THE IMPACT OF THE BRING YOUR OWN DEVICE PROGRAM ON ACADEMIC ACHIEVEMENT IN MATHEMATICS IN A SAMPLE OF 7TH GRADERS: AN EXPLANATORY SEQUENTIAL MIXED METHODS INQUIRY

A Dissertation

by

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This dissertation meets the standards for scope and quality of
Texas A&M University-Corpus Christi and is hereby approved.

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ABSTRACT

The State of Texas Assessments of Academic Readiness (STAAR) and Bring Your Own Device (BYOD) program were among the major topics of interest in Texas middle schools in the 2014-2015 school year. Many institutions have been implementing a BYOD policy, which allows students and teachers purchase their own electronic devices without offering detailed specifications. The primary purpose of the study was to examine the impact of the BYOD on standardized academic achievement in mathematics.

The mixed methods study was conducted in two middle schools in South Texas. The State of Texas Assessment of Academic Readiness (STAAR) scores were analyzed to test the hypothesis that 7th graders who used the BYOD program (n = 297) would score higher on standardized mathematics achievement than did the students who had not used the BYOD program (n = 297). For the qualitative component of the study, a focus group was conducted to document the perspectives of a sample of teachers and educational leaders regarding the effectiveness of the BYOD program on mathematics academic achievement.

Based on the quantitative results, the study's hypothesis was not supported and it was concluded that the students who used the BYOD program did not score higher on the seventh grade standardized mathematics STAAR test than did the students who had not used a BYOD program. There were 13 educators who participated in the qualitative component of the study of which, eight did not feel that achievement in mathematics could be affected by the BYOD program, complementing the quantitative results. Analysis of the qualitative data resulted in five themes, namely, Access to BYOD, Distractions Due to BYOD, Cost of BYOD, Monitoring of BYOD, and BYOD as a Tutorial Tool.

The study examined the impact of the BYOD program on seventh grade standardized mathematics STAAR scores in a South Texas middle school setting. After adjusting for the confounding variables, the results demonstrated that, at the 0.01 level of significance, the non-BYOD group outperformed the comparison group on the majority of the outcome measures. The educators in the focus group stated that the BYOD program, when properly used, helps students access the newest mathematics resources that may result in academic achievement. In non-BYOD schools, other factors that may influence the outcomes must be taken into consideration, which may include parent and community involvement, teacher assessments, teacher-made worksheets targeting specific objectives, daily in-school small group tutoring, and after school tutoring prior to the STAAR test. Additionally, providing the teachers with sufficient planning time to develop the subject areas may be instrumental in increasing mathematics scores. Whatever the case may be, it can be informative to examine the effectiveness of other potential interventions.

DEDICATION

I dedicate my dissertation work and my doctorate to my family. A special feeling of gratitude to my loving parents, Ramon and Irma Tijerina whose words of encouragement and push for drive and success planted a dream in my heart to pursue a doctoral degree. My sister Anna and her gorgeous boys, my darling nephews, Seth and Evans, you all have never left my side and are very special. I also dedicate this dissertation to my Husband, Joe, and my daughter, Trinity Grace, whom I dearly love. You both have had to endure the time without me while I pursued this dream. I Hope I have made you both proud, you two are my biggest motivation to want to always do my best. Trinity, as you grow, I hope I have instilled in you the confidence to keep working towards your goals. I give a special thanks to the Mendoza family for investing your time to support Trinity and I on this academic journey. I will always appreciate all you have done for me!

