TEACHER EXPERIENCES WITH TECHNOLOGY INITIATIVES AND UNDERSTANDINGS

A doctoral thesis presented
by

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to
The School of Education

In partial fulfillment of the requirements for the degree of
Doctor of Education

in the field of
Curriculum, Teaching, Learning, and Leadership

The College of Professional Studies
Northeastern University
Boston, Massachusetts
November, 2019
Abstract

At the secondary public school level, there have been many technology initiatives introduced to teachers for classroom and administrative use. Despite the upgrades in technology, teachers’ have not had many opportunities to express how the initiatives are experienced and understood. The purpose of this study explored the experiences of teachers using technology within their profession and allowed them to express the impact their experiences had on their profession. Specifically, the study investigated teachers’ experiences with technology initiatives at the high school level. An extensive literature review related to technology in the secondary education level was conducted along with an exploration of Bandura’s theory on self-efficacy applied as a theoretical framework. The research design, data collection, and analysis of the study followed. Nine Secondary Public High School science teachers from the same school district participated in an open interview process where data was collected, coded, and analyzed using qualitative interpretational phenomenology analysis (IPA) methodology. This process led to the researchers’ understanding of the participants’, teachers’, technology initiatives and understandings in the secondary high school setting.
Keywords: Technology Initiatives, Technology Professional Development, Technology Self-Efficacy, Technology Self-Doubt, Technology Transitions, Technology Usage, Technology Support, Technology Perceptions, staff development.
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Acknowledgments

I would like to express my gratitude to all of those who helped me along this journey. It has been a pleasure expanding my knowledge about technology initiatives through the viewpoint of my fellow teachers in my school district. There is a lot that I have learned and a lot more that I want to explore further thanks to this research.

I express my warm thanks to my third reader, Dr. Michael Orlando. It means so much to me to have you step up and play such an integral role in my final moments as a doctoral student. I also want to thank my second reader, Dr. Joan Giblin for helping me to move beyond my comfort zone and expand my thinking on a broader level.

Special thanks go out to my advisor, Dr. Karen Reiss Medwed. Thank you for all your help, support, and guidance through this entire program and my dissertation journey. Dr. Reiss Medwed’s help and guidance have been invaluable.

Thank you, family! First, my work family, for always keeping it positive and helping me through this experience by sharing your endless opinions and constantly checking in to hold me accountable. Also, my immediate family. My brother Adam, for proving that anyone can do anything. My brother Brock, for keeping me on track to finish my doctorate before he finishes his. My father, Parke for always being in awe at my accomplishments. And my mother, Mary Jane for being an inspiration in the classroom and always making sure that teachers have a voice. And finally, I owe a huge debt of gratitude to my supportive husband, Corey. You are truly the best person to have by my side and I have always felt like I can accomplish anything thanks to your support and endless encouragement.
Chapter One: Introduction to the Study

Statement of the Problem

At a secondary public school level, there have been many technology initiatives introduced to the teachers to use in the classroom as well as with daily administrative tasks. All of these technology upgrades have not provided many opportunities to hear from teachers about how the initiatives are experienced and understood by the teachers that are asked to implement them. Often, students are issued surveys to evaluate their teachers’ level of implementation and understanding of technology in the classroom, but teachers are not given the opportunity to express how they feel about the technology they are requested and required to incorporate.

The teachers in the school district selected for this research have access to many varying types of technology, including smart boards, document projecting cameras, and class sets of Chromebooks. As well, the curriculum is continuously changing from the school district and distributed without notice via a curriculum website. In addition to student surveys, teachers are being evaluated by the administration on their incorporation of new curriculum rollouts in science that are technology-heavy, yet teachers are given few opportunities to provide feedback or suggestions for the curriculum they are requested to integrate. The new curriculum focuses heavily on the integration of technology, but often links are broken, or the technology focus of the lesson is no longer active. Availability and usability are two very different concepts. Teachers have been requested to use the available technology when it is not usable due to system upgrades or the owner of the technology abandoned their resource, or it is privatized for a profit.
The pressures of technology initiatives and understandings have affected the teachers within the school district studied is twofold, from student pressures and administrative pressures. While enduring these pressures, teachers have not been given the opportunity to share their experiences. The purpose of this study was to provide a voice for the teachers to express their experiences with the technology initiatives and their understandings of them.

Originating from the observations as a teacher looking to other teachers to perfect my practice, I noticed several veteran teachers were frustrated and resistant to technology employment in the classroom as well as using it for administrative tasks that were once done on paper. Veteran teachers, as defined by me, are those with 5 or more years of teaching experience, since it is the first formal observation cycle after tenure is earned within the county for this study. The education system at this public school district has become consistently more reliant on technology embedded in the new curriculum rollouts and for most administrative tasks within the individual schools and to Central Office. From my observations, teachers have grown weary trying to adopt and adapt to the constant changes that technology brings. In this study, teachers have been given a much-needed voice to share their experiences with technology integration practices. This study enabled teachers to address all of the consequences the impact technology has on their daily work lives as well as the possible effects on their emotional and professional wellbeing it is causing.

According to a study by Phelps, Graham, and Watts (2008), teachers with positive technology experiences view technology as essential even when they are not the technology specialist. This vantage point allows them to have a different perspective on
technology experiences. Littlejohn and Margaryan (2006) noted that while teachers may be required to incorporate technology, they may lack the skills to do so. Without proper skillset, technology can be cumbersome and lead to negative experiences.

21st-century teachers have many pressures associated with educating future generations. Teacher experiences from technology initiatives and understandings have yet to be extensively studied after the recent National Technology Education Plan upgrade in 2017 that set a national vision and plan for learning enabled by technology (U.S. Department of Education: Office of Educational Technology, 2017). Two seminal studies, one from Finland and another from Turkey highlighted teacher-related stress-induced by technology within the field of education (Çoklar, Efıltı, Şahın, & Akçay, 2016; Syvänen, Mäkiniemi, Syrjä, Heikkilä-Tammi, & Viteli, 2016). However, this narrow focus eliminates any other experiences that teachers may have with technology and has yet to be investigated in the United States.

The teachers may be growing weary trying to adopt and adapt to the constant changes that technology brings. The teachers in this study have been granted a voice to share their experiences with technology integration practices. Educational reformers, politicians, education boards, administrators, teacher educators, and teachers themselves will have a better understanding of the experiences that technology initiatives have on current teachers experiencing these constant technology shifts in education. With this knowledge, they can hopefully adjust their leadership practices and coordinate more effective professional development sessions to best support teachers with their adoption and adaptation of technology in their profession.

**Significance of Research Problem**
This study aimed to explore the experiences of teachers using technology within their profession and allowed them to express the impact their experiences have on their profession. Specifically, the study investigated teachers' experiences with technology initiatives at the high school level. With the release of the National Education Technology Plan (NETP) starting in 1996, there has been a lot of pressure to “reimagine the role of technology in education” by pushing initiatives on teachers (U.S. Department of Education: Office of Educational Technology, 2017). The influx of this technology integration may be contributing to a new experience of feeling uneasy in a profession that teachers once felt comfortable (Çoklar et al., 2016; Littlejohn & Margaryan, 2006; Quinn, 2000; Syvänen et al., 2016).

This topic is of utmost importance since the recent January 2017 release of the updated NETP: Reimagining the Role of Technology in Education. According to Joseph South, the Director of the Office of Educational Technology for the U.S. Department of Education, there is rapid change across the country in fundamental aspects of the educational technology landscape. These changes include the number of schools that have access to broadband in their classrooms; the types and cost of technology available to schools; an evolution in the approach of leaders to the procurement of ed tech solutions as well as a greater emphasis on data security and digital citizenship; the advent of new research on the use of technology by early learners; and an increased emphasis on preparing teachers to lead with technology before they arrive in the classroom. (n.p.)
Based on the Director’s statement, it is no surprise that seasoned teachers may lack the knowledge about specific technology and have difficulty incorporating it into their already well-developed practices (Ertmer & Ottenbreit-Leftwich, 2010). The impact of the experiences that teachers have with technology has been overlooked for the supposed benefit of students in the classroom. Reasons that teachers do not change their technology practices in the classroom beyond how it may support their existing teaching styles may be the result of a cyclical feedback loop (Palak & Walls, 2009). This loop may be tied to their technology experiences and the impact those experiences have on them. The goal of this study was to give teachers a voice and allow them to reflect on their experiences regarding technology initiatives in hopes that leadership and professional development will adjust to better meet the needs of the teachers.

**Positionality Statement**

The teaching degree I earned was completed entirely online and required technology integration within every assignment. Some classmates learned to adopt and adapt while others did not and failed to complete the program. It was a sink or swim situation in which those that flourished were pushed forward into what I viewed as the microcosm of teaching. In the final portion of my degree, I was placed in a student teaching position. This was the first opportunity that I had in an authoritarian position, a power position. This position allowed whatever happened behind closed doors to be entirely up to me, the individual leading the learners.

Many new technology initiatives are being pushed on teachers, and the role they are taking within the classroom is still shifting rapidly (Basham, Hall, Carter Jr., & Stahl, 2016). Trainings and classes for technology integration occur when necessary tools are
not available to implement specific applications. The rapid change in technology has made it challenging to integrate particular technologies over extended periods, especially year to year for me. Technological “time-savers” are cropping up constantly, but my feelings are that they are not saving any time and often taking up too much time to learn and implement adequately on a regular basis.

My perspective is that technology implementation is creating so much self-doubt in teachers that it is aiding to the decline in morale and leading to work overload. Fortunately, I can be a part of the issue I am studying, which allows me an insider’s perspective (Roulston & Shelton, 2015). I agree that technology does have its place, but it is often overused, and the issue of overuse resulting in negative experiences of teachers is not considered or even acknowledged.

As a current high school educator at a large public school, I experience feelings of self-doubt from technology usage every day. While I recognize that technology can be an asset in the classroom, it can also be overused or misused, taking away from valuable instruction and adding to daily stressors of teachers causing them to doubt their value as professional educators.

I experience technology from a privileged perspective. I have access to a class set of Chromebooks located in my classroom in addition to having a desktop computer in every classroom connected to a smartboard for instruction. We have ample computers in the department lounge for use during our preparation periods or after school. Our grade books are electronic, our assignments for students are electronic, and how we communicate to students is equally electronic as it is face-to-face. As well, our technology specialist is quick to respond and help when called on. However, just because
technology is available and ready to use, it does not mean that it is quickly adopted and adapted within our classrooms. Quite recently, another new software platform for all of our teacher needs was purchased, yet little formal training was provided on how to use it and implement it. The training provided was administered by first adopters within the school that are self-proclaimed experts. These “experts” have not had formal training from the company itself. It can be frustrating when the “experts” do not know the answers to questions and do not have any means of finding them.

Aside from integrating technology within the classroom, I have also participated in additional optional professional development trainings for technology integration. These trainings were available to me through my school district and the state. While in the trainings, it is difficult to witness teachers around me that are frustrated with learning technology since they often create a bias against technology for themselves and those they influence. Often they whispered things like, “I’m too old for this” or “I can’t believe my administrator made me take this course.” These types of comments bring forth serious deficit thinking (Jupp & Slattery, 2010).

The high-pressure situation of adopting and adapting technology is forcing teachers to make changes in their classrooms with little attention to their emotional needs. There is not enough time to feel good about placing technology meaningfully into lessons continually with the influence it has on morale within the teaching profession.

**Research Central Question**

The following research questions guided this qualitative interpretative phenomenological analysis study:
What are secondary science teachers' experiences and understandings with technology initiatives in secondary high schools within Clarence School District?

Clarence school district is a pseudonym.

**Theoretical Framework**

While technology initiatives and understandings have many implications on the experiences of teachers, most notably, the social learning theory of self-efficacy is closest tied to the observed emotional feedback loop. Self-Efficacy Theory delves into the judgments of personal capability (Bandura, 1997). More specifically, how people believe their performance and motivation are influenced by how effective they think they can be. Self-Efficacy Theory can be illustrated directly by the person’s efficacy beliefs which influence their behavior, driving outcome expectations that eventually lead to the outcome (Figure 1).

![Figure 1](image-url)

*Figure 1. The Conditional Relationships between Efficacy Beliefs and Outcome Expectancies. From Self-efficacy: The exercise of control (p. 22), by A. Bandura, 1997., New York: W.H. Freeman and Company.*

According to Bandura (2008), “The most effective way of building a strong sense of efficacy is through mastery experiences” (p. 2). Other ways that efficacy can develop is by social modeling, social persuasion, and physiological feedback. This study aimed to
unpack the experiences that teachers have with technology initiatives and understanding and how they feel about it. The Self-Efficacy framework provided a lens for varying experiences that the participant may partake in that influence their morale for integrating technology. The following efficacy promoters: mastery experiences, social modeling, social persuasion, and physiological feedback, are described.

Mastery experiences are successes of achieving goals and the feelings those successes bring to encourage and motivate people to strive toward another goal (Bandura, 1997). While not all goals are achieved quickly, and failures are sure to occur, people need to treat failures like learning opportunities to build and grow from. This type of reflexivity helps build resilience and grit. Most positive experiences with technology initiatives can be categorized as mastery experiences.

Social Modeling is the act of choosing role models that demonstrate positive self-efficacy (Bandura, 1997). When an appropriate role model is selected, the participant will demonstrate a resiliency toward achieving one’s own goals (Bandura, 1997). Social modeling can be achieved through observation of others that have a positive disposition or mastery skills of the concept in question.

Social Persuasion relies on having someone play an immediate role in the impact of you achieving your goals (Bandura, 1997). Social persuasion includes any teacher to teacher interaction that results in positive feelings (Bandura, 1997). This can include a pep-talk from other teachers that takes place during scheduled meetings or casual talk in the teachers’ lounge or at the copy machine. Teachers may be colleagues or supervisor teachers as well. The experience of social persuasion is highly effective in influencing experiences for the better (Bandura, 1997).
Physiological Feedback refers to emotions, mood, and physical states that affect our interpretation of self-efficacy (Bandura, 1997). Depending on the feelings that one has after the goal is achieved influences personal measures of self-efficacy (Bandura, 1997). This is a reflective act that influences the participant’s outcome with the event and provides a bias for how they share their experience through a personal lens.

The impact of self-efficacy comes in a variety of ways: cognitive, motivational, emotional, and decisional (Bandura, 1997; Bandura, 2008). “People of low efficacy are easily convinced of the futility of effort in the face of difficulties. They quickly give up trying. Those of high efficacy view impediments as surmountable by the development of requisite competencies and perseverant effort” (Bandura, 2008, p. 3). Self-efficacy is measured by people’s goals, values, and aspirations, and not everyone has the same set of beliefs (Bandura, 2008).

This study was designed in a way that used the self-efficacy lens to allow all participants to share their experiences with technology initiatives and understandings with the recognition that each perspective is unique and valuable to the participant. Participants reflected on their experiences with technology in the secondary education context and judged their performance with and motivation for using technology in their professions. If they felt technology initiatives helped them to be more effective, then they were perceived by the researcher to have higher motivation to use technology. Through this study, the researcher provided valuable insight into the unique perspectives that teachers share and do not share regarding technology initiatives and understandings.
Chapter Two: Literature Review

Literature Review Introduction

Technology is leaching into the educational system and on the priority list for many educational reforms. These reforms are pushing technology into classrooms without taking a step back to ask teachers about their experiences with these new initiatives. Teachers are continually experiencing technology and having to understand and effectively implement it in short amounts of time (Reinke & Chamorro-Premuzic, 2014). Adapting and adopting new technology may be wearing on teachers (Reinke & Chamorro-Premuzic, 2014).

Teachers are being forced to embrace technology by society, including the demand from outside educational reform bills mandating its inclusion within the classrooms. While learning opportunities that encompass trainings, professional development, and mentorships for technology initiatives are provided to aid in teacher understandings at the conscious level, their experiences are also influenced at the subconscious level. The subconscious level includes their gender, age, teaching experience, or school culture. However, their perceptions can shift with proper supports. The perceptions teachers have toward technology involve integration within the curriculum. Too many teachers are only using technology at face surface, for teacher-centered teaching, instead of student-centered collaborative practices.

The silver lining for technology integration is its ability to make the classroom more transparent to outsiders. Although, this transparency has the potential to lead to an increased workload and a heightened stressful environment experienced by teachers.

Subconscious Level
A shift in power needs to take place and could be resisted by teacher gender, teacher age, and school culture when incorporating technology in a transformational way. These demographics play into a subconscious perception that educators carry with them when experiencing new technology initiatives. It is essential to be aware of the preconceived notions one might already hold toward particular change processes.

Female teachers have more confidence in their pedagogical skills, whereas males have more confidence in their content skills and technology skills within the classroom (Cabero & Barroso, 2016). However, Cabero and Barroso (2016) noted that confidence does not translate directly to knowledge. Men have a greater wealth of knowledge in reference to technological, content, pedagogical, pedagogical content knowledge, and technological pedagogical knowledge of content as do women (Cabero & Barroso, 2016). This lack of knowledge may contribute to women experiencing a higher amount of technology-related stress than men, as confirmed by Syvänen, Mäkiniemi, Syrjä, Heikkilä-Tammi, and Viteli’s study in 2016.

Age is also a factor of unconscious resistance that forms a bias against technology integration in the teaching profession. Technology training has indicated that it provides a positive impact on older adults’ acceptance and usage of technology (Lagana, 2008). The desire to incorporate technology is embedded in the culture and teaching background of the individual teacher (Phelps, Graham, & Watts, 2011). Attitudes and experiences of young and old adults using technology, namely computers, were equal in findings from a literature review by Broady, Chan, and Caputi (2010). However, anxiety is higher in non-intensive technology users than intensive technology users (Salanova, Llorens, & Cifre, 2013). Typically, younger generations are more intensive users of technology than older
generations. The younger culture perceives technology as a necessary means to live (Russo, Fallon, Zhang & Acevedo, 2014). However, stereotypical views regarding old people fearing technology are outdated (Broady, Chan, & Caputi, 2010). Older people only require more time to feel adequate with technology (Broady et al., 2010). Seasoned teachers lack the inherent knowledge about specific technology and have difficulty incorporating it into their already well-developed practices (Ertmer & Ottenbreit-Leftwich, 2010). “With proper encouragement, clear explanations of the personal benefits and an appropriate time schedule, older people certainly have the potential to become equally effective in using technology and computers as younger age groups” (Broady et al., 2010, p. 474). It is apparent that with time and patience, the older generations are fully capable of everything the younger generations are, in regards to technology and educational practices. It will be critical to allow all age and experience levels of teachers to have a voice within this study.

With the existence of educational standards, variety of conferences and workshops available, and access to digital and print media that afford opportunities to learn and experience appropriate technology integration education, it could be easily assumed that “technology integration knowledge and skills would be ample among professions” (Krause, Franks & Lynch, 2017, p. 176). Teachers state there are a lot of things that they do not know, regardless of how experienced they are (Tatel, 1994). Based on this assertion by Tatel (1994), self-doubt is a shared experience among all teachers. However, teachers late in their careers often question reform, question their teaching arrangement, and even go as far as to question everything in their work environment (Hargreaves, 2005). In general, experienced teachers are more likely to become
disenchanted in the profession. In a study by Levine (2011), experienced teachers were put outside of their comfort zones teaching subjects they had not taught in over 30 years. With technology integration being demanded of them (U.S. Department of Education: Office of Educational Technology, 2017), this is another way to place teachers outside of their comfort zones. In Levine’s (2011) study, the teachers were placed in professional learning communities. With that type of support, they reported their “new work with colleagues seemed to give them both the requirement and the energy to design new curriculum, to try or maintain more challenging and demanding pedagogical approaches, and to adopt new roles vis-à-vis students and colleagues” (Levine, 2011, p. 38). New pedagogical approaches may include technology integration. Professional learning communities, when executed with purpose toward common goals, have been proven to help teachers in their practice.

