborative approach is grounded in the Vygotskyan (1978) theory of cognitive development, stating that learning occurs through social interaction, including
collaborative and cooperative dialogue. Those who saw a benefit to collaboration seemed to seek others out, such as Brittany who “asked one of the teachers from the PD board and we looked into how to incorporate the idea of […] google tours in different projects.” Conversely, there were those who felt as though enough discussion was not present and referenced it as a shortcoming of the PD. Although discussion boards were made available to participants, and it was suggested that participants post their ideas each week, there was no requirement to reply to others’ posts. Catherine reiterated this when they stated, “I noticed that when we responded to your discussion questions, nobody made, I noticed that if I made a comment, nobody made a comment back, so there was a lack of ‘back and forth’ collaboration with my co-teachers.” Not having an opportunity to collaborate with others was consistently mentioned in the research as a barrier to those who might otherwise adopt ICTs in their classroom (Chen, 2010; Fenton, 2017; Mouzakis, 2008). Overall, the PD generated positive perceptions with participants, with a suggestion to improve collaboration if the PD is offered again.

Implications

This research has implications for me, those practicing education in the field, as well as scholarly practitioners and researchers. Three types of implications are considered: (a) personal implications, (b) implications for asynchronous PD, and (c) implications for future research.

Personal Implications

As a result of this research, I have developed a deeper understanding of the research process that I will use as an administrator and action researcher. This understanding includes (a) research methodologies, (b) the importance of positionality as
a researcher, and (c) the value of collaboration as a part of any PD.

**Research methodologies.** The initial goal of this research was to provide my peers with resources to help them with integrating technology. As my positionality changed, so did the focus of the research. Throughout the research, however, I have approached the problem as an action researcher (Mills, 2000), completing various iterations of action and reflection (Bradbury-Huang, 2010) in order to improve myself as an educator. Initially, quantitative measures were going to be the focus of the study, as is common with many educators (Mills, 2000). A change in my population led to a heavier reliance on interviews and other qualitative data sources. This shift in data collection showed the importance of thick rich descriptions, triangulation, member checking, and peer debriefing (Mertler, 2017) as a part of the overall research process. By using these tools, I was able to more accurately display teachers’ thoughts, opinions, and ideas, which helped to inform the qualitative data I was utilizing. When attempting to employ a triangulated, mixed-methods research study, it is important to make sure that all instruments have been reviewed, checked, and are reliable prior to beginning research; otherwise, the data collected may not answer the questions that are being asked. Ultimately, I was able to combine data from both quantitative and qualitative sources to inform each of my research questions.

**The importance of positionality as a researcher.** Changing from a teacher to an administrator had a significant effect on my research. Being previously considered an indigenous insider (Buss et al., 2014) and a fellow teacher, I immediately changed to being an outsider. The people I conducted my research with were no longer my peers. As such, I had to be careful as to how I approached the act of getting volunteers for the PD.
If I was not careful, I could unduly influence those under my employ into thinking they were required to participate. There is also a chance that those who participated only did so in the hopes of appeasing me. Ethics is an extremely important part of the research process (Mertler, 2017), and it was my job to make certain that the research was approached in an ethical manner. I learned that positionality must be considered through the lenses of power and bias. I cannot be certain that responses I received in interviews were entirely truthful based on my positionality and have also noted this in the limitations section of my research.

**The value of collaboration as a part of any PD.** Initially, the design of the course centered strictly around an asynchronous PD. The basic structure was to be a model in which there was no opportunity for collaboration with others. Through a review of the literature, it became clear that a collaborative approach, rooted in Vygotsky’s (1978) collaborative research was more appropriate. This led to the addition of discussion as a part of the PD, mirroring what other researchers had already discovered, collaboration was a key element in PD (Jaipal-jamani et al., 2015; Paskevicius & Bortolin, 2015).

