THE INFLUENCE OF INFORMATION AND COMMUNICATION TECHNOLOGY IMPLEMENTATION ON TEACHER TECHNOLOGICAL SELF-EFFICACY, TECHNOLOGY PROFICIENCY, FREQUENCY, PERCEPTIONS, CLASSROOM PRACTICES, AND STUDENT'S CLASSROOM INTERACTIONS

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ABSTRACT

THE INFLUENCE OF INFORMATION AND COMMUNICATION TECHNOLOGY IMPLEMENTATION ON TEACHER TECHNOLOGICAL SELF-EFFICACY, TECHNOLOGY PROFICIENCY, FREQUENCY, PERCEPTIONS, CLASSROOM PRACTICES, AND STUDENT'S CLASSROOM INTERACTIONS

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The study compared the differences between pre- and post-teacher technological self-efficacy, technology proficiency, frequency of use, perceptions, classroom practices, and student interactions when information and communication technology (ICT) is implemented in the classroom. Survey, teacher information technology logs, observation, and interview data were collected from a purposeful sample of urban middle school teachers in a southeast Texas school district. Quantitative data was analyzed using frequencies, percentages, means and two-tailed paired t-test. Qualitative data was analyzed using thematic analysis. Quantitative analysis revealed there was a significant

mean difference between pre- and post-teacher technological self-efficacy for the *Technology and Teaching Efficacy Scale* and that there was not a significant mean difference between pre- and post- teacher technological proficiency for the *Technology Proficiency Self-Assessment for 21st Century Learning* survey. The qualitative analysis provided supporting evidence of the influence implementation of ICT had on teacher classroom practices and student classroom interactions pre- and post-ICT implementation.

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CHAPTER I

INTRODUCTION

Everywhere education systems are investing in information and communication technology to help deliver personalized instruction, meet the goals of each learner, provide unique learning opportunities, and allow for various types of resources to be readily available for students (Bajunid, 2012; Buckingham, 2013; Kirschner & Selinger, 2003; Trucano, 2012). Information and communication technology (ICT) is a term that encompasses all technological tools used to manipulate and communicate information (Aucoin, 2011). In education, examples of ICT are computers, tablets, projectors, video cameras, interactive white boards, and web based learning sites.

According to Peeraer and Petegem (2012), the past decade has created a high level of concern for the influence ICT has on education. These new technologies have changed the expectations and needs of our education system by requiring new skills, resources, and strategies to be acquired by all key stakeholders, especially the teachers implementing the new technology in PK-12 classrooms (Barbaran, 2014; Ertmer & Ottenbreit-Leftwich, 2010). Information and communication technology has also contributed to the education system by shifting the traditional focus of the system that prepared students to compete on a national level to a more global approach to prepare students for an international level of community and work (Aucoin, 2011). This shift in education has created a demand for teachers to integrate personalized learning and innovations in the classroom by utilizing technology to ensure all students will be

successful in the global economy.

When implementing ICT, various human factors have an effect on the fidelity of the successful implementation of the new technology. An influential factor that affects the success of an ICT implementation is the teacher's competency of technology and classroom integration efforts (Ertmer & Ottenbreit-Leftwich, 2010). A teacher's current technological competency could influence their decision regarding how they will deliver classroom instruction and what technology tools will be integrated into their classroom. Another factor that effects teachers' utilization of technology in the classroom is the teacher's technological self-efficacy. A teacher's belief about their ability to implement new ICT in their classroom could influence if they implement technology, how frequently, and what technology they choose to incorporate into classroom instruction to enhance student learning (Beas & Salanova, 2006). The belief the teacher has of their competence to integrate ICT in the classroom is what Bandura (1997) describes as self-efficacy. Self-efficacy is the belief in oneself to create and deliver action to obtain the desired results. Bandura explains self-efficacy as a critical influence within behavior that guides course of action, time, energy, and emotional investment one has in connection to a task. Downey and Zeltmann (2009) expand upon the idea of self-efficacy by defining technology self-efficacy as one's ability to judge their capability to use technology.

Currently, ICT implementation research is limited to studies measuring the variable of professional development and the influence it has on teacher technological self-efficacy and proficiency. This research expands to include and focus on the influence ICT implementation has on teacher technological self-efficacy, proficiency, frequency of

ICT use, and student's classroom interactions over the course of a semester within urban middle school classrooms.

Research Problem

With the increased use of ICT within education (Edmunds, Thorpe, & Conole, 2012; Fu, 2013; Passey, Rogers, Machell, & McHugh, 2004) the need to research factors that influence how teachers can successfully implement ICT continues to grow (Albion, 1999; Graham, Henrie, & Gibbons, 2014). Information and communication technology is a powerful tool that teachers can utilize to collaborate and create competitive learning opportunities for students to reach their full potential (Agosto, Copeland, & Zach 2013; Riley, Holleman, & Roberts, 2000). The nationwide emphasis on the utilization of technology and the increase of information it provides, "today's teachers are being presented with an opportunity to transform the learning in their classrooms from a traditional transmission model to a student-centered model" (Mahoney & Cameron, 2008, p. 314).

Transformation in the classroom requires teachers to be flexible, open to change, and to possess a high level of self-efficacy, if they are to adapt their technology skills to confidently implement new ICT (Lee & Lee, 2014; Skaalvik & Skaalvik, 2007). Collaboration within the education system by all stakeholders could also help this transformation by redesigning the processes within education systems to increase effectiveness, efficiency, and to provide optimal learning opportunities to prepare students to be successful in the global market (Riley et al., 2000; Wastiau et al., 2013). Most importantly, this transformation provides teachers the opportunity to utilize technology to create more relevant connections for students to facilitate deeper and more

meaningful learning (Ertmer, 2005; Kuhlthau, Maniotes, & Caspari, 2015).

To effectively support teachers during ICT implementation, it is critical to have a better understanding of the potential barriers to technology use in the classroom (Anderson & Groulx, 2011). Teacher technological self-efficacy and technology proficiency are two potential barriers to be addressed to ensure successful ICT implementation (Albion, 1999; Ertmer, 2005; Lee & Lee, 2014). Similar to how teachers are expected to personalize student learning based on their students' knowledge and ability, administrators must personalize teacher education and preparation by understanding their teachers' technological self-efficacy and proficiency to lead effective ICT implementation.

Current research establishes the existence of a significant increase in student engagement and enjoyment of learning when technology is used in the classroom (Heafner, 2004; Plass et al., 2013). However, many teachers feel they lack the knowledge to implement technology, which leads to a limited use of ICT in the classroom (Smith, Rudd, & Coghlan, 2008; Tantrarungroj & Suwannatthachote, 2013). The technological knowledge and skills a teacher possesses correlates with their frequency of ICT use in the classroom (Lawless & Pelligrino, 2007; Lee & Lee, 2013). Teachers who lack the necessary knowledge and skills and who have negative pre-existing beliefs about ICT are less likely to incorporate technology into their classroom (Ertmer, 2005; Tantrarungroj & Suwannatthachote, 2013).

In addition to teacher technological proficiency as a variable in ICT implementation, teacher technological self-efficacy is also an important variable that must be considered when implementing ICT. According to Ertmer (2005), if the teacher

lacks the confidence to integrate technology in the classroom, the knowledge the teacher possesses will not be enough for successful ICT implementation to occur. Zhao and Frank (2003) as well as Aldunate and Nussbaum (2013) add to the idea of teacher beliefs, in regards to ICT, by recognizing that the teacher's attitude about technology is a key factor that determines the rate of ICT adoption. The technological self-efficacy of the teacher reflects the fidelity of the technology integration and guides the teacher's decision to accept or reject the new technology use in the classroom (Rimm-Kaufman & Sawyer, 2004).

In addition to the actual implementation of technology, the variable of teacher technological self-efficacy is one of the most prevalent factors for determining student achievement (Tschannen-Moran & Hoy, 2001). Today's student is considered a native technology user, while today's teacher is considered a non-native technology user (Kongchan, 2012). This non-native teacher may experience a lower technological self-efficacy when integrating new technology within the classroom due to the lack of relevant knowledge and ICT experience they have in comparison to their students or colleagues (Helsper & Eynon, 2010). Before meaningful learning can take place, it is important to identify the generational differences between the student and teacher that affect levels of ICT use in regards to knowledge and technological self-efficacy. Furthermore, to support teacher technological self-efficacy and to ensure successful ICT use, it is imperative teachers are being taught how to effectively implement ICT. When teachers are taught how to effectively utilize ICT in the classroom, they are more likely to overcome barriers that may arise during the implementation process (Ertmer, 2012).

Even though there have been studies that examine factors that contribute to ICT

implementations, there is little research focusing on the influence ICT implementation has on teacher technological self-efficacy and technology proficiency. The purpose of this study was to examine the influence the implementation of ICT has on teacher technological self-efficacy, technology proficiency, frequency of ICT use, and classroom practices of urban middle school teachers. Additionally, the study examined the influence of implementation of ICT on students' classroom interactions.

Significance of the Study

This study contributes to the field of education by adding knowledge regarding the influence ICT implementation has on teacher technological self-efficacy, technology proficiency, frequency of ICT use, and classroom practices. Additionally, the study examines the influence of implementation of ICT on students' classroom interactions. If teacher technological self-efficacy and technological proficiency are not continuously measured and adapted to meet students' needs, educators risk becoming stagnated within their effectiveness of classroom instruction (Ertmer & Ottenbreit-Leftwich, 2010). Educators who become stagnate with technology use, also risk decreasing the level of student engagement within their classrooms and fail to advance the acquisition of 21st Century skills students need in order to compete in the global economy (West, 2013).

Research Purpose and Questions

The purpose of this study was to examine the influence the implementation of ICT has on teacher technological self-efficacy, technology proficiency, frequency of ICT use, and classroom practices of urban middle school teachers. Additionally, this study examined the influence of implementation of ICT on students' classroom interactions. The study addressed the following research questions:

1. Is there a statistically significant mean difference between pre- and post-teacher technological self-efficacy when ICT is implemented?

   $H_{a:}$ There is a statistically significant mean difference in teacher technological self-efficacy when ICT is implemented.
2. Is there a statistically significant mean difference between pre- and post-teacher technology proficiency when ICT is implemented?

   $H_{a:}$ There is a statistically significant mean difference in teacher technology proficiency when ICT is implemented.
3. Is there a statistically significant mean difference between pre- and post-teacher frequency of ICT use when ICT is implemented?

   $H_{a:}$ There is a statistically significant mean difference in teacher frequency of ICT use when ICT is implemented.
4. What are teacher perceptions regarding implementation of ICT?
5. How, if at all, does the implementation of ICT influence teachers' classroom practices?
6. How, if at all, does the implementation of ICT influence students' classroom interactions?

Definitions of Key Terms

The following definitions of key terms were used throughout this dissertation.

Blended Learning: Delivery of content in which a student learns at least part of the content through technology or online instruction (Staker & Horn, 2012).

Frequency of ICT Use: The extent to which ICT is used for teaching and learning (Pelgrum & Voogt, 2009)

Implementation of ICT: The intentional adoption process of ICT that consists of the initial innovative initiative, communication, instructional use and coaching, professional development, student achievement, budgeting, and programming (Johnson, Dennis, & Monroe, 2012).

Information and Communication Technology (ICT): All technological tools used to manipulate and communicate information (Aucoin, 2011).

Information Technology Logs: "Record of the events occurring within an organization's systems and networks" (Kent & Souppaya, 2006, p. 1).

Middle School: A school comprised of grades six through eight (Ravitch, 2007).

Classroom Practices: "Instructional and classroom management strategies and techniques and the curriculum designed by the teacher" (Cole, 2012, p. 4).

Self-Efficacy: The belief of one's own ability to complete a task (Bandura, 1977).

Student Interactions: Student behaviors (Pennings, van Tartwijk, Wubbels, Claessens, van der Want, & Brekelmans, 2014).

Structured Observation Guide: A form to help code and record during observations (Bell, 2014).

Technological Self-Efficacy: An individual's judgment of their ability to use computers/technology (Downey & Zeltmann, 2009).

Technology and Teaching Efficacy Scale (TTES): A 25-item survey instrument used to measure the perceptions teacher have about performing job tasks and their use of technology (Mayo, Kajs, & Tanguma, 2005).

Technology Proficiency: Competency to perform technological tasks (Ropp, 1999).

Technology Proficiency Self-Assessment for 21st Century Learning: A 34-item survey instrument used to measure the technological competencies teachers have about performing technological tasks such as how to use, send, and download information by utilizing technology (Christensen, Knezek, Alexander, Owens, Overall, & Mayes, 2015).

Conclusion

The use of ICT in education has and will only continue to drastically increase (Blurton, 1999), thus supporting the importance of studying the influence ICT has on teacher technological self-efficacy, proficiency, and frequency of use in order to help increase the potential success of ICT integration and adoption (Buabeng-Andoh, 2012; Teo, Lee, Chai, & Choy, 2009). Understanding the factors that yield successful integration and adoption are important because ICT skills are becoming indispensable prerequisites for students and learning (Fu, 2013). The results from this study will help improve future implementation processes within education systems. Chapter 2 will discuss ICT in education, teacher technological self-efficacy, teacher technology proficiency, frequency of ICT use in education, teacher perceptions of ICT implementation, teacher classroom practices, and student classroom interactions.

CHAPTER II

REVIEW OF THE LITERATURE

The purpose of this study was to examine the influence implementation of ICT had on teacher technological self-efficacy, technology proficiency, frequency of ICT use, and classroom practices of urban middle school teachers. Additionally, the study examined the influence of implementation of ICT on students' classroom interactions. The review of the literature will consider the following; ICT in education, teacher technological self-efficacy, teacher technology proficiency, frequency of ICT use in education, teacher perceptions of ICT implementation, teacher classroom practices, and student classroom interactions. This chapter will conclude with a summary of the findings and a theoretical framework.

Information and Communication Technology in Education

Since the invention of motion picture in the 1920's, educational research has increasingly focused on the use and implementation of ICT in the classroom (Hew & Brush, 2007). The integration of ICT in education is an interdependent process that reflects the leadership, innovation, and capacity within an organization (Lawless & Pellegrino, 2007). The definition of what technology integration can in education can be viewed as is:

> The incorporation of technology resources and technology-based practices into the daily routines, work, and management of schools. Technology resources are

> computers and specialized software, network-based communication systems, and other equipment and infrastructure. Practices include collaborative work and communication, Internet-based research, remote access to instrumentation, network-based transmission and retrieval of data, and other methods. This definition is not in itself sufficient to describe successful integration: it is important that integration be routine, seamless, and both efficient and effective in supporting school goals and purposes (Perera, 2008, p. 13).

Need to Study Information and Communication Technology in Education

Successful integration of ICT in education is increasingly becoming more important each year as the use of technology expands into society. The intense focus on technology integration to better prepare our students for their future increases the need to research ICT implementation (Bingimlas, 2009). By the year 2020, which is considered the focus year for educational technology, ICT will be fully optimized within classrooms and all instruction will be completely personalized and adapted so that technology integration effectively adds value to student learning (Nickerson, 1988; Nickerson & Zodhiates, 2013).

In addition to the growing use of ICT in education, school districts and government agencies are increasing the funding for new technologies in education as it continues to become an integral component of enhancing student learning. According to Nagel (2010), school districts in the United States (U.S.) are estimated to invest over $2 billion in educational technology during the 2009-2010 school year. The increase in funding is in direct correlation to the emphasis school systems in the U.S. have placed on implementing ICT into education and the value it has within our economy. The

increased emphasis on ICT has encouraged the U.S. government to support ICT in education by increasing funding and assistance in creating programs that support technology integration success within schools (Hew & Brush, 2007; Lawless & Pellegrino, 2007). As education increases the use of ICT, the necessary support to help integrate ICT will also increase. In order to prepare our students to be successful in this continuously moving culture it is imperative that students be prepared to become advocates for their own learning and responsible for their future (Mahoney & Cameron, 2008).

Support for Information and Communication Technology in Education

Initially, the majority of research on ICT focused on the authentic use of ICT in an educational setting and the influence ICT had on student achievement. As further research presented consistent findings of high ICT rejection rates by teachers, the factors influencing teachers to accept or reject ICT became one of the principal matters within educational technology research (Bebell, Russell, & O'Dwyer, 2004). The factors that were found to influence the teacher ICT acceptance rates were; technical skills and knowledge, self-efficacy, organizational culture, professional development, physical hardware and infrastructure, continuous technical support, and strong organizational leadership (Abuhmaid, 2011; Aucoin, 2011; Williams, Coles, Wilson, Richardson, & Tuson, 2000).

In order for ICT integration to be as effective, all support factors within the organization must be present to maximize the technology integration process (Becker, 2000; Bingimlas, 2009). These support factors range from pedagogical knowledge of ICT integration to allotted time for teachers to collaborate and learn how to use ICT in their

classroom instruction. Currently, research shows that even though the necessary support factor of hardware and infrastructure are readily available, teachers are not maximizing technology for advanced instructional purposes (Buabeng-Andoh, 2012).

Teacher Technological Self-Efficacy

When integrating new ICT into the classroom, it is not enough for teachers to only possess the necessary technology knowledge and skills. The teacher's level of technological self-efficacy is one of the most influential and dominant factors that affects a teacher's decision to utilize ICT in their classroom for desired outcomes (Beas & Salanova, 2006). Abbitt (2011) states that a teacher's pedagogical decisions are based off of their beliefs regarding their capabilities to implement ICT into classroom instruction. According to Pajares (1992), the skills and beliefs of a teacher are intertwined and "beliefs are instrumental in defining tasks and selecting the cognitive tools with which to interpret, plan, and make decisions regarding such tasks" (p. 325). In a study by Ross, Hogaboam-Gray, and Hannay (2001), it was reported that students who had a teacher with high self-efficacy acquired advanced technology skills, while the students who had a teacher with low self-efficacy only learned the basic technology skills. This study demonstrates the influence teacher technological self-efficacy has on student learning and supports why education should continue research on the influence ICT has on teacher classroom practices to ensure all students receive equal opportunity to acquire the technology skills necessary to compete in the global economy.

Technology cannot be thoughtfully integrated without the commitment, dedication, and belief of the teachers implementing the new technology. The beliefs of the teacher are what shape the classroom environment and guide the teacher's

instructional practices (Bandura, 1997). According to Abbitt (2011), a teacher's personal beliefs and ability in regards to technology use can be challenging when preparing teachers to effectively utilize technology in classroom instruction.

In a study conducted by Yuen and Ma (2008), 152 teachers were surveyed to better understand the Technology Acceptance Model, which measures the relationships of a teacher's perceived ease of use, perceived usefulness, intention of use, and self-efficacy of ICT in education. The study aimed to better understand and predict teacher use of ICT by examining teacher perceptions and acceptance of a new e-learning platform. Data was collected by distributing a questionnaire with the constructs; perceived ease of use, intention of use, subjective norm, perceived usefulness, and teacher self-efficacy. Teacher self-efficacy was measured on a 10-point Likert scale and the other constructs were measured on a 7-point Likert scale. Results suggest that perceived usefulness had no significance on the impact of the teacher's intention of use, but that the perceived ease of use had significance in determining the teacher's intention of use. The other variables, subjective norm and self-efficacy, also had significance in determining the teacher's intention of use. Study results exemplified how self-efficacy influences teachers' decisions and intentions to use ICT in their classroom. This study also demonstrated that it is important "to build up teachers' confidence in using technology to increase their willingness to use other e-learning technology in the future" (Yuen & Ma, 2008, p. 239).

To help develop the teacher self-efficacy to use ICT in the classroom, ICT "should be understood as not only as technological development but the development in pedagogical method and the level of education" (Tosun & Baris, 2011, p. 224). Education

must encompass not only devices and programs that come with ICT, but education must also improve the development of teachers to effectively utilize ICT. It is an inevitable factor that technology use will continue to increase in our everyday life and schools must improve and modernize to adapt to the needs of our learners.

Teacher Technological Proficiency

When researching any new innovation, such as ICT, within education, teacher related issues are discussed as integral components to any successful education initiative (Cochran-Smith, 2004; Doyle & Ponder, 1977; Fullan, 1993; Gillingham & Topper, 1999; Sarbib, 2002; Townsend & Bates, 2007). The absence of teacher commitment during ICT implementation, will limit student achievement, ultimately defeating the purpose of integrating ICT to enhance student learning. In order to address issues that inhibit successful initiatives to sustain use in education, teacher related issues must be considered in order to make any educational initiative successful. One of the most influential factors that affects teacher performance and fidelity of new initiatives within education are the skills related to the resourcefulness of the teacher. In the case of implementing ICT in education, one of the most crucial components to be considered in the implementation process is the pre-existing knowledge teachers have about ICT in education (Kim, Kim, Lee, Spector, & DeMeester, 2013). According to Albion (2001), a teacher's knowledge of computers can serve as one of the factors that influence the level of use of technology a teacher will have in their classrooms.