The literature also shows that less experienced teachers are quicker to adapt and change than are more experienced teachers because they have not been in the profession as long (Hargreaves, 2005). Change can include technology integration within the curriculum and the workplace. “The rising generation of younger teachers had also been actively socialized into working with change—through their teacher preparation and their current conditions of employment” (Hargreaves, 2005, p. 971). In school, change was promoted as a good thing, and new teachers were taught how to adapt and be flexible in their teacher preparation programs. “If change in the classroom is to be widespread within a school, efforts to improve schooling must reach more experienced teachers, those who might have the hardest time changing well-established approaches to do their work” (Levine, 2011, p. 33). Similar to above, technology integration is a type of change
that all teaching professionals need to be educated and re-educated on. In conclusion, the newest and greenest teachers may be most open to change (Levine, 2011), but only because they have had the most recent school training to be adaptable and flexible. By providing more opportunities for seasoned teachers to receive training on technology integration, they may also adopt and adapt it more readily into their practice.

In a study by Barber (2014), teachers need to step aside and assume the role of facilitator and not the sole source of knowledge in order for technology to transform the learning process for students. It is possible that an entire school culture needs to be changed for technology-focused professional development to fully be embraced by all staff (Phelps et al., 2011) since school culture directly impacts how teachers perceive dynamic technology (Ertmer & Ottenbreit-Leftwich, 2010). Several case studies by Palak and Walls (2009) indicated that teachers did not change their technology uses beyond the ways it was supporting their existing teaching styles. Teachers need to know that the effort they put forth will be recognized and commended when learning new technology systems (Breslow, 2015). According to Mac Callum, Jeffrey, and Kinshuk (2014), many teachers still resist incorporating technological learning devices into the classroom and sadly, continue to teach in an outdated lecture style.

This literature indicates that well-designed learning opportunities can counteract self-doubt and that teachers need to be aware of their subconscious feelings of self-doubt to embrace transformational technology in education fully. Transformation technology requires a shift in trainings, redirected professional development, and reinstating mentorships to encourage best practices. Trainings and professional development need to delineate from the old structured method of a preset leader within a group guiding the
lesson to a more inclusive discussion-based group full of experts on varying technologies. Communication needs to be transparent and motivational. Motivational communication can only facilitate the desired goal of workplace creativity if it is cemented by positive relationships (Omilion-Hodges & Baker, 2017). All of these factors are conducive to a willingness to work toward transformational change within the organization. Maintaining the old model of professional development of one person disseminating the information to a group will not allow participants the opportunity to explore and investigate things on their own and develop the buy-in factor necessary for change to take place. Mentorships should also be in place to allow for a greater support system through times of great change, particularly since we live in an immediate society where answers are expected as quickly as possible.

Teachers also need to be aware of the feelings they carry with them about technology without even knowing. Those feelings being generated by gender, age, experience, and school culture. Research findings pointed to men being more capable technology learners than women. As well, older adults are fully capable of learning the same technology integration as their younger counterparts; it just may take some more time and patience. Self-doubt from experienced teachers set in their ways can be overcome by additional training opportunities as well as mentorships with younger teachers. School culture also plays a large role in how integrative technology is perceived. If the culture is supportive and making sure that teachers are provided the correct incentives for using technology, then more teachers will be willing to incorporate it into their classrooms. Each one of these factors could influence the morale of teachers
positively or negatively, but regardless should be taken into consideration as a potential impact.

**Conscious Level**

The conscious level includes learning opportunities involving technology, how technology is integrated into the curriculum, and technology experiences in teachers’ daily lives. Together, these three subtopics dissect the nuances that technology has been bringing to the profession of teaching.

**Learning opportunities: Trainings and mentorships.**

Learning opportunities help teachers to grow professionally. Every teaching enterprise has some form of available or encouraged learning opportunities in the form of trainings, professional development, and mentorships to help develop teachers’ best practices and content knowledge as mandated by the NETP (U.S. Department of Education: Office of Educational Technology, 2017). Learning opportunities provide a way to disseminate information to all teachers without personalizing or judging particular teachers’ art of pedagogy (Drago-Severson, 2009). Learning opportunities need to be intentional, and power must carefully be spread among all participants, distributed leadership, to be effective (Drago-Severson, 2009). Additionally, the staff development professionals involved in leading learning opportunities must have clear intentions and strong leadership skills to engage adult learners.

Trainings provide teachers opportunities to grow as professionals. In general, trainings are offered and mandated to keep teaching certification current. Specifically, technology training needs to be redirected to focus on the technological components and not the content or pedagogical elements since teachers are already well versed in these
areas (Cabrero & Barroso, 2016). Content should play a role in the type of technology resources introduced, but the focus must be on learning the technology to implement the content-related resources. Emphasizing the importance of utilizing technology helps guide instructors to properly incorporate technology into their classrooms productively and effectively (Ball & Levy, 2008). As well, teachers already confident in technology have reported that they still need time to practice integrating it effectively (Sadaf, Newby, & Ertmer, 2012).

Staff development leaders must begin to provide more opportunities within the meetings and trainings for staff to discuss best practices and pedagogy in addition to instruction led by technology. The more open discussion, the better received professional development will be (Hardy, 2014). This open dialogue will benefit everyone because it will promote asking questions which can enhance inquiry and strengthen teacher practice (Aritz, Walker, Cardon, & Zhang, 2017; Nicholson, Capitelli, Richert, Bauer, & Bonetti, 2016). However, just opening up to more dialogue and conversation will not provide the necessary steps toward leadership techniques that must be achieved. The type of communication matters greatly. First, the communication needs to be open-ended as to not skew the outcomes toward the desired goal (Raelin, 2016). Then, the communication has to be motivational and positive to generate the type of discussions that the group can address and take action on (Hartung & Wilson, 2016; Mayfield & Mayfield, 2017; Omilion-Hodges & Baker, 2017).

The way that professional development is executed regarding technology needs to focus on student-centered approaches to better allow teachers to fully engage their students in the curriculum through the use of technology (Palak & Walls, 2009). Students
need to take ownership of the material to feel invested and benefit from the learning process. When professional development focuses on teaching teachers how to incorporate technology as student interactive learning opportunities, the benefits to student educational gains are evident as supported by a 2009 study from Palak and Walls. However, just because professional development is available, does not mean that it is all equally accepted. “The ready availability of opportunities for professional development did not necessarily lead to an embracing of learning” (Phelps et al., 2011, p. 59). Just because there is a time and a place for professional development does not ensure that any teachers are developing professionally. “…teacher training and professional development programs should provide learning opportunities so teachers can develop this knowledge and put it into action” (Cabero & Barroso, 2016, p. 634). Therefore, professional development needs to be designed to increase teachers’ computer self-efficacy since computer self-efficacy is linked to usage in the classroom (Ball & Levy, 2008). A way to increase their self-efficacy is to provide more opportunities, both structured and unstructured, to support individual learning gains. In an Australian study, a lack of appropriate professional development opportunities showed a decrease in the morale of teachers (Mackenzie, 2007). This study is of particular interest since it highlights the impact of poor professional development counteracting the entire process.

Aside from dedicating more time, it is crucial to utilize the current staff in an organization that are embracing emerging technologies (Ball & Levy, 2008). Expert staff for a particular form of technology usage need to be readily available for current teachers to feel the necessary support to incorporate these new technologies properly. Additionally, “Preservice teachers need to witness and experience technology use in a
pedagogically sound manner as students, and then hopefully they will implement that in their own teaching” (Bai & Ertmer, 2008, p. 109). Even so, a teaming strategy can be implemented to provide “adults opportunities to question their own and other people’s philosophies and assumptions about leadership, teaching, and learning” (Drago-Severson, 2009, p. 25). This practice can be invaluable in helping to shape the culture of a school and allow everyone to have access to diverse opinions and perspectives they can take ownership of and integrate into their pedagogical practices. Having readily available support will enable teachers to feel more comfortable. The society we live in demands immediate responses, a consequence of the technology boom. If teachers have immediate support available, they are able to quell any buildup of emotions that may lead to anxiety or self-doubt when integrating technology. Teachers exposed to successful technology experiences have higher levels of self-efficacy regarding technology integration in practice (Wang, Ertmer, & Newby, 2004). This support can help build confidence, and confidence needs to be built up in teachers regarding technology (Yeun & Ma, 2008).

Teachers should also be allowed the opportunity to share ideas and discuss technology integration practices (Gorder, 2008). Having meaningful conversations and reflection periods will enable teachers to invest in their practices at deeper levels. Clear periods of reflection helps us to acknowledge our assumptions and critically analyze their meaning. According to Drago-Severson (2009), being able to understand and recognize our assumptions “cultivates meaningful personal and professional learning, behavior change, and improved performance” (p. 76). To reflect on technology practices, teachers must have compelling examples of it and have the opportunity to practice (Chen, 2008). After the practice commences, there must be follow up support with fellow teachers to
assist in reflection and offer support. Without the teacher to teacher support, technology might not always take on the intended meaning. The value of the technology can be lost and therefore not utilized.

Professional development does have drawbacks since there is a serious risk that teachers will become jaded with the ad hoc methods of current professional development technology opportunities (Crosswell & Beutel, 2013). If integrative technology professional development is not provided appropriately, teachers that may have been open to learning new things could potentially shut down.

Many career paths to becoming a teacher involve a student teaching experience where a master teacher is tasked to mentor a teacher in training. Technology use during the student teaching experience improved self-efficacy for using technology during their future careers according to a study by Sadaf, Newby, and Ertmer (2016). But why end at a student teaching mentor-mentee relationship for integrating technology? Being a teacher leader can involve a process aimed toward goals of opening dialogue between members, enhancing inquiry, and strengthening best practices in the classroom (Nicholson et al., 2016). Everyone has the ability to be a teacher leader in the form of a mentor at any point in their careers. Mentorships are essential in education because the position of teaching is never static (McCaughtry, Kulina, Cothran, Martin, & Faust, 2005). This type of mentor-mentee relationship should be mirrored when integrating technology into the workplace for teachers. Technology usage is a continued problem among non-technology education teachers (U.S. Department of Education: Office of Educational Technology, 2017). The art of incorporating technology into the education system allows for more ways to deliver content. The link between technology acceptance
and efficacy of use is directly related according to a study by Ball and Levy (2008). Teacher leaders and mentors highly influence others’ beliefs on technology usage and importance, too (Bai & Ertmer, 2008).

As well, anxiety plays a significant role in deterring users from incorporating technology (Ayyagari, Grover, & Purvis, 2011). Teachers may believe that technology can help their practice, but are too intimidated to incorporate it (Chen, 2008). According to a study on stress and technology by Ayyagari, Grover, and Purvis (2011), “Technology characteristics induce stress by enhancing the misfits between the individual’s abilities—environment’s demands and between the individual’s supplies—environment’s values” (p. 845). When individuals are not properly prepared or in the correct environment to incorporate the technology they are being asked to, this could induce a stressful and anxiety ridden experience for them. Having a mentor-mentee relationship promoting technology will help with our immediate society. Giving teachers a go-to for quick answers in real time may benefit their overall experience and allow open spaces for investigating and exploratory questioning to help take technology integration to the level of collaborative and interactive student learning while reducing stress and anxiety among teachers.

According to Chen (2008), the teacher is the central figure in charge of bringing technology into the classroom. As it is well known, there are many different types of teachers present in the system to date. Specifically, novice teachers vs. experienced teachers will be compared for this study. Novice teachers are typically more flexible and take on a constructivist belief that allows them to remain more positive but also use technology in very fleeting ways (Ertmer, Ottenbreit-Leftwich, & York, 2007). Less
experienced teachers may not need as much technology support as those that are more experienced in teaching (Ertmer et al., 2007). “In a classroom, the teacher perceives and defines a teaching situation, makes judgments and decisions, and then takes related actions” (Chen, 2008, p. 66). Placing experienced teachers with new teachers has proven positive benefits. Several experienced teachers credit younger teachers with re-inspiring them with new pedagogical practices (Tatel, 1994). This means mentorships do not have to be confined by veteran and novice status. They can be strategic pairings, technology-based, for those that are a beginner and those that are more advanced, which can lead to reverse mentorships from the typical setting of a veteran teacher and a new teacher. According to a study by Ertmer, Ottenbreit-Leftwich, and York (2007), “As teachers progress along the continuum from novice [technology users] to accomplished users, it may be beneficial to provide opportunities for them to observe and discuss the direct impacts of technology on student learning as obtained by more accomplished [technology] users” (p. 58).

Strategic pairings may also cross genders. Gender differences between males and females exist surrounding technology adoption and use in educational settings. Female teachers have more confidence in their pedagogical skills, whereas males have more confidence in their content skills and technology skills within the classroom (Cabero & Barroso, 2016). Although it is cautioned that mentors be selected wisely as the process is greatly dependent on effective leaders as mentors (McCaughtry et al., 2005). A study by Shane and Wojnowski (2007) showed that mentorship philosophy decidedly increased the technology skills of mentored teachers. This same study implored the teacher mentors to hold small group workshops that enabled more teachers to be involved with the shifts
in technology. This too had positive results on the adaptation of technology within the classroom setting.

Trainings, professional development, and mentorships must provide more opportunities within meetings for active discourse among all participants. The greater open discussion opportunities, the better-received learning opportunities will be (Hardy, 2014). This open dialogue will benefit everyone because it will promote asking questions which can enhance inquiry and strengthen teacher practice (Artiz et al. 2017; Nicholson et al., 2016). This can be considered a distributed leadership practice if every member is given a specific technology piece to become an expert and report back on expecting an open dialogue and feedback about their presentation of technology. They can also serve as the “go-to” for others trying to explore new forms of technology. However, just opening up to more dialogue and conversation will not provide the necessary steps toward effective distributed leadership. The type of communication matters much. First, the communication needs to be open-ended as to not skew the outcomes toward the desired goal (Raelin, 2016) and the opportunity to provide feedback needs to have an option for anonymity. According to Ertmer and Richardson (2010), when peer feedback is anonymous, peers provide more feedback by offering alternatives and helpful suggestions for improvement. Then, the communication has to be motivational and positive to generate the type of discussions that the group can address and take action on (Hartung & Wilson, 2016; Mayfield & Mayfield, 2017; Omilion-Hodges & Baker, 2017). Motivating leader language has a direct relationship with an increased perception of the worker’s environment and their ability to contribute creatively.
In a study by Hardy (2014), when focused open dialogue was integrated into learning opportunities, interviews revealed that as time progressed, the subjects’ disposition toward learning opportunities became more positive. The subjects credited the shift to the experiences and discursive reflection that they shared with colleagues daily regarding best practices for teaching. Hartung and Wilson (2016) revealed that the greatest learning outcomes were generated from provocation, questioning what is going on, rather than adding to it by other moves such as storytelling, eliciting, resource, or threading. Self-reported learning outcomes for informal conversation cafés soared when the point of view, puzzle (posing a question about what to do next), reframe, propose, and challenges were all used in conversation (Hartung & Wilson, 2016). Creating time to allow participants to learn and engage with one another will improve their ongoing practices (Raelin, 2015). Hardy (2014) helps frame learning opportunities as fluid and happening outside of structured environments. If the experience in the learning opportunities is positive, it will continue organically outside of the structured experience empowering all teachers to be leaders.

Communication is the epicenter of positive learning opportunities. With effective communication, leaders of learning opportunities can communicate to the people around them in a direct and transparent way, so everyone fully grasps what is going on and the goals they are collectively working to achieve (Karlgaard, 2004). Specifically, this ties into technology integration because it is often taught through trainings and professional development. Through effective communication, leaders can delegate effectively and build on strengths of themselves and build the strengths of others. Proper communication supports and challenges motivate colleagues in a way to help them to deepen their
understanding of current issues (Nicholson et al., 2016), like adopting and adapting technology within their work lives. In addition, positive communication helps quell relationship conflict (Solansky, 2008). Specifically, motivating language has a direct relationship with an increased perception of the worker’s environment and their ability to contribute creatively (Mayfield & Mayfield, 2017). Creativity is necessary when integrating technology since many teachers were not taught this in their trainings to become teachers (Ertmer, 2005). The more positive the relationship between leader and learner, the more willing participants are to act on information toward transformational change in the workplace (Herold, Fedor, Caldwell, & Liu, 2008), such as technology adoption and adaptation. Communication is key in fostering good relationships and indicates that the relationships between leader and follower and that of the follower with other followers will assist in productive workplace practices.

Professional development happens outside of the training sessions just as much as it happens inside them, and all teachers can be leaders and share their experiences with others. This is a form of leadership as outlined in Raelin (2016) that describes a focus on dialogue as the emergence of leadership techniques. Leaders can communicate to the people around them directly and transparently, so everyone fully grasps what is going on and the goals they are collectively working to achieve (Karlgaard, 2004). Staff development leaders must envelop these traits and be reflective in practice to be successful. One or two leaders typically lead staff development meetings, but if they were led by more than two leaders or organized in a distributed leadership fashion, more questions emerge and a greater amount of information either to elicit answers or to generate challenges to proposals would greatly increase. Integrating more questions also
allows for more participants to be involved. This type of open floor for discussion could lead to communities of practice that help drive strategy from trainings into classrooms. Creating time to allow participants to learn and engage with one another will improve their ongoing practices (Raelin, 2015). This implies that effective leadership in staff development trainings must provide adequate time for peer-led conversations and perhaps even provide conversational moves in the form of sentence starters to elicit provocation within the conversations. In staff development trainings, often information is disseminated directly and concisely. If staff development trainings offered more motivating language to the employees, creativity would have a greater chance to emerge. Staff trainings should be embedded with motivating language to help employees feel a part of a positive work environment that values their creativity. In education, many lessons are teacher-generated or modified, and teacher creativity would benefit student engagement (Gilbert, 2016). Communication is also crucial in fostering good relationships, and the relationships between leader and follower and that of the follower with other followers will assist in productive workplace practices. Mentor-mentee relationships may be assigned or emerge organically, but need to be encouraged and supported by those in leadership positions to have the proper impact.

**Integrating technology into the curriculum: Perceptions and usage.**

In today’s society, some form of technology may be perceived and experienced within the curriculum every day by the classroom teacher. Whether the classroom teacher chooses to implement it or not, may be up to that teacher. “…exemplary technology use is rooted in teachers’ internal beliefs and commitments to student learning, but is also supported by important extrinsic factors (professional development, technology support)
that tenable in-service teachers to translate those visions into practice” (Ertmer et al., 2007, p. 59). Perceptions of technology vary teacher by teacher and are currently being addressed in professional development opportunities that also offer technology support. Professional development opportunities have aided in informal research as polls on teachers’ feelings about technology (Ertmer, et al., 2007). As well, professional development opportunities have served to provide the space and time necessary to influence teachers’ perceptions of technology integration (Ertmer, et al., 2007). The perception that teachers have about integrating technology affects the type of technology usage in the classroom. Since technology can be a transformational learning device, it is essential that usage is analyzed as a potential impact on teacher morale and work efficiency (Ertmer, et al., 2007).