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CHAPTER I

INTRODUCTION

Background and Setting

The two major topics of interest in Texas middle schools in the 2014-2015 school year were the State of Texas Assessments of Academic Readiness (STAAR) and Bring Your Own Device (BYOD) program. Many institutions have been implementing a BYOD policy, which allows students and teachers purchase their own electronic devices without offering detailed specifications (Edudemic, 2012). The implementation of the BYOD program in various school districts in the state of Texas has given students the opportunity to bring personally-owned devices to school for educational purposes. In a non-BYOD program school, students are not allowed to use mobile devices for educational purposes and could face credit reduction for using a mobile device for an assignment or receive some type of disciplinary action as per the campus' student code of conduct. Texas middle schools vary in the implementation phases of the BYOD program, as some programs are stronger than others. Accordingly, to help support a trend like the BYOD program, the Texas Education Agency (TEA) has a long-range plan for technology that started in 2006 and extends to 2020. Likewise, the implementation of the BYOD program in schools is intended to help support this initiative by moving students forward into the 21st century classrooms. Being able to use their own mobile devices in classrooms is intended to assist students in expanding their content knowledge beyond the classroom. Consequently, the use of mobile devices in classrooms is regarded a 21st century learning environment that is unique and filled with diverse digital curricular resources (2012 Long-Range Plan for Technology, 2006-2020).

The STAAR test began in the 2011-12 school year, which is the state of Texas' standardized tests for all students in public schools. The STAAR assesses students' level of mastery of the Texas Essential Knowledge of Skills (TEKS). According to Dillard (2010), the STAAR was a tougher and longer standardized test than the ones previously used in Texas. The TEKS were the state standards for what students should know and be able to do (Texas Education Agency, 2015). The TEKS in mathematics were guided by college and career readiness standards. These standards were indicators of how successful Texas students would be in a competing, complex, and global society. The commissioner of education, Robert Scott, illustrated the importance of the STAAR test with the following statement: "These standards will be challenging for our students and will push academic performance to a new level in Texas. Students who pass the STAAR end-of-course assessments would be better prepared for success in the next course or in postsecondary pursuits" (Texas Education Today, 2012, p. 2).

Texas state law also requires that students receive instruction, interventions, and resources to help them be successful on the STAAR mathematics test. The Student Success Initiative (SSI) was created by Texas Legislature to ensure that the initiative was enforced in mathematics classrooms. One way public schools have faced the challenge of the intensity of the SSI requirements is through the use of Response to Intervention (RTI). The RTI is a system and framework being used by educators to address instruction, interventions, and resources for students that are struggling to master the TEKS. According to Amanda VanDerHeyden (2017), a researcher who has published more than 60 scholarly articles related to RTI, states that "RTI properly understood and used, is focused on improving student learning and ensuring the development of mathematics competence during the primary grades is essential to later learning success" (p. 1). The Council for Exceptional Children (CEC) recognized the positive impact the RTI can have on the education of all children (Collins, 2008).

The study was delimited to 7th grade, because of the previous changes in seventh grade TEKS, STAAR had to be revised and now consists of the following: (1) probability and numerical representations, (2) computations and algebraic relationships, (3) geometry and measurement, and (4) data analysis and personal financial literacy (Texas Education Agency, 2015). Additionally, according to Weiss (2014), grade seven students were struggling with the old standards and some were failing most of the STAAR mathematics tests.

Under the SSI grade advancement requirements, the seventh grade mathematics STAAR was not a requirement for grade advancement, and students were not allowed to use calculators in taking the test. The irony surrounding the issue of the BYOD schools is that seventh graders were known to use their calculators on their mobile devices for homework and class assignments. Once these students were in eighth grade, they were able to use graphing calculators on the STAAR test. However, these calculators were issued by the school and not the ones in their mobile devices. Students reported that they were more comfortable using their own devices to solve mathematics problems in comparison to their school-issued graphing calculators. Students were also being faced with a more challenging mathematics STAAR test. The reason for this was that the new mathematics testing standards and some curriculum requirements were pushed down to lower grade levels (Weiss, 2014). Likewise, this had caused learning gaps for students if school districts did not prepare the affected teachers adequately and in a timely manner for the change. Curriculum specialists should have been busy preparing campuses for at least two years prior to the change. Weiss (2014) stated that 43% of the grade six mathematics standards stayed the same and the other 57% moved down from grade seven and

Algebra 1. The shift to move mathematics standards down to earlier grade levels continued from kindergarten to grade twelve. Grade seven mathematics teachers were accountable to their eighth grade counterparts to have students prepared for that grade level. The grade seven STAAR mathematics score was the most recommended measure of success, because federal funding was tied to campus performance.