**Implications for Asynchronous PD**

There are many different methods of providing PD to teachers; however, this study focused specifically on one approach, asynchronous PD. Although the results of this study, like most action research, are not considered to be generalizable, there are two major implications for those who provide asynchronous PD (a) collaboration is a key component and (b) there are benefits to this form of PD.
**Collaboration is key.** Other researchers have noted the importance of collaboration with regard to PD (Chen, 2010; Curwood, 2011; Fenton, 2017; Koehler & Mishra, 2005; Paskevicius & Bortolin, 2015). Although a collaborative approach was provided in the form of an open-ended discussion board, participants were reluctant to use it for anything other than what was explicitly stated in the directions. When developing PD, not only does collaboration need to be a key component, it needs to be deliberately and explicitly included for teachers. Collaborative efforts should focus on allowing teachers to discuss how they are implementing technology, strategies they have employed and allow for self-reflection in a setting that can be openly discussed (Chen, 2010; Fenton, 2017). If teachers are provided with the opportunity to collaborate in PD, there is a better possibility for increased ICT usage as a result.

**Benefits of PD.** Needs-based PD can be an effective approach to providing teachers with skills needed to incorporate ICTs (MacDonald, 2008). Similar to MacDonald, in this study, research suggests that PD on specific applications and their uses related to the SAMR (Puentedura, 2006) framework is an effective way of increasing ICT usage in teachers. In this study, I learned that teachers felt it was important to be in control of their schedules, and to set times to participate that benefited them. This is in contrast to standard PD, which typically occurs in a set location and time during the day. It also became evident that even seemingly the most experienced teachers of technology and those with strong integration skills had something to learn from a PD course. It is important not to discount those who are considered to be power-users just as much as it is to not discount those who we feel are in the most need of our support. Some of the strongest proponents of the PD course were individuals whom I believed would
receive little to no benefit. Finally, at least in my context, asynchronous PD appears to be successful at changing teachers’ opinions of ICT usage, providing them with more tools to incorporate ICTs in their classroom and, ultimately, become models for their peers.

**Implications for Future Research**

Researchers who are interested in carrying out their own research regarding the effects of asynchronous PD on classroom ICT usage by teachers may be interested in this study. Recommendations for future research include:

- Replicating this study with a larger population of individuals. The sample size of this study was too small to be generalizable and results may not be consistent among a larger population. A larger sample size would also help to eliminate potential sources of bias. A larger population of individuals may also be more conducive to collaboration (Agyei & Voogt, 2014), one of the concerns addressed by participants in this study.

- Expand this study to teachers of different grade levels. This will provide support to teachers in elementary and middle schools who also struggle with ICT integration due to lack of technical knowledge (Ahmad et al., 2016), keeping in mind that changes may need to be made to specific areas of the course to tailor content to different grade levels; and

- Increase the duration of the study to monitor effects of long-term support. Research suggests that the most successful PD is sustained over longer periods of time to give participants the time to implement skills learned (Curwood, 2011).
Limitations

This study, like any other action research study, did not exist under perfect conditions; therefore, there are limitations that should be noted. These limitations include sample size, setting, the researcher’s positionality, and the reliability of the instruments. The most significant limitation was the sample size. As participation in the study was voluntary, the number of participants was limited to those who were willing to participate in an additional course during their free time. With only five participants, data collected could not be taken as representative of the school population, for example, teachers from each subject area were not represented. Since all teachers in the school were not a part of the study, the findings cannot be representative of the school, nor high schools in general. Generally, action research is not considered to be generalizable, nor does this study. Any insights gleaned as a result of this research are done on the part of the reader. In my own context, other teachers in the building and other teachers in my district struggling to implement classroom ICTs would potentially benefit from this innovation. This small sample size led to a change in how the study was reported, with initial plans relying heavily on quantitative data, to final reporting relying heavily on qualitative data and instruments.

The researcher’s positionality was also a limitation in the study. When originally conceived, the researcher was a peer with teachers in the building and planned to use his position to solicit participants. The researcher’s positionality changed when he was hired as an assistant principal in another school in the district, changing the power dynamic over the potential teacher-participants. Now, the researcher was in a position of power over the participants, and it would be unethical to convince others to participate outside
of asking for volunteers with no guarantee of reward. Because of this, the sample size was limited to those who answered the general calls for their participation.