In a study by Sadaf et al. (2016), it was found that if students express an interest in technology, then teachers are more likely to incorporate it into their teaching. Broadly, teachers generally report that they believe technology is important and technology supports learning (Howard, Chan, & Caputi, 2015). Literature has narrowed these two perceptions teachers’ have about integrating technology into two main ideas, student-centered or teacher-centered. These two ideas can be placed on a continuum for teaching using technology. They can be analyzed by two opposite spectrums, the transference of knowledge, and the facilitator of knowledge (Levin & Wadmany, 2006). A study investigated by Hsu (2016) found that seventy-five percent of K-6 teachers held constructivist (student-centered) beliefs for technology and executed this methodology in their classroom. Student-centered benefits for technology integration include increasing student interaction, increasing student communication, improving writing, and the ability
to extend class time beyond the classroom (Sadaf et al., 2012). Teachers that believe in student-centered pedagogy regarding technology also tend to experience high self-efficacy regarding their usage of technology (Hsu, 2016; Park & Ertmer, 2008). Similar to teachers needing goals for technology, when students are presented goals for technology, they too demonstrate an increase in self-efficacy for technology integration (Wang, Ertmer, & Newby, 2004). It can be inferred that teachers that know how to use technology are making sure it is student-centered since student expectations for technology integration are the driving force behind teachers’ intentions to use them (Sadaf, Newby, & Ertmer, 2016). This type of technology incorporation, student-centered, is seen as ideal, but not necessarily practical (Chen, 2008). Student-centered instruction requires much more preparation and knowledge based on content and technology. Therefore, teachers recognize that this is the best practice, but are unsure of how to properly make this practice happen in their classrooms. Teachers must keep an open mind and attempt to use technology in a transformational way because often their beliefs do not reflect in their practices (Chen, 2008). Just because teachers are aware that student-centered technology integration is the most effective in the transference of knowledge, does not mean that they can easily adopt this practice into their classrooms seamlessly.

There are innate differences between primary school teachers and secondary teachers. Secondary teachers have a higher perceived attitude toward the positive need for technology integration over primary teachers (Gorder, 2008). Not only does age range taught influence technology perceptions, but subject area taught does as well. According to an ANOVA variance analysis by Howard, Chan, and Caputi (2015), subject area
taught influences the integration of technology significantly. Generally, Science teachers hold more value in technology over English teachers and lastly Mathematics teachers (Howard et al., 2015). For these reasons, this study selected secondary science teachers to interview.

Another influence on teacher experiences with technology is the years of experience teachers have in their field. For this reason, teachers of all ages and teaching experience need to be heard from. The more removed teachers are from the university setting, the less they adopt new practices into their teaching methods (Syvänen et al., 2016). Younger teachers are trained in technology that immediately has an impact on their teaching. Whereas seasoned teachers have solace in the methodology, they have developed over the years that seem to be effective enough. Despite these differences, teacher attitudes (Palak & Walls, 2009) as defined by drive and personal belief (Ertmer et al., 2007) toward technology are the most important factor in technology usage in the classroom. The biggest impact on attitudes toward technology included perceived usefulness, perceived ease of use, and perceived compatibility (Sadaf et al., 2016). The easier technology is perceived to be used, the more likely teachers are to incorporate it into their lessons (Sadaf et al., 2016; Sadaf, Newby, & Ertmer, 2012; Yuen & Ma, 2008). Important data results from Yeun and Ma (2008) indicate that whether or not the technology is actually meaningful in practice was found not to be an important factor in the perception of teachers toward using technology. Therefore, the mere ease of use overshadows the quality of technology incorporated. In the classroom, computer self-efficacy of teachers greatly influences their use of technology (Ball & Levy, 2008). Teachers value speed, ability to modify and produce information, access, and the support
from others using the same technology to be of the most important factors when choosing to use technology (de Aldama & Pozo, 2016). The teachers’ competence and ability to adequately incorporate technology results in effective integration within the classroom (Gorder, 2008).

“…change in teachers’ beliefs may follow rather than precede teaching practices, and by helping teachers adopt new practices that are successful, the beliefs associated with these practices may also change” (Park & Ertmer, 2008, pp. 258-259). Teachers must be willing to trust in the process to influence their current practice. Teacher perceptions can be changed so long as teachers are willing (Levin & Wadmany, 2006). Levin and Wadmany (2016) continue to reflect

It seems that the learning processes that take place when teachers are exposed to new goals, practices, types of problems, and instructional tools function as a discourse, and encourage or pressure teachers to modify their teaching styles and even their underlying beliefs regarding effective teaching (p. 172).

Giving teachers goals with technology is an effective way to enhance technology integration, “which can be easily achieved by making the link between class objectives and learning goals explicit” (Wang, Ertmer, & Newby, 2004, p. 240). Similar to teachers needing goals for technology, when students are presented goals for the technology they too demonstrate an increase in self-efficacy for technology integration (Wang, Ertmer, & Newby, 2004). Pushing technology without challenging and changing beliefs of teachers will not result in the transformative 21st-century classroom helping students integrate technology. First, teachers must be groomed in technology experiences and gently urged
with proper supports to give technology a chance before being asked to implement it within their classrooms.

Hsu (2016) found a direct correlation between beliefs and practice. The more you believe in technology as a beneficial educational tool, the more likely you are to use it. The power of belief, paired with the power of technology, can be quite transformational in education. The power of technology is best defined by Palak and Walls (2009) as having the ability to create independent learners all while individualizing the education experience for diverse learners. Bai and Ertmer (2008) echo this by calling on educators to “realize the uniqueness of each learner and to understand how to support students’ learning” by individualizing education. Being able to individualize education and reach all different types of learners appears to solve an overarching theme of educational shortcomings. Curricular goals can reflect the technology chosen to accomplish lessons (Palak & Walls, 2009) and all students can make learning gains because of it.

Technology is multifaceted and used by teachers in the classroom integrated into the curriculum and as collaborative and cooperative student engagement tools (Gorder, 2008). However, not all technology usage is created equal. Most teachers are still at the stage where they are having students acquire information in closed instructional contexts as well as limiting them from presenting information (de Aldama & Pozo, 2016).

…the mere introduction of technological devices into classrooms does not ensure change. We need to promote spaces for reflection in which to re-think the role that teachers and students play in society and education in the twenty-first century, where conceptions and beliefs and teaching and learning can be reformulated (de Aldama & Pozo, 2016, p. 275).
Teachers using technology could also be confining its potential and thus limiting its effect on diverse learners. The integration of technology based on a teacher-centered approach involves the students acquiring information and presenting material (Palak & Walls, 2009). Basic level technology integration is better than an absence of technology integration since it does individualize education at some level allowing students to work at their own pace and foster a more positive learning environment. Teachers use technology in the classroom, but it is not effectively integrated (Gorder, 2008). While teacher-centered approaches are still better than not integrating technology at all, the goal is for student-centered approaches. Teacher-centered approaches will always overshadow student-centered approaches if there is not a shift in focus directly breaching this topic (Palak & Walls, 2009). According to a study by Levin and Wadmany (2006), the use of technology in the classroom does not imply the positive integration of technology into the curriculum in a transformative educational experience. Technology integration from a student-centered approach fosters a collaborative and interactive learning environment (Palak & Walls, 2009). Classroom and student-to-student discourse are pillars of the learning process. It is nearly impossible to shift teacher practice from the teacher-centered approach to the student-centered approach despite positive technology experiences and adequate technological support (Palak & Walls, 2009).

“Teachers need to know how and why to use technology in meaningful ways in the learning process for technology integration to work” (Gorder, 2008, p. 64). Although there is a wide gap between the transformative experience that technology promises and the type of incorporation in the everyday classroom (de Aldama & Pozo, 2016) the focus needs to switch away from the knowledge teachers can impose on students, and toward
the knowledge students can construct among each other (de Aldama & Pozo, 2016). Technology also has the ability to teach the transferable skill of communication in the 21st century (Breslow, 2015). The teacher is the most important aspect of successful technology integration (Gorder, 2008) and if students express an interest in technology, then teachers are more likely to incorporate it into their teaching (Sadaf et al., 2016). When technology is used regardless of the approach, it is the driver of pedagogy in the classroom (Krause et al., 2017). Therefore, the focus must shift away from teacher-centered approaches and toward student-centered approaches. The immediate society we live in today requires innovative and creative thinkers that can be generated from student-centered technology integration. Teachers that have a stronger foundation of pedagogical skills and their content area are more likely to incorporate technology into their lessons (Cabero & Barroso, 2014). Therefore, technology should be scaffolded and targeted at master teachers that already believe in the power of technology. Moreover, teachers with a stronger background in technology are even more likely to incorporate technology into their lessons (Ball & Levy, 2008).

The literature indicates that although teacher perceptions and experiences play a large role in whether or not the teacher integrates technology into the curriculum, their perceptions and experiences with the effectiveness of technology can be changed. Teachers need to have a purpose for changing their beliefs, whether it be from their pedagogical growth or pressure from the administration to do so. As well, merely integrating technology without purpose is not enough to engage students in innovative and collaborative learning practices. There are two main ways technology can be integrated, but only one of them, student-centered teaching, provides a stronger
foundation for student learning. Teacher-centered technology integration should be transformed into student-centered technology integration. Because of the patterns of transformative technology, teacher perceptions may lead to poor morale. If teachers believe they must integrate technology and are unable to ditch teacher-centered integration for student-centered integration, this could drive feelings of frustration.

**Technology experiences in the daily lives of teachers.**

Teachers are faced with many tasks every day, and technology is typically perceived as a benefit from the outside world, as evidenced by the push for educational technology reforms. However, inside the many moving parts of the teaching profession, technology can cause a work overload which can lead to stress. This section will provide a foundation for understanding how technology experiences can incite work overload and how technology-related stress impacts the profession.

Role overload is expressed as the third most prevalent reason for teachers leaving the profession (Litt & Turk, 1985). The difference in technology skills is a potential issue that could lead to work overload (Littlejohn & Margaryan, 2006). Since teachers are pressured by society to join the technology laden world, feelings behind these pressures have emerged and can be categorized into six distinct feelings, uncertainty, distrust, demotivation, exhaustion, obstruction, and stuck without alternatives (Revilla Muñoz, Penalba, & Sanchez, 2016). All of these feelings vary based on the individual and their work setting and expectations. According to Phelps et al. (2008) for technology to be successful, it needs to be viewed as essential for all teachers and not just specialist teachers. Although teacher educators also need the time to experience the use of their lessons in the classroom before taking the time to mentor or train other educators on how
to use them (Sadaf et al., 2012). This time is not easy to come by in the teaching profession. The shift in educational practices to include technology at a student-centered teaching approach has led to more teachers feeling extra work. There is a dramatic difference between being digitally literate and being able to properly integrate technology into the classroom (Mac Callum, Jeffrey, & Kinshuk, 2014).

The demands of having to use advanced skills, such as integrating technology, and having a high work overload like that of a teacher who plays varying roles for their students, colleagues, and administrators during the day and outside of the day can be stressful (Tadić, Bakker, & Oerlemans, 2015). “Teachers are busy teaching in the classroom and need more time for learning, planning, and preparation to integrate technology” (Gorder, 2008, p. 74). Locating the correct technology to incorporate can be burdensome and inconvenient to both students and teachers (Chen, 2008). “The difference between technology use and technology integration for learning is that integration implies full-time, daily operation within lessons” (Gorder, 2008, p. 65). Lessons must be created around technology, and technology must be the centerfold of the idea and not the afterthought to a lesson (Krause et al., 2017). However, with the constant updates and upgrades to technology, it is difficult to stay current and continuously ensure the technology is still available year to year. A case study by Palak and Walls (2009) interviewed a teacher that expressed, “I remember doing a lot less than I do now… I cannot do the job I do now without computers” (p. 429). Despite this cynical view, “Teachers hold positive attitudes towards the importance of computers in teaching, and are concerned about developing their skills…” (Hamdan Al-Rabaani, 2008, p. 27). Teacher skills need to be better developed before technology integration expectations are
set (Hamdan Al-Rabaani, 2008). However, developing these skills also leads to work overload and increased stress levels. Tadić, Bakker, and Oerlemans (2015) found that “daily job resources acted as a buffer against the unfavourable impact of daily hindering job demands on daily well-being” (p. 718). Whether the resource of technology is helping or hurting teachers, work overload is still yet to be determined.

Technology is found to increase general daily stress (Russo et al., 2014). Very versatile, technology is authentic to the administrator and user in an educational setting. Sadly, many teachers lack the knowledge of how to effectively integrate technology into the curriculum in a student-centered way (Gorder, 2008). The lack of knowledge could contribute to high amounts of stress if the technology is an expectation in the classroom and no longer a choice. Integrating technology can be a highly stressful experience for a teacher that has fixed beliefs about her or his teaching style. A study by Syvänen et al. (2016) showed “that the key predictors of technostress were, in descending order of importance, [technology] competence, concordance of ICT with the teaching style, school support, and attitude to [technology]” (n.p.). Deciding which technology to use when it may not be reusable the following year can also add increased stress to teachers’ lives (Littlejohn & Margaryan, 2006).

Aside from integration in curriculum, technology increases the transparency of teachers to the administration, parents, and surrounding community, causing an increase in work overload to maintain (Mackenzie, 2007). This type of openness forces teachers to stay accountable in ways that were not previously expected. As well, the time limitation for learning and utilizing new technology can be a barrier to technology usage (Palak &
Walls, 2009). Professional development needs to be offered on a less structured and more available basis for busy teachers to take advantage of a positive mindset (Gorder, 2008).

Technology is not fool-proof. Stress is also derived from the lack of technical support needed at the time of user or technological errors (Chen, 2008). In a study by Çoklar, Efilti, Şahin, and Akçay (2016) the results showed that the majority of subthemes, the reason why teachers feel the greatest technology-induced stress, is due to individual and technical problems. When technology fails, teachers are discouraged and frustrated (Quinn, 2000). Not all technologies are free either, and, therefore, it is stressful to acquire funding for licensing of certain technologies (Palak & Walls, 2009). Technological communication also has a way of leading to stress because of misinterpretations of text (Russo et al., 2014).

Teachers new to the profession have a lot to think about and therefore, have communicated to researchers that they “had to be cautious about implementing technology-integrated lessons” (Hsu, 2016, p. 36). To reduce anxiety and stress, preservice teachers should have introductory trainings to the profession, which includes the use of technology to improve their self-confidence (Akugun & Ozgur, 2014). Talking with others is also a good way of coping with stress in the work environment (Litt & Turk, 1985). Although technology, namely in the form of email, has drastically reduced the amount of face-to-face communication that takes place in schools. Salanova, Llorens, and Cifre (2013) found that a teacher who is helped by other teachers feels a need to reciprocate the help. This type of cyclic effect can add to the stress.

With the increase in email, the feeling of email overload (Szóstek, 2011) is causing stress. In a 2017 study in Singapore, teachers used email for administrative
matters, sharing of resources, and communication with students and parents (Oberst, Wegmann, Stodt, Brand, & Chamarro, 2017). Email literacy is often not taught in teacher preparation programs (Oberst et al., 2017) generating email misunderstandings that present themselves that otherwise would not occur in face-to-face interactions (Oberst et al., 2017). Additionally, improper use of email organization leads to a jam-packed unnavigable inbox (Szóstek, 2011) that could result in oversight for important email messages. Specifically, teachers with computers at their desks are frequently interrupted by incoming email messages (Oberst et al., 2017) causing elevated levels of stress and distress (Mano & Mesch, 2010; Szóstek, 2011). “While email increases access to required information, and hence increases work effectiveness, this is obtained at the cost of overload effects on the user’s wellbeing” (Mano & Mesch, 2010, p. 67). According to a study by Reinke and Chamorro-Premuzic (2014) overload of email has been linked to career burnout.

Work overload and stress are both negative factors for any profession. The research indicates that technology has to be viewed as essential for progress toward technology advanced skills to be made. The gap between technology and education is there, in part because teachers need proper development, training, and time to acquire the necessary skills to use the tools efficiently and correctly. Without a foundational technology skill set, negative feelings toward technology begin to emerge. The research did also shed light on the well-known fact that teachers are very busy people without any of the added technology drives. Locating the right technology and recreating lessons all take the time that many teachers do not have to spare, especially without the promise that
the same technology will be reusable in subsequent years. While technology is a resource, it has the potential to both help and hurt.

**Conclusion**

This literature review was completed to assess perceptions and experiences on transformative educational technology and investigate the potential stress that evolves from technology initiatives within the teaching profession. Benefits made available by technologies are not decisive factors influencing employees’ adoption. Instead, it is employees’ normative environment, their co-workers’ attitude toward the use of technology (Kraut, Rice, Coo, & Fish, 1998) that has the potential to sway the outlook she or he has on integrating and understanding technology.

Based on the above review of literature, it is apparent that perspectives are drawn from the subconscious level and the conscious level. The subconscious level represented by specific demographics, including gender, age, and school culture. The conscious level represented by the structure of professional development opportunities, teachers’ beliefs about technology, and how technology is integrated into the curriculum. From these varying perspectives, it is clear to distinguish that as technology is evolving, so is technostress in the form of work overload and daily stress which contributes to negative teacher morale.

This researcher believes that teacher perspectives and their effect on technology-induced stress are impacted by many different aspects of the teacher at an individual level and systemic within education. Previously, professional development was viewed as having a leader or central figure that dictated a specific message to the people present for training. The literature, however, added to this narrow perspective and suggested that
professional development needs to be more open to discussion and sharing of best practice and technology applications and their values. Involving more stakeholders in the process helps to provide mentors and give ownership back to the educators.

Another aspect brought to light in this literature review is the nonimpact of age. Previously, age can be seen as a primary constituent holding back teacher acceptance of technology and causing more stress, but the literature revealed that age itself does not attribute to stress. Age-related anxiety can be overcome with proper training and patience. People that are older are just as accepting of technology change as are younger people. They need more time to learn and adjust. Teacher-centered instruction dominates over student-centered, even though student-centered instruction has a greater potential to make learning more interactive and collaborative. The daily life of a teacher is quite stressful, and work overload is an incredible experience.

In conclusion, multiple perspectives toward the benefits and drawbacks of specific types of technology integration in the classroom paired with the evolutionary aspect that technology has daily must result in some level of stress and declining morale of educators alike. Additionally, teachers are constantly experiencing technology, and its pressures are often credited with mitigating learning issues for students when the consequences for teachers are unexplored. Although every teacher is an individual, and they bring forward their outlook on technology integration, technology is not something that is going away. On the contrary, technology is progressing every day, every minute. Teachers’ jobs are becoming increasingly more work.

Similar to allowing students to learn by inquiry, teachers should have the opportunity to become experts on certain aspects of technology and share their findings
with others in a less pressure-induced setting. Being introduced to many modes of technology can seem overwhelming, especially when there never seems to be the right choice or perfect option that can be reusable. It is essential to analyze how experiences and understandings with new technology initiatives are impacting teachers.
Chapter Three: Research Design

Methodology

The central research question for this study was: *What are secondary science teachers' experiences and understandings with technology initiatives in secondary high schools within Clarence School District?* The methodology selected by the researcher was a Qualitative Research Interview methodology. According to Wagstaff et al. (2014), flexibility in an interview-style approach helps to highlight the lived experience of the participants which is interpreted by the researcher based on a close interpretation of the words from each participant. Using an interpretational phenomenological analysis (IPA) approach helped the researcher examine how people made sense of their life experiences (Smith, Flowers, & Larkin, 2012). The goal of this methodology was to help make sense of how the participant experienced technology initiatives by giving a voice to teachers’ feelings about technology integration in education at the administrative application level and classroom integration level.