The technological proficiency a teacher possesses influences the implementation of ICT in classroom instruction in regards to frequency of use and level of use. Becker (2000) states that teachers who do not frequently use computers within their classrooms

possess limited technology skills and knowledge. Research shows that lack of technology skills is one of the main inhibiting factors that influences teachers to use ICT in the classroom (Williams et al., 2000). Anderson (2000) stated that competency of technology skills was the gatekeeper to experiences provided by the teacher to enhance student learning. Anderson believes that by assessing a teacher's technological skill set, one can effectively plan professional development that will increase the use and success of technology used within the classroom.

Whale (2006) states that teacher competency of technology is becoming so important some schools have made it a consideration in the teacher hiring process. Lawless and Pellegrino (2007) believe technology literacy should be considered a basic skill all teachers should have in order to be prepared to effectively integrate technology into their classroom instruction. Research supports that teachers who have an above average knowledge of how to use computers in both their personal and professional life,are able to utilize technology in more effective ways for their students compared to teachers who have limited technology skills (Becker, 2000).

The outcome of a teacher's ability to implement ICT in education has an impact on student achievement. According to Williams et al. (2000) the technology skill of a teacher is one of the most inhibiting factors that influences a teacher to utilize ICT in their classroom instruction. This inhibition to use ICT in instruction has a direct impact on student achievement (Waxman, Connell, & Gray, 2002). Regardless of how clear or organized a teacher's vision may be for their classroom instruction, they may be limited in their achievement of great successes in the classroom due to the lack of technology skills they possess. According to Williams et al. (2000), "it is also clear that even when

teachers have very firm ideas of how they would like to apply ICT in the classroom, they can be held back by lack of technical skills and knowledge" (p. 317).

In a collective case study, conducted by Anderson (2014), teacher technological proficiency was examined by collecting quantitative and qualitative data to measure the progress of technology integration into a language arts curriculum. For this study a purposeful sample of the population of language arts teachers in Texas were selected through criterion sampling to participate in the study. Teachers completed the Texas Teacher STaR Chart survey and participated in classroom observations to measure their technology proficiency and use of technology in the classroom in the following domains; Patterns of Classroom Use, Design of Instructional Setting using Digital Content, Content Area Connections, and Online Learning. For the quantitative portion of this study teacher proficiency levels in each domain were rated as "Developing" or "Early" technological proficiency levels. For the qualitative portion of this study the research coded classroom observations and lesson plans to triangulate the Texas STaR results. Based on the observation and archival data, the researcher coded the levels of technology proficiency analyzed in the qualitative data. The responses from the quantitative portion concluded that teachers with higher technology proficiency, as rated on the Texas STaR survey, used technology in their classroom more frequently then teachers with a lower technology proficiency.

Frequency of Information and Communication Technology Use

The frequency of ICT use in the classroom is influenced by the factors that contribute and support the ICT implementation in a school (Pelgrum & Voogt, 2009). Dexter (2008) suggests effective leadership that develops and maintains support for the

teachers within the organization during ICT implementation yields to effective ICT implementation and use within the classroom. The frequency of ICT use in the classroom is dependent upon the clear vision and goals set by the organizational leader (Dexter, 2008).

In a study conducted by Nguyen and Tri (2014), a convenience sample of 146 English Language Learners were surveyed to determine how frequently and for what purposes learners used ICT in the classroom. The survey comprised of four sections to include; background information, hours spent and general use of ICT, hours spent and educational use of ICT, and close-ended questions to investigate students' perceptions of educational ICT use. The results of the survey revealed students' frequency of general ICT use was on average more than 20 hours a week, while the frequency of educational ICT use was less than 10 hours a week. The results from the students' perceptions of using ICT for educational purposes indicated ICT had a positive influence on student learning and students hoped to use ICT more to learn. Further studies need to be conducted to determine what activities students use ICT for outside of the classroom to help create best practices to emulate and implement these ICT activities into learning opportunities.

In an exploratory study by Pelgrum and Voogt (2009), archival data from a national sample of math teachers from countries with various ICT use was analyzed to compare the results from high frequency countries and low frequency countries. The study aimed to address the differences between high and low frequency countries to determine the factors that lead to stagnation and barriers in the ICT implementation process. The archival data was analyzed and found 53 items from the initial survey

showed a meaningful effect size of (≤ -0.5 or ≥ 0.5). The research presented a summary of the variance in results between the high frequency countries and the low frequency countries. According to the survey results, in high frequency countries students worked in groups according to their interests, had flexible schedules, were exposed to ICT integration in all academic subjects, and teachers used a learner centered approach. In low frequency countries, students worked according to a fixed schedule, ICT was a separate subject in the school, and students were expected to use ICT solely according to teacher directions. Due to the exploratory nature of the research, further analysis to refine the results and minimize the data selection criteria need to be conducted to find even more meaningful results to continuously improve ICT use in education.

Teacher Perceptions of ICT

As the trend of learning with technology becomes an integral part of education, the concept of using technology as a learning tool has become an urgent need for teachers to realize and utilize in the classroom (Şad & Göktas, 2014). Teacher perceptions and beliefs about ICT are influential factors that affect integrating technology in the classroom (Kim et al., 2013). Even though national statistics continue to increase, indicating more access to technology, teacher perceptions continue to decline due to the barriers identified preventing technology implementation (Wachira & Keengwe, 2011). Teachers who have reported positive perceptions of ICT implementation in the classroom are often hindered in ICT use due to the internal and external barriers that prevent maximum implementation to occur (Wachira & Keengwe, 2011).

Technology and Students' Futures

The innovative opportunities ICT has provided to education are invaluable for increasing effective teaching and enhancing student learning (Thorsteinsson, 2012). The use of ICT in education has expanded to become a skill that must be taught and mastered by all students for their future, not just future engineers and scientists (U.S. Department of Education, 2010a). According to the U.S. National Educational Technology Plan (2016), "Preparing students to be successful for the future requires a robust and flexible learning infrastructure capable of supporting new types of engagement and providing ubiquitous access to the technology tools that allow students to create, design, and explore" (p. 69). Technology is an inevitable component of the future and by investing in technology for current students in the education system, an investment is being made for the future (Garland & Tadeja, 2013).

Technology Implementation as a Learning Process

Implementing technology in the classroom is not only a valuable tool for students' futures, it is a valuable tool to model and create learning processes for students. The technology implementation process serves as an opportunity to redesign the learning environment to allow for shared control between the teacher and students. It is important students help in development of new pedagogy and teachers utilize students as a resource to increase effective teaching practices (Beetham & Sharpe, 2013). According to Beetham and Sharpe (2013), "It is a powerful idea that the teacher can learn about teaching from their exchanges with students" (p. 18). This mindset of creating a collaborative environment supports the idea of technology implementation as a learning

process where the teacher and students integrate new technologies in a shared effort (Laurillard, 2013).

In a study conducted by Umbach and Wawrzynski (2005) the relationship between faculty practices and student engagement was explored to provide an understanding of what influences student engagement and learning. This study utilized two national data sets from the *National Survey of Student Engagement (NSSE)* that identified best teaching practices that increased student engagement. For this study, 137 schools were surveyed with a sample of 42,259 students and 14,336 faculty members that were assessed on how they structured their classroom and assignments. Hierarchical Linear Modeling was used to analyze data to examine the relationship between students and faculty. The results from this study revealed that student engagement was higher when students were included in the learning design process. Survey items measured students' level of contribution to the learning process to include; the use of technology in the classroom, creating relevant work related skills, and solving complex problems. Students that *Very Much* to their level of contribution, had a high level of engagement and believed learning was a collaborative process.

Student Engagement

In a study conducted by Sadaf, Newby, and Ertmer (2012), 286 preservice teachers were randomly sampled to voluntarily participate in a study to reveal perceptions and factors that contribute to current and future use of technology in the classroom. Teachers were surveyed and interviewed to collect quantitative and qualitative data. The survey instrument used in this study was the *Web 2.0 Preservice Teacher Survey* framed from the Decomposed Theory of Planned Behavior with a Cronbach's Alpha of .83 to

.90. Results from the survey indicated teacher attitude towards technology had the greatest impact on intention of technology use ($\beta = 0.107$, $t = 2.494$) and that subjective norm had no significant impact on intention of technology use ($\beta = 0.049$, $t = 0.990$). Interview data and open-ended survey data was analyzed using an inductive coding process to triangulate survey results. Qualitative data results revealed teachers had an overall positive perception towards using technology in education and stated positive comments such as "I would like to incorporate Web 2.0 technologies within my classroom because I think they are a great way to communicate in the class and get students more involved and interact with each other" and "I think that it would be a great way for the students to use technology and advance in their learning" (Sadaf et al., 2012, p. 182). From the interview responses the most common theme reported by every teacher that was interviewed was student engagement. Teachers believed that technology use provided a platform to increase personalized learning, which resulted an increased student engagement. Overall, interview data indicated teachers' perceptions of technology to have a positive impact on student learning, engagement, motivation, and provide various learning experiences.

Teacher Classroom Practices

Based on conducted research, teachers believe effective ICT implementation has a positive impact not only on student learning but also the planning, delivery, and content of instruction (Comi, Gui, Origo, Pagani & Argentin, 2016). Carle, Jaffee, and Miller (2009), believe there are endless opportunities for teachers to improve pedagogy and enhance student current and future learning, when technology is present. Overall, teachers are challenged to continue to grow and improve their classroom practices as they

face the possibilities of the 21st Century that come with the expansion of ICT (Albion, Tondeur, Forkosh-Baruch, & Peeraer, 2015).

Classroom Management

In order for ICT implementation to have a positive influence on the pedagogical classroom practices, basic infrastructure and classroom management must be established in order to use the new technology (Mandinach & Cline, 2013). To further reveal the barriers to ICT implementation a study by Wachira and Keengwe (2011) explored these barriers among urban math teachers. In this mixed methods study 20 teachers were sampled to participate in interviews, surveys, and classroom observations. Teachers participated in interviews that were further explored by a technological self-efficacy survey created from the responses from the teacher interviews and triangulated with classroom observation data. The results from the study successfully identified external and internal barriers to technology implementation. The external barriers of the study included, the availability, lack of reliability, and lack of support in order to implement technology. The internal barriers were the lack of time, knowledge, and confidence of the teacher in order to integrate technology. The lack of time teachers experienced due to curricular demands was one of the main obstacles identified to technology use. Teachers reported feeling as if they did not have time to explore technology with students and may not have the knowledge or confidence to implement technology, which would result in using valuable instructional time. Even though teachers felt like they did not have time with students to use technology, they wanted to learn how to use technology and to try to implement technology even though external and internal barriers prevented maximum ICT use (Wachira & Keengwe, 2011).

Student Classroom Interactions

With the integration of ICT, student classroom practices will inevitably be affected. From the way students communicate with one another to their levels of motivation, technology changes the way students interact with teachers, other students, and learning (Shieh, 2012). According to Grant and Basye (2014),

> Digital tools can fuel student-centered learning by allowing students more control over, a sense of ownership of, and accountability for the learning methodologies that fit their particular learning styles, the processes that best fit these styles, and, to a great extent, the content areas that spark their interests. (p. 1)

Technology increases student ownership and engagement that results in increased student engagement (Fonseca, Martí, Redondo, Navarro, & Sánchez, 2014). In a study by Şad and Göktas (2014), 1,087 teachers were surveyed to examine their perceptions of using laptops and mobile phones as relevant learning tools. Out of the 1,087 teachers, all teachers owned a mobile phone and an estimated 650 owned laptops. The researchers developed a 5-point Likert scale survey with 32 items to collect teacher attitudes and perceptions of using technology for student learning. The instrument was validated through NVivo analysis of literature reviews, reviewed by a panel of experts, and piloted with 368 teachers. Results from the survey indicated teachers preferred to use laptops for learning and believed that laptops motivated learners through individualized learning opportunities and quick access to information. In addition, teachers believed laptops encouraged lifelong learning and made students more motivated to learn because technology made learning more interesting and enjoyable. Last, teachers believed

technology had a positive effect on students by encouraging students to learn anytime and improved student achievement through more active learning.

Student Reflection

Student reflection is a distinctive outcome of effective technology implementation that provides students the opportunity to gain awareness and understanding of their learning experience. It is reported that students who have more experiences with technology expand their knowledge, practice and foster reflection at an increased rate compared to students who do not have multiple perspectives and experiences with technology (Strampel & Oliver, 2007). Using technology to promote student reflection can be one of the most powerful ways for students to reflect at the highest level of critical thinking (McNicol, Lewin, Keune, & Toikkanen, 2014).

In a study conducted by Kori, Pedaste, Leijen, and Mäeots (2014) effective student reflection practices were identified through qualitative research of archival data. The purpose of the study was to determine the reflection practices that were most effective for students in a technology enhanced learning environment. Through the coding process of 33 scholarly articles, three reflection tools were identified to be most effective in a technology enhanced learning environment; technical support tools (blogs, videos), technical support tools with predefined guidance (prompts, guiding questions), and technical support tools with human interaction (peer observation, peer feedback). The results from this study reported that student reflection has a positive impact on student learning and suggests educators take time to determine which type of reflection would be most beneficial to student learning. Regardless of the specific type of reflection used in a technology-enhanced environment, the influx of technology use in the classroom has

increased the focus and integration of student reflection in the learning process (Strampel & Oliver, 2007).

Personalized Learning and Relevancy

According to Chuong and Mead (2014) in order to achieve personalized learning in education, initial and long-term investments in technology have to happen in order for effective implementation to occur. From professional development to technological infrastructure, personalized learning has costs that policy makers must support in order to fund and maintain such initiatives in education (Chuong & Mead 2014). To measure the impact personalized learning has on students, Hwang, Sung, Hung, Huang, and Tsai (2012) completed a study to examine the impact of personalized educational gaming and technology. The participants in this study included 46 fifth grade students who voluntarily agreed to participate in the study. Three instruments were used in this study. The first instrument was adapted from the *Index of Learning Styles Questionnaire* developed by Soloman and Felder (2001) with the reliability of 0.72 for the pre survey and 0.81 for the post survey. The second instrument used in this study was the student motivation survey to assess the impact technology had on student motivation with a Cronbach's Alpha of 0.87. The last instrument, a technology acceptance survey, was used to measure student's perceived ease of use of technology with the Cronbach's Alpha 0.94 and 0.95 for each dimension of the survey. In order to assess the impact of personalized learning, students in the control group and in the experimental group completed a pre-assessment. After students completed the lesson, which included the same content just different formats, students completed a post assessment.

> According to the results *(F = 4.64, p<0.05)*, there was a significant difference between the two groups; that is, the students who learned with the personalized educational computer game showed significant better learning achievements than those who learned with the game that did not meet their learning styles (Hwang, et al., 2012, p. 632,).

The results from this study demonstrate effective personalized learning, enhanced by technology, provides the individualized attention for each student, similar to the idea of the virtual tutor (Brusilovsky, 2001). According to Tosun and Baris (2011), ICT allows for the inevitable enrichment of education by offering various learning opportunities for students to develop their personalized learning portfolio. As an education system, there is a high need to create a level of relevancy to match the increasing usage of ICT in our students' everyday lives (El-Hussein & Cronje, 2010).

Summary of Findings

The implementation of ICT in the classroom is an increasingly important focus for education to research to discover best practices that enhance student learning (Hew & Brush, 2007; Roehl, Reddy, & Shannon, 2013). According to the results of the study by Yuen and Ma (2008), a teacher's technological self-efficacy is a predicting factor that determines the extent to which ICT is implemented into the classroom (Yuen & Ma, 2008). Another factor that contributes to the frequency of ICT use in the classroom is the technological proficiency a teacher possesses to implement ICT effectively. According to Williams et al. (2000), the technology skills of a teacher is one of the most inhibiting factors for a teacher to utilize ICT in their classroom instruction. In order for the frequency of ICT use to increase in education, the exploratory study conducted by Dexter

(2008) revealed effective leadership, learner centered classrooms, and a flexible environment contribute to the success of using ICT for student learning. Last, literature supports that even though barriers to implementation may exist, teachers have a positive perception of technology use and believe technology has a positive impact on student learning and interactions (Şad & Göktas 2014; Shieh, 2012).

Theoretical Framework

The theoretical framework for this study is a combination of the activity theory devised by Vygotsky and Leont'ev and Bandura's social cognitive theory that provided the foundation for the concept of self-efficacy. The activity theory provides the theoretical tools to understand the correlation between activity and cognition in a variety of settings (Lim, 2002). The activity theory stems from the theory of cognition from Vygotsky which then leads to the perspective that:

> Cognition is no longer studied in light of individuals learning in isolation with only their minds to guide them; instead, the emphasis is on individual learning with a wide variety of tools, and people that help them carry out their goal-oriented activities in a sociocultural setting (Lim, 2002, p. 413).

The activity theory serves as a connection with learning and the socio-cultural setting the learning is occurring in. The theory uses activity systems as the unit of analysis providing the opportunity for observation of the learning process in the respective socio-cultural setting. Lim (2002) believes that ICT in education cannot be researched through isolation and must be observed through a broader setting that considers multiple variables. In this study, the activity theory supports the observation of ICT implementation within the context of the classroom and includes all variables that

have an influence on the implementation of ICT.

Bandura's social cognitive theory is popularly identified for the specific emphasis on the concept of self-efficacy. Self-efficacy is the beliefs in one's self to create and deliver action to obtain the desired results. Bandura explains self-efficacy as a critical behavioral influence that guides the action, time, energy, emotional investment, and success one has in connection to a task. In this study, the influence of the integrated ICT was researched to examine the influence the integration has on the self-efficacy a teacher possesses in regards to technology.

Conclusion

The review of the literature supported this study by providing an overview of ICT in education, the need to study ICT in education, teacher technological self-efficacy, teacher technology proficiency, frequency of ICT use in education, teacher perceptions of ICT implementation, teacher classroom practices, and student classroom interactions. Chapter 3 will provide an overview of the research problem, operational of theoretical constructs, research purpose and questions, research design, population and sample, instrumentation, data collection procedures, data analysis, privacy and ethical considerations, and the research limitations of the study.

CHAPTER III

METHODOLOGY

The purpose of this study was to examine the influence the implementation of ICT has on teacher technological self-efficacy, technology proficiency, frequency of ICT use, and classroom practices of urban middle school teachers. Additionally, the study examined the influence of implementation of ICT on students' classroom interactions. Survey, teacher information technology logs, observation, and interview data were collected from a purposeful sample of urban middle school teachers in a southeast Texas school district. Quantitative data were analyzed using frequencies, percentages, means, and a two-tailed paired t-test. Qualitative data were analyzed using thematic analysis. This chapter will present an overview of the research problem, constructs, research purpose, research questions, research design, population and sample, instrumentation, data collection procedures, data analysis, ethical considerations, and research design limitations for this study.

Overview of Research Problem

According to Riley et al. (2000), technology has become one of the most powerful tools to revolutionize education. With the increased use of technology within education, the need to research the human factors that influence how teachers can successfully implement information and communication technologies within their classroom continues to grow (Albion, 1999; Graham et al., 2014). To help support implementation of new

ICT, it is important to understand teacher technology self-efficacy and proficiency as critical factors that contribute to the teacher's anticipated use of ICT in the classroom (Anderson & Groulx, 2011; Ertmer, 2005). Research shows the lack of teacher knowledge and confidence to implement technology within the classroom has a direct correlation with the teacher's level of technology use in the classroom (Ertmer, 2005; Lawless & Pelligrino, 2007).

Specific factors that contribute to ICT implementations have had minimal focus on the influence ICT implementation has on teacher technological self-efficacy and technology proficiency (Sang, Valcke, & Braack, 2010). By researching the influence ICT implementation has on teacher technological self-efficacy and technology proficiency before, during, and after the implementation this study improved the current understanding of the human factors that need to be considered in order to improve future implementation practices to occur within education (Dillon, 2001).