The final limitation was the reliability of the instruments used. Because of the small sample size, reliability coefficients were not calculated for this study using the pre-and post-tests regarding individual application usage. Due to the unstructured nature of the observation tool, it did not yield data that would be used to triangulate with interview data.

Conclusions

There continues to be debate about the effectiveness of ICT in the classroom, especially when discussing one-to-one solutions (Goodwin, 2018; Kraushaar & Novak, 2006; Mueller & Oppenheimer, 2014). One thing is certain, as districts look for ways to bring students into the 21st century, laptops and other computing technologies will be integrated into the classroom environment (Awuah, 2015; Dalton, 2014; Zheng et al., 2016). Professionals will need to learn to work with technology to meet the needs of their students. In a profession that is notoriously known for being overworked and underpaid, more time out of the standard day for training simply is not an option for many. Solutions need to be provided for teachers that allow them the time to learn how to implement new ICTs on their own schedules, with the flexibility to meet the needs of an ever-changing profession. By providing teachers with an asynchronous option for PD, they have the freedom to work at their own pace. This PD should still focus on meeting best practices for PD, such as relevance, timeliness, and collaboration (Curwood, 2011; Lloyd, Cochrane, & Beames, 2005). By providing such an experience, teachers can develop the
strategies and tools necessary to integrate classroom ICTs and be ready to usher students into the 21st century.
REFERENCES


Bradbury-Huang, H. (2010). What is good action research?: Why the resurgent interest?


https://doi.org/10.1080/07380560802157972


https://doi.org/10.1080/11356405.2016.1203526


https://doi.org/10.1016/j.compedu.2009.11.015


Peckham, S. (2008). Middle school laptop program improves writing skills. *Education Digest, 73*(6), 75–76.


APPENDIX A

TEACHER TECHNOLOGY QUESTIONNAIRE (TTQ)

(Lowther et al., 2008)

Section 1:

<table>
<thead>
<tr>
<th>Items by Category</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Impact on Classroom Instruction</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. My teaching is more student-centered when technology is integrated into the lessons.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>16. I routinely integrate the use of technology into my instruction.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>18. Technology integration efforts have changed classroom learning activities in a very positive way.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>20. My teaching is more interactive when technology is integrated into the lessons.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td><strong>Impact on Students</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. The use of computers has increased the level of student interaction and/or collaboration.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>8. The integration of technology has positively impacted student learning and achievement.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>10. Most of my students can capably use computers at an age-appropriate level</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>19. The use of technology has improved the quality of student work</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Teacher Readiness to Integrate Technology</td>
<td>5 4 3 2 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------</td>
<td>----------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. I know how to meaningfully integrate technology into lessons.</td>
<td>5 4 3 2 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. I am able to align technology use with my district’s standards-based curriculum.</td>
<td>5 4 3 2 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. I have received adequate training to incorporate technology into my instruction.</td>
<td>5 4 3 2 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. My computer skills are adequate to conduct classes that have students using technology.</td>
<td>5 4 3 2 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overall Support for Technology in the School</th>
<th>5 4 3 2 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Parents and community members support our school’s emphasis on technology.</td>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>13. Teachers receive adequate administrative support to integrate technology into classroom practices.</td>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>15. Our school has a well-developed technology plan that guides all technology integration efforts.</td>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>17. Teachers in this school are generally supportive of technology integration efforts.</td>
<td>5 4 3 2 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Technical Support</th>
<th>5 4 3 2 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Most of our school computers are kept in good working condition.</td>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>2. I can readily obtain answers to technology-related questions.</td>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>6. My students have adequate access to up-to-date technology resources.</td>
<td>5 4 3 2 1</td>
</tr>
</tbody>
</table>
7. Materials (e.g., software, printer supplies) for classroom use of computers are readily available.