Research Design

This research followed a qualitative design that allowed participants, the teachers, to share their voice on their experiences with technology initiatives and understandings in the secondary high school setting, a purely interpretative activity. A dominant feature of qualitative research interview methodology is the practicality of its application and usefulness paired with the social validity of derived findings (Wagstaff et al., 2014). Adding to the understanding of technology-induced stress in our current educational field proves invaluable with the constant push for more technology within the teaching profession.
Research Tradition

A phenomenological study was conducted in the form of an interpretative phenomenological analysis (IPA) study. As an evolving and dynamic approach to qualitative research, IPA was the best-suited methodology for this research. The researcher selected IPA as the methodological approach since IPA explores the lived experience of the participant’s emotional and psychologically constructed world. It is a digression of phenomenology that “appeals to our immediate common experience in order to conduct a structural analysis of what is most common, most familiar, most self-evident to us” (van Manen, 1990, p. 64). “IPA is a particularly useful methodology for examining topics which are complex, ambiguous and emotionally laden” (Smith & Osborn, 2015, p. 41). Experiences with technology initiatives are happening more frequently every day within the researcher’s life, and the researcher sees it also affects those around the researcher. Within this study, a two-stage interpretive process was employed: (1) participants try to make sense of their world while (2) the researcher tries to make sense of the participants trying to make sense of their world (Smith & Osborn, 2003; Smith et al., 2012). The researcher was committed to the detailed examination of each participant and wanted to know “what the experience for this person is like, what sense this particular person is making of what is happening to them” (Smith et al., 2012, p. 3).

One of the founding principles of IPA is a phenomenological inquiry that was first argued by Husserl who urged the researcher to examine the everyday experiences of others outside of the researcher’s typical perception (Smith et al., 2012). Husserl further developed a method that “was intended to identify the core structures and features of
human experience” (Smith et al., 2012, p. 13). His student Heidegger further morphed Husserl’s beginning steps toward IPA methodology. Heidegger introduced a hermeneutic that viewed the person, participant, in the context of their situations (Smith et al., 2012). Later came phenomenology researcher Merleau-Ponty, who suggested humans themselves create a vantage point of subjectivity within the research (Smith et al., 2012). The perception of the researcher directly influences the research. Finally, Sartre extended phenomenology in the direction of IPA and “indicates that we are always becoming ourselves and that the self is not a pre-existing unity to be discovered, but rather an ongoing project to be unfurled (Smith et al., 2012, p. 19).

Another founding principle of IPA is hermeneutics. Hermeneutics serves as a way to make meaning explainable by interpretation. One of the first researchers to write directly about hermeneutics was Schleiermacher who dissected interpretation to involve grammatical and psychological pillars (Smith et al., 2012). By offering a holistic view of the interpretive process, Schleiermacher helps researchers to acknowledge that “our analysis might offer meaningful insights which exceed and subsume the explicit claims of our participants (Smith et al., 2012, p. 23). Heidegger also contributed to the hermeneutic foundation of IPA. Heidegger argues that “the reader, analyst or listener brings their fore-conception (prior experiences, assumptions, preconceptions) to the encounter, and cannot help but look at any new stimulus in light of their own prior experience” (Smith et al., 2012, p. 25). Gadamer extends hermeneutics to include an “emphasis on the importance of history and the effect of tradition on the interpretive process” (Smith et al., 2012, p. 25). Preconceptions can unfold during the interpretation process.
The final underpinning of IPA is idiography. Idiography digs deeper into the personal lived experience of each participant before drawing conclusive ideas from the research (Smith & Osborn, 2015). It is founded in keeping the integrity of the participant while also making meaning of the detailed information divulged, particular insight from the participant, and the unique characteristics and thoughts the participant gives (Eatough & Smith, 2010). Therefore, “a given person can offer us a personally unique perspective on their relationship to, or involvement in, various phenomena of interest” (Smith et al., 2012, p. 29). As addressed by Wagstaff et al. (2014) this process can be grueling since researchers expressed “personal resistance against moving from the particular to the shared, and a reluctance to abandon the focus on the individual” (p. 6). Emphasizing the individual’s contributions causes IPA to have a smaller sample size of participants. Each interview can be given careful individual attention before drawing any generalizations. From this process, “the researcher can make specific statements about study participants because the analysis is based upon a detailed case exploration” (Pietkiewicz & Smith, 2012, p. 363).

IPA finally emerged as a qualitative data analysis strategy in the UK primarily as a psychology approach to experiences in the health and clinical/counseling fields (Eatough & Smith, 2010). This methodology, derived from the three underpinnings above of phenomenology, hermeneutics, and idiography, allows the researcher to have an active role in interpreting the participants’ meaning-making experiences of a phenomenon. The researcher has an integral role in taking first-hand accounts of a person's beliefs and subjective knowledge on the phenomenon (Eatough & Smith, 2010; Pietkiewicz & Smith, 2012) often in a conversational interview style. This experiential approach to
understanding the participant’s viewpoint is seeded deeply in how the researcher is choosing to interpret the data given by the participant (Eatough & Smith, 2010). The core of IPA “recognizes the action oriented nature of talk and that people negotiate and achieve interpersonal objectives in their conversations, and that reality is both contingent upon and constrained by the language of one’s own culture” (Eatough & Smith, 2010, p. 22). The centerfold of this IPA research is the participant’s story. “IPA deals with issues that matter to people and that in some way, change or influence how people think about themselves and their place in the world” (Eatough & Smith, 2010, p. 28). Therefore, thoughts and feelings are entangled, and both the researcher and the participant influence the meaning-making of the phenomenon, which involves extensive reflection from both parties.

**Participants**

This study included nine (9) high school science teachers from various high schools within the school district. Science teachers made up the selection pool since they had the most integrative technology opportunities within the classroom, including access to Chromebooks, newer technology embedded curriculum, and laboratory equipment connected to technology. In addition to integrative experiences within the classroom, all teachers within the school district experience similar administrative trends, formal pressure, that is heavy on technology use for daily tasks like filling out leave forms, training, and sorting and analyzing student data. The sample type and size for this study was purposively selected to maintain the standard with IPA studies (Smith et al., 2012). Narrowing down the sample criteria helped to provide for the most homogenous sample group, ideal for IPA studies (Smith et al., 2012). Nine participants were selected and
provided the researcher with an opportunity to fully immerse themselves in their participants’ detailed lived experiences with technology initiatives while maintaining IPA’s idiographic underpinning.

Having a limited sample did not mean that the researcher viewed the sample as representative of the population as a whole. Each participant was given the opportunity to share their emotional and psychologically constructed world. In IPA studies, much detail is required in analyzing and re-analyzing to give life to the experiences of the individuals being sampled. To thoroughly analyze the lived experiences, the researcher detailed the “psychological variability within the group, by analyzing the pattern of convergence and divergence which arises” (Smith et al., 2012, p. 50). The purpose of this IPA study was to give a voice to the secondary science teachers at various schools within the same school district.

**Recruitment and Access**

Approval for participants was first acquired through IRB, followed by the internal school district application process through the Office of Shared Accountability. Participation was voluntary and was advertised through department-wide emails to all 25 high schools in the school district. The email informed participants of the study topic, style of interview, informed consent procedures (see appendix a), and included an attachment of the school district approval for the study to be conducted. Twelve total participants responded, and nine were selected. The criteria used for selection narrowed the participants to the most homogenous sample group (see appendix b). At the conclusion of the study, participants received a thank you letter through the school district mailing system and if they requested, a copy of the final dissertation. Following
school district regulations to appropriately safeguard the privacy of current employees, the identity of and information about all research participants was kept confidential by having participants specify a pseudonym of their choosing. At the beginning of the interview, participants were required to complete the IRB, and school district approved written consent form (see appendix c) in addition to verbally consenting on the audio recording. All participants were given the right to withdraw at any point within the study. As with all human participant studies, IRB approval was obtained before proceeding with any part of the study (see appendix d).

**Data Collection**

Qualitative data were collected through direct interviews between the researcher and the teacher participants under the guidance of the Principal Investigator. Interviews were semi-structured and ranged in length from twenty to thirty-five minutes. The interviews took place in various locations throughout the state of Maryland at locations selected by the participant. The researcher requested that participants bring an artifact to support an anecdote that pertains to their technology experiences. Artifacts were left open to the participants’ interpretation. Since artifact is a commonly used word in the teaching profession, items provided by the teachers included a Chromebook, student assignments, teacher-made webpages, as well as curricular documents that supported their feelings on technology integration. The researcher followed an interview schedule to help guide the participant to feel comfortable, which allowed them to share their experience under investigation regarding technology initiatives and understandings (see appendix e). After verbal consent participants were informed that the researcher did not have a pre-set agenda and was only interested in the information that the participant wished to share.
about their experiences in as much or as little detail as they prefer to give. At the beginning of each interview, the researcher emphasized that they cared about the individual and their experiences and that there were no wrong answers. Background questions were asked first to help ease the participant in a comfortable setting. Prepared open-ended and expansive research questions followed, which allowed the participant to elaborate on their original answers in their way. Focusing questions were developed and utilized to minimize assumptions about the participant’s concerns or experiences and enabled them to share their genuine thoughts during the data collection phase (Appendix E). The researcher provided ample wait time and minimal input in the form of pre-generated probes to help with elaboration. This form of passive interviewing helped to encourage natural reactions from the participant. As an active listener, the researcher remained flexible with the participant and kept in mind that not every question on the schedule needed to be asked in a particular order or even at all. This made each interview authentic to the participant and the researcher. The interview was recorded using a digital recorder while the researcher took notes about the participants’ reactions and physical demeanor during the interview process. The researcher coded the demeanor of the participant by writing down the time during the interview, in which the participant had an individual reaction corresponding with the digital recorder’s transcription time.

**Data Storage**

The use of a password-protected digital recorder was used with both written and verbal consent of the participants. Voice recordings were converted into a .mp3 file and saved under the participant’s selected pseudonym. All observational notes followed the same coding by a pseudonym to ensure confidentiality. The .mp3 files were transcribed
by the researcher into a word document and then uploaded into the password-protected MAXQDA software located on a personal desktop that was password protected in the researcher’s home. The observational notes were stored in a lock and key firebox in the researcher’s home. The researcher was the only person with access to material regarding this study. After transcription, the .mp3 files were destroyed. At the completion of the study, all transcriptions and observational notes were destroyed.

**Data Analysis**

Recordings were transcribed and uploaded by the researcher directly into MAXQDA software. The researcher treated each participant’s transcript as an isolated story with its dedicated attention before drawing any themes or generating any groupings about data for analyzation. To comply with this commitment, the transcriptions were analyzed using an inductive systematic three-step approach (Creswell, 2013; Rubin & Rubin, 2012). First, narrow units of analysis were coded, such as significant statements by using a highlighting feature within MAXQDA. Next, the selected significant statements were revisited and coded into one of the three types described by Creswell (2013), (1) short, eye-catching quotes, (2) embedded quotes to “prepare the reader for a shift in emphasis” and (3) longer quotations “used to convey more complex understandings” (p. 219). Then, broader units, such as general themes were depicted and coded for within the recognition phase (Rubin & Rubin, 2012).

The original transcript was revisited in addition to the aforementioned analysis process. This helped to guarantee that the researcher was as familiar as possible with the transcript (Smith & Osborn, 2013). Both coded transcriptions from the same participant were used in tandem to look at similar highlights and extract overlapping notes. The
overlapping notes were then be reviewed as narrow units of analysis. This methodology is referred to as horizontalization. In general terms, “horizontalization is the process of laying out all the data for examination and treating the data as having equal weight within the initial data analyzation” (Merriam & Tisdell, 2016, p. 27).

From the overlapping notes, a horizontalization method (Creswell, 2013) will be used to once again “highlight ‘significant statements,’ sentences or quotes that provide an understanding of how the participant experiences the phenomenon” (Creswell, 2013, p. 82). Next, these highlights will be further culled to eliminate any repetition or overlapping statements. Following horizontalization, the text will be divided into meaning units sifting for similarities, differences, echoes, amplifications, and contradictions between interviews (Smith & Osborn, 2003). From each analyzation of the transcribed interviews, a group of themes will emerge, and the transcripts will be re-analyzed for commonalities and differences. The researcher will also use their background from the literature review to help code particular themes. Themes will be developed after grouping repeating ideas (Auerbach & Silverstein, 2003). Emergent themes can be connected and clustered before they will be organized into a table of superordinate themes (Smith & Osborn, 2003). Themes will then be translated into an overarching “narrative argument interspersed with verbatim extracts from the transcripts to support the case” (Smith & Osborn, 2003, p. 76) and can be used to build an imaginative variation describing the participants lived experience with technology initiatives and understandings as described in the findings using code weaving (Saldana, 2016). This new set of statements, each having equal value in meaning-making, will then be clustered into groups using a concept
coding method (Saldana, 2016). Concept coding allows for data to be segmented into a similar single word or phrase expressions, themes.

In addition to themes, a common way for IPA studies to be analyzed is by looking at the layers of interpretation and finding the ‘gem’ (Eatough & Smith, 2010). Layers of interpretation involve multiple looks during coding and avoiding a top-down approach. The pieces in this study will be separated from the whole to help with the emergence of the meaning from text to exemplify and amplify analyzation (Eatough & Smith, 2010). The gem can often be missed, but when it is found, it adds to the research by acting as the missing key (Eatough & Smith, 2010). The gem will be located within this study and presented in the research findings. The entire meaning of this study can be generated through the gem. Additionally, the process of data analysis is continually reflective and allows for different ways of meaning-making from the researcher, acknowledging the subjectivity of the researcher and the participant.

**Trustworthiness**

The use of multiple participants divulging their personal accounts of technology initiatives and understandings allows the researcher to triangulate the collected data. Triangulation is a process that “involves corroborating evidence from different sources to shed light on a theme or perspective” (Creswell, 2013, p. 251). Using multiple participants and comparing their data against one another helps the researcher identify cohesive themes. This method helps to confirm findings from one participant with another and validate the research.

As with most qualitative research, this study will not need to debrief the participants extensively but will use member checking. After the interview, participants
will be reminded what the data is to be used for, and their contact information will be confirmed for follow up contact. Once the transcriptions were completed, the participants were given the opportunity to check and approve them before the analyzation process. Follow up interviews were not requested after member checking since participants clarified any misrepresentation of transcription via email.

Throughout the study, the researcher kept orderly documentation of all research and performed periodic independent audits. The goal of these independent audits was to ensure that the data presented was transparent and accounted for within the entirety of the study to the extent that someone else could follow the researcher’s process (Smith et al., 2012). An independent audit helped validate the research and confirmed that the content was credible.

In addition to keeping orderly documentation, the researcher also remained reflexive throughout the research process. Reflexivity is “seen to be a means of increasing the transparency in the research process” (Crowley, 2010, p. 240). Including researcher positionality and potential bias helped to improve the validity and the reliability of the study in context since it “likely shaped the interpretation and approach to the study” and needs to be recognized (Creswell, 2013, p. 251). As with most IPA studies, external validity was limited by the specifics of this study. The application was restricted to a reflective insight into the participants’ experiences with technology initiatives since data was derived from these participants’ first-person perspective of their meaning-making, experience of the phenomenon.
Chapter Four: Research Findings

Introduction

The purpose of this study was to give teachers a voice on the technology initiatives and understandings that are being implemented in their school system and suggested throughout the newly introduced science curriculums in the school district. It is believed that data produced in this study will benefit the continued introduction of technology throughout curriculum updates and staff development within the school system. This chapter presents key findings on technology experiences and teacher understandings on technology initiatives derived from nine in-depth teacher interviews.

This study was conducted using nine teachers from a selected public school district in Maryland located outside of Washington, D.C. The district’s total number of science teachers exceeds 300 personnel with varying titles and subject content specializations ranging from core content subjects and electives in Earth/Space, Life, and Physical Science. Many varying programs are available at each school including Academies (such as Project Lead the Way), Signatures (such as Medical Careers), International Baccalaureate, and Advanced Placement classes in addition to special services for English for Speakers of Other Languages (ESOL), Emotional Deprivation Disorder (EDD), Bridge Autism Program, and Interim Instructional Services (such as Home and Hospital). Both inclusion and self-contained class structures are also available for select students. This variety of programs and classroom set-ups allowed for a multitude of teachers with vast experiences to participate in the study, which helps reflect on a broader population while still maintaining a narrow participant selection.
This school district began its new curriculum roll-outs shortly after the introduction of NGSS in the state of Maryland during the summer of 2013. New curriculums first started in Biology and progressed to Chemistry and now Physics—the new required science pathway for graduation in the school district. All curriculums intermix technology standards in accordance with the NETP that aligns to support effective uses of technology, Title IV A, of Every Student Succeeds Act as authorized by Congress in December of 2015. As a living document, the NETP is consulted when refining and supplementing the living curriculum being updated continuously by the school district Central Office personnel and volunteer and paid teachers to improve the integration of technology.

Central Research Question

The following research questions guided this qualitative interpretative phenomenological analysis study:

What are secondary science teachers' experiences and understandings with technology initiatives in secondary high schools within Clarence School district*?

Participant Information and Data Collection

For this research study, the researcher used face-to-face interviews with participants following a qualitative research methodology. Teachers were recruited as volunteers via their school emails after being identified from their school directories as current science teachers. Nine teachers were selected from thirteen that replied based on their longevity of teaching within the school district. The reason for this selection was to provide a better opinion on the shift toward the new curriculums that now implement technology. The nine participants in the interview process represented various science
specialties across several different high schools within the school district and two of which were department heads, resource teachers, for science. The first participant interviewed, Jennifer, is a fourth-year teacher in the school district who teaches AP Environmental Science and Biology. Jennifer is from the same school as Peter. Peter teaches Chemistry. Kelly is from a different school than all other participants and has been a teacher for seventeen years. She teaches Biology. Ben is also from a different school and is a career changer to teaching. He has taught for eight years and teaches AP Chemistry and Chemistry. Mary is also a career changer and has taught for eleven years. She teaches Biology. Sophie is from the same school as Mary. She has taught for fifteen years and teaches AP Chemistry, Biology, and a science signature course called Project Lead the Way. Science Signature is a special program that, at this school, focuses on Biomedical Sciences. Diane is from a different school and has been a teacher all of her life, over thirty years. She teaches Biology. Amy has been a teacher for eight years and teaches Biology, also at a different school than any other participant. The final participant, Bruce, teaches at a different school than the other participants and has been a teacher for five years after changing careers. He teaches AP Physics I and Physics. Only the core content introductory courses have curriculums that are produced by the school district and mandate technology. Those courses are Biology, Chemistry, and Physics. All of the above descriptions are summed up in Table 1 below.

Table 1.

Participant Information

<table>
<thead>
<tr>
<th>Participant</th>
<th>Gender</th>
<th>Age Range</th>
<th>Years Teaching in the School district</th>
<th>Subject Areas</th>
<th>School district Curriculum Requires Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Gender</td>
<td>Age</td>
<td>Experience</td>
<td>AP Environmental Science</td>
<td>Biology</td>
</tr>
<tr>
<td>-------</td>
<td>--------</td>
<td>------</td>
<td>------------</td>
<td>--------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Jennifer</td>
<td>F</td>
<td>20-30</td>
<td>4</td>
<td>No</td>
<td>Biology</td>
</tr>
<tr>
<td>Peter</td>
<td>M</td>
<td>30-40</td>
<td>10</td>
<td>Chemistry</td>
<td>Yes</td>
</tr>
<tr>
<td>Kelly</td>
<td>F</td>
<td>40-50</td>
<td>17</td>
<td>Biology</td>
<td>Yes</td>
</tr>
<tr>
<td>Ben</td>
<td>M</td>
<td>50-60</td>
<td>8</td>
<td>AP Chemistry</td>
<td>No</td>
</tr>
<tr>
<td>Mary</td>
<td>F</td>
<td>40-50</td>
<td>11</td>
<td>Biology</td>
<td>Yes</td>
</tr>
<tr>
<td>Sophie</td>
<td>F</td>
<td>40-50</td>
<td>15</td>
<td>AP Chemistry</td>
<td>No</td>
</tr>
<tr>
<td>Diane</td>
<td>F</td>
<td>60-70</td>
<td>&gt;30</td>
<td>Biology</td>
<td>Yes</td>
</tr>
<tr>
<td>Amy</td>
<td>F</td>
<td>30-40</td>
<td>8</td>
<td>Biology</td>
<td>Yes</td>
</tr>
<tr>
<td>Bruce</td>
<td>M</td>
<td>30-40</td>
<td>5</td>
<td>AP Physics I</td>
<td>No</td>
</tr>
</tbody>
</table>

Of twenty-five potential high schools, the nine participants represented seven different high schools. These participants were selected to best represent the overall initiatives and understandings of technology integration within the new science curriculum (Biology, Chemistry, and Physics) from varying content and school backgrounds throughout the school district.