Operationalization of Theoretical Constructs

This study consisted of five constructs: (a) technological self-efficacy, (b) technology proficiency, (c) frequency of ICT use, (d) classroom practices, and (e) student interactions. Technological self-efficacy was defined as the individual's judgment of their ability to use computers/technology (Downey & Zeltmann, 2009) and was measured by the *Technology and Teaching Efficacy Scale Survey* (Mayo et al., 2005). Technology proficiency was defined as one's competency to perform technological tasks (Ropp, 1999) and was measured by the *Technology Proficiency Self-Assessment for 21st Century Learning* survey (Christensen et al., 2015). Frequency of ICT use was defined as the extent to which ICT is used for teaching and learning (Pelgrum & Voogt, 2009) and was measured by the teachers' information technology logs obtained from the district

technology department. Classroom practices were defined as “instructional and classroom management strategies and techniques and the curriculum designed by the teacher” (Cole, 2012, p.4) and were measured by classroom observations and teacher interviews. Student interactions were defined as student behaviors (Pennings et al., 2014) and were measured by classroom observations and teacher interviews.

Research Purpose, Questions, and Hypotheses

The purpose of this study was to examine the influence the implementation of ICT has on teacher technological self-efficacy, technology proficiency, frequency of ICT use, and classroom practices of urban middle school teachers. Additionally, the study examined the influence of implementation of ICT on students' classroom interactions. The study addressed the following research questions:

1. Is there a statistically significant mean difference between pre- and post-teacher technological self-efficacy when ICT is implemented?

   $H_{a:}$ There is a statistically significant mean difference between pre- and post-teacher technological self-efficacy when ICT is implemented.
2. Is there a statistically significant mean difference between pre- and post-teacher technology proficiency when ICT is implemented?

   $H_{a:}$ There is a statistically significant mean difference between pre- and post-teacher technology proficiency when ICT is implemented.
3. Is there a statistically significant mean difference between pre- and post-teacher frequency of ICT use when ICT is implemented?

   $H_{a:}$ There is a statistically significant mean difference in teacher frequency of ICT use when ICT is implemented.
4. What are teacher perceptions regarding implementation of ICT?

5. How, if at all, does the implementation of ICT influence teachers' classroom practices?
6. How, if at all, does the implementation of ICT influence students' classroom interactions?

Research Design

For the purposes of this study, a sequential mixed methods case study design was used to examine the influence the implementation of ICT had on teacher technological self-efficacy, technology proficiency, frequency of ICT use, classroom practices of urban middle school teachers, and students' classroom interactions. This design had significant advantages by allowing for a more in-depth exploration of the results from the quantitative portion of the study by following up with the qualitative portion of the study. This case study was appropriate because it allowed for a more in-depth understanding of each participant in the study and the influence the ICT implementation had on their technological self-efficacy and proficiency. A purposeful sample of 6th grade teachers who were participating in a community funded blended learning grant were selected to participate in the *Technology and Teaching Efficacy Scale* and the *Technology Proficiency Self-Assessment for 21st Century Learning* surveys, interviews, and classroom observations. Quantitative data was analyzed using frequencies, percentages, mean and a two-tailed paired t-tests, while qualitative data was analyzed using an inductive coding procedure.

Population and Sample

For this study, the population consisted of one middle school, grades six through eight, within an urban large Southeastern school district in Texas. In the 2014-2015 school year, the district enrolled 35,218 students and employed 1,984 teachers (Texas

Education Agency, 2014). The district consists of five early childhood/Pre-K centers, 26 elementary schools, eight middle schools, and seven high schools. The middle school selected for this study consists of 6th through 8th grades. This school was selected given that it was selected by the school district to participate a community funded blended learning grant to pilot blended learning for the school district. The grant has provided funding for the resources and training necessary for the 6th grade teachers to implement ICT into their classrooms.

From the participating middle school, a purposeful sample of eight 6th grade teachers were selected to participate in the study. The eight 6th grade teachers were selected to participate in the study given that the grant only funded the technology integration for 6th grade classrooms; therefore, they were the grade level that integrated technology across all classes. Table 3.1 displays the middle school's student population including grade level, ethnicity, and socioeconomic status. Table 3.2 displays the total staff of the middle school. Table 3.3 displays the middle school's teacher demographics including ethnicity, gender, and years of teaching experience. To protect participant identities, the participating school and participants were identified by pseudonyms.

Table 3.1

Student Demographics of Southeast Middle School

Students	Frequency (n)	Percentage (%)
Total	945	100.0
By Grade Level		
Grade 5	103	10.9
Grade 6	319	33.8
Grade 7	263	27.8
Grade 8	260	27.5
Race/Ethnicity		
African American	24	2.5
Hispanic	887	93.9
White	28	3.0
Asian	2	0.2
American Indian	2	0.2
Two or More Races	2	0.2
Economically Disadvantaged (ED)	860	91.0
English Language Learners (ELL)	392	41.5
At-Risk	687	72.7

Table 3.2

Staff of Southeast Middle School

Staff	Frequency (n)	Percentage (%)
Total	62.5	100.0
Professional Staff	57.5	92.0
Teachers	49.1	78.5
Professional Support	4.4	7.1
Campus Administration	4.0	6.4
Educational Aides	5.0	8.0

Table 3.3

Teacher Demographics of Southeast Middle School

Staff	Frequency (n)	Percentage (%)
Total Teachers	49.1	100.0
Race/Ethnicity		
African American	7.4	15.1
Hispanic	17.1	36.1
White	23.9	48.6
Two or More Races	0.1	0.2
Gender		
Male	19.9	40.6
Female	21.2	59.4
Years Teaching Experience		
Beginning	6.8	13.8
1-5	18.1	36.9
6-10	5.6	11.5
11-20	9.6	19.5
+ 20	9.0	18.3

Participation Selection

All participants who completed the survey voluntarily agreed to participate in the individual interviews and classroom observations following the survey. The researcher emailed an electronic copy of the informed consent form for participants to review and send back to the researcher agreeing to participate in the interviews and surveys. Table

3.4 displays the demographics of the teachers who voluntarily participated in the quantitative and qualitative portions of this study.

Table 3.4

Teacher Participant Demographics

Staff	Frequency (n)	Percentage (%)
Total Teachers	8	100.0
Race/Ethnicity		
Hispanic	3	37.5
White	5	62.5
Gender		
Male	1	12.5
Female	7	87.5
Years Teaching Experience		
0-4	2	25.0
5-9	3	37.5
10-14	1	12.5
15-19	2	25.0
Subject Taught		
Elective	1	12.5
Language Arts	2	25.0
Math	2	25.0
Science	2	25.0
Social Studies	1	12.5

Instrumentation

Technology and Teaching Efficacy Scale

The instrument used for this study to measure teacher technological self-efficacy was the *Technology and Teaching Efficacy Scale* (TTES) which is a survey adapted by Mayo et al., (2005) by Underwood and Tanguma (1999). The TTES survey was developed in a three year longitudinal study that assessed the level of confidence a teacher perceived themselves to have in order to use technology in their classroom and was piloted at the University of Houston-Clear Lake (UHCL) (Mayo et al., 2005). The pilot study tracked 435 teacher candidates (TC) during their first year as classroom interns to their first year as classroom teachers. Over the duration of the study, researchers utilized results from pre- and post-tests of technology training in the teacher preparation program and results from a comparative study of the UHLC TC's compared to alternative certification teachers who did not go through the teacher preparation program. The results from the studies showed the researcher the survey items of teacher self-efficacy that exhibited the most change during the three year study to be included as items in the survey.

The TTES contains 25-items teachers rate on a 5-point Likert scale, 1= *Strongly Disagree* (SD) *to* 5 = *Strongly Agree* (SA). Composite scores are calculated by calculating the sum of the individual responses to create a response range of 25 to 125. The higher the composite score, the more technology self-efficacy a teacher possesses. The Cronbach's alpha reliability coefficient for the TTES is 0.96.

Technology Proficiency Self-Assessment for 21st Century Learning

The instrument that was used for this study to measure teacher technological proficiency was the *Technology Proficiency Self-Assessment for 21st Century Learning;* a survey adapted by Christensen et al., (2015) from a survey by Ropp (2009). The *Technology Proficiency Self-Assessment for 21st Century Learning* survey is an updated assessment of the *Technology Proficiency Self-Assessment* (2000) that assesses the level of proficiency a teacher perceives of their technological proficiency. The *Technology Proficiency Self-Assessment for 21st Century Learning* was piloted in 2014 with 466 participants from primary and secondary education from several states. The participants for the pilot included pre-service and in-service teachers with a range of teaching experience from 0 to 43 years.

The *Technology Proficiency Self-Assessment for 21st Century Learning* contains 34-items teachers rate on a 5-point Likert scale, 1 = *Strongly Disagree* (SD) to 5 = *Strongly Agree* (SA). Composite scores are calculated by calculating the sum of the individual responses to create a response range of 34 to 170. The higher the composite score, the more technological proficiency a teacher possesses. The Cronbach's alpha reliability coefficient for the *Technology Proficiency Self-Assessment for 21st Century Learning* is 0.96.

Data Collection Procedures

Quantitative

The researcher first submitted a request for the approval from the Committee for Protection of Human Services (CPHS) from the University of Houston-Clear Lake (UHCL). A research request for the selected district to research was also submitted. Once

approved, the principal of the selected school was contacted to discuss the research. The population sample of teachers were selected to participate in the quantitative portion of the study by soliciting all 6th grade teachers to participate in the study through an email informing teachers about the proposed study to be conducted and to reply to the researcher if they would like to voluntarily participate in the study.

After the researcher received the replies from each voluntary participant, the researcher sent an email to each participating teacher with a link to the *Technology and Teaching Efficacy Scale* and the *Technology Proficiency Self-Assessment for 21st Century Learning* (see Appendix A). A survey cover letter (see Appendix B) was embedded in the email with the links to the survey and assessment that explained the purpose of the study, their participation was completely voluntary, the estimated time of 25 minutes it would take to complete the survey and assessment, and assurance that their identities would be confidential. There were two weeks between when the email was sent to the when data were collected. After ten days, the link to the survey was no longer available. Teacher responses were collected using the survey instrument administered via SurveyMonkey.

In order to gain informed consent from participants, the teacher electronically agreed to participate in the study as question one of the survey before completing the rest of the survey. The results of the survey were collected and downloaded into an Excel file and then imported into the Statistical Package for Social Sciences (SPSS). To measure the teacher's level of use of technology in the classroom, the researcher contacted the technology department of the school district to request monthly records of the participants' Information Technology logs. IT logs were stored in a locked cabinet for

analysis by the researcher until the completion of the study and will remain in the locked cabinet for five years before being destroyed.

Qualitative

Upon receiving research approval, the researcher solicited a purposeful sample of eight 6th grade teachers involved in a community-funded blended learning grant who participated in the quantitative portion of the study to participate in two semi-structured, in-depth, individual interviews and classroom observations for the qualitative portion of the study. An in-depth interview can be viewed as a conversation kept at an informal level (Lichtman, 2010). This method of interviewing was used in order to gain as much information as possible from participants in the most unbiased method possible (Lichtman, 2010).

With informed consent from the participants, all interviews were recorded with an Apple iPhone on the Sound Recorder App and a Roland M360 Recording device. The goal of the interviews was to understand how the implementation of ICT influenced the teacher technological self-efficacy, technology proficiency, teacher perceptions of ICT, classroom practices, and student classroom interactions. All participants who completed the last question of the quantitative survey agreeing to participate in the follow up interviews were contacted via email to inquire about participating in the research. After receiving responses from all participants, dates and times to meet for interviews were arranged. The first individual interviews occurred as pre-interviews in November, and the second individual interviews occurred as post-interviews in April. Questions focused on the experiences the 6th grade teachers had with ICT implementation and how ICT implementation influenced their technological self-efficacy and technology proficiency.

Interviews lasted approximately 45 minutes each, utilizing a semi-structured format and followed the teacher interview guides (see Appendices D and E).

In addition to interviews, observations were conducted to understand how the implementation of ICT influenced teacher technological self-efficacy, technological proficiency, teacher perceptions of ICT, classroom practices, and student classroom interactions. 15-minute pre-observations occurred one time in November and one time in December. Starting in January through April, 15- minute observations were conducted with each teacher four times a month on a weekly basis. The data from the quantitative portion of this study and qualitative portion of this study will be stored for a minimum of five years on a flash drive that will be locked in a cabinet of the faculty sponsor's office. After five years, the documentation will be destroyed.

Table 3.5

Data Collection Timeline

	November	December	January	February	March	April
Interviews	X					X
Observations	X	X	X	X	X	X
Surveys	X			.		X
IT Logs	X	X			X	X

Data Analysis

Quantitative

To determine the results from each survey, the data collected through SurveyMonkey was exported into an Excel document, which was then imported into SPSS. To answer research question 1, a two-tailed paired t-test was conducted to determine if there was a statistically significant mean difference between pre- and post-teacher technology proficiency. The measurement of both variables was continuous. To answer research question 2, a two-tailed paired t-test was conducted to determine if there was a statistically significant mean difference between pre- and post-teacher technological self-efficacy. The measurement of the variables was continuous. To answer research question 3, means were calculated to determine the mean pre- and post-frequency of ICT use and a two-tailed paired t-test was conducted to determine if there was a statistically significant mean different between pre- and post-frequency of ICT use. Effect size was measured using Cohen's *d* and coefficient of determination r^2. A significance value of .05 was used for this study.

Qualitative

To answer research questions 4, 5, and 6, the researcher analyzed the interview and observation data using thematic analysis. Thematic analysis was used for this particular study to interpret the data collected into themes that were easy to communicate and create actionable steps associated to the emergent themes. The researcher started data analysis by first downloading all audio files from the iPhone to a laptop and organized files in a Qualitative Research folder in the "Documents" on the laptop. The researcher then transcribed the interviews from the iPhone audio files to review.

The model of the data analysis that was used comes from the Three C's as specified by Lichtman (2010). The three C's consist of six steps; from the initial coding process, editing the codes, developing categories, editing categories, and creating concepts based on categories. The researcher reviewed the transcriptions the initial time and developed initial codes, using the software NVivo. After all transcripts had been read through and coded multiple times, the researcher went back and re-read the initial emergent codes to modify and/or condense any codes. After making the necessary revisions to the emergent codes, the researcher organized the codes into categories to become the emerging key concepts from the collected data.

Privacy and Ethical Considerations

Before the researcher collected data, approval from the UHCL Committee for the Protection of Human Subjects (CPHS) was obtained. To conduct research in the selected district, Institutional Review Board approval was also obtained. Once approved, the principal of the approved school was contacted to discuss the research. Data collection did not begin until the researcher had all approvals. All teachers who were selected to participate in this study were voluntary participants and provided with a survey cover letter and consent form.

The procedure for obtaining informed consent for the surveys was as follows: the researcher sent an email to all 6th grade teachers to solicit for voluntarily participation in the study. After the researcher received replies from each voluntary participant, the researcher sent an email to each participating teacher with a link to the surveys and survey cover letter. In order to gain informed consent from participants, the teachers electronically agreed to participate in the study as question one of the survey before

completing the rest of the survey. The procedure for obtaining informed consent for the interviews and classroom observations was as follows: the last question of the quantitative surveys solicited volunteers for interview and classroom observations. In addition to giving consent for the interviews and observations in the last question of the survey, the participants also signed the teacher consent form (see Appendix C).

The researcher collected all informed consent agreements from the surveys, interviews, and observations to print, and will store informed consent agreements in a locked file cabinet for five years. In order to maintain confidentiality during the research process, the researcher used pseudonyms for the school and teachers. Data were collected and recorded through SurveyMonkey with an account only the researcher had the log in information for. During the data collection process only participants who gave informed consent and the researcher were involved in the data collection procedures. All data collected will be stored on a flash drive and locked in a file cabinet in the researcher's office for five years before being destroyed.

Research Design Limitations

As with all studies, this study had several limitations. First, the sample for the study included one urban intermediate school. Due to the small sample of the school selected to participate in the study, this is not a large enough sample to be able to state as representative of the district. This small sample limits the generalizability of the study by minimizing the external validity of the results. Second, the school being selected for the study has a high population of English Language Learners as well as Economically Disadvantaged (ED) students. Differences in student populations can affect the factors that contribute to teacher technological self-efficacy and technology skills of ICT

implementation. Third, the past experiences teachers have with implementing ICT in education can influence their current experience with ICT implementation. The past experiences a teacher has with ICT implementation could influence their self-efficacy based on the positive or negative experience they may have had prior to the implementation that occurred during this study. Another limitation of this study is the time that was allocated for classroom observations was 15 minutes each week. This limited amount of time in each teacher's classroom each week to conduct classroom observations could have impacted the qualitative data collected for this study depending on the part of the lesson the researcher observed. That last limitation of this study that threatens the internal validity is the validity of results from the surveys completed by the teachers. The honesty of participants that complete the surveys is a confounding variable that could impact the results of the study if a participant did not respond honestly.

Conclusion

Chapter 3 discusses the overview of the research problem, operational constructs, the research purpose, questions, and design that will be used in this study. The purpose of this study was to examine the influence the implementation of ICT has on teacher technological self-efficacy, technology proficiency, frequency of ICT use, and observable classroom practices of urban middle school teachers. Additionally, the study examined the influence of implementation of ICT on students' classroom interactions. Chapter 4 will report the results from the *Technology Proficiency Self-Assessment for 21st Century Learning* and *Technology and Teaching Efficacy Scale* and the data that was collected from the teacher interviews and classroom observations.

CHAPTER IV

RESULTS

The purpose of this study was to examine the influence the implementation of ICT has on teacher technological self-efficacy, technology proficiency, frequency of ICT use, and classroom practices of urban middle school teachers. This chapter presents the results from the quantitative and qualitative data analysis of the study. Survey, interview, IT logs, and observation data were analyzed comparing the influence the implementation of ICT had on teacher technological self-efficacy, technology proficiency, frequency of ICT use, and classroom practices pre- and post-ICT implementation. This chapter begins with the demographic characteristics of the participants, instrument reliability, and data analysis for each of the six research questions, concluding with a summary of the findings.

Demographic Characteristics of the Participants

During the fall of 2015, the researcher met with the school principal of the selected middle school for this study requesting support for the research. After principal approval was received, teachers were invited to a voluntary informational meeting to learn more about participation in the study. Teachers were requested to voluntarily participate in the study based on their participation in the community funded blended learning grant. At the conclusion of the informational meeting, eight out of the nine (88.9%) teachers solicited voluntarily agreed to participate in the study. After the informational meeting, the teachers that agreed to participate in the study signed the

informed consent forms, were sent two electronic surveys to complete, and scheduled for individual interviews and observations.

Table 4.1 represents the demographic data of the teachers who participated in the study. The teachers consisted of 12.5% male teacher (n = 1) and 87.5% (n = 7) female teachers. The race/ethnicity of the teachers that participated in this study consisted of 62.5% Caucasian (n = 5) and 37.5% (n = 3) Hispanic. The teacher participants in this study were distributed between 25.0% (n = 2) Mathematics, 25.0% (n = 2) English Language Arts, 25.0% (n = 2) Science, 12.5% (n = 1) Social Studies, and 12.5% (n = 1) an Elective (e.g., Technology Applications, Culinary Arts, and Choir).

Within the sample of teachers selected for the study, the years of teaching experience varied with 25.0% (n = 2) reporting 0-4 years of teaching experience, 37.5% (n = 3) reporting 5-9 years of teaching experience, 12.5% (n = 1) reporting 10-14 years of teaching experience, and 25.0% (n = 2) reporting 15-19 years of teaching experience. The age range within the sample of teachers selected for the study varied with 37.5% (n = 3) reporting to be in the age range of 21-30, 25.0% (n = 2) reporting to be in the age range 31-40, 12.5% (n = 1) reporting to be in the age range 41-50, 12.5% (n = 1) reporting to be in the age range 51-60, and 12.5% (n = 1) reporting to be in the age range of 60 or older. Years of teaching experience varied within the total sample population according to survey responses with 25.0% (n = 2) reporting 0-4 years of experience, 37.5% (n = 3) having 5-9 years' experience, 12.5% (n = 1) having 10-14 years' experience, 25.0% (n = 1) having 15-19 years of experience. Table 4.2 represents the student demographics represented in the study. The students of the teachers selected to participate in this study were majority Hispanic with 82.0% (n = 182), the next largest ethnic group White with

15.0% (n = 35), African American with 1.5 % (n = 3) and Other Pacific Islander 1.5% (n = 3).