A lot is at stake when it comes to the STAAR test and the BYOD program. Support from parents, teachers, stakeholders, and the community is vital to the success of the STAAR test and the BYOD program. Preparing grade seven students for the STAAR mathematics test and the BYOD program is thought-provoking, because both can change how middle school mathematics is taught and learned. Students live and learn in a digital world and it is important that educators are mindful of the resources and accommodations that provide our students with the best learning opportunities.

Statement of the Problem

One South Texas middle school had implemented the BYOD program to support mathematics skills. By taking advantage of the equipment students already had and by providing a filtered, wireless network (Wi-Fi), the school could provide the students with the best available academic resources. This middle school had three grade seven mathematics classes and teachers. For the 2014-15 school year, there were 297 grade seven students. The effectiveness of the BYOD program had not been systematically evaluated at this school. Thus, the nature of the relationship between the intervention and the outcome measures was unknown. Additionally, the perspectives of the involved educators regarding the advantages and disadvantages of the BYOD program had not been documented.

Theoretical Framework

Downes's Connectivism Theory model established the foundation of the study. Downes defined Connectivism as a thesis that knowledge is distributed across a network of connections; therefore, learning consists of the ability to construct and traverse those networks (Downes, 2011). Accordingly, BYOD programs allow students to practice a form of Connectivism by being able to have access to newly discovered knowledge that is up-to-date. The learning occurs when information is distributed within a social network that is technologically enhanced, and capable of recognizing and interpreting patterns. A review of mobile learning literature revealed that mobile phones made up 75% of the devices used in education (Wu et al., 2012). Likewise, Connectivism encompasses students using mobile learning to choose when and where they learn. For instance, learners will become more motivational, more active in communication and learn much better when they either own the learning tool or treat it as if they own it (Luckin, Brewster, Pearce, Siddons-Corby & du Boulay, 2004).

In addition, the study is grounded by Mark Barnes's approach to Student-Centered Learning Theory. Student-centered teaching methods shift the focus of activity from the teacher to the learners (Felder, 2016). Barnes described how students and teachers were making the shift from traditional student-centered learning to student-centered learning through the use of mobile devices and social media. Barnes' credentials include five books on educational technology, student-centered learning, using mobile devices and social media in the classroom, global learning, and 21st-century assessment. Student-centered instruction focuses on skills and practices that enable lifelong learning and independent problem solving (Barnes, 2015).

For the purpose of the study, the BYOD school served as a student-centered leaning approach. Barnes (2013) described a student-centered classroom as the one which offers interactive lessons that integrate technology and engage students in project-based learning.

Purpose of the Study

The primary purpose of the study was to examine the impact of the BYOD programs on academic achievement in mathematics among seventh grade students. The secondary purpose of the study was to document the perspectives of selected educators regarding the advantages and disadvantages of participating in a BYOD campus. The researcher had hypothesized that participation in a BYOD program would have a positive impact on student achievement in mathematics as measured by the STAAR. The secondary purpose of the study was designed to complement the quantitative component of the inquiry to better understand the impact BYOD may have in influencing academic achievement in mathematics. The study was guided by the following questions:

1. To what extent does participation in a BYOD program impact seventh grade academic achievement in mathematics?
2. What are the perspectives of seventh grade mathematics teachers and educational leaders regarding the impact of the BYOD program?

Operational Definitions

Participation in a BYOD program was measured as a binary variable (1 = yes, 0 = no). Academic achievement in mathematics was measured by the proportion of correct answers to questions in each of the four STAAR mathematics categories. Perspectives of the study participants were documented by analyzing the focus group qualitative data and identifying themes.