Data was collected and analyzed to distinguish particular trends in secondary science teachers’ experiences and understandings of technology initiatives within this school system since they are adopting and adapting the NGSS standards into new core curriculums while working technology throughout the lessons. This study was not designed to test any hypothesis or intended to develop any theories. In this chapter, findings from nine secondary science teachers will be presented as elicited from the central research question. All interview transcripts were carefully read and reviewed several times to identify significant themes between participants’ experiences and understandings of technology initiatives. The major three themes include technology used by teachers, initiating and maintaining technology implementation, and teaching with
technology. Commonalities and digressions are presented within the dissected themes to follow.

**Teachers’ Technology Usage**

Throughout the technology boom, various types of technology have developed and evolved. There are a lot of varying modes of technology being incorporated into the classrooms as the push for technology continues. They range from physical devices like laptops and cell phones to applications, such as online simulation labs or learning management systems. Teachers are using various forms of technology both in the classroom and out of the classroom for school use. All of these technology resources have common goals, as reported by the teacher participants. These goals include the reduction of paper, overall organization, and student choice for learning as well as assignment completion, known as the Universal Design for Learning (UDL). The reasons behind using technology elicited four key findings: ease of use, access/availability, student need, and pressure.

**Types of technology used.**

Amy mentioned how she uses her cell phone, laptop, and computer. Sophie added that she specifically uses her “laptop for emails, my cell phone for emails, internet searches, and that type of thing.” Ben also worked from home and shared that, “I will come home and finish a flipchart on the computer and obviously the internet.” Knowing what technology teachers are using helps to unveil why they are using it and what is influencing them to use it.

All teachers interviewed echoed in some way the same sentiment that the classroom is now drifting away from computer labs and toward 1:1 technology utilizing
Chromebooks. Kelly, Mary, Jennifer, and Bruce all explicitly mentioned that transitioning from the computer lab to Chromebooks was the most significant transition in technology that they have experienced as educators. Bruce stated, “There is a big focus, essentially a big focus on technology. The Chromebook rollout has been happening for several years. We still don’t have Chromebooks for every single classroom, but most schools have quite a few of them.”

Aside from literal technology in the form of Chromebooks, teachers’ mentioned the shift to online classroom spaces. Everyone uses some type of online learning platform other than Diane. Amy uses Moodle and Blackboard to lesson plan virtually. Amy noted that,

I was looking for an online course management, and I was under the impression that blackboard was that system. No one used it. They had Edline that was not, had no capabilities for online course management in a way that was meaningful for student-student interactions and student-teacher interactions.

While Amy was disappointed by the idea that Blackboard was not the online course management system, Bruce, Peter, and Kelly shared they prefer to use Google Classroom for online learning management. Other classroom management systems include outside sources like Wordpress, or the county endorsed system of Canvas. While they all share similar features, their platforms and user-friendliness varied among the participants’ interviews.

The software platform debate between Canvas vs. Google Classroom surfaced within almost every interview in some capacity. Teachers mentioned that at first, everyone had a program called Edline, then it changed. Ben, Peter, Bruce, and Kelly all
stated that they now use Google Classroom, while Sophie and Amy utilize Canvas. Jennifer uses an outside source on a consistent basis, a Wordpress site, to maintain her online classwork, but also uses Google Classroom in conjunction. Jennifer stated that,

I had to transition entirely from the server-based document system to the Google Drive based document system because that’s the best way to keep a website current and organized and updated for my students so that they can stay organized and so that I can have the flexibility to edit my documents from wherever and still get them to my students and have them be updated whenever I need them to be.

And Diane does not use any online classroom system. Ben shared that, “We started with Edline…then MCPS shifted to a cooperated agreement with Google, so now we use Google.” Peter was also using Edline for a while until they got rid of it. Peter shared that, “And Google Classroom came first, and so I learned that and then when Canvas came, they didn’t get rid of Google Classroom and it wasn’t user-friendly.” Peter brought up a good point that he didn’t want to switch to Canvas if he did not think it would last. And Ben decided to forgo Canvas because he has not “fully gotten the time to ingest it.” Sophie is under the impression that the school district wants Canvas used exclusively. Even though Amy also uses Canvas, she brought up that it “has not been a smooth transition.” Diane was the most apprehensive toward any technology for online classrooms because she felt it does not possess the capabilities to match the course in the way that she would want. Overall, Bruce surmised that “…the school district is offering us options and verbally encouraging us to use technology in the classroom, but I don’t think there is a concerted effort or any sort of consensus about how technology should be used in the classroom.” These mixed messages, paired with varying interpretations from
various teachers in different schools all over the school district, provides a glimpse into the murky application and roll-out of the technology being used by teachers. Some teachers are told to use one platform while others are under the impression they must use the other, all while one participant is flat out refusing to maintain an online classroom altogether. Continuity and transparency are lacking and creating a rift within the school system and online platforms for technology.

Participants continued to explore the types of technology they use by sharing their favorite classroom resources. Peter integrates computer simulations and utilized the Chromebooks in that way in addition to trying to “assign as much as I can on google docs as possible.” Mary, Kelly, Sophie, and Bruce emphasized the use of Chromebooks in the classroom in some capacity, and Mary even went as far as to state, “The Chromebooks should be used weekly, if not daily in some way.”

Amy shared that she is a very connected teacher who “…when I am sick at home, I will pull up go guardian and see where my students are online and answer their questions and be teaching even though I am at home.” Go guardian is a platform that the school system pays for that can link students within a class to the teacher, and the teacher can access all of the students’ computers and redirect them as they needed or message them when appropriate. This feature allows teachers to be a type of Big Brother that students seem to have mixed feelings about, but no control over. Diane shared that “disruptive technologies and watched videotapes coming back, when videotapes were brand new, they were flooded in every place…Calculators the same thing.” As types of technology evolve, it cycles through old trends in new ways and is not always beneficial.
However, some beneficial technologies never have enough time to evolve and allow teachers to take advantage of them.

“We have this database for school, for the school district: FileMaker. And it’s super useful. Nobody knows how to use it” (Kelly, personal communication, March 15, 2019). Other forms of technology mentioned directly by teachers include Promethean boards that have interactive software such as ActivInspire to help students interact with the lessons, Adobe Flash for online simulations, PhET for online simulations, Kahoot for game-based review, Elmo’s for document projection, and Performance Matters as an internal county system online tool to help sort student data.

Kelly was the first participant to mention the use of Smartboards in the classroom earliest in her interview. She mentioned that it was an available tool for students. In other interviews, participants shared more feelings about this program which, will be explored in the following subtheme. Adobe Flash is a computer extension that provided really great simulations. Although, like many forms of technology, flash has become outdated and as Kelly put it, is “like virus susceptible” and is no longer able to be used in the classroom despite how great the simulations were and how Kelly expressed, “…but man I really wanted to use it and stuff like that.” PhET, Physics Education Technology, is a source of online simulations and labs that were initially just based in the content area of physics but have now expanded to include all of the science disciplines and math as well. PhET is a hit or miss type of technology that sometimes uses Adobe Flash to run and sometimes uses other forms of software that are Chromebook compatible. Kahoot is a gaming platform that teachers use to find or generate their questions with four multiple-choice answer selections. Students can interact with the game as a whole group in a
review like setting. Elmo’s are document projectors that are still found in many classrooms. While Elmo’s are not used to the extent to which they were intended, creating videos of teachers modeling work to upload, they are used to show students modeling in real-time. The final type of technology directly mentioned by participants was Performance Matters. “That has been a big change. So I have been in several sessions lately where we are learning how to use Performance Matters and administer assessments on that” (Peter, personal communication, March 25, 2019). Performance Matters is a new initiative in the school system used to track students’ assessment achievement across grade levels and disciplines. This new initiative is only being implemented at pilot schools with the hopes that it will become the overall student management system for tracking and analytics of students over their entire school experience within the school district.

For the study, most participants brought or shared artifacts that reflected their experiences with technology as professional educators. One of the participants brought a printout representing how they use technology in the form of a calculator to obtain and analyze laboratory data (Figure 2). Several participants verbally told the researcher it would be a Chromebook, and one participant even brought a Chromebook with them. One participant shared a google doc that a student had completed and they had evaluated (Figure 3). And one participant shared their personal website (Figure 4).
Figure 2. Calculator data analyzed by a student.

Figure 3. Google document with teacher evaluation and feedback.
Reasons for using technology.

While teachers have specific types of technology they use, it is essential also to consider what exactly is influencing their usage of technology. Teachers interviewed shared four main reasons that directly influence their usage of technology: ease of use, access/availability, student need, and pressure. Peter, Ben, and Diane emphasized that ease of use is the most critical factor for them that influences their technology use. Peter put it plainly, stating, “So if something is pleasant to interact with, I will use it. If it’s not, I will probably avoid it.” Access was most important for Bruce, Kelly, Jennifer, and Diane. Access can be summed up as availability and convenience. When technology is readily available and convenient, more teachers are prone to using it. The final influential reason for technology usage is student needs, “what’s best for the students” (personal
communication, Amy, March 22, 2019) and “…what’s best for the students to learn whatever it is you are teaching them” (personal communication, Kelly, March 15, 2019). The students must get a better understanding (personal communication, Mary, March 16, 2019), and the best way to do that is to “listen to your students and do what works for your students” (personal communication, Amy, March 22, 2019). Sophie added that the relevance for the students and the lesson should also be considered in addition to the “how easily trainable it is for me or how easily I can get trained on it.” Even though student needs are highly valued when considering what technology to use, technology should never be forced into education using pressure tactics. Jennifer stated, “I never push technology just for the sake of pushing technology. It’s got to be in the right situation to help my students do the right thing and to make things easier for me.” Pushing technology leaves a distaste for its effectiveness and usage. Ben feels the discomfort that the push for technology has brought and shared, “I am only going to do it [integrate technology] if I am told to.” But Peter took a different perspective and decided, “…if Google is going to be everywhere you might as well help push them [students] to start using Google.” In terms of influences for technology usage, different teachers value different motivators to help them integrate technology into the classroom, whether it be ease of use, access, student need, or pressure.

**Initiating and Maintaining Technology Implementation**

Teachers shared their viewpoints about how to best approach technology from three different directions: new teachers, school district administrators, and students. Altering the lens that they viewed technology from changed the perspective of importance. The way that technology is initiated is often formally through professional
development. Professional development can be delivered in a variety of methods to help initiate technology implementation. Throughout implementation, support is required to help teachers continue to implement technology. Support is also available to teachers in a multitude of ways.

**Viewpoints on technology integration.**

New teachers, school district administrators, and students were the three lenses that teacher participants used to explain their perspective on the importance of technology integration. Some teachers interviewed felt that technology was not essential for a new hire. They also felt that when administration encourages technology, they should do so in a purposeful and direct manner. The goal of technology integration should also be student authenticity for learning and assignments.

From a new teacher perspective, Diane shared that she “…would say don’t worry about it [technology integration]. Your skills are probably just fine. It’s a pretty ordinary use of computers and mainly computers.” Amy agreed with Diane and shared that she would want new teachers to reflect, “Where do they see their strengths in how they approach their classroom and how technology can naturally fit into helping with that.” New teachers should not be so stressed about technology and integrating it within their teaching because it will come with time and is not essential yet to be a great teacher, according to Diane and Amy.

Kelly took a different angle and felt that the school district needed to be more direct in their push for technology. She shared that, “…if we are going to spend money on technology, you should make sure that your teachers know how to use it.” Just merely
having the available resources will not help the teachers implement it effectively in their classrooms. They need to have trainings and those trainings need to be purposeful.

Sophie and Mary focused on approaching technology from a student perspective. Sophie felt that “…as an educator you need to know what the school district has out there for you and what students may be used to so I show them what they can do so that they have those resources available.” Mary added to Sophie’s sentiment,

It is really important for kids to understand that technology is more than their phone and that we just really make sure that kids have the true experience of being a scientist inside the classroom to use research to guide their understanding and giving them that time to think about what’s out there by the Chromebooks. Since teachers dictate the use of technology in the classroom for students, it is important to look at the perception of teachers, administrative presence from the school district, and students when considering how to best approach technology embedded education.

**Ways of learning.**

Another point of discussion among the participants was how professional development is relayed to teachers from the way that it is delivered to the type of opportunities offered. The way that professional development is approached can make all the difference in teachers selecting to be actively involved and being able to apply it to their practice. The types of opportunities offered also has a significant impact on teachers’ integration of technology.

In the workplace, Bruce felt that “There are a few teachers who are using technology in the school and doing a fantastic job with it.” But those who are doing it are most likely doing it on their own accord. Kelly shared, “We spent all this money on the
technology, but we didn’t spend enough money on the implementation of the technology.” While the technology is available, teachers are unsure how to use it properly and effectively in their classrooms due to a lack of or misguided trainings. When asked about any professional development that was offered that had impacted the use of technology, Diane shared that she had not recently had any and that “You’d have to go back ten years to find anything that really had an impact.” And Mary agreed, stating that “I don’t think any professional development is going to help me be better at using it.” So why is it that trainings have not met the teacher standard for technology integration? Perhaps, as Ben shared, “…there has been a pause, a dearth of relative training for technology because they want technology to be such an integral part of our instruction, but they are not giving us the proper training.” So, who needs to give the proper training, and what does proper training entail? These crucial components to technology support are explored below.

Participants had different views about what methods work best for them to encourage them to bring the technology back to their classroom. Aside from learning things on their own, as Peter mentioned his experience with the Google Suite, Ben felt that teachers need to “…get as much training as possible.” Sophie said the way that she gets training is by volunteering to learn things and become the trainer. She shared,

I purposefully stepped in to be a grade book advisor so I can know the ins and outs of grade book. I purposefully stepped in to be a Canvas classroom trainer for our school so that I would know how to use it, and I could get that training and show others how to use it.
Amy brought up a good point about being a trainer or instructor, though. She felt that they “need to be trained in best practice with that [technology] vs. just using it as a toy.” Sophie took a more active approach with professional development (PD) using technology as an example. She stated, “When I see it used in PD, then I am more willing to use it in my classroom, and I can take examples from there and use them.” Peter stressed that he wants the trainings to be useful because he does not “really see them as necessary” right now. He expressed,

I have always found it really hard to be in a session or a training where I am sitting with a device, and there is someone up with a screen up, and they are trying to guide me where to go. I hate that. And I don’t learn anything, or much and I just kind of check out and sometimes I start using the time to explore on my own.

Rather than an instructor formally guiding a class through technology, Amy shared, “I think I learn the most in the classes that required it.” So rather than formally introducing technology, if it is embedded within a class, Amy was able to have a more significant take away with it. But Jennifer felt the opposite and wanted it to be directly taught. She shared, “I love educational technology professional development where they just teach you how to use a tool.” Sophie wanted a mix of the above two approaches. She expressed,

The PD’s that I have gone to training for again the Canvas classroom training that I went to two summers ago was some of the best training that I have had because they gave us a practice classroom and said here is how it is now you do it. And
that’s the kind of training I like. Show me and then let me figure it out on my own how I want to use it.

Rather than focus on the instruction piece of technology professional development, Kelly viewed the process of how trainings are executed. She did not like the format that the school district offered trainings. She noted,

I would have to go to a class for a couple of hours every day to be able to learn what I wanted to do with it. And that’s not how professional development works. You know. You have like a couple hours a week for five weeks. Or you know how you do in the summer, it’s like eight hours a day for a week, and after-hour two, my brain is completely fried, and I have no idea what is going on.

Distributing too much information in a short amount of time appeared very stressful to Kelly as she shared her view. Amy did not think that face-to-face trainings were necessary, which may solve Kelly’s issue about the time constraint paired with information overload. Amy elaborated that using technology to teach technology may be effective. She shared, “…all of those platforms can be used very successfully, and I feel you can learn more through those platforms than by going to a face-to-face classroom if it’s done well. If it’s done poorly, then it doesn’t work.” However, Diane shared that regardless of instructor and delivery method, “…the biggest issue for us is there is just not time.”

Professional development opportunities come in many different forms. The participants cited classes or institutes, conferences, workshops, breakout sessions, and specific staff development personnel that lead sessions throughout the school year. Diane referenced a summer institute at a local University that she took many years ago that was
valuable, but also stated, “they don’t do these anymore.” Amy said that she “attended a technology institute, conference, then tried to bring technology back to the school.” Jennifer mentioned an “educational technology conference. It was right after school ended, and there were presentations and workshops, and it was so cool. It was amazing. It was like fantastic. By far, the best professional development I have had in this school district hands down.” Kelly thinks that the school district does a good job offering professional development opportunities. “The OCTO, I don’t know what OCTO stands for, but it’s something in Central Office, and they teach you how to use computers” (personal communication, Kelly, March 15, 2019). Bruce echoed the value of OCTO by stating, “…the entire point of the office was to implement technology across the school district and offer support for any kind of technological problems the teachers might be having.” OCTO, the Office of the Chief Technology Office, is a great resource that many teachers relied heavily on at one point, but as Bruce pointed out, “I think the office was either kind of downsized or even disbanded because of the top-level rearrangement or reorganization.” Sadly, OCTO does not have the same human resources that it once did, and the opportunities for professional development with teachers have suffered. Because of this, Kelly brought up, “I think it’s very incumbent on the teacher to find those [professional development courses] and take them when they have the opportunity to take them.” Peter felt that his school was doing a good job making up for that though and shared,

Our pre-service meeting had breakout sessions led by different teachers. We had one breakout session, which was for google classroom, and one for changes to google classroom. One was for people new to Canvas classroom, and one session
was for more advanced users of Canvas classroom who are ready to build on to that next step.

Although Ben felt that the professional development is falling short of the curricular direction, the school district is moving. He commented, “I would think that if they wanted everyone to be writing MISA (Maryland Integrated Science Assessment) flavor questions to get the students ready for the MISA, they would be getting everyone certified for MISA assessment training. They are not.” Professional development offered is frustrating because it is not directly tied to the expectations teachers’ are asked to meet with their students, such as passing a statewide assessment test required for graduation. However, trainings do provide value even if they are not necessarily precisely matched to curricular focus and just helping with software understanding and implementation. Peter shared, “when the trainings stopped, I think I kind of just reverted to using it as a place to post pictures, text, embed video, and I used the dragging and dropping. Just simple stuff.”

Having trainings does provide value, but some trainings are more valuable than others, and this seems directly tied to the participant interviewed. Bruce brought up a good point about how value can be perceived differently based on how people push technology. He shared, “But from admin, from Central Office, and from our development people, I’ve received very little solid encouragement to use technology. Very little vision or clear instruction on how they want to see technology used in the classroom.” The lack of clarity is disappointing and can be directly linked to teachers’ desire to attend trainings and implement technology in the classroom.
Technology support for teachers.