Table 4.1

Teacher Participant Demographics: Gender, Race/Ethnicity, Subject Matter, and Years of Teaching Experience

	Frequency (n)	Percentage (%)
1. Gender		
Male	1	12.5
Female	7	87.5
2. Race/Ethnicity		
White	5	62.5
Hispanic	3	37.5
3. Subject Matter		
Elective	1	12.5
Language Arts	2	25.0
Math	2	25.0
Science	2	25.0
4. Years Teaching		
0-4 years	2	33.3
5-9 years	0	0.0
10-14 years	4	62.5
15-19 years	2	25.0

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Table 4.2

Student Demographics in 6th Grade Blended Learning Classrooms

	Frequency (n)	Percentage (%)
African American	3	1.5
Hispanic	182	82.0
Other Pacific Islander	3	1.5
White	36	15.0

Instrument Reliability

To assess the reliability or internal consistency of the two instruments used in this study, Cronbach's alphas were calculated. In Table 4.3 the reliability coefficient for the *Teaching and Technology Efficacy Scale* reported by Mayo et al. (2005), Kajs et al. (2001), and the coefficient for the *Technology Proficiency Self-Assessment for 21st Century Learning* reported by Christensen et al. (2015) and Ropp (2009) are compared to the reliability coefficients reports by the researcher. According to Fraenkel and Wallen (2006), a reliability coefficient that is .70 or greater is acceptable.

Table 4.3

Reliability Coefficients for Instruments

	Cronbach's α Rossacci (2016)	Cronbach's α Mayo, Kajs, and Tanguma, (2005), Kajs, Underwood, Coppenhaver, Driskell, and Crawford (2001); Christensen et al., (2015) and Ropp (2009)
1. Technology and Teaching Efficacy Scale	.83	.96
2. Technology Proficiency Self-Assessment for 21st Century Learning	.99	.96

Research Question One

Research question one, *Is there a statistically significant mean difference between pre- and post-teacher technological self-efficacy when ICT is implemented?,* was answered by conducting a two-tailed paired t-test to determine if there was a statistically significant mean difference between pre- and post-teacher technological self-efficacy. The *TTES* asked participants to rank their technological self-efficacy on topics such as their perception of their ability to use technology to increase student engagement and their perception of their ability to use technology to increase student understanding of content. Participants pre-ICT implementation reported a higher mean of technological self-efficacy (M = 4.3) than participants post-ICT implementation technological self-efficacy (M = 4.0). Findings indicated that there was a statistically significant mean difference between the pre- and post-technological self-efficacy scores, $t(7) = 2.70$, $p =$

.039, d = .96 (large effect), r^2 = .075 (see Table 4.4). The implementation of ICT had a large effect on the technological self-efficacy of the teachers and 75% of the variance in technological self-efficacy is attributable to the implementation of ICT.

Table 4.4

Paired t-test: Pre-scores and Post-scores on Technology and Teaching Efficacy Scale

	N	M	SD	*t*-value	df	*p*-value	d-value	r^2
1. Pre-Scores	8	4.3	4.67	2.70	7	.039	.96	.075
2. Post-Scores	8	4.0	5.45					

*Statistically significant ($p < .05$)

The frequencies and percentages of responses to the *Technology and Teaching Efficacy Scale* (TTES), a 23-item survey which required participants to rate themselves using the frequency scale (1 = *Strongly Disagree,* 2 = *Disagree,* 3 = *Neutral,* 4 = *Agree,* 5 = *Strongly Agree)* is displayed in Table 4.5. The first eight items in the survey pertained to the teacher's ability to incorporate technology in the classroom. Before ICT implementation, teachers responded *Strongly Agree* or *Agree* that technology use led to; students learning better (75.0%), teaching without sacrificing the basics (62.5%), capturing students' interests (100.0%), improving the quality of education (87.5 %), getting students excited about learning (100%), solving classroom problems (75.0%), and students thinking better (75.0%). Post-ICT implementation teachers responded *Strongly Agree* or *Agree* that technology use led to; students learning better (75.0%), teaching without sacrificing the basics (87.5%), capturing students' interests (87.5%), improving

the quality of education (75 %), getting students excited about learning (100%), solving classroom problems (62.5%), and students thinking better (62.5%).

Out of the eight items, there was a difference in opinion with four of the items pre-and post-ICT implementation. There were 62.5% of pre-ICT implementation teachers compared to 87.5% post-ICT implementation teachers who believed they could teach with technology without sacrificing the basics. Only 87.5% of post-ICT implementation teachers felt they could capture students' interests in learning using technology compared to 100.0% pre-ICT implementation. Another difference indicated by the results was 87.5% of teachers believed they were improving the quality of education using technology pre-ICT implementation which decreased to 75.0% post-ICT implementation. Last, 75.0% of teachers believed they could get their students thinking better pre-ICT implementation that decreased to 62.5% post-ICT implementation.

The next nine survey items pertained to the teacher's job as a successful teacher. Table 4.5 demonstrated pre-ICT implementation teachers responded *Strongly Agree* or *Agree* for the items; all students benefitted from the way the teachers taught (100.0%), students were successful because the teacher had done a good job (87.5%), the teacher is good at explaining things in terms the students can understand (100.0%), students with poor academic records could benefit from their teaching (87.5%), students who did not understand a concept, the teacher could explain it so it became clear (87.5%), the teacher could create an atmosphere of conducive learning (87.5%), the teacher was able to accurately evaluate their students' progress (100%), students retained more because their technology enhanced learning activities (75.0%), teachers varied strategies to meet students' needs (100.0%), and students were successful because of their teachers ability

to incorporate technology (75.0%). Post-ICT implementation teachers responded *Strongly Agree* or *Agree* for the items; all students benefitted from the way the teachers taught (75.0%), student were successful because the teacher had done a good job (75.0%), the teacher is good at explaining things in terms the students can understand (75.0%), students with poor academic records could benefit from their teaching (87.5%), students who did not understand a concept the teacher could explain it so it became clear (75.0%), the teacher could create an atmosphere of conducive learning (100.0%), the teacher was able to accurately evaluate their students' progress (87.5%), students retained more because their technology enhanced learning activities (75.0%), teachers varied strategies to meet students' needs (100.0%), and students were successful because of their teachers ability to incorporate technology (75.0%).

Out of the nine responses, five responses were different pre-and post-ICT implementation. Pre-ICT implementation teachers rated *Strongly Agree* or *Agree* for 100.0% of the items; all students benefitted from the way the teachers taught and the teacher is good at explaining things in terms the students can understand compared to 75.0% post-ICT implementation. Another significant difference was that 87.5% of pre-ICT implementation teachers rated *Strongly Agree* or *Agree* for the items; students were successful because the teacher had done a good job, and students who did not understand a concept the teacher could explain it so it became clear decreased to 75.0% post-ICT implementation. Last, only 87.5% of teachers post-ICT implementation rated they were able to accurately evaluate their students' progress compared to 100.0% of teachers pre-ICT implementation.

The last five survey items described how teachers were perceived and how teachers perceived their students. Out of the total responses, 75.0% of pre-ICT implementation teachers responded *Strongly Agree* or *Agree* to being perceived as a valued colleague, 50.0% as an asset to their school, 100.0% believed students who have difficulty in other classes do not have difficulties in their class, 75.0% felt that difficult students could learn in their class, and 87.5% believed they were able to adjust their teaching to help students having difficulty in their class. Post-ICT implementation, 75.0% of teachers responded *Strongly Agree* or *Agree* to being perceived as a valued colleague, 62.5% as an asset to their school, 100.0% believed students who have difficulty in other classes do not have difficulties in their class, 100.0% believed difficult students could learn in their class, and 100.0% believed they are able to adjust their teaching to help students having difficulty in their class.

Out of the five responses, three of the items pre-and post-ICT implementation had a significant difference in opinion. Results indicated 62.5% of teachers felt like were an asset to their school post-ICT implementation compared to 50.0% pre-ICT implementation. Last, 100.0% of teachers post-ICT implementation felt difficult students could learn in their class and they could adjust their teaching to help difficult students learn in their class.

Table 4.5

Pre- and Post-Technology and Teaching Efficacy Scale (TTES) Responses

Survey Item		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. My students learn better because I am able to incorporate technology into their activities	Pre	0.0 (n = 0)	0.0 (n = 0)	25.0 (n = 2)	25.0 (n = 2)	50.0 (n = 4)
	Post	0.0 (n = 0)	0.0 (n = 0)	25.0 (n = 2)	37.5 (n = 3)	37.5 (n = 3)
2. I am unable to incorporate technology into any classroom subject	Pre	37.5 (n = 3)	25.0 (n = 2)	25.0 (n = 2)	0.0 (n = 0)	12.5 (n = 1)
	Post	37.5 (n = 3)	37.5 (n = 3)	12.5 (n = 1)	12.5 (n = 1)	0.0 (n = 0)
3. I can incorporate technology into my teaching without sacrificing the basics	Pre	0.0 (n = 0)	12.5 (n = 1)	25.0 (n = 2)	37.5 (n = 3)	25.0 (n = 2)
	Post	0.0 (n = 0)	0.0 (n = 0)	12.5 (n = 1)	62.5 (n = 5)	25.0 (n = 2)
4. I am able to use technology to capture a student's interest	Pre	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	37.5 (n = 3)	62.5 (n = 5)
	Post	0.0 (n = 0)	12.5 (n = 1)	0.0 (n = 0)	50.0 (n = 4)	37.5 (n = 3)
5. I am able to use technology in my teaching to improve the quality of education	Pre	0.0 (n = 0)	0.0 (n = 0)	12.5 (n = 1)	25.0 (n = 2)	62.5 (n = 5)
	Post	0.0 (n = 0)	0.0 (n = 0)	25.0 (n = 2)	37.5 (n = 3)	37.5 (n = 3)
6. I can get students excited about learning by using technology in the classroom	Pre	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	50.0 (n = 4)	50.0 (n = 4)
	Post	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	87.5 (n = 7)	12.5 (n = 1)
7. I am able to use technology to solve many classroom problems	Pre	0.0 (n = 0)	0.0 (n = 0)	25.0 (n = 2)	50.0 (n = 4)	25.0 (n = 2)
	Post	0.0 (n = 0)	12.5 (n = 1)	12.5 (n = 1)	62.5 (n = 5)	12.5 (n = 1)
8. My students can think better because of my use of technology in the classroom	Pre	0.0 (n = 0)	0.0 (n = 0)	25.0 (n = 2)	50.0 (n = 4)	25.0 (n = 2)
	Post	0.0 (n = 0)	12.5 (n = 1)	25.0 (n = 2)	50.0 (n = 4)	12.5 (n = 1)

9. All of my students benefit because of the way I teach	Pre	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	75.0 (n = 6)	25.0 (n = 2)
	Post	0.0 (n = 0)	0.0 (n = 0)	25.0 (n = 2)	62.5 (n = 5)	12.5 (n = 1)
10. When my students are successful it is because I have done a good job as a teacher	Pre	0.0 (n = 0)	0.0 (n = 0)	12.5 (n = 1)	62.5 (n = 5)	25.0 (n = 2)
	Post	0.0 (n = 0)	0.0 (n = 0)	25.0 (n = 2)	62.5 (n = 6)	0.0 (n = 0)
11. I am good at explaining things in terms that students can understand	Pre	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	75.0 (n = 6)	25.0 (n = 2)
	Post	0.0 (n = 0)	0.0 (n = 0)	25.0 (n = 2)	37.5 (n = 3)	37.5 (n = 3)
12. Even students with poor academic records can benefit from my teaching	Pre	0.0 (n = 0)	0.0 (n = 0)	12.5 (n = 1)	62.5 (n = 5)	25.0 (n = 2)
	Post	0.0 (n = 0)	0.0 (n = 0)	12.5 (n = 1)	75.0 (n = 6)	12.5 (n = 1)
13. When students do not understand a concept, I can explain it so it becomes clear to them	Pre	0.0 (n = 0)	0.0 (n = 0)	12.5 (n = 1)	50.0 (n = 4)	37.5 (n = 3)
	Post	12.5 (n = 1)	0.0 (n = 0)	12.5 (n = 1)	62.5 (n = 5)	12.5 (n = 1)
14. I can create an atmosphere conducive to learning	Pre	0.0 (n = 0)	0.0 (n = 0)	12.5 (n = 1)	50.0 (n = 4)	37.5 (n = 3)
	Post	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	75.0 (n = 6)	25.0 (n = 2)
15. I am able to accurately evaluate my students' progress	Pre	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	75.0 (n = 6)	25.0 (n =2)
	Post	0.0 (n = 0)	0.0 (n = 0)	12.5 (n = 1)	75.0 (n = 6)	12.5 (n = 1)
16. My students retain more because I incorporate technology into their learning activities	Pre	0.0 (n = 0)	0.0 (n = 0)	25.0 (n = 2)	37.5 (n = 3)	37.5 (n = 3)
	Post	0.0 (n = 0)	0.0 (n = 0)	25.0 (n = 2)	37.5 (n = 3)	37.5 (n = 3)
17. I vary my teaching strategies to meet the needs of my students	Pre	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	62.5 (n = 5)	37.5 (n = 3)
	Post	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	62.5 (n = 5)	37.5 (n = 3)
18. Students are successful in my classes because of my ability to effectively incorporate technology into my teaching	Pre	0.0 (n = 0)	0.0 (n = 0)	25.0 (n = 2)	50.0 (n = 4)	25.0 (n = 2)
	Post	0.0 (n = 0)	0.0 (n = 0)	25.0 (n = 2)	62.5 (n = 5)	12.5 (n = 1)

19. Other teachers consider me a valued colleague	Pre	0.0 (n = 0)	0.0 (n = 0)	37.5 (n = 3)	37.5 (n = 3)	25.0 (n = 2)
	Post	0.0 (n = 0)	0.0 (n = 0)	25.0 (n = 2)	50.0 (n = 4)	25.0 (n = 2)
20. I am perceived as an asset to my school	Pre	0.0 (n = 0)	0.0 (n = 0)	50.0 (n = 4)	37.5 (n = 3)	12.5 (n = 1)
	Post	0.0 (n = 0)	0.0 (n = 0)	37.5 (n = 3)	50.0 (n = 4)	12.5 (n = 1)
21. Students who have difficulty learning from other teachers are able to learn in my class	Pre	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	87.5 (n = 7)	12.5 (n = 1)
	Post	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	100.0 (n = 8)	0.0 (n = 0)
22. Even difficult students can learn in my classes	Pre	0.0 (n = 0)	0.0 (n = 0)	25.0 (n = 2)	75.0 (n = 6)	0.0 (n = 0)
	Post	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	75.0 (n = 6)	25.0 (n = 2)
23. When students have difficulty in my class, I can adjust my teaching to help them be successful	Pre	0.0 (n = 0)	0.0 (n = 0)	12.5 (n = 1)	62.5 (n = 5)	25.0 (n = 2)
	Post	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	75.0 (n = 6)	25.0 (n = 2)

Research Question Two

Research question two, *Is there a statistically significant mean difference between pre- and post-teacher technology proficiency when ICT is implemented?*, was answered by conducting a two-tailed paired t-test to determine if there was a statistically significant mean difference between pre- and post-teacher technology proficiency. Results indicated no statistically significant mean difference between pre- and post-teacher technology proficiency when ICT was implemented, $t(7) = 1.204$, $p = .268$, (see Table 4.6). Teachers pre-ICT implementation reported a lower mean of technological proficiency of ($M = 4.15$) then post-ICT implementation technological proficiency of ($M = 4.68$). Even though this study had no statistical significance with a medium effect size, this could be attributed to the small sample size ($n = 8$).

Table 4.6

Paired t-test: Pre-scores and Post-scores on Technology Proficiency Self-Assessment for 21st Century Learning

	N	M	SD	*t*-value	df	*p*-value
1. Pre-Scores	8	4.15	1.25	1.204	7	.268
2. Post-Scores	8	4.68	.189			

*Statistically significant ($p < .05$)

The frequencies and percentages of responses to the *Technology Proficiency Self-Assessment for 21st Century Learners*, a 34-item survey which required participants to rate themselves using the frequency scale (1 = *Strongly Disagree*, 2 = *Disagree*, 3 = *Neutral*, 4 = *Agree*, 5 = *Strongly Agree)* is displayed in Table 4.7. The first five items in the survey pertained to the teacher's email proficiency. Out of the 8 teachers surveyed, all teachers, post-ICT implementation, responded *Strongly Agree* or *Agree* to all five items compared to teachers pre-ICT implementation. The next five survey items pertained to the teacher's proficiency of using the internet. Approximately 88.0% of pre-ICT implementation teachers responded *Strongly Agree* or *Agree* to; using internet search engines, keeping track of visited websites, and finding sources on the internet to use in their teaching. Only 62.5% of pre-ICT implementation teachers knew how to create their own web page. There was a significant difference for these items post-ICT implementation with 100.0% of teachers responding *Strongly Agree* or *Agree* to using internet search engines, keeping track of visited websites, and finding sources on the internet to use in their teaching as well as 87.5% of teachers that knew how to create their own web page.

The next five items on the survey measured the teacher's proficiency to use computer applications to complete tasks. Teachers post-ICT implementation responded *Strongly Agree* or *Agree* more frequently then pre-ICT implementation teachers to each item. The most significant difference in these items was the percentage of teachers who could create a database post-ICT implementation 87.5% compared to 62.5% pre-ICT implementation.

The next 13 items pertained to the teacher's proficiency of applying technology skills and knowledge to student and professional learning. All 13 responses were different pre-and post-ICT implementation. For the item, I can write a plan with a budget to buy technology for my classroom 50.0% of pre-ICT implementation teachers rated *Strongly Agree* or *Agree* compared to 62.5% post-ICT implementation. In addition, 50.0% of pre-ICT implementation teachers rated *Strongly Agree* or *Agree* for the item, I can use social media tools for instruction in the classroom compared to 87.5% post-ICT implementation.

Another significant difference was 62.5% of pre-ICT implementation teachers rated *Strongly Agree* or *Agree* for the items; I can create a lesson or unit that incorporates subject matter software as an integral part and I can integrate mobile technologies into my curriculum that increased to 87.5% post-ICT implementation. In addition, 62.5% of pre-ICT implementation teachers stated they could use technology to collaborate with teachers or students who are distant from their classrooms that increased to 100.0% post-ICT implementation. Next, the following survey items increased from 75.0% of teachers rating *Strongly Agree* or *Agree* pre-ICT implementation to 87.5% post-ICT

implementation; I can write an essay describing how I would use technology in my classroom, I can create a wiki or blog to have my students collaborate, and I can use online tools to teach my students from a distance. The last significant difference in this set of 13 items is 75.0% of teachers' pre-ICT implementation responded *Strongly Agree* or *Agree* to the following items that increased to 100.0% post-ICT implementation; I can teach in a one-to-one environment in which the students have their own device and I can use mobile devices to have my students access learning activities.

The last six survey items described how teachers could download and store data. Out of the total responses, 87.5% of pre-ICT implementation teachers responded *Strongly Agree* or *Agree* to being able to send a text message and transfer data via smart phone. Out of the responses from pre-ICT implementation teachers, 75.0% rated *Strongly Agree* or *Agree* to being able to download e-books and movies and 62.5% to being able to retrieve data from a cloud. Post-ICT implementation, 100.0% of teachers responded *Strongly Agree* or *Agree* to being able to download movies, send text messages, and transfer data via smart phone and 87.5% to being able to download an e-book and retrieve data from a cloud.