Delimitations, Limitations, and Assumptions

The study was delimited to (1) seventh graders, (2) the predictor variable of participation in a BYOD program, (3) the student outcome measures of academic achievement in mathematics, and (4) perspectives of seventh grade mathematics teachers and educational leaders regarding the effectiveness of the BYOD. Due to the non-probability nature of sampling, external validity was limited to the study's participants. Due to non-experimental nature of the study, no causal inferences were drawn. It was assumed that the focus group participants would honestly share and discuss their opinions of the BYOD program and the quantitative data provided to the researcher by the TEA were accurate. Additionally, it was assumed that the researcher remained academically unbiased and rigorously objective and subjective towards the quantitative and qualitative portions of the study, respectively.

Significance of the Study

America's middle school students have expressed negative views of the climate of their schools and peer culture (Grills & Ollendick, 2002). Based on the most current STAAR mathematics scores in Texas, students are struggling with the old standards. Studies have documented the benefits of using mobile devices in classrooms and its relation to academic success. The implementation of the BYOD program may be the answer teachers, students, parents, and stakeholders have been searching in an attempt to improve students' perceptions of middle schools. Barnes (2015) noted that kids love mobile learning. For instance, imagine students entering the classroom, excited to be there, because they can learn in a way they enjoy

(Barnes, 2015a). Barnes (2015) stated “I contend that we are not far from every student, no matter his or her age, having some kind of Internet-ready mobile device. This puts remarkable power in students’ hands. The sooner teachers embrace mobile learning; the faster education will improve” (¶ 1).

The study was significant because, although it did not support the hypothesis, it revealed the need for additional attention to planning and implementing the BYOD program to help improve academic achievement. The results may capture the attention of educational leaders to support additional studies on BYOD and classroom management, BYOD and academic honesty, and BYOD as a resource for academic intervention. The results may also be instrumental in suggesting that concerned individuals should invest in resources and tools to promote learning in a technology absorbed world. Overall, school officials who believe that the BYOD program is still in the theory stage may become compelled to try its implementation.

Chapter II

REVIEW OF THE LITERATURE

Introduction

Chapter Two provides a thorough review and historical overview of the literature and research related to the Bring Your Own Device Program (BYOD), high-stakes testing in mathematics for grade seven in the state of Texas, the State of Texas Assessments of Academic Readiness (STAAR), and the nation's crisis surrounding mathematics. In retrieving the literature, the following search engines and literature data bases and sites were utilized: Google, Google Scholar, and the Mary and Jeff Library at Texas A&M University-Corpus Christi. The on-line literature search was delimited to K-12 schools. The books, *Bring Your Own Learning: Transform Instruction with any Device* by Lenny Schad (2014)*, Toys to Tools Connecting Student Cell Phones to Education* by Liz Kolb (2012)*, One Nation Under Taught Solving America's Science, Technology, Engineering and Math Crisis* by Vince M. Bertram (2014) were also used to describe the historical implications of the early stages of The BYOD programs in Texas. The review of the literature focused on the following: (1) Bring Your Own Device Program, (2) Theoretical Framework, (3) State of Texas Assessments of Academic Readiness (STAAR), (4) Mathematics Crisis, and (5) Summary.

Bring Your Own Device Program

At the core of the BYOD concept is the need for mobile devices to be constantly connected to the Internet and having access to applications outside the traditional business network. Schad (2014) stated that power of mobile devices and cloud computing were extending the boundaries of our internal resources and began to formulate his concept of mobile learning. He believed if educators could put instructional resources out into the cloud, students could use the cloud for storing, emailing, and doing their homework, we could have the foundational layer in place allowing for anytime and anywhere education. Additionally, he noted that mobility and cloud-based solutions would transform and redefine the traditional classroom and class-day paradigms. His position was that transformation could not be an option and that educational institutions embracing and implementing this new philosophy would have a huge advantage in preparing students for life in the digital world, resulting in competition among various K-12 institutions. Based on Schad's viewpoints, it can be concluded that parents who can would move their children to the institutions that provide this new way of educating. Overall, mobility and cloud-based solutions have the potential to change the school day, learning opportunities, and support infrastructure available for teachers, students, and parents.