<table>
<thead>
<tr>
<th></th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
</table>
APPENDIX B

WEEKLY PROFESSIONAL DEVELOPMENT QUESTIONNAIRE

<table>
<thead>
<tr>
<th>Week 1</th>
<th>Creating a Presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>When participating in the PD did you have prior knowledge of the SAMR</td>
<td>Yes No Not Sure</td>
</tr>
<tr>
<td>Model?</td>
<td>1 - Not very Knowledgeable 5- Extremely Knowledgeable</td>
</tr>
<tr>
<td>If your answer above was yes, would you rate your prior knowledge.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>How would you rate your knowledge after this week’s PD?</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>1 - Not very Likely 5- Extremely Likely</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>How likely are you to implement a lesson using SAMR as a guide.</td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Week 2</th>
<th>Creating a Presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>When participating in the PD did you have prior knowledge of Google</td>
<td>Yes No Not Sure</td>
</tr>
<tr>
<td>Slides?</td>
<td>1 - Not very Knowledgeable 5- Extremely Knowledgeable</td>
</tr>
<tr>
<td>If your answer above was yes, would you rate your prior knowledge.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Question</td>
<td>Scale</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>How would you rate your knowledge after this week’s PD?</td>
<td></td>
</tr>
<tr>
<td>How likely are you to implement a lesson using Google Slides?</td>
<td></td>
</tr>
<tr>
<td>When participating in the PD did you have prior knowledge of Prezi?</td>
<td></td>
</tr>
<tr>
<td>If your answer above was yes, would you rate your prior knowledge.</td>
<td></td>
</tr>
<tr>
<td>How would you rate your knowledge after this week’s PD?</td>
<td></td>
</tr>
<tr>
<td>How likely are you to implement a lesson using Prezi?</td>
<td></td>
</tr>
<tr>
<td>Week 3</td>
<td>Quizzes and Tests</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>When participating in the PD did you have prior knowledge of MasteryConnect?</td>
<td>Yes  No  Not Sure</td>
</tr>
<tr>
<td>1 - Not very Knowledgeable 5- Extremely Knowledgeable</td>
<td></td>
</tr>
<tr>
<td>If your answer above was yes, would you rate your prior knowledge.</td>
<td>1  2  3  4  5</td>
</tr>
<tr>
<td>How would you rate your knowledge after this week’s PD?</td>
<td>1  2  3  4  5</td>
</tr>
<tr>
<td>1 - Not very Likely 5- Extremely Likely</td>
<td></td>
</tr>
<tr>
<td>How likely are you to implement a lesson using Mastery Connect?</td>
<td>1  2  3  4  5</td>
</tr>
<tr>
<td>When participating in the PD did you have prior knowledge of Google Forms?</td>
<td>Yes  No  Not Sure</td>
</tr>
<tr>
<td>1 - Not very Knowledgeable 5- Extremely Knowledgeable</td>
<td></td>
</tr>
<tr>
<td>If your answer above was yes, would you rate your prior knowledge.</td>
<td>1  2  3  4  5</td>
</tr>
<tr>
<td>How would you rate your knowledge after this week’s PD?</td>
<td>1  2  3  4  5</td>
</tr>
<tr>
<td>1 - Not very Likely 5- Extremely Likely</td>
<td></td>
</tr>
<tr>
<td>How likely are you to implement a lesson using Google Forms?</td>
<td>1  2  3  4  5</td>
</tr>
<tr>
<td>Week 4</td>
<td>Formative Assessment</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>When participating in the PD did you have prior knowledge of Quizziz?</td>
<td>Yes  No  Not Sure</td>
</tr>
<tr>
<td>1 - Not very Knowledgeable 5- Extremely Knowledgeable</td>
<td>1  2  3  4  5</td>
</tr>
<tr>
<td>If your answer above was yes, would you rate your prior knowledge.</td>
<td>1  2  3  4  5</td>
</tr>
<tr>
<td>How would you rate your knowledge after this week’s PD?</td>
<td>1  2  3  4  5</td>
</tr>
<tr>
<td>1 - Not very Likely 5- Extremely Likely</td>
<td>1  2  3  4  5</td>
</tr>
<tr>
<td>How likely are you to implement a lesson using Quizziz?</td>
<td>1  2  3  4  5</td>
</tr>
<tr>
<td>When participating in the PD did you have prior knowledge of EdPuzzle?</td>
<td>Yes  No  Not Sure</td>
</tr>
<tr>
<td>1 - Not very Knowledgeable 5- Extremely Knowledgeable</td>
<td>1  2  3  4  5</td>
</tr>
<tr>
<td>If your answer above was yes, would you rate your prior knowledge.</td>
<td>1  2  3  4  5</td>
</tr>
<tr>
<td>How would you rate your knowledge after this week’s PD?</td>
<td>1  2  3  4  5</td>
</tr>
<tr>
<td>1 - Not very Likely 5- Extremely Likely</td>
<td>1  2  3  4  5</td>
</tr>
<tr>
<td>How likely are you to implement a lesson using EdPuzzle?</td>
<td>1  2  3  4  5</td>
</tr>
<tr>
<td>Week 5</td>
<td>Field Study</td>
</tr>
<tr>
<td>--------</td>
<td>-------------</td>
</tr>
<tr>
<td>When participating in the PD did you have prior knowledge of Google Tour Builder?</td>
<td>Yes</td>
</tr>
<tr>
<td>If your answer above was yes, would you rate your prior knowledge.</td>
<td>1 - Not very Knowledgeable</td>
</tr>
<tr>
<td>How would you rate your knowledge after this week’s PD?</td>
<td>1</td>
</tr>
<tr>
<td>How likely are you to implement a lesson using Google Tour Builder?</td>
<td>1 - Not very Likely</td>
</tr>
<tr>
<td>When participating in the PD did you have prior knowledge of Google Expeditions?</td>
<td>Yes</td>
</tr>
<tr>
<td>If your answer above was yes, would you rate your prior knowledge.</td>
<td>1 - Not very Knowledgeable</td>
</tr>
<tr>
<td>How would you rate your knowledge after this week’s PD?</td>
<td>1</td>
</tr>
<tr>
<td>How likely are you to implement a lesson using Google Expeditions?</td>
<td>1 - Not very Likely</td>
</tr>
</tbody>
</table>
APPENDIX C