Table 4.7

Pre- and Post-Technology Proficiency Self-Assessment for 21st Century Learners Responses

Survey Item		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. I feel confident that I could send email to a friend.	Pre	12.5 (n = 1)	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	87.5 (n = 7)
	Post	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	100.0 (n = 8)
2. I feel confident that I could subscribe to a discussion list.	Pre	12.5 (n = 1)	0.0 (n = 0)	12.5 (n = 1)	25.0 (n = 2)	50.0 (n = 4)
	Post	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	25.0 (n = 2)	75.0 (n = 6)
3. I feel confident that I could create a distribution list" to send e-mail to several people at once create a distribution list" to send e-mail to several people at once.	Pre	12.5 (n = 1)	0.0 (n = 0)	12.5 (n = 1)	12.5 (n = 1)	62.5 (n = 5)
	Post	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	12.5 (n = 1)	87.5 (n = 7)
4. I feel confident that I could send a document as an attachment to an e-mail message.	Pre	12.5 (n = 1)	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	87.5 (n = 7)
	Post	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	100.0 (n = 8)
5. I feel confident that I could keep copies of outgoing messages that I send to others.	Pre	12.5 (n = 1)	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	87.5 (n = 7)
	Post	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	12.5 (n = 1)	87.5 (n = 7)
6. I can use an Internet search engine (e.g., Google) to find Web pages related to my subject matter interests.	Pre	12.5 (n = 1)	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	87.5 (n = 7)
	Post	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	100.0 (n = 8)
7. I can search for and find the Smithsonian Institution Web site.	Pre	12.5 (n = 1)	0.0 (n = 0)	12.5 (n = 1)	0.0 (n = 0)	75.0 (n = 6)
	Post	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	100.0 (n = 8)

8. I feel confident that I could create my own web page.	Pre	0.0 (n = 0)	12.5 (n = 1)	25.0 (n = 2)	25.0 (n = 2)	37.5 (n = 3)
	Post	0.0 (n = 0)	0.0 (n = 0)	12.5 (n = 1)	0.0 (n = 0)	82.5 (n = 7)
9. I feel confident that I could keep track of Web sites I have visited so that I can return to them later. (An example is using bookmarks.)	Pre	12.5 (n = 1)	0.0 (n = 0)	0.0 (n = 0)	12.5 (n = 1)	75.0 (n = 6)
	Post	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	100.0 (n = 8)
10. I feel confident that I could find primary sources of information on the Internet that I can use in my teaching.	Pre	12.5 (n = 1)	0.0 (n = 0)	0.0 (n = 0)	37.5 (n = 3)	50.0 (n = 4)
	Post	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	12.5 (n = 1)	87.5 (n = 7)
11. I feel confident that I could use a spreadsheet to create a bar graph of the proportions of the different colors of M&Ms in a bag.	Pre	12.5 (n = 1)	0.0 (n = 0)	12.5 (n = 1)	25.0 (n = 2)	50.0 (n = 4)
	Post	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	25.0 (n = 2)	75.0 (n = 6)
12. I feel confident that I could create a newsletter with graphics.	Pre	12.5 (n = 1)	0.0 (n = 0)	0.0 (n = 0)	37.5 (n = 3)	50.0 (n = 4)
	Post	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	12.5 (n = 1)	82.5 (n = 7)
13. I can save documents in formats so that others can read them if they have different word processing programs.	Pre	12.5 (n = 1)	0.0 (n = 0)	0.0 (n = 0)	12.5 (n = 1)	75.0 (n = 6)
	Post	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	100.0 (n = 8)
14. I can use the computer to create a slideshow presentation.	Pre	12.5 (n = 1)	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	87.5 (n = 7)
	Post	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	100.0 (n = 8)
15. I can create a database of information about important authors in a subject matter field.	Pre	12.5 (n = 1)	12.5 (n = 1)	12.5 (n = 1)	37.5 (n = 3)	25.0 (n = 2)
	Post	0.0 (n = 0)	12.5 (n = 1)	0.0 (n = 0)	25.0 (n = 2)	62.5 (n = 5)
16. I can write an essay describing how I would use technology in my classroom	Pre	12.5 (n = 1)	0.0 (n = 0)	12.5 (n = 1)	12.5 (n = 1)	62.5 (n =5)
	Post	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	12.5 (n = 1)	87.5 (n = 7)

17. I can create a lesson or unit that incorporates subject matter software as an integral part.	Pre	12.5 (n = 1)	0.0 (n = 0)	25.0 (n = 2)	25.0 (n = 2)	37.5 (n = 3)
	Post	0.0 (n = 0)	0.0 (n = 0)	12.5 (n = 1)	25.0 (n = 2)	62.5 (n =5)
18. I can use technology to collaborate with teachers or students, who are distant from my classroom.	Pre	12.5 (n = 1)	12.5 (n = 1)	12.5 (n = 1)	12.5 (n = 1)	50.0 (n = 4)
	Post	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	12.5 (n = 1)	87.5 (n = 7)
19. I can describe 5 software programs or apps that I would use in my teaching.	Pre	12.5 (n = 1)	0.0 (n = 0)	0.0 (n = 0)	37.5 (n = 3)	50.0 (n = 4)
	Post	0.0 (n = 0)	50.0 (n = 3)	50.0 (n = 3)	0.0 (n = 0)	0.0 (n = 0)
20. I can write a plan with a budget to buy technology for my classroom.	Pre	12.5 (n = 1)	12.5 (n = 1)	25.0 (n = 2)	50.0 (n = 4)	0.0 (n = 0)
	Post	0.0 (n = 0)	0.0 (n = 0)	37.5 (n = 3)	37.5 (n = 3)	25.0 (n = 2)
21. I can integrate mobile technologies into my curriculum.	Pre	12.5 (n = 1)	0.0 (n = 0)	25.0 (n = 2)	25.0 (n = 2)	37.5 (n = 3)
	Post	0.0 (n = 0)	0.0 (n = 0)	12.5 (n = 1)	50.0 (n = 4)	37.5 (n = 3)
22. I can use social media tools for instruction in the classroom. (ex. Facebook, Twitter, etc.)	Pre	12.5 (n = 1)	25.0 (n = 2)	12.5 (n = 1)	12.5 (n = 1)	37.5 (n = 3)
	Post	0.0 (n = 0)	0.0 (n = 0)	12.5 (n = 1)	37.5 (n = 3)	50.0 (n = 4)
23. I can create a wiki or blog to have my students collaborate.	Pre	0.0 (n = 0)	12.5 (n = 1)	12.5 (n = 1)	37.5 (n = 3)	37.5 (n = 3)
	Post	0.0 (n = 0)	12.5 (n = 1)	0.0 (n = 0)	25.0 (n = 2)	62.5 (n = 5)
24. I can use online tools to teach my students from a distance.	Pre	12.5 (n = 1)	0.0 (n = 0)	12.5 (n = 1)	37.5 (n = 3)	37.5 (n = 3)
	Post	0.0 (n = 0)	0.0 (n = 0)	12.5 (n = 1)	37.5 (n = 3)	50.0 (n = 4)
25. I can teach in a one-to-one environment in which the students have their own device.	Pre	12.5 (n = 1)	0.0 (n = 0)	12.5 (n = 1)	25.0 (n = 2)	50.0 (n = 4)
	Post	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	75.0 (n = 6)	25.0 (n = 2)
26. I can find a way to use a smartphone in my classroom for student responses.	Pre	12.5 (n = 1)	0.0 (n = 0)	0.0 (n = 0)	50.0 (n = 4)	37.5 (n = 3)
	Post	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	37.5 (n = 3)	62.5 (n = 5)

27. I can use mobile devices to connect to others for my professional development.	Pre	12.5 (n = 1)	0.0 (n = 0)	0.0 (n = 0)	50.0 (n = 4)	37.5 (n = 3)
	Post	0.0 (n = 0)	0.0 (n = 0)	12.5 (n = 1)	50.0 (n = 4)	37.5 (n = 3)
28. I can use mobile devices to have my students access learning activities.	Pre	12.5 (n = 1)	0.0 (n = 0)	12.5 (n = 1)	37.5 (n = 3)	37.5 (n = 3)
	Post	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	50.0 (n = 4)	50.0 (n = 4)
29. I can download and listen to podcasts/audio books.	Pre	0.0 (n = 0)	12.5 (n = 1)	12.5 (n = 1)	25.0 (n = 2)	50.0 (n = 4)
	Post	0.0 (n = 0)	0.0 (n = 0)	12.5 (n = 1)	37.5 (n = 3)	50.0 (n = 4)
30. I can download and read e-books.	Pre	0.0 (n = 0)	12.5 (n = 1)	12.5 (n = 1)	37.5 (n = 3)	37.5 (n = 3)
	Post	0.0 (n = 0)	0.0 (n = 0)	12.5 (n = 1)	37.5 (n = 3)	50.0 (n = 4)
31. I can download and view streaming movies/video clips.	Pre	12.5 (n = 1)	0.0 (n = 0)	12.5 (n = 1)	25.0 (n = 2)	50.0 (n = 4)
	Post	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	25.0 (n = 2)	75.0 (n = 6)
32. I can send and receive text messages.	Pre	12.5 (n = 1)	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	87.5 (n = 7)
	Post	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	100.0 (n = 8)
33. I can transfer photos or other data via a smartphone.	Pre	12.5 (n = 1)	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	87.5 (n = 7)
	Post	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	100.0 (n = 8)
34. I can save and retrieve in a cloud-based environment.	Pre	12.5 (n = 1)	0.0 (n = 0)	25.0 (n = 2)	12.5 (n = 1)	50.0 (n = 4)
	Post	0.0 (n = 0)	0.0 (n = 0)	12.5 (n = 1)	25.0 (n = 2)	62.5 (n = 5)

Research Question Three

Research question three, *Is there a statistically significant mean difference between pre- and post-teacher frequency of ICT use when ICT is implemented?*, was

answered by recording the frequency of ICT use (FICT) and calculating the means of pre- and post-frequency of ICT use (see Table 4.8). After calculating the pre- and post-frequency of ICT use means, a two-tailed paired t-test was conducted to determine if there was a statistically significant mean difference between pre- and post-frequency of ICT use when ICT was implemented. Results indicated no statistically significant mean difference between pre- and post-frequency of ICT use when ICT was implemented, $t(7) = .447$, $p = .648$ (see Table 4.9). Teachers' pre-ICT implementation reported a lower mean of frequency of ICT use (M = 159.1) than post-ICT implementation frequency of ICT use (M = 175.9).

Table 4.8

FICT Use by Teacher Pre- and Post-ICT Implementation

	November	December	Pre-Mean	March	April	Post-Mean	Mean Difference
Teacher 1	114	127	120.5	103	190	147.5	27.0
Teacher 2	85	214	192.0	167	131	149.0	-43.0
Teacher 3	85	175	130.0	277	343	310.0	297.0
Teacher 4	49	161	105.0	131	130	130.5	25.5
Teacher 5	223	621	422.0	480	178	248.5	-173.5
Teacher 6	70	147	108.5	78	161	119.5	11.0
Teacher 7	57	142	99.5	214	92	153.0	53.5
Teacher 8	44	146	95.0	149	150	149.5	54.5

Table 4.9

Paired t-test: FICT Use Pre- and Post-ICT Implementation

	N	M	SD	*t*-value	df	*p*-value
1. Pre-Scores	8	159.1	110.6	.447	7	.648
2. Post-Scores	8	175.9	66.7			

*Statistically significant ($p < .05$)

Research Question Four

Research question 4, *What are teacher perceptions regarding implementation of information and communication technology?*, was answered through thematic analysis of interview and observation data. Themes were coded in the interview transcripts of

participant responses and observation data. The qualitative data analysis includes three major themes identified in the teacher responses from the pre and post teacher interviews and observations including: (a) Technology is the Student's Future (b) Technology Implementation as a Learning Process (c) and Increased Student Engagement.

Technology is the Student's Future

The theme, Technology is the Student's Future, emerged through the inductive coding process of first identifying codes and then creating an emergent theme. In the responses from the individual interviews, the teachers had positive perceptions in regards to implementation of technology and emphasized the important role technology plays in order to prepare students for their futures. This theme was illustrated by five of the eight teachers interviewed about their perceptions and intentions when it comes to implementing technology in the classroom. Teacher H described how technology plays a role in students' futures:

> Technology is a tool that helps students to complete tasks in more efficient ways and helps students reshape information in ways that they best understand it, and then help communicate it in different ways to other people as well. It is so important students learn that technology is a tool that they can leverage in their futures, it's not just some big, shiny thing that, "Yay, technology time," it's really a tool that has very specific purposes that can really help them in their futures.

To examine the perception of technology as the future for our students in more detail, a sub-theme that emerged was the perception of technology use in the classroom as an essential skill and knowledge development for students' futures. Teacher B stated:

> In the real world, engineers, and geophysicists might take a document in paperwork, but they're going to do all their reports and set it all up on a computer. They (students) need to learn how to move into that sort of thinking, and programming.

In addition to students needing to know technology for existing careers teachers are familiar with, there is a need for students to know technology for careers that do not yet exist. Teacher F described this perspective of critical skill development through technology for students' futures stating:

> They [students] build the skills that they're going to need to be even more successful at using the computer and technology in the future. Because what is continuously being said is that the jobs that are going to be available for these students aren't even created yet, and they will be technology. They will probably be in the technology field, and if they can't start layering those skills on now, they will not be able to compete for the best job possibilities. Many of our students don't have computer access at home and their brains aren't getting prepared. They need the organizational skills that are necessary for navigating on computers. Having it right there in their face and the thinking process is critical for their brain development.

The intention for teachers to integrate technology in the classroom; goes beyond replacing a worksheet as typically observed in classrooms, it is to give students opportunities to learn that they may not have at home and truly prepare them for the unknown future. Teacher D also shared her intent around integrating technology by stating her ideas around technology skills students will need now and in their futures:

> My intent is to let them use their knowledge of technology but also implement new things and have them look at different ways of doing things. My intent really is to see what they already know and use those skills and then also build on those skills and find that there's different options of doing things to help them in their futures.

Technology as a true enhancement to student learning and the future was commonly described in teacher responses. Teacher E described her perception of student's use of technology in their futures as:

> When we look at how our students are going to have to work in their futures it's ridiculous not to teach them to use computers. It's a necessity. It's a basic knowledge skill now. It's not like before you have specific jobs that you will use a computer so you went to a class and you learned how to use a computer, but right now it does not matter what you're going to do in your life you're going to have to deal with technology. You're going to have a car, it's going to have technology. You're going to have a house and right now the houses talk to you. Technology is going to be part of your life. It's a little bit ridiculous not to teach them how to be aware, at least the basic, turn it on, know how to type a letter because when was the last time you got a letter on the mail? That would be exciting to get one right now. Everything is on the computer.

Teacher H described how his intention to use technology aligned with the hopes of preparing students for their futures by explaining his purpose when it comes to implementing technology in his classroom:

> I want my students-that whenever they have a task ahead of them such as

applying to college, buying something online like Amazon, that they have a comfort and have a set of skills to tackle that problem on their own. And know that I will not always be here so it is more of building skills with each other as well.

In addition to interview data, classroom observation data supported this theme through specific observations where teachers and students were discussing how technology could be used in their futures. When observing Teacher F, who believes technology prepares students for jobs that do not exist yet, the teacher and students were reviewing different methods in which they could utilize technology to assist them in finding information they did not know. The teacher was asking students to think about a time they did not know an answer to a problem and how technology helped them solve it. One of the students described a time when he was with his mother and they used the navigation on their phone to get to a destination they had not been before. The teacher responded, “Great!” and asked the class to think of another example.

Another student raised his hand and talked about how he used his calculator on his phone right before class started to figure out how much change he needed to give back to a student he sold candy to for a fundraiser going on in the school. This use of the calculator inspired many other students to speak up about how they also had used their calculator. The teacher then diverted the conversation to focus on how technology could help students with specific vocabulary they may not know and asked the class to use their laptops to go to the Merriam Dictionary website that is bookmarked on their toolbar for easy access. Once all students were on the correct site, the teacher showed the different tools available on the website such as how to look up a word, how to find synonyms, and then clicked on a vocabulary game. The game started with a picture of an object and four

words students could choose from that best matched the picture. The students were excited and raised their hands and shouted out their answers. The teacher selected the most heard answer and then the game indicated if it was correct or not. The teacher went through four more pictures and then told students this would be a great option for them to do as a Do Now, an activity students do as soon as the bell rings for class.

The teacher then gave students permission to explore the website independently. Most students went to the game to play or explored the website. The students were pointing to each other's screens and helping their neighbor navigate through the website, showing their neighbor something they had found, or helping their neighbor answer the questions in the vocabulary game. After about five minutes of the students exploring on their own, the teacher focused the class on the assignment for the day and how they could use their online dictionary to help complete the assignment. Teacher F's classroom observation offered a representative look at how teachers conveyed to students the various ways technology can be used as a helpful resource now and in their futures.

Technology Implementation is a Learning Process

The next theme, Technology Implementation is a Learning Process, emerged through the multiple references teachers made in regards to their experience of implementing technology in their classrooms as well as in classroom observations. The categories teachers discussed include: teacher willingness to try new things and utilizing students as a support system when implementing new technology. Teacher A described this learning process:

> I feel confident on the things that I know how to use. There are some things that they [administrators] might want to push us to do, and I'm like ehh, but I'm okay

> with that. But so far the things that I have used I can work, and I trust my kids, and they trust me, so if things don't work out, they're okay with it, and if it doesn't work I'm like Okay, we'll just try option B or C whatever works out.

Teacher G described her perspective of learning technology with students as “I find that one thing with technology is, if you don't know it, get in and try it. If you don't know, ask a kid or a younger generation to help you.” Teacher G demonstrated the learning process was when she was modeling an activity the students were about to complete in Google Classroom and could not find a specific button she was looking for in order to share her post. After trying to independently find the button, she asked the class if they knew how to post her response. One of the students had used Google Classroom in another class and was able to guide Teacher G to the correct way to share her post via Google Classroom. Teacher G demonstrated willingness to try something new in her classroom and was open to the support from students in order to enhance her lesson for her students. This willingness to try new additions in lessons was also described by Teacher A and her experience of technology implementation. Teacher A chose to use her personal learning process of implementing new technology in the classroom as an example for students. She used learning and trying to implement technology as an opportunity to model the importance of trying new things to her students as well as being okay with failing if something does not go as planned. Teacher A stated:

> I was a little skeptical at first because I was like, "All these kids know way more than me." I don't know but it's actually been a learning process for me as well. I'm learning while they're learning and they teach me things, but I feel like that's what the education world is all about. From the beginning of the year we taught them

about failure and about how failure is okay sometimes and you just keep trying and learning from that failure. Even yesterday when we implemented something new I told them, I was like, "This is my first time doing this. I might mess up but is it okay to fail?" They're like, "Yes." It's in the learning process for everybody.

This theme was also evident while observing Teacher E's classroom during a lesson where technology was being utilized. Students were sitting in groups of four with their laptops out ready for class to begin. After the bell rang and Teacher E welcomed the class, she selected the link on her Google site that took the students to their assignment for the day. When Teacher E clicked on the link, an error message appeared. The students began discussing possible reasons as to why an error message popped up and were respectful as Teacher E tried to problem solve in the middle of her lesson. After she tried for a few minutes, the teacher explained they would move to the activity that was intended be done at the end of class and that she would try to figure out what happened to the link while the students worked on their assignments. During the time while the teacher tried troubleshooting, only two students out of a class of 17 talked and got off task. The teacher thanked the class for being respectful and trying to support her trouble shoot the error message that was supposed to be the link to their lesson. After the students worked on their latter class assignment, two students tried to help Teacher E. This observation supported the learning process of the teacher and the issues that arise when integrating technology but the students were available as a support system through the trouble shooting and teacher learning process.

Increased Student Engagement

The last emergent theme created through the inductive coding process was the

theme of Increased Student Engagement. Based on interview and observation data, teachers' perceptions of technology were influenced by the way implementing technology in their classroom had increased student engagement. Teacher F described the influence technology has had on her students by explaining the shift in student focus that has occurred in her classroom since implementing technology:

> It [using technology] has improved the lack of focus for all students when coming in and getting ready for class. If they get their computer and are required to log-in and go their [subject folder] with "Symbaloo", they aren't having conversations or interactions about what was going on before they came to class. They should have "Tiles" for each internet source and be able to login as instructed and begin something like silent reading in the class text book or another activity incorporating technology. Overall, they are more focused on the subject matter!

This response demonstrates how the use of technology has changed the way her classroom functions as a result of keeping students focused on learning from the second they walk into her classroom with the assistance of technology. This increased attention to learning is not only present in Teacher F's classroom. Teacher D also shared a similar experience of increased engagement in the classroom by sharing her experience with implementing technology:

> When technology (specifically their own computer work) is implemented in the classroom, I do see changes in behavior which are mostly positive. The students are more involved in the learning process. When students are reading and writing on paper, they tend to get more distracted and bored. However, writing and reading are an integral part of the learning process. The only negative behaviors

> that typically arise when computers are used are when they are not doing what they are supposed to on the computer, but I have seen more engagement in wanting to do the lessons.

Teacher C also had an opinion of how technology has influenced her classroom, stating, “Implementing technology has increased student motivation and engagement because we are able to meet students where they are.” Since the technology allows for the teacher to target lessons to meet students where they are, the students are more engaged in learning and can determine their own learning progress based on the level of difficulty of each lesson. Meeting students where they are is discussed in a subsequent theme, personalized learning, but gives insight into one of the components of how technology is utilized to increase student engagement.