Participants shared that technology was supported by school personnel such as the Media Center Specialists or the IT Specialist at the school or the school district level, software platform help personnel, and other teachers. Some participants believed that they did not have any support or need any help with technology integration.

Jennifer brought up the valuable use of the Media Center Specialist. This position is being cut out of some school systems (Sparks & Harwin, 2018), but it was refreshing to hear that they are still playing a valuable role in helping students learn the software. Kelly, Diane, Amy, and Ben all mentioned their internal IT Specialist. But as Diane said in her interview, not every IT Specialist is as valuable as the last. It is personnel dependent. Amy boasted, “When something is not working right, the IT Specialist addresses it. So, I think the school district hears us with that, I think.” Amy’s uncertainty was best articulated by Ben, who stated, “I have had challenges with the technology people and their savviness to handle problems.” These wavering feelings can pose a hiring dilemma and cause teachers to become stuck in a mindset of old ineffective ways when new personnel that are more capable are hired.

Other forms of help come in the form of the software itself. Mary mentioned that “I communicated with ActivInspire that I was always having a problem there.” Jennifer also concurred that going straight to the source of the software application resulted in quality assistance with any issues that arose using different educational technology applications.

Bruce, Peter, Amy, Kelly, and Sophie all felt that teachers around them or themselves were able to help other teachers with technology integration issues. Bruce
made a blanket statement, “Most of the help I get is from other teachers.” Peter stated, “I tend to find someone that I like interacting with that can show me how to do things.” And Amy mentioned, “…one or two people in the building with certain pieces of technology that can help you further with it.” Kelly pinpointed a specific subgroup of teachers by sharing, “So a lot of new teachers, just because they are younger and they use it all the time. I rely on them a lot.” These four participants all rely on other teachers and have their idea of what type of other teachers are worth asking for their help. Sophie specifically set herself up to be that teacher that others seek for help. Sophie commented,

I will do a training for new teachers during in-service week then usually right after school on back to school night when they now actually maybe realize they don’t know what they are doing with grade book, but now they are like oh I actually have grades to put in let’s actually do this.

She put herself in that position by becoming a leader and volunteering to do trainings and follow-ups when the teachers had time to apply the training.

Jennifer and Mary felt that they did not require any internal help, though. Jennifer did not think that she needed it, but also mentioned that she never really asked for it either. Jennifer shared her feelings by stating, “I can’t ask anyone in the school because no one has used it yet, and they don’t know how to help me.” This was not a negative thing for her, though, because she shared, “I really love educational technology, and I love learning about new things.” Mary was a bit more pessimistic when she shared why she does not require help. “They help me a little bit here and there with stuff, but mostly I have to figure it out myself. The IT person and I probably know an equal amount. So I usually don’t seek help” (personal communication, Mary, March 16, 2019). These
statements emphasize that the IT Specialist has a different value depending on the specific person that holds that position at each school.

**Teaching with Technology**

Technology had both setbacks and advantages in the classroom, as reported by the teacher participants. Setbacks included the constant transition of technology and curriculum being difficult to keep up with. Student capabilities with technology were creating misconceptions. Teachers often believed students knew how to do things, causing disconnect between what students can actually do and what teachers believe they already know how to do. Because of these frustrations, teachers’ mindsets about technology are not always positive. Neutral feelings echoed that technology was simply just another tool. Negative feelings had a variety of emotions attached to them. Negative feelings encompassed the notion that technology is seen as a fix-all, as a substitute for real teaching, that technology itself is buggy or unable to be used correctly, and finally that technology is actually minimizing students’ ability to think critically. The advantages that technology presented to teachers included a reduction in paper, organization, or Universal Design for Learning (UDL). There were also positive feelings focused on how technology enhanced their practice in general and how it allowed for students to show quality work and minimized teacher subjectivity.

**Setbacks in the teaching practice.**

Participants had a lot to share about how they feel educational technology in the current school district is playing out. Amy shared that, “And yet every year we see things turnover and turnover and turnover. It’s really hard to keep up with at this point. There is so much out there.” Diane and Bruce shared the most on the topic. They both felt great
disappointment in how technology is being used in the current school system. Diane shared, “There is a lot more of it. It is certainly more accessible. It is generally used more, but I don’t see the use as deep as when we first started using tech. I don’t see many creative uses.” Bruce echoed Diane’s statement, “There is change coming, but I tend to ignore, avoid thinking about it very much…There is an interest in integration, but there is not a coherent policy on integration in technology.” Diane, Bruce, Peter, Ben, Amy, Sophie, and Kelly all had strong feelings about where the school district has taken them so far and where it is headed using technology. The confusion and misdirection leached from their interviews. Diane noted, “…the specific pieces of technology where you interact with the kids is not there, and a lot of the maintenance and updating is not there.” Bruce continued Diane’s thoughts in his interview by stating that,

…the technology seems to be changing so fast that it is hard to keep up. You know you adopt something, and it’s the hot new thing, and then a couple years later, something else has taken its place, so I tend to not be an early adopter. I wait to see what the consensus is around a new piece of technology.

Peter furthered these thoughts by expressing how “you kind of had to do whatever the school district was doing. You had to get a Promethean board. You had to get Chromebooks.” And Kelly agreed with the ideas that you were forced into whatever the school district wanted. But she emphasized that she will stand her ground by sharing, “I am not going to learn something that’s going to change every two years.” However, Peter felt differently and shared how the school district really has opened up and is allowing for more teacher choice in technology since he will be using IPads this year instead of Chromebooks.
The impact of the various technology transitions above had different effects on the participants interviewed. The curriculum has taken quite the turn that has helped drive the push for technology in the classroom. “…suddenly everybody wanted to NGSS their courses, and it has not gone smoothly,” Kelly shared. NGSS is the Next Generation Science Standards that include a proponent about the inclusion of technology in the classroom. This “pendulum swingy” (personal communication, Kelly, March 15, 2019) curriculum is really undermining the work of creative teachers and destroying great things that were already in place, according to Diane. “The school district is also making an effort to centralize data collection,” Bruce stated. While technology has the capability to be impactful, Kelly brought up a good point that “it’s more of a management issue of how you are going to use the technology.”

Having constant access to technology for students is also blinding teachers to student capabilities. Sophie asserted that “The other thing that I am concerned about is that we don’t offer basic classes for students anymore. So basic silly little things like all the parts of Microsoft Word, or even Google Docs or Google Sheets. Kids aren’t getting those basic skills anymore. And we now just assume that students know how to do this and that and they really don’t. So basic formatting and things like that are presenting a big challenge.” The impact that technology can have is a double-edged sword from most teacher’s perspective. While Sophie has great concerns about student’s basic capabilities with technology, Mary wants the kids to take over and “not just sit there and listen.”

Technology has the ability to make this happen, but the students need to have the foundational skills to make this leap. The ebb and flow of technology in a students’ life from the perspective of a teacher-led Jennifer to believe that “…seeing the social media
networks the students are using are constantly fluctuating, and so I have seen changes in
technology not being a hardware perspective, but an app perspective.” These changes in
apps make it difficult to keep up with technology. Amy noted that “I imagine that
textbooks aren’t as common anymore now that we have more online resources.” With all
of these resources, teachers are seeing a dynamic shift in the work that students can
produce. “Technology has allowed my students to do the coolest things ever. I’m so
proud of them.” Jennifer boasted in her interview. Bruce also commented that “I am
really looking forward to a lot of the great things that technology has already brought us
and promises to bring us.” Overall, technology has mixed reviews about the impact not
being so great in some aspects, but really bringing out the best in the students’ quality of
work in other instances.

In addition to the turnover in technology and students’ lack of preparedness to
capitalize on the technology, teacher participants’ also shared their mindsets on
technology. The neutral or objective opinions about technology circled on the idea that
technology is just present and is a part of the evolution of education, neither good nor
bad. Bruce felt that “They [the school district] talk about technology in the classroom, but
as a teacher, I don’t feel that directly impacted by it.” Peter shared, “So we are competent
with using it, but it is not like a part of who we are.” While technology is available and
suggested, it is not overcoming these teachers in their practice. Diane shared that, “But in
terms of really using it, it’s really used more as just a tool.” This tool, technology, “…can
be used well,” according to Amy. Amy also believed that “…some teachers can be very
effective without using it, but I think that you can miss out on a lot of opportunities to
extend learning beyond the school day by ignoring it.” So while technology is available
and enhances learning, it is not necessary for students to learn in general. Peter did not perceive technology as good or bad. “It’s just, it’s just a tool for helping teachers and students educate and learn.” Peter, like many other participants, does not “believe in technology the sake of technology.” This cycles back to the concept of pushing technology just for the sake of its availability. In order for technology to be used effectively, it must be intentional and planned. Peter continued, “sometimes I perceive that people buy new technology just because they think technology is good, and it will automatically help you learn when it really needs to be used well.” Having these viewpoints on technology, just being an available tool, helps unlock the positive and negative perspectives from varying uses that technology brings to education.

Peter, Amy, and Mary were the only participants that did not have anything negative to say about technology integration. The rest of the participants shared a plethora of feelings that varied from the basic viewpoints of technology to the details about why technology is frustrating. Jennifer shared that, “I think that sometimes education technology is seen as a fix or a cure-all. And I think that is just a common misconception.” Bruce feels that “…the basic functionality is often more frustrating than it is useful.” While technology has it’s positives as mentioned above, there are drawbacks that are creating negative feelings among teachers. Bruce continued to add that he is “more annoyed with it more often than impressed” and “there is lots of times where technology is buggy.” These issues often arise and interrupt quality learning experiences for students. It is essential to remember as educators that, “They [the students] can be completely interactive and you don’t need technology at all,” as Kelly pointed out. Sophie harped on what technology is taking away from students. She claimed that,
Sometimes it’s awesome, but I also perceive that our students are lacking some basic skills. Most of them have no idea how to use a textbook. Most of them, if they can’t google an answer, have no skills on how to reason through the answer. Most of my AP students cannot look at the notes I have given them with a clear example where I say this is just like question 62 in your homework and cannot look back at that example and answer question 62 because they can’t reason through the process.

Recognizing that using technology, teachers may be taking away other critical thinking skills is not how technology was meant to be used. It is not a substitute for the student’s critical thinking skills. Diane feels that it is taking away from creativity in learning. “There just isn’t much happening that is really exciting,” she shared. Kelly likes “the opportunities you get with technology,” but she does long for more time to plan lessons to properly utilize technology “instead of kind of using it as ugh oh we are doing a research project, get the Chromebooks out,” which seems like a haphazard way of using technology in education. Diane shared that she needs more time to fix issues. She referenced a Webquest that used flash, a software platform, which is no longer supported by Chromebooks. She expressed,

…we are told that Chrome is not using flash anymore. Well, that’s not fair to us. And if those are the things that are going to happen, then we should have time to sit down and get those things ready sometime other than five minutes before class or with no notice.

Ben, Kelly, Bruce, and Jennifer all pointed out the flaws in other types of physical products endorsed by the school district with good intentions but lousy delivery. Ben and
Kelly harped on the smartboards. Ben stated, “[The school district] at some point decided to go through a different vendor for the projectors. The new projectors sometimes have issues interfacing with the board.” While Kelly and Bruce both shared their angst with the placement of the boards themselves. Kelly expressed,

The smartboards are great, but they weren’t paying enough attention to what the teachers wanted from the smartboards or what you wanted to do with the smartboards. So it sounds stupid, but it’s a major problem that they put all the smartboards in the middle of the whiteboard. So now we have no options whatsoever to have the kids use the whiteboard. You have to use the technology in order for them to draw something? It just didn’t make any sense.

Bruce agreed, “We have the Promethean boards, the smartboards in our classrooms. They are bolted to the front and center. They take up a quarter of the whiteboard that’s in the front of my entire classroom. Just bisecting the entire whiteboard at the front of the classroom. Which is fine, but I honestly use my Promethean board as a whiteboard.” So while the technology is available, it was not thought out well to best aid the teachers and the students alike in learning. However, just because things are not entirely thought out and interfere with other things does not mean they were not worth it. Jennifer expressed, “I strongly believe it is worth the document camera not working and the internet sometimes going down. And it’s frustrating in those moments when I’ve built those lessons to rely on technology every single day.” Diane feels the opposite of Jennifer, though, and does not believe that those things should happen anymore. Ben feels that the school district is going in the wrong direction with the push for technology to gather data
to be analyzed and used in the classroom. When asked how he felt about educational
technology, Ben shared,

I don’t like it…it is big data collection. [The school district] wants to gather a data
point for every question that is possibly asked in every classroom by every
student…and try to glean some piece of information that is going to improve your
teaching or help that student…but it’s not going to help describe the big
picture…because I think teaching is sort of like meteorology in a way. It’s a blend
of art and science. There are processes going on that are too complex, and the data
won’t help at all.

What Ben was getting at is that educational technology is not a one size fits all magical
solution. There are an ebb and flow to quality teaching that cannot and should not be
quantified through technology even though he is perceiving the pressure of that system
coming to fruition around him.

Another point of contention brought up by Kelly was a management issue. Kelly
commented, “It’s harder to manage student behavior with the several different ways they
can access things that they shouldn’t be accessing. So it’s a lot more management than
you think should be necessary.” Classroom management is already difficult enough, now
add in other distracting factors, and it is setting up new teachers for failure. The final way
that technology is being used, or instead avoided, is to eliminate student distractions.

Peter, Kelly, Ben, and Jennifer recalled their experiences with students using cell phones
are detrimental to their education. Peter is “very skeptical about having students use or
have access to their phones in the classroom because it is much more of a distraction than
it is a benefit.” And Kelly summed up his notion by stating,
I would say that they need to be prepared about how they plan to use it [technology] in the classroom. How they want students to use it in the classroom. And how they are going to manage because everyone has issues with kids using cell phones they are not supposed to.

Ben proclaimed that “It is impossible to, without becoming a military state, to get students to put their cell phones away.” And Jennifer added to Ben’s statement by stating, “I really strongly try to stay away from cell phones or personal devices in the classroom because the temptation to veer off course is too strong.” Bruce and Diane had a more holistic view of the cell phone epidemic. Bruce felt that while cell phones were a major distraction, “there are a lot of opportunities to use cell phones in teaching…cell phones are incredibly useful during labs. Slow-motion videos of labs, keeping time, doing calculations, videos of experiments of labs—yea, I encourage that.” And Diane felt that, “We are trying to keep the kids off their phones rather than letting them on there when they are walking around with these very powerful computers that sometimes give them better access than their Chromebooks.” The cell phone epidemic is a real technology usage debacle that many teachers struggle within their classrooms. While technology is opening up more opportunities for students, it is also creating distractions that take away from their learning at the same time. Cell phone management is presenting a constant challenge for teachers.

**Advancements in the teaching practice.**

Technology in the classroom setting is primarily used for one of three reasons: reduction in paper, organization, or UDL. Peter and Ben both mentioned the ease of use going electronic and not having to worry about getting copies made of papers for
students. Peter stated, “But we try to use Chromebooks as much as possible to avoid using paper.” And Ben agreed that “[We convert everything to] Google Docs so we can use Google Classroom to interact with students.” Jennifer also utilizes google classroom. She stated, “I think it’s the most user-friendly way to collect stuff from students.” Peter even uses the Google Suite to communicate with colleagues during leadership meetings and department meetings as well. Reducing paper helps to archive information in an easy to reach way for both students and teachers that may not be as organized or be inundated with papers and not have the organizational skills to keep documents accessible. Jennifer also agreed that organization is a key reason for technology usage from both the teacher and student perspective,

I use Google Drive extremely heavily, and the whole Google Suite of stuff to manage my entire life as a teacher. And everything is always on Google Drive, and I live exclusively on Google Drive because we, I am not moving between classrooms this year, but I have moved between classrooms during the day, during periods for all of my other years of teaching and the flexibility that Google Drive gives me with being able to pull up all of my files on every computer wherever I am is critical…When they [students] are using the technology they are keeping their technology organized for themselves, and if they are using the servers that connect to all the computers here they are carefully organizing all their materials in folders and if they are using Google Drive they are doing the same thing because sometimes with technology we can get a little sloppy with how we are using it and it’s really important to remember that the way you use technology
needs to be in the same organized fashion as we organize physical grade books and physical files.

The reliance on Google Suite for organization from grade book to lesson plans as a teacher and working/living documents for students is a critical component of why technology is used in the educational setting. Students can be more successful if they can have access to the materials and not rely on keeping hard copies themselves.

Additionally, technology allows for the achievement of more students through a UDL approach. Students can complete assignments in a variety of ways, thanks to technology. Amy noted that “The kids can have access to more material for cheaper and the school systems can as well” with the use of various forms of technology. Both Peter and Mary brought up their specific UDL approaches to help every student succeed. Peter stated,

We are going to buy iPad’s for our ESOL students, science students, so that each student has an iPad. It will help with things like reading the text at whatever pace they need and highlighting the words as they are reading, and they click on a word and look it up. They can do a lot of drawing; the apple pencils are really fun with drawing.

And Mary added in how she uses UDL with the students,

I am having them [my students] show me the Webquest or building their own background of the knowledge, so they are having a viewpoint of ‘oh this is what you said’…Usually, what I do from there is I have them apply it by writing an essay or something to get them to compile all the information they have just done and put it into a paragraph or whatever.
Both of these uses of UDL provide glimpses into why technology is also used in the classroom. It is every teacher’s goal to help every student learn, and technology is offering another way to help accomplish that.

From a positive perspective, Amy, Ben, Mary, Jennifer, and Sophie shared how technology has enhanced their practice. Amy views technology as “an extension of ourselves” that Ben feels “it’s awesome if it is used in the right way.” So what is the right way to use technology? While technology can solve a lot of problems, according to Ben, “teaching is special and perhaps even unique in that it is an interpersonal trade.”

Jennifer’s interpersonal trade led her to believe that,

I think about it [technology as a tool to help students do something better or easier or faster, and when I am thinking about using a word processor, I know that students typically write better and longer passages when they are given a word processor instead of a blank piece of paper. They have better editing skills, and as their teacher, it is easier for me to read their writing because I am not trying to decipher their handwriting and just looking at the quality of their typed text. Being able to separate the students’ quality of work by eliminating the interpretation of handwriting can help accelerate a student’s voice and is a very positive impact that technology has on education. Jennifer noticed that her students “self-empowerment has skyrocketed because they can be responsible for so much more now…I feel like when students are allowed to use technology to do their projects, the quality of their work is so much better than if they are doing it by hand.” Mary thinks that technology “is a necessity in the classroom.” The point of school is to help students in their future. The world we are surrounded by is immersed in technology in every capacity, and Mary
believes that “…you can’t in today’s 21st-century world, you can’t expect kids to learn just from you. It has to be from all sources that they have available,” technology included. While Amy, Ben, Mary, and Jennifer all shed a positive light on technology in education, Sophie had a mixed opinion. She thinks “technology is awesome,” but at the same time, she shared, “I think it is robbing some of the skills our students might need to be successful.” What are those skills exactly? Sophie expressed that the basic skills needed to use technology with students are being skipped over since they are assumed that students already have them. Just because students are immersed in technology and asked to complete specific tasks does not mean that they have the foundational knowledge to complete the tasks. Technology certainly has positive benefits, but most participants dwelled on their negative aspects of technology being pushed in the classroom.