The BYOD provides students with the option to borrow electronic devices from the school or using their own equipment. Bruder (2014) described the theory of the BYOD as the means of allowing students to use the technology to actively participate in classroom activities. There are some concerns; for example, students being easily distracted and finding ways around restrictions on banned and social networking sites and widening the already significant technological gap for lower income students (Bruder, 2014). Another possible disadvantage is the disparity and inequality in student access, because not all devices are created equal when it comes to usability (Estable, 2013).

The benefits to schools are obvious as funding can be directed toward other technological tools such as smartboards and networking. The BYOD program saves schools money on providing devices for students. It may also free up the time spent on enforcing the restrictions school must follow in not letting students use the mobile devices for academic purposes. The time saved can be used to assist students in learning the proper and efficient use of the devices.

In addition, Bruder (2014) suggested the following as some of the advantages of letting students use their own phones, tablets, and the like: using the devices to conduct research as well as using cell phones to participate in audience-response systems; playing background music to focus and block out distraction and Skyping; teachers making interactive assignments by allowing students use their cameras and/or photo and video sharing sites; using games like *Angry Birds* (video game franchise) to teach physics and mathematics; and storing assignments in the cloud. Overall, the BYOD program offers students convenience, anytime and anywhere learning, personalized learning, autonomous learning, and social media integration (Kukulska-Hulme &Traxler 2007).

Changes in our society and economy increase the need for educators to increase their knowledge of the BYOD public relations. The media often emphasizes the reasons why educators do not or should not consider cell phones as learning tools (Kolb, 2012). School districts and their educational leaders need the public relation skills to help the public understand the BYOD program. Kolb (2012) stated that educators should consider the other side of the argument, that is, considering cell phones as learning tools and realizing that in the 21st century, they are responsible to help students navigate and stay safe in a world overflowing with technology and information (Kolb, 2012).

A school district implementing the BYOD program is responsible to address the reasons that make cell phones controversial in classroom instruction. District leaders are responsible for addressing campus and community concerns or confusion. Leaders from various departments with different points of views who voice concerns or make helpful suggestions about solutions are encouraged to meet monthly, note that consistency of messaging is one of the most important elements in the overall success of a BYOD plan, and realize that the campus open house is an important opportunity to speak directly to hard-to-reach groups of parents (Schad, 2014). In summary, professional educators have a responsibility to be prepared for any BYOD concerns that parents, students, and stakeholders may have.

The public is usually supportive of school districts' needs, such as money, if it is directed at supporting students' growth. School district leaders have the responsibility to take into consideration the money that can be saved by allowing students bring their own mobile devices to school. Kolb (2012) illustrated the financial incentive as one of the most important factors to consider when using cell phones. The public should not perceive that the BYOD program is going to create pressure for families by requiring them to buy expensive devices for their children. According to Kolb (2012), the issue of the added expense provides an opportunity for parents and children to talk about cell phone plans and realize that cell phone text messaging or calls are not always free, and that some cell phone companies may be interested in teaming with schools to develop curriculum and activities in exchange for free or very inexpensive cell phones.

Another area regarding money/finances in the BYOD program is the cost associated with implementing the program in school districts. Schad (2014) noted two funding elements to be considered regarding the cost, namely, district funds and E-Rate funds. For example, he reported his school district funded 100% of the BYOD program, spending $38 per month on each device in addition to the device cost. Another challenge of being a BYOD district is the issue of connecting the devices to any Wi-Fi network within range and developing a network that is cost efficient and provides an easy connection.

An integral aspect of the curriculum, using the BYOD program, is the "digital disconnect" between how students use technology for everyday communication and how they use technology in the classroom (Kolb, 2012). School districts should be encouraging the use of technology on all campuses. Kolb (2012) explained that cell phones are by far the most common and accessible devices that students can use to communicate with the world around them. Preventing students from the use of technology, especially the one they are most accustomed to using, holds them back from meeting the expectations of the modern civilization.