Similar to observations in other classrooms, in the first observation with Teacher C, students worked individually on [subject specific] paper packets that were scheduled to be turned in in one week. The room was silent and students wrote in their packets. During the observation many students sat up from writing and took elongated breaks and stared at the front of the room, walked around, went to the restroom, or sharpened their pencils. The students worked hard to finish their assignment but Teacher C frequently reminded students to stay on task and sat with students to watch them complete their work. At the end of the class period the teacher informed the students know they would continue to work on their packet the next day and a few students sighed out loud, seeming not to be excited about class the next day.

In another observation post-ICT implementation, the engagement in the room was the opposite of the pre-ICT implementation. Teacher C supported her post-ICT

implementation practice of using technology to meet students where they were during an observation where students independently worked on laptops, watched videos, or read the textbook to complete their assignment according to their mastery of content. Each student worked on something different while the teacher targeted specific groups of learners who learned similar concepts or served as individual student support. The teacher explained students who worked on the laptops were at the highest mastery level and that students progressed from the textbook to watching videos to the final level, the independent laptop work. The students that worked on the laptops went through [subject specific] questions and at the end of so many correct answers they played a [subject specific] game as their reward.

As the teacher walked around and monitored each student, one student told her he "could not wait to get past the questions so he could continue his game." The game was a continuous building process that students earned more features of the game as they progressed through their lessons. For the students not on the laptops, their goal was to achieve the level of mastery where they could use the laptops. One student that worked in his textbook discussed with the Teacher C how she wish she would have not missed school due to her being sick so she could be on the laptops by now. The students who did not work on the laptops focused on their work and were motivated to use the laptops. As the students worked, one student exclaimed "YES!" which caused the student next to him that was not on the laptop to become distracted and he watched the [subject specific] game being played. Teacher C redirected the student who watched the other student by telling him to keep up the "great work" so that he could also play the game and use the

laptop to complete his assignment. The opportunity for students to participate in the game after they completed their assignment not only increased student engagement, but also student excitement in the learning process.

Overall, teachers perceived technology as essential for students to learn to use in order to be successful in their futures. Teachers were also willing to try new lessons by implementing new technology and ways of completing assignments through technology in their classrooms. Teachers and students engaged in the collective learning process by having a relationship of support and learning as a community. This community of learning was created by the leadership of the teachers being open to receiving help from students and being okay with admitting to the class they were trying something new.

Research Question Five

Research question 5, *"How, if at all, does the implementation of ICT influence teachers' classroom practices?"* was answered through thematic analysis of interview and observation data. Themes were coded from the interview transcripts of participant responses and observation data. The qualitative data analysis includes four major themes identified in the teacher responses for the pre and post teacher interviews and classroom observations including: (a) Classroom Management, (b) Student Reflection, (c) Personalized Learning, and (d) Relevancy

Classroom Management

Classroom management was a theme identified through the qualitative data analysis as a changing component in teacher's classroom practices when technology was implemented in the classroom. The two categories developed from this theme includes the relationship between time and implementing technology in the classroom and

monitoring students. Through the interview and observation data, these two categories frequently emerged as teachers expressed their use of time when implementing technology and change in practices of monitoring students to ensure all students were engaged in learning and not off task due to technology implementation.

Time. Offering evidence that time was a barrier to integration, Teacher B discussed the difficulties of integrating technology effectively in her particular subject, especially with the expectation to independently implement technology. Even with the support of a blended learning consultant that frequented the school on a regular basis, Teacher B still experienced difficulties with effective integration. Teacher B stated:

> It takes time to integrate technology. Just getting the laptops out takes time. We don't always have time to pull the computers out and make sure they are charged and it also takes time to put them up. If I do not have enough computers for all my students to have one I can only integrate technology for the students that may finish early or something like that. Also, when you are just trying to teach the basic and foundational skills it is hard to find the time to integrate technology. Honestly, I haven't been able to do a lot with technology. For my subject I usually use a video to enhance/add to the lesson, use a computer program with activities, or use the Active board for interactive lessons or directions for the day. I think the main difference I have seen since implementing technology, is that we are trying to figure out how to integrate it into our lessons and how to fit it in.

Teacher C had a different perspective of the influence technology implementation has had on time and classroom management by sharing how she believes implementing technology has saved her time during the lesson planning process. Teacher C said:

> One of the biggest differences for me when technology is implemented is that when the students are done with their work I don't have to think, "Okay now what do they do?" I can have them get on [name of program]. It is at their level and it is what they need to be working on. It helps me because I do not have to spend time doing extra planning.

Teacher A, who regularly integrated technology in her classroom, explained the adjustments she has made in her class post-ICT implementation in regards to time management:

> I have my timer. My timer goes off eight minutes before the bell rings, and the kids already know they have eight minutes left in class so we start wrapping it up, wrapping up the lesson, whatever it is, and when we have computers they already know to start wrapping it up, get the computer to log off, put it back in the slot.

Teacher A adjusted time in her classroom to accommodate procedural components of technology integration but also to teach students necessary technology skills. By making time in her lessons to teach skills and basic functions, the students were able to fully utilize technology to complete assignments. During an observation in Teacher A's classroom, time management was apparent in the restructuring of time allotted for the activities planned during her lesson as well as the re-teaching of basic technology skills in order for students to successfully complete the assignment. During this classroom observation, students were entering the classroom and picking up their journals and an assignment on the desk close to the entrance of the classroom as soon as they walked in. Teacher A was standing by the classroom door, greeting students as they walked in the classroom and handed them an assignment they would use later in the class

period. The students looked at the seating chart the teacher created for the class period and found where they were seated. The students were instructed to put their name on the paper they picked up and to get a computer. The students got their computers one at a time and brought it to their desk to turn on. The teacher told them to give it a "handshake" after they log in, which was a classroom procedure of placing the computer at a forty five degree angle so that students were not distracted by the computer.

The teacher explained to the students that they would be taking a test online and that she wanted the students to practice taking online tests and utilizing the computer. She continued to explain how they would use computers to complete assignments in their futures and how important it was for the students to feel comfortable using computers to complete their work. The teacher then reviewed test procedures with students. She instructed the students to log in to Google Classroom. As the students worked to get to Google Classroom, one student who was logging in slower than the other students shouted "Wait! Wait! Wait!" Teacher A modeled on her screen in the front of the classroom the website students should be on. A group of students started to guess where they would click next and said "Oh we click on test don't we?" The teacher told them that was exactly right and instructed the students to click on the word Test. The teacher continued to explain when students typed their answers they could spell check to correct any misspelled words by right clicking. The teacher also taped commonly misspelled words to each student's desk to help guide their use of vocabulary throughout the test. The teacher showed the students how to complete and submit their test. Teacher A instructed the students to begin and walked around the room to monitor each student starting their test.

As she monitored the classroom, she helped students who were struggling to open the documents and supported some of the students who did not follow the instructions to type their name, date, and class period. One of the student the teacher was helping was struggling to understand how to use the Enter key on the keyboard to adequately space and type his answers. The teacher realized multiple students were having this issue and stopped the class to demonstrate multiple scenarios where formatting could be an issue and how to resolve spacing. Teacher A also reviewed the back arrow in the instance a student might make a mistake and other basic functions students may need to know as they complete their test. After the students finished listening and asking questions as needed, they were silent and continued to complete their test wherever they left off.

This observation of Teacher A's classroom is an example of how technology has influenced her classroom practices. From allotting time for students to get the laptops out to taking the time to demonstrate basic functions in Google Classroom for students to complete their assignment, technology has influenced the time teachers have during a class. Technology has afforded many teachers more time to focus on other aspects of student learning, but has also added a different need for teachers to take time to teach the students how to use this technology in their learning.

Monitoring Students

Monitoring students was a theme identified through the qualitative data analysis as a barrier to technology implementation that influenced teacher's classroom practices. In addition to managing time while implementing technology in the classroom, almost every teacher voiced their anticipation and increased focus on the monitoring of students while utilizing technology in the classroom. Teacher E described this component of

classroom management as one of the disadvantages to implementing technology in the classroom by stating:

> I think a disadvantage to implementing technology is that we can't always tell if every kid is doing what they're supposed to be doing. Yes, I can walk around the room and I can look but that doesn't tell me anything, because they can flip back and forth sometimes. I have started having the students “face-away” their computers from where I am and that way I have an ability to view where they are or what they are doing.

Teacher B also shared her concern with monitoring students while using technology in the classroom by explaining:

> It can be difficult to keep kids where they are supposed to be. It is hard to monitor every single student and know what they are doing. What if the student could have been stuck and not asking for help or what if they are even in a different program? I’d like to say it is not an issue but honestly I think yes. As you can see I am tracking points, when I have a student that has less points I know he hasn’t really been doing his work, I can guarantee that. Even though I am sitting back there [referring to the back of the classroom] it is hard to monitor every single student. Without a system to monitor the programs they are on it is hard to make sure every student is where they are supposed to be.

Monitoring students was also a frequent theme in classroom observation data. In Teacher B’s classroom, the pre ICT implementation observation that occurred in November recorded the position of the teacher to be primarily located at the front of the classroom. The teacher was standing up near the ActivBoard teaching a lesson, seated at

the teacher's desk, or working with an individual student at the front of the room at the teacher's desk. This location of the teacher at the front of the classroom remained consistent for the following observations until the fourth observation that occurred post-ICT implementation. During this observation, the teacher walked around her classroom to help monitor and support students as they worked independently on their laptops. If a student needed assistance, the student raised their hand or the teacher noticed the student not moving on to the next question and Teacher B would help the student at their desk compared to pre-ICT implementation where student would come up to the teacher's desk for support. The primary position of the teacher remained in the front of the classroom, but she was much more active in supporting students throughout the various parts of the classroom by walking around and checking in with each student.

The significant change observed in regards to monitoring students occurred during the final observation in Teacher C's classroom in April. During this observation, all students were working independently on their laptops completing online lessons and quizzes, and the teacher was positioned in the back of the classroom where each student and their screen could be seen. The teacher frequently got up to circle the room and to ensure no students needed assistance and then would go back to her location in the back of the classroom. This observation demonstrated the significance of the influence technology implementation had on teacher classroom practices as a gradual change occurred in this teacher's classroom. By moving her primary location to the back of the classroom, the teacher was able to view all students' screens simultaneously and ensure students were remaining on task throughout the class period.

The last data collected to support the theme of Classroom Management is through

the classroom observations and individual interviews with Teacher G. Teacher G discussed and demonstrated both categories of time and monitoring students through her interview and classroom observations. When asked about her classroom practices once technology was integrated, she responded:

> Well, first of all, I need to make sure that they're getting on the computer and logging in quickly, so even timing them helps so they know how fast it's taking for them to get ready [for class]. Also I have made sure to just be very clear what the expectations of the district and the school are to help focus our time, and if they don't follow the rules they have to learn that there's consequences.

Pre-ICT implementation, students in Teacher G's classroom worked individually on assignments and read silently at their desks. An observation that demonstrated significant change in Teacher G's classroom practices post-ICT implementation was a lesson where students worked in groups to complete a project using videos posted on YouTube. Students worked on laptops, watched commercials and related it to their persuasive writing prompt. Students were able to view a list of YouTube videos to watch from options posted on Teacher G's class website. The students were all engaged as they were interested in watching the different videos on YouTube.

The teacher consistently walked around the room working with students individually and in their groups to ensure students were on the right video and not taking too much time on certain videos. One of the students laughed at the commercial she was watching and another student leaned over to see what she was watching. The teacher noticed the two students get distracted from completing their projects and walked over to their desks and requested they got back on task. The teacher then walked over to another

student that was scrolling through different videos that appeared on the screen after the commercial they were assigned to watch was over. Teacher G stayed with this student to monitor his work and had a conversation about classroom expectations when using technology to complete assignments. The student agreed to stay on task and follow classroom expectations in order to continue to use technology in Teacher G's classroom. After talking with the student, the teacher continued to monitor the rest of the students by actively walking around and checking in with each group of students. The teacher gave a ten minute warning for students to be prepared to move on from watching their videos to writing.

In addition to the time warning, the teacher went around to each student to encourage them to move to the writing section of the assignment. The teacher walked over to another group of students and facilitated a conversation about how the OxyClean commercial related to persuasion. She helped the students think about the connection between OxyClean and persuasion by asking probing questions such as, "What makes OxyClean a good product?" The students responded in Spanish and the teacher guided the students to look up Spanish words in English via Google translator. Once the students correctly translated the words, the teacher and students discussed how technology could be a way to help learn English.

The teacher moved to another group of students and asked what their opinion of Diet Coke was. The student told her he really liked the song in the commercial, but did not answer what his opinion about diet coke was. After the teacher noticed the students were focused more on the aesthetic parts of the commercial rather than relating it to their assignment, she advised them to watch it again and pointed out key components to look

for to relate to their persuasive writing assignment. This activity was a clear representation of the influence technology had on teacher classroom practices. Teacher G had to increase monitoring of her students because even though the students appeared to be engaged in learning, they may have not been grasping the connection of watching commercials to their persuasive writing assignment. This observation also represented the influence technology implementation had on the time structured in the classroom and the increased need for time management to ensure each student was staying on task to successfully complete their assignment. Since the opportunity for students to look up whatever videos they want is unlimited with resources like Youtube, the teacher had to consistently monitor all laptops to make sure they were on the correct videos and giving themselves enough time to complete the assignment.

Student Reflection

In addition to the influence technology has on classroom practices such as procedural components like classroom management, technology has also influenced the learning process in the classroom by adding the practice of student reflection into lessons. Student reflection encourages students to reflect on their learning and receive constructive feedback in order to participate in the continuous improvement process. Integrating student reflection helps teachers create a more insightful layer to student learning that increases student awareness and ownership of their learning. The category of automatic feedback is a category apparent in the theme Student Reflection as a catalyst to drive immediate reflection in student learning and is discussed through interview and observation data.

Teacher D discussed how she integrated class discussions as a result of

technology implementation in order to enhance student learning and engage students in the process of reflection by stating:

> I will have the students use technology in order to dig deeper in their learning. Actually I did something yesterday where students got on to Edmodo and we had a class discussion about which energy source they would use, renewable or non and talk about why and think about why. Then they got on the computer and they were able to take a poll right there on Edmodo. The students started to have like a chatting debate in a way where they were posting similar to Facebook and going back and forth giving each other feedback and saying things like, "I would use this one because," and then they would say, "I disagree with so and so because," and they were interacting with each other in the classroom and reflecting on what they learned during class and their opinions.

Similar to the depth of learning Teacher D added to her classroom practices, Teacher H has added reflection to his classroom to enhance student learning through the discussion and feedback process. Teacher H described this change in classroom practices:

> In the past, the way I integrated technology was through videos and my assignments were very much step, step, step. Whereas now, and with the work we have been doing with our blended learning consultant, it is more critical thinking and more working in teams. We are doing a lot of things that involve critical thinking and discussion and there is no right answer. We are never quite done, it is this ongoing discussion that continues to go on throughout the year. For example, last year I would have my students make a slideshow with pictures about themselves and when they were done they were done, but now we are

> taking it a step further and discussing it. We reflect and talk about their lessons. We also talk about skills like what does being a good team member look like and sound like? What does good feedback on your work look and sound like? If they have worked in groups we talk about what they did and how they contributed to the group. And this is something that we can't answer in a day or even a week these are lifelong conversations. If anything, my focus is not on what project am I going to do, it's not the last thing, but what is primary on my list is what skills am I trying to get my students to understand and those skills are teamwork, feedback, working as a team, that sort of thing.

An example showing how student reflection has been integrated as a regular classroom practice that occurred in Teacher A's classroom. Students were working in groups of four with their desks grouped together to complete a research project on the industrial revolution. The students had self-assigned roles in order to get the project completed. One student used his laptop to look up information on various websites that described the diseases that occurred during the industrial revolution. Another student in this group used his computer to look up what cholera was, while another student in his group looked up Google images of the diseases they were learning about that took place during the industrial revolution. One student was writing on the poster board about the different diseases they are researching while the other students continued to talk about information that needed to be on their poster as they used the laptops to research.

In another group, one student was reviewing their progress of their poster so far and reminding the group about what they needed for their project to be completed according to the rubric posted by Teacher A on Google Classroom. The students were

instructed to email their project to the teacher once it was completed. One of the students told the teacher he just emailed their group's project to her and you hear a ding from Teacher A's computer go off and the student said, "I just heard the noise! I just emailed it to you."

The teacher walked around the room and gave students feedback on how they should make their images they were about to print bigger because they were going on a poster so the way the image looked on the computer was different then what it would look like on a poster. As the class period came to an end, the students started to independently clean up and put their laptops back in the laptop cart. The students were opening their journals to complete a reflection the teacher posted on the board in the front of the room. The reflection for the day asked the students to give feedback to one another on each other's projects. The students created a chart in their journal where other students would come around to their project to write what they thought about the other students' projects and list three glows and three grows for the student to review. The students started moving from group to group and wrote feedback in the notebooks the students had laid out on their desks.

A group of girls started to provide feedback over a groups of boys' poster and immediately said to one another "Oh I know what I am going to put for a grow!" The students worked together as a group to give specific feedback on the posters. Some of the comments that were written included: "You should add more pictures" and "It could be more organized." The students talked about what other glows and grows they saw on the group's poster. The teacher explained that tomorrow, the students could look at the feedback they were provided from the other students and would have time to make

changes. She also reminded the class that this was a work in progress and part of the feedback and reflection process was changing and improving. The students went back to their desks and the groups of boys that the girls had provided feedback for immediately opened their journals to read their glows and grows. One of the students exclaimed “OH COME ON!” when he read his grow and said “I don’t think anyone liked our poster!” The teacher heard him and reiterated the process of feedback and accepting glows and grows.

The reflection process has been evident in teachers’ classroom practices by being able to have automatic feedback due to the implementation of technology. Teacher D describes the benefit automatic feedback through technology has had on her classroom practices and student learning:

> One of the goals that we have with using technology is the ability to provide the students with automatic feedback, I mean right away. If they're writing in journals and even when they have a homework turned in, to get that back to them even the next day sometimes is difficult. It's 100 to 110 students, I need to be able to provide automatic feedback to my students and without computers it is very difficult. Yesterday we did an activity where we asked a question, we scanned the room for their answers and they were able to see instantaneously whether they got the right answer or not and that's huge. They're able to do online quizzes and get the right answers and see automatically what grade they got and what they missed. Sometimes whenever we give them their test back, they'll go through but they're like, "Oh, this was a few days ago." It's just not on their radar anymore. With technology they're able to see their results right away.

Teacher E continues this idea of automatic feedback with her experience of implementing technology in the classroom by comparing how there has been an evident mind-set shift in her students due to the automatic feedback students are able to receive from technology use. Teacher E states:

> Students are remembering more details about the activities completed online, making each new concepts. Learning has become an episodic memory that they enjoy and can recall later. They are also seeking immediate feedback and are more willing to go beyond the information given in class due to the ability to see instant individual progress through technology use. I have noticed a small shift in their mindset when it comes to technology- from social to educational.

The ability to see immediate results provides the opportunity for students to reflect about what they know and what they need to learn and offers an opportunity for the teacher to personalize learning which is discussed in the next theme.

Personalized Learning

Personalized Learning was a theme that came up in every interview response with all eight teachers who participated in the study. Teacher classroom practices changed significantly to integrate personalized learning due to the opportunity technology allowed for their teaching to become individualized to meet a variety of needs for their students. Teacher A described how technology became a critical component in her classroom that shaped her classroom practices to become a more personalized environment by describing the opportunity technology afforded for her students to work at their own pace:

> Technology provides students an opportunity to work at their own pace and to

> have more ownership of what they do because when we do any lesson online, any activity, any task that I ask them to do, it's more catered to them. Having computers, helps me cater to specific students, their needs, their interests.
>
> An example of how I have used technology to personalize in my classroom is by having more online resources for my struggling students and having more enhanced activities for my higher learners. I also teach them to be independent and how to use Edmodo more since I keep telling them "If you have questions, go to Edmodo."

Teacher A expands her thoughts about personalizing learning in her classroom and how her classroom practices have changed because of technology by continuing her previous statement:

> Student learning [in my classroom] has been more independent and student-centered. Any time the computer is used, it is for a purpose therefore students already know that whenever there are plans to use the computers it may be for them to learn at their own pace, give feedback through surveys or complete research. Students even know that if there is any extra time at the end of class, online games must be content specific such as icivics.org. So overall, students learning, my classroom practices, and view of computers has changed for the better. It has changed to an academic view.