**Chapter Summary**

The preceding chapter addressed three major themes throughout the participants’ interviews. All of the themes were organized in a way that reflected the literature review and a holistic view of research questions used in the study. Data collected from the teacher interviews revealed the research subjects’ experiences with their usage of technology, how and why technology is initiated and maintained, and what is happening when they integrate technology into their pedagogical practices in the classroom. Direct quotations were used throughout the chapter to allow the researcher to tell the lived experiences of the participants in the most direct way possible, as is such in a qualitative research study.
The first theme, teachers’ technology usage, was further subdivided into two subthemes: types of technology used and reasons for using technology. Technology types revealed that participants felt the move from computer labs to Chromebooks was ubiquitous. The main educational component that opened up with the transition to Chromebooks was the use of online classroom spaces. Participants used a variety of different software platforms and have varying viewpoints on what was mandatory or just encouraged by the school district based on the high school that they represented. The two main frontrunners for online classroom space was Google Classroom and Canvas. This major transition revealed that teachers are more connected to their classrooms outside of the school hours and physical building than they were before. The type of technology used by teachers was reported to be based on the ease of use, access/availability, student need, and external pressures.

The second theme, initiating and maintaining technology implementation, delved into viewpoints that the teachers cared most about to influence their technology usage in the school setting, the ways that technology can be learned that optimize learning technology, the necessary support teachers need to continue to implement technology. Teachers shared from the perspective of what they would tell new teachers, what administrators should be doing, or what students need to be able to do. Participants shared that they would not make technology integration a big deal to any new teachers because they would assume new teachers already have basic use of technology, and there is so much else going on it is not necessary for the first years to harp on technology integration. From an administrative opinion, if the technology is going to be promoted, then it needs to be supported. As far as students are concerned, students need to
understand that technology is not just their cell phone and move beyond the basic skills into more 21st-century technology skills. Professional development methods that worked best for participants were learning things on their own, putting themselves into a leadership position to force them to learn, taking classes that require it, but it is not the main focus, and virtual trainings rather than face-to-face. The opportunities available for professional development included classes or institutes, conferences, workshops, breakout sessions, and staff development led sessions embedded throughout the school year. Several participants mentioned a specific Central Office unit called OCTO, Office of the Chief Technology Office, which was very beneficial for learning technology. Sadly, participants’ also said that OCTO was downsized and no longer could help in the same capacity that once had. Teachers receive help from school personnel such as the Media Center Specialist or IT Specialist, specific help personnel for individual software companies they use, and other teachers in their buildings. Although some participants believed they were unable to be helped by anyone.

The third theme, teaching with technology, explained the setbacks associated with technology and the advancements technology was bringing to the teaching profession. Overall, technology transitions in education are affecting both students and teachers alike in how they deliver and produce products in the educational setting. A drawback echoed by the participants was the lack of time provided for them to figure out and use the technology in their classrooms before it changed or became disrupted due to upgraded systems or incompatible software. Most teachers’ feelings toward technology were mixed. Some participants shared they were highly overwhelmed by all the rapid changes, and others welcomed the improvements. Some participants felt they were forced into
using certain technology while others thought they had the option between platforms. The impacts that technology had on the participants was shifting the curriculum and perhaps not in the best way. Teachers noted that technology is taking away from the creative pedagogy and holistic viewpoints of the students since it is so forced. Additionally, while one would think that technology would enable students to do more, many participants felt that students lacked the basic skills that technology required in order for them to push their learning to the next level. Some teachers considered technology just to be another tool and were not impressed by it. Negative feelings about technology as a whole were also expressed in the forms of glitches in technology and the frustrations that come from it. The mindset of participants can be a major setback for teacher experiences with technology implementation. The advancements that technology has to offer must override the setbacks for teachers to want to incorporate it into their profession. Advancements in the teaching practice were rooted in three main ideas, as revealed during the interview process: reduction in paper, organization, or UDL. Reducing paper was linked to organization since it allowed teachers and students to archive information in an easy to reach way for both students and teachers. UDL enables students to produce more meaningful work and removes a level of subjectivity for the teacher when assessing student learning. Several interviewees had positive feelings about technology integration and collectively shared that if integrated correctly, technology can be highly effective in teaching.

The researcher believed this study was significant because it allowed the participants, teachers, to have a voice to express their experiences and understandings with technology initiatives in their secondary school setting and together with the school
district system. Teachers expressed how technology is transitioning in education, their usage of technology, their perceptions and feelings about technology integration, and the support they are receiving when learning and implementing technology in the classroom. This study aims to explore the experiences of teachers using technology within their profession and allow them to express the impact their experiences have on their profession. It is valuable to gain the teacher’s perspective since it dictates what happens behind closed doors in the classroom. This study can guide prospective technology initiatives and implementation on a broader scale and promote technology strategically with the knowledge and insight gained from the teacher participants.
Chapter Five: Discussion of Findings and Implications for Practice

Introduction

The study explored the experiences of nine teachers using technology within their profession and allowed them to express the impact their experiences had on their profession in the secondary education setting within a single school district representing seven different high schools. Teachers' experiences with technology initiatives and understanding at the high school level were investigated. Specifically, transitions in technology, technology usage, technology perceptions, and technology support were the points of focus throughout the study. The researcher hoped to give a voice to the teachers to truly understand their experiences and understandings of technology in the classroom setting.

This qualitative study used a semi-scheduled interview process for one-on-one in-depth participant-led, and researcher guided interviews. The participants in the study included nine secondary science teachers that represented seven different high schools all within the same school district. A central research question was used to guide the interview process. The data were coded, organized, and analyzed several times. Several themes emerged within each category representative of the sub-questions: Transitions in Technology, Technology Usage, Technology Perceptions, and Technology Support. These themes were previously presented in this thesis.

The most critical findings of this study are broken down into three themes. For the first theme, teachers’ technology usage, there were two key findings:

1. Teachers are using varying forms of technology
2. Teachers are using technology for different reasons
For the second theme, initiating and maintaining technology implementation, there were three findings:

1. Teachers view technology through others’ perspectives
2. There are best practices for implementing professional development, from the form of professional development and the design for implementing.
3. Teachers receive support from various sources.

For the third theme, teaching with technology, there were two critical findings:

1. Setbacks occur in the practice of teaching with technology
2. Advances occur in the practice of teaching with technology

All of these findings above were presented in the previous chapter as a comprehensive narrative that showed the lived experiences of the participants. The purpose of this chapter is to provide interpretive insights into the findings.

**Interpretation of Findings**

Key findings emerged throughout each theme. The highlights include that teachers cannot be pigeon-holed into a one size fits all model with technology usage, learning and receiving support for technology, and how technology affects their practice. It is a very individual art and teachers’ may share some opinions, but not all on how to best initiate and support technology in their profession.

**Teachers’ technology usage.**

For the first theme, teachers’ technology usage, participants revealed that classes are heading toward a 1:1 student to technology ratio, and they are using different modes of technology to capitalize on this change. The most popular resources mentioned were online learning platforms, computer simulations, Promethean boards, and document
cameras. Having multiple modes of technology being used is essential because the more teachers use technology, the better their attitudes become toward it (Bai & Ertmer, 2008). With a better attitude and more willingness to use technology, teachers can have more mastery experiences with it. An indirect factor influencing technology usage is self-efficacy (Sadaf et al., 2016). According to Self-Efficacy Theory, mastery experiences bring feelings of success and promote social modeling and social persuasion for others. This was evidenced by the artifacts chosen by the participants. Most participants shared or even brought a Chromebook, which is a surface level piece of technology that is an obvious choice. This shows how technology is just catching on in the district and teachers are still not sure what is going to stick. One teacher interpreted technology being her calculators and the software and functions that it can perform now. This was a creative use of sharing technology since it took a somewhat older piece of technology and made it useful in the 21st century again. One participant brought a sample of student work in the form of a google doc that he had evaluated. This was an important artifact because it pinpointed what he felt a best feature of the Chromebook was. And finally, one participant showcased her own website. This is an advanced use of technology and represented the technological proficiency of the participant. By collecting artifacts, it became apparent that teachers’ views of technology encompassed a wide range from basic to enhanced uses. While not all teachers are using the same technology, they are mainly using two platforms that are supported by the school district: Canvas and Google Classroom. Reasons for technology use were also explored. The technology was used based on four factors: ease of use, access/availability, student need, and pressure. Similar findings were discovered in a study by Sadaf et al. (2016), where both perceived ease of
use and usefulness were found to have the biggest impact on attitudes toward technology. However, contrary to this study’s findings, according to teachers in a study by Ertmer et al. (2007) intrinsic factors influence teachers’ use of technology more than extrinsic factors even though both still play a role in technology integration. Intrinsic factors include confidence and commitment, whereas extrinsic factors include resources and time. This study supported the ideas of a study by Sadaf et al. (2016), where a participant in their study noted, “Just availability in school is a big factor…there is difficulty in hardware and software installed in classes, so being able to access the material from the web makes it very easy. You really don’t have to do anything” (p. 52). Two driving factors that discourage teacher use of technology, according to Sadaf et al. (2016) are limited access to technology and unsupportive mentor teachers.

**Initiating and maintaining technology implementation.**

The second theme, initiating and maintaining technology implementation, considered the viewpoints the teachers took, the ways of learning technology that teachers experienced, and the support they received throughout the technology integration process.

Participants shared three different viewpoints they approached initiating technology: new teachers, administrators, and students. The participants shared that they would tell new teachers technology is not essential, which was surprising to the researcher since technology is pushed so heavily. Although, participants shared that new teachers typically already have a grasp on simple concepts in technology and nothing extraordinary is being done with technology in education that they would need to learn to be a successful teacher. Hamdan Al-Rabaani’s study (2008) echoed the participant’s
interviews, that, before technology integration expectations are set, teacher skills need to be better developed. Participants shared that they wished that administrators would be more purposeful and direct in the technology that they wanted teachers to utilize. It seems that people in positions of power lack specific direction that teachers crave. Teachers are getting mixed signals about what is important and must be done vs. what is optional, and it is confusing them. The participants demonstrated this confusion when some felt that Canvas was mandatory while others thought they had a choice for any online learning platform, and some thought that it was either Canvas or Google Classroom. Participants also felt it was important for students to have authentic experiences while using technology for educational purposes. While technology can be great, it needs to give the students options for learning to reach the most learners like mentioned in the technology usage theme above.

The best ways for teachers to learn technology through professional development about technology integration were shared by the participants. Similar to Cabrero and Barroso’s 2016 study, no teachers brought up content based training in technology as necessary. They all felt that technology trainings should focus strictly on technology. Teacher participants shared that the best way to learn during these opportunities was to be the teacher implementing the technology for other teachers. Without a leadership role, other teacher participants shared that technology professional development needed to be purposeful and intentional to the teachers that need to learn it, technology needed to be a requirement for the professional development, but not the focus of the class, and they needed to be given proper time to explore and practice with the technology while a support person is present. Professional development in general also had to be gradually
implemented throughout a more extended period to allow participants to digest and practice what they had learned before acquiring too much information at once and becoming overwhelmed. The way that professional development is executed regarding technology also needed to focus on student-centered approaches to better allow teachers to fully engage their students in the curriculum through the use of technology (Palak & Walls, 2009) since so many teacher participants shared that students were the centerfold to their pedagogical decisions. Professional development opportunities can include classes or institutes, conferences, workshops, breakout sessions, and staff development that is led throughout the school year. In a study by Ertmer et al. (2007), they reported 76% of teachers specified their preferred professional development approaches as workshops, seminars, and conferences for technology integration.

Additionally, in this study, younger teachers were more apt to adopt and use technology than older teachers, supported by Diane’s interview. Although Diane was the most experienced teacher with the greatest number of service years, she was opposed to new technology, and this contradicted Broady et al.’s (2010) results that concluded attitudes and experiences of young and old adults using technology, namely computers, was equal in findings. Diane did fit Hargreaves’ (2005) conclusion that teachers late in their career often question reform, question their teaching arrangement, and even go as far as to question everything in their work environment becoming disenchanted in the dynamic profession. As well, Diane seemed less apt to adopt new technology which could be correlated to Syvânen et al.’s study results that concluded the more removed teachers are from the university setting, the less likely they are to adopt new teaching methods, like technology-integrated teaching (2016).
As far as support for professional development, participants’ suggested that it was lacking and they were unable to properly implement the level and depth of technology they felt they were being asked to integrate into their classrooms. The support given was reported to come from either the Media Center Specialist, IT Specialist, software platform support, or other teachers. Although participants reported that despite the help, technology was still buggy and not always reliable, unreliable technology could result in stress which can be derived from the lack of technical support needed at the time of user or technological errors (Chen, 2008).

**Teaching with technology.**

Participants claimed that it was challenging to keep up with changing curriculum and changing technology. This feeling of difficulty is not a new sentiment toward change for teachers or merely all people. According to a study by Tarafdar, Tu, and Ragu-Nathan (2007), “Employees hardly get accustomed to one kind of application before they are forced to learn another” (p. 308). The participants of this study agreed with the results of the aforementioned study. This leads the researcher to believe that change may be difficult and change can be viewed as a stressful experience. Another finding was the students’ lack of basic skills. While students can produce better products for assignments, they lack basic skills in computer technology such as typing and creating spreadsheets. A lack of basic skills is alarming since students need basic technology skills to be successful in their future outside the classroom. Some participants shared they felt neutral, like technology is just a tool, or they harbored negative feelings. Negative feelings surmised the ideology that technology hurt education, like the literature review revealed, since it can be viewed as a fix-all, a substitute for real teaching that is
eliminating critical thinking in students. The technology was also negatively viewed since it can be buggy with technological glitches that cause stress and frustration.

These methods of technology being used were mainly to reduce paper, help teachers and students be organized, or give students a choice, UDL approach, to help them all be successful in producing assignments. As Bai and Ertmer (2008) suggest, teacher educators have a duty to uphold to assist students’ understanding and learning processes by recognizing each learner as unique and being able to set them up for success in their way. Teachers can help students inadvertently by maintaining an online classroom since the student no longer needs to make sure they write everything down or keep track of things since the teacher is already helping the student be more organized through the online classroom. This form of transparency helps students be more successful in the classroom. However, as indicated in the literature review, this transparency comes at a cost to teachers; it requires more of their time. Although, this time can be argued as well spent since extra effort is critical to helping our special education students or students that need additional organization to be successful in the content. Students can be more effective because teachers have set up these resources for them to use. According to Ertmer et al. (2007), the most influential technology integration factors are drive and personal belief. Participants felt positive and confident that technology was enhancing their practice by allowing students to produce a higher quality of work that eliminates teacher guessing and prepares them for the 21st century future beyond high school that centers on technology. Just like many studies before this one, the more positive the outlook the participants had for technology in education, the more likely they were to use it (Sadaf et al., 2016; Sadaf et al., 2012; Yuen & Ma, 2008).
Acknowledging teacher’s feelings and beliefs about technology will help to understand their usage of technology.

**Support of Theoretical Framework**

Each of the three themes, teachers’ technology usage, initiating and maintaining technology implementation, and teaching with technology, revealed something unique from the lens of Self-Efficacy Theory. Self-Efficacy Theory is the social learning theory that is tied to an emotional feedback loop. This loop cycles through how people believe their performance and motivation are influenced, which affects their behavior, thus driving a result. That outcome then influences their motivation and the next performance, continuing the cycle.

Self-Efficacy Theory supported the cyclical idea that performance and motivation are influenced by the prior outcome leading to a change in behavior and driving a new outcome. This cyclical pattern is demonstrated through the ideas that classes are moving to 1:1 student to technology, the change in behavior is how curriculums are now integrating technology, the outcome is the difficulty to keep up with the changes, and the revelation that students lack basic technology skills.

Self-Efficacy Theory was also reflected through the promoters of Social Modeling and Social Persuasion. While teachers use multiple forms of technology for the core reasons of paper reduction, organization, and student choice in the delivery of products, their usage of technology is influenced by others that use the technology, social modeling, and how others recommend that technology, social persuasion. Teachers believed that usage of technology was impacted most by the ease of use, access/availability, student need, and pressure. This mirrors Self-Efficacy Theory since
“Evidence indicates that teachers’ beliefs in their instructional efficacy partly determine how they structure academic activities in their classrooms” (Bandura, 1997, p. 240). Therefore, the more comfortable teachers feel about technology, the more likely they are to use it. For teachers to be introduced and accelerate their level of comfort with this technology, the technology had to be modeled in some way, either from other teachers, support personnel, or tutorials from a software application. It can also be concluded that pressure is directly linked to the Self-Efficacy Theory concept of social persuasion.

Physiological feedback was a prevalent factor in supporting the critical findings that explain how technology depended on the viewpoint that the participant resonated with. Physiological feedback refers to emotions, mood, and physical states that affect our interpretation of self-efficacy. Teachers interviewed reported how they view technology and how they feel about technology was directly influenced by their perceptions of understanding technology initiatives. The alignment of responses from positive to neutral to negative reflects Self-Efficacy Theory in that “different people with similar skills, or the same person under different circumstances, may perform poorly, adequately, or extraordinarily, depending on the fluctuations in their beliefs” (Bandura, 1997, p. 37). Because of these feelings, the theoretical framework supported the analysis in a way that influenced how the participants measured their self-efficacy with integrating technology.

All of the Self-Efficacy Theory promoters were present in supporting the ideas of how technology is supported and who supports it. First, mastery experiences were the goal of the support that teachers received with technology through personnel or trainings. Some teachers reported they wanted to be the trainers. According to Bandura (1997), “a personality disposition of perceived control spawns efficacy beliefs” (p. 41). From these
support personnel and trainings, there was ample social modeling and social persuasion present. Social modeling was evidenced through the support personnel being available to assist the teachers and teachers in reporting positive feelings about these support personnel. Social persuasion was present in the form of trainings that were perceived as positive and worthwhile experiences. And, physiological feedback supported the analysis since teachers gave feedback about what best practices look like in the professional development setting. Their emotions, mood, and physical states about technology integration impacted their interpretation of how professional development can be implemented to best support technology initiatives.

In conclusion, the four pillars of Self-Efficacy were prevalent throughout the themes. Mastery experiences, social modeling, social persuasion, and physiological feedback all played a critical role in how the participant shared their experience. Their biases were portrayed from their cognitive, motivational, emotional, and decisional characteristics that came forth from the interview process as interpreted by the researcher. “Efficacy beliefs affect performance both directly and by influencing intentions” (Bandura, 1997, p. 43). In this case, the teacher’s self-efficacy with technology contributed to the lens that they understood technology initiatives.

**Implications for Practice**

As a result of this research study, the researcher has gained directional insight from the participants’ experiences of technology initiatives and understandings of technology transitions, technology usage, technology perceptions, and technology support within the school district. Personally, the researcher believes that giving a voice to the teachers will help to promote technology within education the right way. Some
steps are missing to integrating technology within education that will make it more worthwhile for the educators and the students. Referring back to the theoretical framework of Self-Efficacy Theory, teachers should be provided with ample opportunities to have mastery experiences with technology, partake in social modeling, recognize social persuasion, and interpret their physiological feedback reflectively and reflexively. According to Wang, Ertmer, and Newby (2004), the first step to accomplishing these four pillars of self-efficacy is goal setting. Goal setting should happen in preservice and be revisited throughout the school year. “Providing preservice teachers with goals seems to be an effective way to enhance efficacy levels for technology integration, which can be easily achieved by making the link between class objectives and learning goals explicit” (Wang, Ertmer, & Newby, 2004, p. 240).

Mastery experiences with technology can be developed in professional development opportunities that introduce technology and revisit that same technology throughout the year in more in-depth levels. Several teachers mentioned two online learning platforms that the district focused on Canvas and Google Classroom. Since these are two primary pieces of technology that appear to be used the most frequently, the researcher suggests having intermittent professional development and learning opportunities, both optional and mandatory for the teachers in this school district. Social modeling and social persuasion can be both be achieved by peer-to-peer visits throughout the school year complimented with meetings both before and after the visits. This activity can also serve as a two way mentorship. Mentorships are essential in teaching because the position of teaching is never static (McCaughtry et al., 2005). Having more teacher observation opportunities will glean a greater sense of
accountability in the classroom. A benefit for observation of teachers is the increased use of technology in their classrooms (Wang et al., 2004). Teachers will be able to have a partner, an automatic role model for social modeling or will learn about other teachers that may serve as role models from discussions about observations. Providing the opportunity for peer-to-peer visits will also give teachers the chance to give each other direct feedback.