TEACHER INTERVIEW QUESTIONS

1. What is your opinion of the online professional development courses?
   a. How did you approach taking the course?

2. How did you use the information provided in the online professional
development courses?

3. What recommendations, if any, would you make for the online professional
development courses?

4. How has your knowledge of the SAMR model changed since starting the online
   professional development module?

5. In what ways, if any, has your planning been affected by the online professional
development module?

6. Can you provide an example of a time when you incorporated a strategy from the
   SAMR model into your classroom?
a. Can you think of a time when you specifically modified a previous lesson to incorporate a SAMR strategy?

7. In what ways, if any, has your integration of technology in the classroom been affected by the online professional development module?

8. Is there anything else you would like to share in relation to the online professional development or your level of technology integration?
APPENDIX D
CLASSROOM OBSERVATION PROTOCOL

Teacher’s Name: ______________
Date: ______________
Course: ______________

Standard/Objective:

First Activity/Task: List what the teacher is doing, what the student is doing, and if there is technology use observed. If technology use is observed, what is taking place?

Student technology Use (in each box, describe usage that falls into that particular area):

<table>
<thead>
<tr>
<th>S</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td></td>
</tr>
</tbody>
</table>
Time Spent on Activity/Task: ____________

Time Students spent on technology: ____________

Time Teacher spent on technology: ____________

**Second Activity/Task:** List what the teacher is doing, what the student is doing, and if there is technology use observed. If technology use is observed, what is taking place?

Student technology Use (in each box, describe usage that falls into that particular area):

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td></td>
</tr>
</tbody>
</table>

Time Spent on Activity/Task: ____________

Time Students spent on technology: ____________

Time Teacher spent on technology: ____________
Third Activity/Task: List what the teacher is doing, what the student is doing, and if there is technology use observed. If technology use is observed, what is taking place?

Student technology Use (in each box, describe usage that falls into that particular area):

<table>
<thead>
<tr>
<th>S</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td></td>
</tr>
</tbody>
</table>

Time Spent on Activity/Task: ____________

Time Students spent on technology: ____________

Time Teacher spent on technology: ____________

Fourth Activity/Task: List what the teacher is doing, what the student is doing, and if there is technology use observed. If technology use is observed, what is taking place?