Ensuring the use of computers remains at the core of enhancing student learning, Teacher C talks about how her classroom practices and views of technology has changed over time by discussing her change of technology use in her class:

> When our campus administrators first presented about how we were going to

> integrate technology in our classrooms to me, I was like, "Great, we can do online textbooks." Then I came to realize, that's not what blended learning is. Blended learning is about choices. Blended learning is about giving them the freedom to learn.

To support Teacher C's classroom practices of personalized learning, Teacher C utilized subject specific software to help students work independently to enhance their understanding of her subject. For example, during one of Teacher C's classes, students worked independently on laptops in a [subject specific software] for the entire class period at their personalized level. Students worked on a pre-quiz to determine their level of understanding and then had lessons adjusted to their level they would need to complete independently on their laptops while the teacher went around to help students individually. If the student needed help with a problem they could click on the right hand side of the screen and there were resources to help them solve their problems. Students could also watch a video, utilize a calculator, and had the option to select audio for question and answers to be read to them. The teacher explained this program was a preparation program for another software that was correlated with a specific test that students took on a frequent basis to measure their growth on TEKS for her subject.

A follow up observation with the new software implemented was conducted to continue to observe how technology had influenced personalized learning in the classroom as well as the integration of automatic feedback and student reflection. Teacher C started the class by explaining the new software and how the lessons were programmed to their individual skills based on their most recent assessment scores. While the students worked on their lessons, the teacher utilized the class dashboard to

monitor student progress and assign skills and goals if they mastered their current skill or successfully finished a test. The teacher directed students to use their resource bank, managed by the teacher, for additional assistance when completing lessons. All students were working independently on their laptops at different paces. The teacher continued to go back to her computer to check each student's progress and targeted interventions to specific problem areas noted in the student's progress. At the end of each lesson, the students rated themselves on their performance and how comfortable they felt with the learned skills. The teacher used these responses to guide her support throughout the class. The teaching practices that have varied in this particular observation were a gradual release model where the students and teacher worked together and then the students worked independently.

This observation is an example of how technology influenced the teaching practices by aligning standardized test scores, classroom practices, and individualized student performance. In addition to integrating technology to such a personalized level, Teacher B, a teacher who consistently struggled to integrate technology in her classroom, noticed a shift in her classroom practices by offering different mediums of learning opportunities for students. Teacher B explained what inspired her perspective saying, "It [technology] is extremely helpful to integrate in the classroom as it allows for alternate approaches to help students learn and some students understand it better coming from multimedia." Teacher G has chosen to integrate technology in her classroom practices by using it as a tool to expand choice in her students' learning. Teacher G explains:

> My intent with using technology in my classroom is to give it as an option. Like if I want them to do textbook work, well they can do it on the computer. If they

> aren't mastering something, it's a way I can have them practice through gaming or something like that. Project-wise, they could do some research, but we don't do that many projects right now, but hopefully I will continue to get better at that.

Giving students more options in choice of learning is a benefit of implementing technology in the classroom that encourages students to choose to learn beyond the school day. Teacher A explains how technology has influenced the idea of learning outside of school hours:

> My students have come to realize there's always more questions, there's always more conversations, and there are now days where I have to stop the conversation, stop the questions and say "Okay, Google it. Go to this website." I'm like "You'll be able to find something." It opens up their minds a little more, and their learning doesn't stop in the classroom, there able to go check it out and I even hear them say, "I'm going to go check out the website that she said."
>
> Students have been able to continue with the planned lessons when I'm out a day since lessons are now planned out and carried out online. Tools such as Google Classroom, and Google Drive have been great for students to work at their own pace inside and outside the classroom. Therefore, students are always busy and [it] leaves them with no excuse for [not] completing any work.

Technology implementation has expanded teacher classroom practices in a way they did not know was possible before implementing technology. Teacher H has even started to think about how he would like to continue to move forward with technology implementation in his classroom by describing his future goals of technology use for his students:

> It [technology] makes curriculum, grading, where students are academically and behaviorally much more transparent. My goal is to have my curriculum on a website or learning management system so that it is there and students can always access it and students can always know where they stand. Again, it lets students go at their own pace. We are not at their own place yet, but we are at our own pace.

Teacher H's response is an example of how technology has not only influenced his current classroom practices, but has influenced his perception about his future classroom practices. When teachers embrace technology and choose to use it to enhance learning, it starts to become a part of their everyday and truly provides a more personalized learning environment for their students by being able to meet students where they are, provide automatic feedback to inspire immediate student reflection and guide action to help increase student outcomes.

Relevancy

The last theme, relevancy, was mentioned as a benefit of using technology that has increased student understanding by creating relevant connections with the learning process. Since students are used to using technology on a regular basis outside of school, using technology in school connects their activities outside of school to learning creating a more relevant learning experience. Teacher B explains how she has had her classroom practices influenced through technology:

> Technology can offer so much more than I could offer on a piece of paper. They're able to interact with something that they're used to seeing on a daily basis, because outside of school they're on the computer or playing video games and on

> Facebook. And social media, that is their life and it's so different than our generation but that's their life. They zone out when they just see teachers up here just talking and talking and talking because their attention span is so low. When they get that technology they're really able to interact and I'm able to implement more things than I would normally be able to do back in the old traditional teaching methods.

A lesson created to help students understand different kinds of energy exemplifies the relevancy students have experienced in the classroom as a result of technology implementation. This was a new lesson the team of teachers created together with the hopes of creating a relevant lesson that would help students understand and remember what they learned in class and how it could be applied to their life. The observation was conducted in Teacher E's classroom where students used laptops to learn about potential energy through the building and testing of virtual roller coasters.

Throughout the classroom you could hear students cheering as their roller coaster they built started to go up a hill while another student made noises of anticipation, scared as their roller coaster began to go up the hill out of fear that they did not build the roller coaster right. The students started to yell to their teacher as their roller coasters crashed or succeeded. The room was loud with all the noises from the roller coaster game. The students were learning about potential and kinetic energy by playing this game. The teacher was helping the students by walking around the room. The students were so engaged in their game and kept showing each other their roller coasters. The teacher said she heard a lot of the noise that stated the roller coasters were failing and reviewed kinetic and potential energy with the student and gave them hints of where in their roller

coaster they were possibly failing to build their roller coaster correctly.

The teacher made a bet with a group of the students that if they got the roller coaster to work they would get a 100 on the next test. They shook hands and watched the roller coaster go. The roller coaster crashed and they both exclaimed. Throughout the room you could hear all the students going “AHHH” when their roller coaster crashed and some cheering when it was done right. Various students shouted for the teacher to come watch their roller coaster. She was helping them relate how the energy they were learning about related to their roller coaster. The students kept trying to build a successful roller coaster. One of the students rolled back in her chair and threw her hands down and said “ah it crashed again” one of the students was saying “I’m going to make it I’m going to make it” and the teacher told him “You have a lot of kinetic energy left!” While the students were working, the teacher comments:

> Do you see the difference? [Referring to the difference in her classroom observations when technology is present and when it is not.] I love teaching with technology. Do you remember the other day when you [referring to the researcher] came in the other day and how I was like “Ugh” lets read and cut something else. Do you see me today? I am so excited! It’s so fun and the students, Oh my gosh, look at the students, they are having so much fun. Do you think they understand kinetic and potential energy now? I know they do!

Overall, technology influenced teacher classroom practices by changing procedural classroom management strategies, adding in student reflection as a part of lessons on a regular basis, transforming their practices in teaching to incorporate, personalized learning, and creating relevancy in the classroom to better enhance student

learning.

Research Question Six

Research question 6, *"How, if at all, does the implementation of ICT influence students' observable classroom interactions?"* was answered through thematic analysis of interview and observation data. The qualitative data analysis includes three major themes identified in the teacher responses for the pre and post teacher interviews and classroom observations including: (a) Student Communication, (b) Student Ownership, and (c) Student Motivation

Student Communication

Student communication has been influenced by the implementation of technology due to the changing classroom practices of the teachers and presence of technology in the class. Overall, teachers believe technology has influenced their students' classroom interactions in a positive manner. Teacher H describes the influence technology implementation has had on his students' classroom interactions:

> The biggest change [since implementing technology] has been student interactions. Students redirect one another. We talk about feedback a lot right now whereas before the students would say to each other "Shut Up!" or "Look at the Teacher!" and the immediate result was the same as now but it did not create a positive culture. Whereas now it is changing because we have a discussion about how to build those skills and what to say in order to redirect each other. And some kids were like, "I got this, leave me alone" and so as a class we also had to work on how to accept direction. I have kids adopting it and I have kids who also catch themselves. They catch themselves when they start saying "Shut up" or

something.

Technology implementation has also had a positive influence on the students' interactions in Teacher C's classroom as she described the change in her students pre- and post-ICT implementation, saying, "Students are more willing to help each other because they want to show their knowledge in regards to using the computers and they're motivated to work together, collaborate, and get along because they are excited to use the computers."

Teacher E explains how technology has increased students' willingness to work together and collaborate with each other by discussing the shift she has seen in student interactions since utilizing technology:

> Students' interactions have changed in my classroom since we use technology now. Students work well using technology, both independently and as a group. They always see the technology as a "prize" but in reality technology is being used as a medium to have them analyze problems or information, solve problems and evaluate samples of work. All these skills are very high level, cognitive skills that are they are able to reach because of the use of technology. The interactions and conversations are respectful and cordial since the devices are assigned to particular students so everybody understands who is responsible for the devices and wants to use them.

Teacher D, who implements technology on a weekly basis, talks about the difference in her students over the year:

> On the days we are really able to implement blended learning, I do find that students interact differently. For the most part, they work as a group better and

> make decisions fairly. Often times they will make decisions amongst the group rather than me appointing someone. Last year, [referring to semester before] I found it more difficult to have students work together in random groups. We set the stage when we introduced the blended learning culture. While I think we could have all done a better job at keeping up the culture amongst the team, I still feel that it has made a difference in my classroom. I also see them helping each other out more in regards to computer issues and helping each other navigate.

Overall, technology has influenced the way students communicate with each other by creating more collaborative and respectful classroom interactions. Students want to use the technology, which creates unity among the students to work together so they can use the laptops. The theme of student communication has helped create a positive classroom culture that has allowed for teachers to implement more collaborative projects and increase time on student learning rather than student behavior.

Student Ownership

The positive classroom culture that has been influenced by technology has led to the opportunity for teachers to utilize technology to help students be accountable for their own learning. Teachers are holding students accountable to their interactions at both a social and academic level where students understand how their interactions impact themselves and their classmates. Teacher H has noticed technology has not only changed the way the students communicate with one another, but also how they take ownership of their learning. Teacher H describes this change in his classroom:

> When students are working on projects I would normally say, “Okay, get back to working, why are you not working?” Whereas now I go up to them and say, “Hey

> are you meeting our teams' expectations?"- which they came up with at the beginning of the year through discussions. They have a completely different response when I ask what expectation you are not meeting and why. Also, because my work is collaborative with other people it puts a more social aspect to it by asking how are you contributing to the group right now. It is having a conversation and putting the work back on them and at the end of the day it is more of a coaching conversation.

Teacher E also noticed technology implementation over time helped her students becoming more responsible for their own learning as well as the technology devices themselves. She states:

> There has been a change in my student behavior, especially when they see that the final step of the lesson is an online activity. They finish their work, they want to make sure they have earned the computer rights for that day. Students are showing responsibility with their devices also. My students have a device assigned to them and they are really good at keeping the device safe, updated and they let me know if there are any problems with their device.

Another aspect of student ownership that Teacher F describes, is the sense of collaborative spirit in the classroom that has occurred since implementing technology:

> One thing the students have picked up on is a few of them take charge to oversee the process. They become managers! They are aware of watching the time and developing a sense of pacing themselves. At the end of class, they're becoming more aware that if they get to a certain point with a task they might as well go ahead and log out and put their computer back up. They don't have the traffic jam.

> I have a couple of students who naturally oversee the process to deal with the traffic jam and managing to make sure the computers are in order and on the chargers.

In Teacher H's classroom, students were using technology and working in groups to create essays, illustrating the themes of student ownership and classroom practices. Students helped each other complete the project by pointing out where students should click in order to access and complete the assignment. One of the student groups had two of the four students actively working while the two other students were not. The teacher realized the group was not working and walked over to remediate the group's progress. The teacher and group of students had a discussion on what they thought was the best way for them to best fix the situation. The teacher asked for all the students to be engaged in the conversation and to take their hands off of the computer while they were talking through and reflecting how they were working as a team.

The students that were working began the conversation with how hard it was not having the other two students contribute. After hearing the other students discuss their concerns, the students who were not contributing to the group took ownership and apologized to the group members for not working. This practice placed the ownership on the students and increased teamwork and collaboration among students.

Student Motivation

The last theme to support the influence technology implementation has had on student interactions is student motivation. Most of the teachers noted a change in student motivation since using technology in their classrooms. Teacher E shared how her

classroom has encouraged students to be more motivated and excited about learning in the classroom:

> I have seen much more engagement in student learning with the blended learning initiative is established. When there are quizzes, students enjoy taking them online and seeing their immediate feedback. They get excited about watching the videos and completing [subject specific] games. It truly is amazing to watch them figure out the process of the technology and learn even more than I intended. I also enjoy giving the students options in completing projects online or on posters. Several students chose the computer and came out with some great results! Overall students are just more motivated to learn.

Teacher F has noticed the student motivation has increased with the use of technology in the classroom specifically with her more challenging students. Teacher F states:

> Since using technology, students that tended to create problems have become less problematic. They became more focused and motivated to complete the tasks at hand. Their conduct improved also. They have to think inward rather than outward to get logged in and follow instructions for the assignment.

Overall, the sample of teachers interviewed had seen a positive influence on student motivation in their classroom since using technology. Many of the teachers had effective classroom practices before implementing technology but were excited to experience a different way to motivate their students by using technology.

Summary of Findings

This chapter reviewed the analysis and results of the quantitative and qualitative data collected from eight teachers participating in a community funded blended learning grant. The results from the quantitative portion of this study indicated a statistically significant mean difference in teacher technological self-efficacy between pre- and post-ICT implementation teachers, no statistically significant mean difference in teacher technological proficiency between pre- and post-ICT implementation teachers, and no statistically significant mean difference in teacher technology frequency of ICT use pre- and post-ICT implementation teachers.

The results from the qualitative portion of this study revealed teachers' perception of technology, the influence technology implementation has had on teacher classroom practices, and the influence technology implementation has had on students' classroom interactions. The themes, (a) Technology is the Student's Future (b) Technology Implementation as a Learning Process (c) and Increased Student Engagement were derived from the emergent codes in participant responses and observation data for Research Question 4, "*What are teacher perceptions regarding implementation of information and communication technology?*" The themes, (a) Classroom Management, (b) Student Reflection, (c) Personalized Learning, and (d) Relevancy were derived from the emergent codes in participant responses observation data for Research Question 5, *"How, if at all, does the implementation of ICT influence teachers' classroom practices?"* The themes, (a) Student Communication, (b) Student Ownership, and (c) Student Motivation were derived from the emergent codes in participant responses observation data for Research Question 6, *"How, if at all, does the implementation of ICT*

influence students' classroom interactions?" The themes from the qualitative portion of this study provided supporting evidence of the influence implementation of ICT had on teacher classroom practices and student classroom interactions pre- and post-ICT implementation.

Overall, the differences between pre- and post-ICT implementation teachers were changes in classroom practices and student interactions that yield more for a personalized and positive learning environment with little to no significant change in teacher technological self-efficacy or technological proficiency pre- and post-ICT implementation.

CHAPTER V

SUMMARY IMPLICATIONS, AND RECOMMENDATIONS

The purpose of this study was to examine the influence the implementation of ICT has on teacher technological self-efficacy, technology proficiency, frequency of ICT use, and classroom practices of urban middle school teachers. Additionally, the study examined the influence of implementation of ICT on students' classroom interactions. This study was completed during the fall of 2015 and spring of 2016 with eight teachers from an urban district in southeast Texas were solicited to participate in this study. Teachers were solicited to complete the survey instruments, participate in interviews, and classroom observations. Paired t-test, descriptive statistics, and inductive coding were used to analyze the data collected. This chapter includes a summary of the findings, implications, and recommendations of the findings.

Summary

The research questions for this study addressed the differences between pre- and post-ICT implementation on teacher self-efficacy, proficiency, frequency of use, classroom practices, and students' classroom interactions. The research questions for this study were:

1. Is there a statistically significant mean difference between pre- and post-teacher technological self-efficacy when ICT is implemented?

2. Is there a statistically significant mean difference between pre- and post-teacher technology proficiency when ICT is implemented?
3. Is there a statistically significant mean difference between pre- and post-teacher frequency of ICT use when ICT is implemented?
4. What are teacher perceptions regarding implementation of ICT?
5. How, if at all, does the implementation of ICT influence teachers' classroom practices?
6. How, if at all, does the implementation of ICT influence students' classroom interactions?

Research Question One

Research question one examined if there was a statistically significant mean difference in pre- and post-teacher technological self-efficacy when ICT was implemented. The researcher's hypothesis stated there would be a statistically significant mean difference in the technological self-efficacy when ICT was implemented. The quantitative results from this study indicated a statistically significant difference between pre- and post-teacher technological self-efficacy when ICT was implemented but indicated that a teacher's pre-ICT implementation technological self-efficacy was higher than post-ICT implementation technological self-efficacy. These results disagree with the study by Yuen and Ma (2008) that indicate there is no significant impact on teacher technological self-efficacy when ICT is implemented.

Since the results from this study demonstrated a decrease in teacher technological self-efficacy when ICT was implemented, the idea of building teachers' confidence that Yuen and Ma (2008) discuss as critical in ICT implementation, could have been a

missing variable in this study that could have impacted the teachers' technological self-efficacy. To further analyze the specific difference in pre- and post-ICT implementation the researcher found that the mean score for *Teaching and Technology Self-Efficacy* was lower post-ICT implementation even though responses for 35% of survey items changed from "Neutral" to "Agree" or changed from "Disagree" to "Agree" indicating a higher technological self-efficacy for some survey items post-ICT implementation. The results from this study indicate a negative effect of technology implementation on teacher technological self-efficacy that could be explained by the barriers of ICT implementation (Anderson & Groulx, 2011; Wachira & Keengwe, 2011). Another factor that could contribute to why teachers had a lower technological self-efficacy post-ICT implementation is that they could have felt more confident with technology before it was implemented and then realized post-ICT implementation they are not as confident as they initially thought they were.

Research Question Two

Research question two examined if there was a statistically significant mean difference in pre- and post-teacher technology proficiency when ICT was implemented. The researcher's hypothesis stated there would be a statistically significant mean difference in teacher technology proficiency. The quantitative results from this study indicated there was not a statistically significant mean difference between pre- and post-teacher technology proficiency when ICT was implemented. The quantitative results from this study do not support the study by (Anderson, 2014) that state teachers have an increase in technology proficiency when ICT is implemented and also frequently used. To further analyze the specific difference in pre- and post-ICT implementation the

researcher found that the mean score for *Technology Proficiency for 21st Century Learning* was higher post-ICT implementation and responses for 97% of survey items changed from “Strongly Disagree” and “Disagree” to “Neutral” or “Neutral” and “Agree” to “Agree” and “Strongly Agree” indicating a higher technological proficiency for most survey items post-ICT implementation. This decrease in technology proficiency could be due to lack of time teachers were able to learn, adapt, and implement technology in their classroom. Since the teachers who participated in this study implemented technology over a semester in comparison to a school year, this decreased the amount of time teachers were exposed to technology to further the ICT implementation process.

Research Question Three

Research question three examined if there was a statistically significant mean difference in pre- and post-teacher frequency of ICT use when ICT was implemented. The researcher’s hypothesis stated there would be a statistically significant mean difference in teacher frequency of ICT use. The quantitative results from this study indicated there was not a statistically significant mean difference between pre- and post-teacher frequency of ICT use when ICT was implemented. The quantitative results from this study disagree with study by Nguyen and Tri (2014) that states an there is an increase in teacher frequency of ICT use when ICT is implemented. The results from this study suggests that the more implementation of ICT in education, does not increase the frequency of ICT that will be used in the classroom. The results from this study suggest that the presence of technology does not increase use of technology but factors such as professional development, time, and necessary supports in order to effectively implement technology have the greatest influence on frequency of ICT use.