Teachers should also have the opportunity for anonymous feedback. A way for anonymous feedback to be worked into peer visits is a reflection piece that is shared with the whole school anonymously. According to Ertmer and Richardson (2010), when peer feedback is anonymous, peers provide more feedback by offering alternatives and helpful suggestions for improvement. When teachers are given feedback, their knowledge improves on their practices (Ertmer & Richardson, 2010), including technology integration. Feedback affects our interpretation of self-efficacy (Bandura, 2008). Many teachers learn how to integrate technology through their desire to learn it and attend professional development workshops to improve their practice (Ertmer et al., 2007). These outside professional development opportunities need to be promoted to help teachers keep up with their practice and integrate technology in effective ways. “Teacher training experiences need to include opportunities for preservice teachers to develop actual lesson plans that integrate Web 2.0 technologies, micro-teach those lessons in teacher education courses and reflect on their experiences” (Sadaf et al., 2012, pp. 188-189). Having the opportunity to develop lessons is a good start, but they also need the time to practice and reflect. “Preservice teachers need to witness and experience
technology use in a pedagogically sound manner as students, and then hopefully they will implement that in their own teaching” (Bai & Ertmer, 2008, p. 109).

Similar to Sadaf et al.’s 2012 findings, the participants shared that they lacked time to incorporate technology into their lessons in meaningful ways. This time limitation for learning and utilizing new technology can be a barrier to technology usage (Palak & Walls, 2009). The time needs to be allocated for this type of lesson, planning and should be paired with a peer-to-peer observation on the lesson followed by a reflection period to improve their practice. Experiencing technology through professional development enables teachers to keep up with and refine their tech skills (Ertmer et al., 2007).

Since teacher technology use influences student technology use (Park & Ertmer, 2008), teachers need to be motivated by the school district to incorporate cutting edge technology to prepare the students for the 21st-century skills they will need when they leave the classroom. There needs to be a way to give students more of a voice to guide the direction of educational technology to best suit their needs when they leave the classroom. A simple way to gain this knowledge is by asking students both formally through class and school-wide surveys and informally through casual conversations within the classroom.

**Implications for the researcher.**

As a rising leader and change agent in education within this school district, the researcher plans to promote educational technology by assisting in professional development opportunities and presenting herself as a point person for others to look at as a role model who demonstrates positive self-efficacy. The researcher has a desire to volunteer to be a resource to assist in professional development at the school level and at
the county level. Notably, the researcher wants to be looked at as a school representative from the Central Office Science Specialist Team. The researcher plans to attend focus groups to represent the school in addition to attending workshops with the hopes of bringing information back to the teachers. The goal is to help other teachers integrate technology into the scientific content. Finding the right technology to integrate will help the school-wide mission: an ongoing reflection on student performance used to guide instruction.

All teachers state there are a lot of things that they do not know, regardless of how experienced they are (Tatel, 1994). Based on this assertion by Tatel (1994), self-doubt is a shared experience among all teachers. We need to come together to overcome our self-doubt by helping each other and supporting each other in as many ways as possible. This includes giving our students a voice in their learning. Another goal the researcher has is to bring students and teachers together in their educational experiences. The researcher plans to do this by providing students with open forum discussions, similar to the focus groups that teachers take part in, and provide anonymous student voice surveys. Through these two action methods, the intended outcome will help guide the direction that technology takes in the classroom. Using technology to benefit the students from the student’s point of view will also increase student buy-in and ultimately best help them be prepared for the changing world before them.

**Implications for the audience.**

The audience of this research study includes educational reformers, politicians, education boards, administrators, teacher educators, and teachers. With this research, the researcher hopes that all of these stakeholders now have a better understanding of the
experiences that technology initiatives have on current teachers experiencing the shift in education to include the integration of technology. For all of these stakeholders, the main takeaways include that technology is rapidly changing, teachers that use technology do so for specific reasons, not all teachers think technology is necessary to advance education, and technology support still has to come a long way.

The changes in technology make it difficult for teachers to come up with due to the limited time they have available to lesson plan. These changes also lead to frustration when the time has been spent making these integrations into lessons for them not to work in subsequent years due to the rapid development of technology. The stakeholders need to find a way to provide more time for teachers to fully digest the transitions in technology or provide well-developed lessons for them. If neither of these options is feasible, some grace should be extended to the educators that are trying hard to juggle the position that requires so much from them already.

It is critical for stakeholders to understand why teachers are choosing to use technology. The teachers interviewed reported that their technology choices are based on what is easy to use, what is available, what they feel students need, and pressure to use technology from stakeholders. The main reasons they use technology are to reduce paper, to help with organization for both themselves and the students, and to give students more ownership of their learning through student choice. Recognizing that teachers are trying to reduce the amount of paper could imply different issues in the educational setting. Perhaps copiers are unavailable, and this lends itself to a different resource issue. Or maybe teachers are more self-conscious of the environment, and that is the reason they are selecting to minimize paper. It does lead right into the organizational aspect, though.
Students can stay better organized without so many loose papers floating around, and teachers too. Giving students a choice in their education helps them buy-in and be more invested and motivated in what they are learning.

Stakeholders can also draw conclusions about technology experiences based on how teachers perceive technology. Not every teacher perceives technology through the same lens, and they also have an alignment of understandings toward the technology initiative. Stakeholders should be able to see technology initiatives through the teachers’ perspective and the students’ perspective when making decisions about technology integration on their behalf. From this research study, teachers already understand that there are different motivating factors behind pushing technology based on what angle you are thinking from: new teachers, school district administrators, and students. It was evident that technology is not viewed as critical by current teachers when they shared that they would not push new teachers to use it. Therefore, stakeholders should be targeting veteran teachers when implementing the technology. When teachers felt pressure from the administration to use technology, they implemented it more, proving that stakeholders can dictate the direction of technology. With this power, stakeholders should be careful when doing so because not all teachers share the same alignment of feelings toward technology integration. Regarding students, technology can be introduced in a way that expands their already well-developed skill set. Students, like all people, tend to stay within their comfort zone, but they should be stretched to expand what they already know about technology and its capabilities.

When stakeholders consider technology support, they need to make sure that teachers have many different available options to obtain support, and that those options
are intentionally and well thought out. Teachers receive support from multiple different sources, so ensuring that they always have multiple sources available to them will continue to help them feel confident in integrating technology. Stakeholders should consider reinstating personnel to the OCTO team, as many teachers’ reported immense value in this resource. Teachers’ reported that professional development should embed technology, but technology should not be the focus of the training. Any professional development needs to be spaced out over a longer period to give teachers time to process and apply what they learn. In addition to classes, conferences, workshops, breakout sessions, and small groups led by trained staff, it will give teachers the most opportunities to learn about how to integrate technology effectively and efficiently in their classrooms.

While all of these considerations above may not be feasible immediately, creating a plan to work toward implementing changes to the delivery of technology integration in the classrooms will go a long way with teachers. Teachers want to be heard and have little time to waste, so thoughtful approaches to transitioning technology, to mandating specific technology usage, to taking into consideration how teachers perceive these changes, and to providing them with adequate support will smooth the process of this dynamic educational shift.

**Positionality Revisited**

Throughout this research study, I have developed into a more open person. I recognize that everyone brings their positionality and lens to the topic at hand, and no two people share identical views. I no longer think that technology implementation is a source of teacher doubt. Instead, teacher doubt is rooted in not listening to what teachers are saying. They are in the weeds of education, yet others are dictating their needs
without consulting with them. It is crucial to gain teacher voice in any decision making that involves teachers and students. While you may not be able to please every teacher, the input can help guide the direction of education. While mandating things may be necessary, there are right and wrong ways to go about it. When integrating technology, it cannot be forced, and there has to be ample time to digest the change to integrate it effectively in the classroom. While I still have an insider’s perspective, my perspective is not the only one to consider. Those that do not usually speak up also need to have an opportunity to voice their opinion. As an outspoken person, I often only hear other outspoken people, but they are not the voice for everyone. The teachers interviewed in this study helped me to understand that. Everyone interviewed alluded to some feelings of self-doubt regarding technology, which was not surprising, as I still have those feelings myself. After interviewing the other teachers from various high schools, I no longer think that I come from a privileged perspective in comparison. Many teachers spoke highly about the support system at their school and the technology available to them daily. Going forward, I know that when I lead any professional development sessions that I cannot be the sage on the stage, and I must give ample time for people to process any new technology and be available for them to follow up. Likewise, I know the feedback that I can provide to professional development sessions that I attend that are not entirely up to par. As a teacher, I know that I need to do a better job of listening to everyone, including students, and providing the support that they need to be successful. As a rising leader in my profession, I know that I can make a difference by acting on what I hear from fellow teachers and students about technology initiatives and other education-related topics.
Recommendations for Future Research

For future research, these participants could be asked for a follow-up interview at a later point in time to see how their initiatives and understandings have remained the same or changed. Continuing with a longitudinal study would help to follow the technology transitions throughout the new curriculum roll-out. Since the curriculum is converting to align with NGSS standards and technology is a central component, gaining insight from the curriculum writers as to how and why they choose specific technology would help to make the participants experience with technology initiatives and understandings more clear. Several participants shared that the students drive their integration of technology, so the next step could be finding out how the students can influence those that write the curriculum. Finally, a quantitative follow-up study would prove very valuable, as well. A survey could be distributed to all secondary science teachers to gain their perspective on technology initiatives and understandings within the district to account for a greater perspective on the technological changes in the curriculum and their pedagogical practices as a whole. This data could be compared to this study to track any overall trends among a greater amount of teacher voices and be supported with the lived stories of the participants in this study.
References


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Appendix A.

Email informing participants of study

Dear High School Science Teachers,

I am a student researcher currently working on a thesis project for my Educational Doctorate Degree in Curriculum, Teaching, Learning, and Leadership in the College of Professional Studies at Northeastern University. I have an interest in investigating your experiences with technology initiatives and understandings in the realm of being a teacher, both in the classroom and what it means out of the classroom.

Would you be willing to be interviewed, at a time and place convenient to you as part of my research? Participation in this research study is voluntary and restricted to secondary science teachers at this high school. The interview will take roughly an hour at a location and time convenient for you. Your participation and answers will be kept confidential by issuing a pseudonym of your choosing. You will be asked to validate the transcript of the interview in addition to the data analysis at the completion of the study, which should take no longer than 30 minutes each time.

Your participation is deeply appreciated and the goal of my doctoral research is to provide educational leaders with a snapshot into technology initiatives and the impact it has on teachers’ daily lives. At the end of the study you will be formally thanked for your participation in the form of a thank you letter and be given the option to have a copy of the final dissertation for your files.

I sincerely hope that you will be able to help me with my research. If you have any questions regarding this research study, please contact me, the researcher, at morgan.a.stevens@mcpsmd.net or my dissertation chair and Principal Investigator, Dr. Karen Reiss Medwed, at k.reissmedwed@northeastern.edu.

Thank you for taking the time to consider my request and I look forward to your reply.

Sincerely,

Morgan Stevens
Appendix B.

Criteria for participation selection

1. Years teaching in the school district
2. Years teaching
3. Content area with technology inclusive curriculum
Signed Informed Consent Form

Northeastern University, Department
Name of Investigator(s): Dr. Karen Reiss Medwed and Ms. Morgan Stevens
Title of Project: Teacher Experiences with Technology Initiatives and Understandings

Informed Consent to Participate in a Research Study
We are inviting you to take part in a research study. This form will tell you about the study, but the researcher will explain it to you first. You may ask this person any questions that you have. When you are ready to make a decision, you may tell the researcher if you want to participate or not. You do not have to participate if you do not want to. If you decide to participate, the researcher will ask you to sign this statement and will give you a copy to keep.

Why am I being asked to take part in this research study?
We are asking you to be in this study because you are a secondary science teacher that experiences technology initiatives at a greater volume than other secondary educators.

Why is this research study being done?
The purpose of this research is to give a voice to teachers regarding technology initiatives. As the push for technology continues to increases it is important to measure the insight that teachers have toward its initiatives and understanding.

What will I be asked to do?
If you decide to take part in this study, we will ask you to partake in an interview which take approximately one hour. You will be asked to discuss and expand upon your experiences with technology initiatives as an educator and share your feelings.

Where will this take place and how much of my time will it take?
You will be privately interviewed at a time and place that is convenient for you. The interview will last approximately one hour. The researcher will transcribe the interview and ask for you to check it over before the analyzation process begins. After the analyzation process, you will be asked to validate the researcher’s interpretations and conclusions of the data.

Will there be any risk or discomfort to me?
There are no foreseeable risks of discomfort to you. You contributions to this research study will in no way affect your employment.

Will I benefit by being in this research?
There will be no direct benefit to you for taking part in the study. However, the information learned from this study may help improve technology initiatives at your school.
Who will see the information about me?
Your part in this study will be confidential. Only the researchers on this study will see the information about you. No reports or publications will use information that can identify you in any way or any individual as being of this project. In place of your name, a pseudonym will be given for your interview and any other identifiable information. Research materials will be stored in a locked firebox and on a password-protected desktop computer located at the researcher’s home. In rare instances, authorized people may request to see research information about you and other people in this study. This is done only to be sure that the research is done properly. We would only permit people who are authorized by organization such as the Northeastern University Institutional Review Board.

What will happen if I suffer any harm from this research?
There are no foreseeable reasons for you to suffer any harm. No special arrangements will be made for compensation or for payment for treatment solely because of participation in this study.

Can I stop my participation in this study?
Your participation in this research is completely voluntary. You do not have to participate if you do not want to and you can refuse to answer any question. Even if you begin the study, you may quit at any time. If you do not participate or if you decide to quit, you will not lose any rights, benefits, or services that you would otherwise have.

Who can I contact if I have questions or problems?
If you have any questions about this study, please feel free to contact Morgan Stevens at 717-371-7104, the person mainly responsible for the research. You can also contact Dr. Karen Reiss Medwed at 617-390-4072, the Principal Investigator.

Who can I contact about my rights as a participant?
If you have any questions about your rights in this research, you may contact Nan C. Regina, Director, Human Subject Research Protection, Mail Stop: 560-177, 360 Huntington Avenue, Northeastern University, Boston, MA 02115. Tel: 617.373.4588, Email: n.regina@neu.edu. You may call anonymously if you wish.

Will I be paid for my participation?
There will be no payment for your participation.

Will it cost me anything to participate?
There will be no cost for you to participate.

Is there anything else I need to know?
Your time and effort in participating in this study is greatly appreciated.

I agree to take part in this research.
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<td>Signature of person who explained the study to the</td>
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Depending upon the nature of your research, you may also be required to provide information about one or more of the following if it is applicable:

1. A statement that the particular treatment or procedure may involve risks to the subject (or to the embryo or fetus, if the subject is or may become pregnant) which are currently unforeseeable.
2. Anticipated circumstances under which the subject’s participation may be terminated by the investigator without regard to the subject’s consent.
3. Any additional costs to the subject that may result from participation in the research.
4. The consequences of a subject’s decision to withdraw from the research and procedures for orderly termination of participation by the subject.
5. A statement that significant new finding(s) developed during the course of the research which may be related to the subject’s willingness to continue participation will be provided to the subject.
6. The approximate number of subjects involved in the study.
Appendix D.

NOTIFICATION OF IRB ACTION

Date: January 2, 2019  IRB #: CPS18-12-03
Principal Investigator(s): Karen Reiss Medwed
                        Morgan Stevens
Department: Doctor of Education Program
            College of Professional Studies
Address: 20 Belvidere
         Northeastern University
Title of Project: Teacher Experiences with Technology Initiatives and Understandings
Participating Sites: [Redacted]
DHHS Review Category: Expedited #6, #7
Informed Consents: One (1) signed consent form
Monitoring Interval: 12 months

APPROVAL EXPIRATION DATE: JANUARY 1, 2020

Investigator's Responsibilities:
1. The informed consent form bearing the IRB approval stamp must be used when recruiting participants into the study.
2. The investigator must notify IRB immediately of unexpected adverse reactions, or new information that may alter our perception of the benefit-risk ratio.
3. Study procedures and files are subject to audit any time.
4. Any modifications of the protocol or the informed consent as the study progresses must be reviewed and approved by this committee prior to being instituted.
5. Continuing Review Approval for the proposal should be requested at least one month prior to the expiration date above.
6. This approval applies to the protection of human subjects only. It does not apply to any other university approvals that may be necessary.

C. Randall Colvin, Ph.D., Chair
Northeastern University Institutional Review Board

Nan C. Regina, Director
Human Subject Research Protection

Northeastern University FWA #4630
Appendix E:

Interview Schedule
Teacher Experiences with Technology Initiatives and Understandings

Time of Interview: ______________________________

Date: ______________________________

Place: ______________________________

RESEARCH QUESTION: What are secondary science teachers’ experiences and understandings with formally pressured technology initiatives at Clarence High School?

Part I:

Introductory Session Objectives (5-7 minutes): Build rapport, describe the study, answer any questions, and review and sign informed consent.

Introductory Protocol

You have been selected to speak with us today because you have been identified as someone who has a great deal to share about educational technology. My research project focuses on the experience of educators with technology initiatives during their workday. Please take a moment to review the consent form and sign if you would like to participate in the study. If you have any questions about the consent form, please feel free to ask during this time.

Because your responses are important and I want to make sure to capture everything you say, I would like to audio tape our conversation today. Do I have your permission to record this interview? I will also be taking written notes. I can assure you that all responses will be confidential and only a pseudonym of your choosing will be used when quoting from the transcripts. What pseudonym would you like given to your interview? I will be the only one privy to the tapes which will be eventually destroyed after they are transcribed. Do you have any questions about the interview process or how your data will be used?

This interview should last about one hour. During this time, I have several questions that I would like to cover. If time begins to run short, it may be necessary to interrupt you in order to push ahead and complete this line of questioning. Do you have any questions at this time?

Interviewee Background (5-10 minutes)
Objective: To establish rapport and obtain the story of in the participants’ general with the research topic. This section is brief as it is not the focus of the study.

A. Interviewee Background

1) What is your background, how did you get to this position you are in now?
2) What has been your experience here at this school?
3) What transitions in education have you been a part of or witnessed or seen?
4) How do you feel about the school culture here?
5) What were your experiences with technology growing up?

Part 2:

One of the things we are interested in learning about is how educators feel about technology initiatives. I would like to hear about your experiences about technology initiatives and understandings as a teacher in your own words. To do this, I am going to ask you some questions about the key experiences you encountered. If you mention other people, please do not mention names.

1. Could you describe your usage of technology in school and out of school?
2. What changes in this organization have you seen regarding technology?
3. If someone new was hired and you were their mentor, what would you say about the technology integration in this school?
4. How do you perceive educational technology?
5. What factors influence your usage of technology?
6. How have learning opportunities, like professional development, impacted your use of technology?
7. What type of help have you experienced when using technology?
8. How do you think about technology?
Elaboration Probes:
1) Can you tell me more about that experience?
2) How did it make you feel?
3) If you could, what would you do differently next time?
4) Can you give me an example or say more about that?

Evidence Probes:
1) Are there any other feelings that you have personally experienced?
2) What are your reactions to __________ [professional development trainings]?

This is the end of the interview. Thank you for your participation, do you have any remaining questions before we complete this phase of the study for you?