Student technology Use (in each box, describe usage that falls into that particular area):
<table>
<thead>
<tr>
<th>S</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td></td>
</tr>
</tbody>
</table>

Time Spent on Activity/Task: ____________

Time Students spent on technology: ____________

Time Teacher spent on technology: ____________
APPENDIX E

SAMPLE LESSON FOR ASYNCHRONOUS PROFESSIONAL DEVELOPMENT MODULES

Outline for Week 2:

1. Read introduction and background information on Google Slides and Prezi
2. Watch videos on Google Slides and Prezi
3. Discussion Board 1 - Brainstorm how you would integrate these presentation methods in your classroom. If you are already using one or both of these tools, how do you currently use them and how might you “take it a step further?”
4. Discussion Board 2 - Create a lesson outline with these tools as the core functionality. What products will students produce, and how will you assess student content knowledge based on these products?
5. Complete the reflection feedback form for the week.
Section 1: Introduction/SAMR Integration

Presentations are an excellent way for teachers or students to convey knowledge. Students can utilize presentations to share notes, reports, lab discoveries/findings, or as a part of a larger project. Teachers can use presentations as a method of conveying information in the form of notes, but also for interactive activities such as “choose your own adventure” style games or game shows. The two presentation tools we will be discussing are Google Slides and Prezi. Google Slides works just like Microsoft powerpoint and integrates seamlessly with your Google Apps account. Prezi can import both Microsoft and Google Slides shows but can incorporate significantly more functionality.

On the SAMR scale, presentation software can be used at each level, from taking what would normally be a paper/pencil brochure and turning it into a digital poster to a fully interactive experience where the slides are used to teach the learner through buttons and transitions without teacher interaction.

Getting started with google slides: https://gsuite.google.com/learning-center/products/slides/get-started/

APPENDIX F

SITE USE PERMISSION

November 8, 2018

To Whom It May Concern:

Pending approval from the [redacted] school district, I grant permission for Taylor Bradley, Assistant Principal to conduct research for his dissertation at [redacted] school. I am aware that his research involves an online professional development module, teacher observations, interviews and questionnaires. Please feel free to contact me if you have any questions. Thank you.

Tim McDowell
Principal
[redacted] High School

[Handwritten note: Tim McDowell]
Memo

To: Taylor Bradley
From: Kevin L. O’Gorman, Ph.D.
Through:
CC: Tim McDowell
Date: November 20, 2018
Re: Dissertation Approval

Please consider this communication as official permission to conduct your research study in the [redacted] School District.

Please keep in mind this will be on a volunteer basis and potential subjects do not have to participate. Unless otherwise specified in your request all information regarding individuals, school names, and the name of the district will remain confidential.

I look forward to receiving and reviewing your findings.

If I may be of further assistance in your research, please let me know.

Thank you
APPENDIX G

IRB APPROVAL

UNIVERSITY OF SOUTH CAROLINA

OFFICE OF RESEARCH COMPLIANCE

INSTITUTIONAL REVIEW BOARD FOR HUMAN RESEARCH
APPROVAL LETTER for EXEMPT REVIEW

Taylor Bradley
820 Main Street
Columbia, SC 29203 USA

Re: Pro00083997

Dear Taylor Bradley:

This is to certify that the research study Exploring the Effects of an Asynchronous Professional Development With the SAMIR Integration Model on High School Teachers’ Technology Integration in the Classrooms: An Action Research Study was reviewed in accordance with 45 CFR 46.101(b)(1). The study received an exemption from Human Research Subject Regulations on 11/3/2018. No further action or Institutional Review Board (IRB) oversight is required, as long as the study remains the same. However, the Principal Investigator must inform the Office of Research Compliance of any changes in procedures involving human subjects. Changes to the current research study could result in a recertification of the study and further review by the IRB.

Because this study was determined to be exempt from further IRB oversight, consent document(s), if applicable, are not stamped with an expiration date.

All research related records are to be retained for at least three (3) years after termination of the study.

The Office of Research Compliance is an administrative office that supports the University of South Carolina Institutional Review Board (USC IRB). If you have questions, contact Lisa Johnson at ljohnson@email.sc.edu or (803) 777-8050.

Sincerely,

Lisa M. Johnson
ORC Assistant Director and IRB Manager