Research Question Four

Research question four explored what teacher perceptions of technology implementation were. Eight teachers were interviewed and participated in classroom observations to gain a deeper understanding of their perceptions of technology implementation. Qualitative analysis resulted in three themes; (a) Technology is the Student's Future (b) Technology Implementation as a Learning Process (c) and Increased Student Engagement. In exploring the theme of Technology is the Student's Future, teachers believed that technology was critical to the learning environment as it will only become an increasing requirement in the future jobs of students. This theme supports the idea proposed by the U.S. Department of Education (2010) that all students will need to know how to use technology for their future job, not just the positions that are normally thought of that currently use technology. The theme of Technology Implementation as a Learning Process was supported by the teachers' observations and interviews that demonstrated teacher humility and role modeling of learning. This theme supports the research by Beetham and Sharpe (2013) that student involvement in the learning practice is one of the most effective pedagogical practices a teacher can implement in the classroom. Teachers commented that they would frequently ask for student support when trying a new technology tool in their classroom and that making mistakes was an acceptable practice in the classroom.

These results suggest more emphasis on collaboration between students and teachers to increase the effectiveness of technology implementation and foster a mutually shared learning space. Last, the theme of Student Engagement was present in each of the eight teacher interviews suggesting that technology use increases student engagement in

the learning process. These finding support the research by O'Keefe et. al. (2013) that reported student engagement and enjoyment of learning increases when technology is implemented. Overall, the results from this research support that teachers have an overall positive perception of technology implementation and believe that technology is a tool to not only enhance student learning, but make learning more engaging for students.

Research Question Five

Research question five explored how technology implementation influenced teachers' classroom practices. The qualitative analysis of interview and observation data resulted in four themes; (a) Classroom Management (b) Student Reflection (c) Personalized Learning, and (d) Relevancy. In exploring the theme of Classroom Management, teachers mentioned two barriers that occurred when implementing technology; time and monitoring of all students. Anderson and Groulx (2011) describe these barriers as hindering variables to effective ICT implementation. The results from this study conclude technology takes time to implement and that teachers must structure their classrooms to accommodate technology. The results from this study also support research by Wachira and Keengwe (2013) that reported internal barriers to implementation of ICT include; lack of time, knowledge, and confidence but that time remained one of the main obstacles to effective ICT implementation.

In addition to the theme of Classroom Management, Student Reflection was an increased classroom practice as a result of technology implementation. With the integration of technology, the teachers who participated in this study believed there were more opportunities for students to reflect using technology because it afforded them a more efficient and engaging method for student reflection. Teachers attributed effective

student reflection to the automatic feedback technology was able to provide to the teacher and student that helped maintain student engagement of the content. Teachers explained the difference of technology providing feedback as an instantaneous experience compared to feedback without technology that usually took place days or weeks after a lesson. The results from this study support the idea that with effective implementation technology has a positive influence in the classroom and affords opportunities for students and teachers such as the practice of reflection (Mandinach & Cline, 2013).

The next themes, Personalized Learning and Relevancy relate with each other as personalized learning is more manageable with the increased amount of relevancy for the student. Technology is a tool that increases this relevancy because it allows for teachers to differentiate instruction based on students' needs using a method familiar and engaging for students. The idea of relevant and personalized learning was best demonstrated in the observation of a class where students were working on subject specific course work that was created for their level of mastery. In addition to personalized content, students were able to engage with a game during their learning journey that created relevant experiences that maintained their engagement throughout the learning process. The results from this study support the literature by Hwang et al., (2012) that suggest technology is the most relevant tool for education that educators should utilize to increase personalized learning opportunities for students.

Research Question Six

To explore how technology implementation influenced students' classroom interactions, qualitative data were analyzed to produce three themes; (a) Student Communication, (b) Student Ownership, and (c) Student Motivation. The results from

this study suggest that overall technology has a positive influence on student interactions, especially on student motivation. Teachers indicated that students who would not participate in class pre-ICT implementation were more engaged, willing to learn, and completed assignments post-ICT implementation. These findings agree with the research by Şad and Göktas (2014) that found learning with technology increases student enjoyment and engagement, which increases student motivation. The data collected from research questions four and five support the change in student interactions because there was a dynamic shift in the classroom environment. Students who are used to traditional methods of teaching that do not use technology have become more engaged in learning with technology. The increase in student engagement is supported by the teachers who participated in this study and have an overall positive perception of implementing technology.

Implications

According to the literature review, technology is a tool that positively enhances student learning both academically and emotionally. Technology provides students the opportunity to engage in personalized learning and increases student enjoyment of learning (Heafner, 2004; Plass, O'Keefe, Homer, Case, Hayward, Stein, & Perlin, 2013). Utilizing technology is a proven teaching tool that enhances student learning and must be continuously researched to help educators continue to use technology to increase student achievement. The results from this study have implications that lead to the need for more questions and research to be conducted to explain the findings from this study.

Implications for Administrators

When implementing any new tool in education the teacher related issues are discussed as the most important components to plan for (Cochran-Smith, 2004; Doyle & Ponder, 1977; Fullan, 1993; Gillingham & Topper, 1999; Sarbib, 2002; Townsend & Bates, 2007). Administrators working to integrate new technology should be aware of common barriers that occur when using technology and plan to overcome these barriers to increase the rate of technology adoption on their campus. By proactively identifying barriers of technology integration and planning adequate support, teachers can effectively integrate technology with the assistance of their administrators. Based on the results from this study, there was a decrease in teacher technological self-efficacy when ICT was implemented. The factors that contributed to this decrease should be further explored to identify what specific barriers prevented effective technology implementation on the campus used in this study. To help identify these specific barriers to explain the decrease in technological self-efficacy, administrators could interview the teachers who participated in this study to gain insight into their experience implementing new technology on the campus. After specific barriers are identified, administrators could create a robust support plan to help overcome the barriers present on the campus to ultimately help teachers use technology to increase student learning.

Another implication an administrator should be aware of during technology implementation is the need for professional development to be heavily front loaded in order to prepare teachers with the necessary technological self-efficacy and proficiency needed in order for effective implementation. The lack of professional development was a contributing factor for the teachers in this study that was demonstrated by teacher

responses to interviews that stated they had to independently implement technology into their subject. For one of the teachers in the study the lack of knowledge how to implement technology in her specific subject led to rejection of ICT. In order to prevent this rejection during ICT implementation, administrators should ensure they are providing teachers with the necessary support and knowledge to be able to implement technology effectively in their subject specific classroom.

The need for professional development leads to the next implication administrators should be aware of, the level of technological proficiency and self-efficacy each teacher on campus possesses. According to Ertmer (2012) rejection of new technology usually occurs when the necessary supports are not available for the teachers implementing technology. To determine each teacher's level of technological proficiency and self-efficacy before administering professional development, an administrator could survey teachers and use the results to create personalized professional learning opportunities pre-ICT implementation. During this professional learning, administrators and teachers could collaboratively set personalized technology implementation goals and review action plans and necessary supports to help each teacher meet their technology implementation goals. This initial time investment to strategically implement technology, will help teachers feel supported when using technology.

Another implication of this study for administrators to consider is the planning time needed for teachers to adapt, adopt, and implement new technology. The teachers who participated in this study discussed the lack of time available to collaborate and figure out how to implement technology into their specific subject. This lack of time also poses a challenge for teachers who are trying to implement interventions for students

considered below grade level. Based on these results, if a campus is going to pilot new technology, administrators should consider to plan the master schedule for teachers to have sufficient planning and collaboration time to improve technology implementation in their classrooms.

The last implication of this study, derived from the results of increased positive student classroom interactions, this increase in positive interactions suggests the need for administrators to identify the specific classroom practices and variables of technology implementation that increased positive student communication, motivation, and ownership. By identifying the specific contributing factors to positive student interactions, these practices could be replicated and planned to be scaled in order to implement these practices organization wide that could impact the overall student achievement and culture of a school.

Implications for Teachers

In order for teachers to effectively implement technology, teachers have to be willing to not only adopt the new technology but also the experience of using new technology in their lesson planning and implementing. According to the results from this study, teachers created a comfortable and safe environment in their classrooms in order to try new technology regardless of the outcome. The teachers modeled not being afraid to try new things that created a classroom culture of acceptance and support. The teachers also reported that if something in the lesson did not go as planned, their students adapted quick to continue learning. The results from this study suggest for teachers to accept the process of trial and error in order to most effectively implement technology in their

classroom and establish the culture of learning collaboratively with their students to maximize the technology implementation experience.

From the results of this study teachers reported a lack of time and knowledge of how to effectively implement technology in their classrooms. The administrators are available to support the professional learning and necessary supports to encourage effective technology implementation but ultimately the teacher in the classroom decides how and when technology is used to enhance student learning. To address the issue of time and lack of content specific technology implementation practices, teachers can independently investigate how other teachers plan and implement technology regardless of if there are the necessary supports in place or not. This individual motivation must come from the teachers themselves to be committed to their students' learning and willing to grow as a professional. Teachers could organically create a professional learning community and share best practices around technology integration they have found to work in their classroom or through independent research. By taking the initiative to find a way to implement technology regardless of time or content specific strategies, educators are embracing the idea of life-long learning and creating their own solution for the barriers present to hinder effective technology implementation.

Recommendations for Future Research

There are several recommendations for future research based on the results of this study. The first suggestion for future research is to replicate the study with more schools in a district that has different demographics. The demographics for the school that participated in this study is majority Hispanic. With a larger population and difference in

demographics, the results of this study could be more generalizable to the district or other districts rather than just the school that participated in this study.

Another recommendation for future research is to replicate the study on a school that is participating in a district wide technology implementation. The school researched in this study was the only school participating in technology implementation due to receiving a school-specific community funded blended learning grant. If a school was researched that was participating in a district wide initiative it could yield different results due to the district having more support in place for the implementation process. A district wide implementation would influence the results because the district would have more input and perspective over the implementation process rather than the school having autonomy over the implementation.

In addition to the context and sample size of this study, further research is recommended to correlate teacher technological self-efficacy and teacher technology proficiency with student classroom interactions. Teacher technological self-efficacy and teacher technology proficiency were independently researched in the study but were not examined in correlation with student classroom interactions. By examining the influence of technological self-efficacy and proficiency on student classroom interactions, data could be collected to further explain and inform administrators about how to identify, develop, and measure progress of teachers with low technological self-efficacy and proficiency to increase positive student interactions post-ICT implementation.

Another recommendation for future research is to replicate the study and cross-reference the survey results, interviews, and observations with the participant demographics. By cross-referencing the demographics of participants, results could

reveal specific personalized learning needs for the teachers and themes that could be found among specific demographic groups. The variance in years of teaching experience, subject matter, age, and gender could add to the research about effective ICT implementation practices for all teachers in various demographic groups.

The last recommendation for future research is to replicate this study over a longer period of time that could measure the teachers' technological self-efficacy and proficiency from the beginning of the school year to the end of the school year. By examining the influence of ICT implementation over an entire year instead of the six month period this study was conducted in, there will be more data to identify the barriers and opportunities that occur throughout an entire school year that influence technology implementation.

This research provided more data on the influence ICT implementation has on urban middle school teachers by measuring their technological self-efficacy, technology proficiency, frequency of ICT use, classroom practices, and overall perceptions of ICT. The results from this study contributed to the growing research of ICT in education and support the critical need for education to continue researching factors that contribute to effective ICT use in classrooms to enhance student learning.

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APPENDIX A

INTRODUCTORY COMMUNICATION LETTER TO TEACHERS

APPENDIX A

INTRODUCTORY COMMUNICATION LETTER TO TEACHERS

Dear Teachers,

I am a doctoral student at the University of Houston-Clear Lake (UHCL) conducting a survey among teachers who are participating in the blended learning initiative this year. You have been identified as a potential candidate for participation due to your involvement in the technology integration process occurring on your campus this year. I have designed a study to measure the influence the new technology integration has on technological self-efficacy and proficiency.

The purpose of this study is to examine the influence the implementation of information and communication technology has on teacher technological self-efficacy, technology proficiency, frequency of ICT use, and classroom practices use of urban middle school teachers. Additionally this study will examine the influence of implementation of ICT on students' classroom interactions.

Data collected from the surveys will only be used for educational and/or publication purposes so you will not be identified by name. Your participation as a survey respondent is entirely voluntary. Included in the survey is a request for participation in an interview process as well. The individual responses will be kept confidential, but all responses will be complied, summarized, and shared with UHCL for the purposes of program improvement. If you choose to participate, please click on the link below to open the survey.

Insert link here

Please complete as soon as possible and no later than month day. Your participation and feedback is greatly appreciated.

Sincerely,

Skyler Rossacci
The University of Houston-Clear Lake

APPENDIX B

SURVEY COVER LETTER

APPENDIX B

SURVEY COVER LETTER

Dear Teachers,

I am a doctoral student at UHCL and I am conducting a survey with involved in the blended learning pilot this year. With that in mind, I have designed a study to investigate teacher perceptions and knowledge regarding technology integration. The purpose of this study is to examine the influence the implementation of information and communication technology has on teacher technological self-efficacy, technology proficiency, frequency of ICT use, and classroom practices use of urban middle school teachers. Additionally, the study will examine the influence of implementation of ICT on students' classroom interactions.

The data collected from the surveys will only be used for educational and/or publication purposes so you will not be identified by name. Your participation as a survey respondent is entirely voluntary, and you may decide to cease participation after you have begun. The individual responses will be kept confidential, but all responses will be compiled, summarized and shared with UHCL for the purposes of program improvement. **If you choose to participate, complete the attached survey. If you decline, do nothing further. There are no benefits and no penalties for choosing or declining to participate, and you may withdraw any time during the study without consequences and your data will not be included. Your willingness to participate in this study is implied if you proceed with completing the survey. You may keep this cover letter for your records.**

Please try to answer all the questions, since responding to each item will the make survey results more useful. The anticipated time commitment for completing the survey will be approximately 15 minutes. Included in the survey is a request for interview, if you are interested and/or willing to participate in this portion of the study, please complete the interview consent portion of the survey. No obvious undue risks are associated with completing the survey. While you will receive no direct benefit from your participation in the survey process, your participation will help the researcher better understand the technology beliefs associated with each of the classroom models.

Sincerely,
Skyler Rossacci
The University of Houston-Clear Lake

APPENDIX C

TEACHER CONSENT FORM

APPENDIX C

TEACHER CONSENT FORM

Informed Consent to Participate in Research

You are being asked to participate in the research project described below. Your participation in this study is entirely voluntary and you may refuse to participate, or you may decide to stop your participation at any time. Should you refuse to participate in the study or should you withdraw your consent and stop participation in the study, your decision will involve no penalty or loss of benefits to which you may be otherwise entitled. You are being asked to read the information below carefully, and ask questions about anything you don't understand before deciding whether or not to participate.

Title:

PRINCIPAL INVESTIGATOR: Skyler Rossacci, M.Ed.
STUDENT RESEARCHER: Skyler Rossacci, M.Ed.
FACULTY SPONSOR: Dr. Jana Willis, Ph.D.

PURPOSE OF THE STUDY

The purpose of this study to examine the influence the implementation of information and communication technology has on teacher technological self-efficacy, technology proficiency, frequency of ICT use, and classroom practices use of urban middle school teachers. Additionally, the study will examine the influence of implementation of ICT on students' classroom interactions.

PROCEDURES

The research procedures are as follows: Survey data will be collected from a random sample of urban middle school teachers in a southeast Texas school district. Teacher self-efficacy will be measured by the administration of focus groups and the *Technology and Teaching Self Efficacy Scale*. Teacher technology *proficiency* will be measured by the administration of *Technology Proficiency Self-Assessment for 21st Century Learning*. Quantitative data will be analyzed using frequencies, percentages, and paired t-test. Qualitative data will be analyzed using thematic analysis. Thematic analysis will be used for this particular study to be able to interpret the data collected into themes and will be easy to communicate and able to create actionable steps associated to the emerged themes.

EXPECTED DURATION

The total anticipated time commitment will be approximately 25 minutes to complete the electronic survey and 45 minutes to participate in the interviews. A series of four 15 minute classroom observations will take place throughout the duration of the study.

RISKS OF PARTICIPATION

There are no anticipated risks associated with participation in this project.

BENEFITS TO THE SUBJECT

There is no direct benefit received from your participation in this study, but your participation will help the investigator(s) better understand There is no direct benefit received from your participation in this study, but your participation will help the investigator(s) better understand teacher perceptions of new information and communication technology integration.

CONFIDENTIALITY OF RECORDS

Every effort will be made to maintain the confidentiality of your study records. The data collected from the study will be used for educational and publication purposes, however, you will not be identified by name. For federal audit purposes, the participant's documentation for this research project will be maintained and safeguarded by the Dr. Jana Willis for a minimum of five years after completion of the study. After that time, the participant's documentation may be destroyed.

FINANCIAL COMPENSATION

There is no financial compensation to be offered for participation in the study.

INVESTIGATOR'S RIGHT TO WITHDRAW PARTICIPANT

The investigator has the right to withdraw you from this study at any time.

CONTACT INFORMATION FOR QUESTIONS OR PROBLEMS

The investigator has offered to answer all your questions. If you have additional questions during the course of this study about the research or any related problem, you may contact the Student Researcher, Skyler Rossacci M.Ed. The Faculty Sponsor Dr. Jana Willis, Ph.D., may be contacted.

APPENDIX D

TEACHER PRE-INTERVIEW GUIDE

APPENDIX D

TEACHER PRE-INTERVIEW GUIDE

1. Why are you doing the blended learning initiative?
2. Have you ever done blended learning before?
3. What is your intent when it comes to integrating technology within the classroom?
4. Do you feel confident in your technological skills and knowledge to implement blended learning?
5. Do you feel confident in your teaching to implement blended learning?
6. How do you plan to implement blended learning?
7. How do you intend to use blended learning to enhance your classroom?
8. What are you intending the learning outcomes to be?
9. Do you have specific classroom management strategies you are going to implement to accommodate the new technology?
10. What advantages and disadvantages do you think the blended learning implementation will have in your classroom?

APPENDIX E

TEACHER POST-INTERVIEW GUIDE

APPENDIX E

TEACHER POST-INTERVIEW GUIDE

1. Think back prior to blended learning implementation, can you describe what your classroom practices were like? Can you describe it now that you have implemented blended learning and if there are any difference?

2. Have you noticed a specific aspect of your teaching practices that has been directly influenced by blended learning?

3. Think back to prior blended learning implementation, can you describe what students interactions were like in your classroom? Can you describe it now that you have implemented blended learning if there are any differences? *(how they completed assignments together, how the spoke with each other, any kind of interaction that you have seen has been impacted by blended learning.)*

4. Have you noticed a specific aspect of your students' interactions that has been directly influenced by blended learning?

5. How has blended learning changed your classroom layout? And why?

6. What is your intent when it comes to integrating technology within the classroom?

7. Do you feel confident in your personal technology knowledge and skills to implement Blended Learning?

8. What advantages and disadvantages do you think Blended Leaning has in your classroom?

9. Have you seen any changes in student behaviors since implementing blended learning? If so, what changes have you seen?

10. Have you seen any differences in student learning since implementing blended learning? If so, what differences have you seen?

11. How has your perceptions about blended learning changed since before and after implementation?

12. What are your overall thoughts on blended learning and integrating technology in education?

RÉSUMÉ

Skyler K. Rossacci, M. Ed.

Education

University of Houston Clear Lake, Clear Lake, Texas
Doctor of Education, Education Leadership — August 2016
Specialization, Curriculum and Instruction

Lamar University, Beaumont, Texas — December 2012
Master of Education, Education Administration

Texas A&M University, College Station, Texas — December 2010
Bachelor of Arts, Communication
Minor, Music

Leadership and Teaching Experience

Spring Branch Independent School District, Houston, Texas — July 2015-Present
Strategic Initiatives and Special Projects Liaison

Victory Lakes Intermediate, League City, Texas — June 2013-July 2015
Career and Technical Education Teacher, Department Chair

Clear Creek Intermediate, League City, Texas — Jan 2011-June 2013
Choir Director

Certifications

Principal
Texas Certified Mediator
Business 6-12
Generalist EC-6
Family and Consumer Science 6-12
Music EC-12
Speech 7-12

Publications

Rossacci, S., & McDonald, D. (Fall 2015). Mock interviews for adolescents: How to get a job. *Academic Exchange Quarterly, 19*(3).