Curriculum conflicts happen when 47% of teachers think it is acceptable for students to have cell phones in school for emergency situations, and more than 25% do not believe cell phones belong to school campuses at all (Project Tomorrow, 2006b). Kolb (2012) provided a vision in which engaged students use the tools of their choice to enhance learning, both inside and outside the classroom. It is also important in the implementation of the BYOD programs to not only train and educate teachers to believe cell phones are learning tools but also to include curriculum specialists. In conclusion, Schad (2014) emphasized that the disagreement between the instructional technology team and the curriculum department can be instrumental in preventing initiatives.

The lack of support from teachers in the BYOD program is one reason classroom management may be difficult when students are allowed to use devices as instructional tools. In addition, one major argument against allowing cell phones in the classroom is that camera and camcorder phones can be used to take inappropriate pictures, which can then be posted on the internet (Kolb, 2012). Kolb (2012) stated that one solution to this problem is for teachers to take control; for instance, they can implement a classroom policy that only allows students to have their cellphones or other devices at their desk if being used for instructional purposes. If teachers just sit by their desks and do nothing, whether students have any devices or not, there will be classroom management issues, which may require disciplinary actions, ranging from the removal of the device for a specified period of time to a parental meeting (Schad, 2014).

At the secondary level, some parents feel disconnected from their children's learning because of different teachers, variety of courses, and emerging independence of their children (Kolb, 2012). Secondary level students may struggle to keep their parents involved with their day-to-day learning experiences; therefore, they may like receiving information about their children's learning via cell phones.

A BYOD campus can set the stage for ideas such as, students creating ringtones of "what they learned" and texting them to parents. A BYOD classroom can be the beginning of the end of students saying they "didn't learn" anything interesting at school. Using the BYOD program to connect with parents can also be the technology solution teachers have been looking for. For example, with the addition of FreeConferencePro, teachers can document the phone conference with parents in an attempt to have a record of everything that was discussed during the conversations (Kolb, 2012). This is a great tool for the end-of-the-year documentation of at-risk students; specifically, for parents who may claim that not enough communication was held between them and the teacher.

Notably, the BYOD program raises concerns for parents that can be categorized into three areas, namely, access control, inappropriate contents, and age restrictions (Schad, 2014). For example, access control creates concerns about the privacy of the children's work as well as the possibility for the work to be deleted or changed by other students. In the context of inappropriate contents, the teaching of digital citizenship as a learning mechanism that can play a central role in every classroom is recommended.

Today's students live in an increasingly knowledge-based and globally-interconnected society, impacted by evolving economic, environmental regulations, and social conditions (Alberta Education, 2012). The 2012 Alberta Education report offered a large number of useful information, as follows:

- Preparing students to become independent, lifelong learners requires that education systems must shift to student-centered learning, giving the power to the students to make decisions about their learning and becoming the center of all classroom instruction. Teachers in a student-centered environment serve as the guide to meaningful, engaging, and flexible learning environments that tap into the students' interests, talents, and abilities.
- The challenge for educators today is one of implementation, that is, how to ensure that every child has access to research-based learning opportunities. Technology represents a vehicle to move schools into appropriate research-based and student-centered learning communities. Teaching students to become self-directed learners who are capable of setting goals and navigating independently through learning experiences can be instrumental in creating life-long learners, capable of using their creative abilities effectively and efficiently.
- Self-directed learners, who can be supported by technology, understand concepts more deeply and achieve at higher levels than do their peers. For example, students can use calendars to do their advance planning with alerts to keep them on schedule; rubrics can be available digitally so that students can continually self-monitor the quality of their work; and digital forms of the work can be revised repeatedly based on feedback. Student-centered learning also includes working collaboratively with other students,

utilizing prior knowledge. In short, technology and the BYOD program, together, can help connect students not only with each other, their teachers, and their parents but also it can connect them with the world around them.

- Teachers, administrators, and other education professionals have an important role to play in ensuring sound technology use in learning and teaching by implementing a shared vision for technology education and recognizing the value of technology in educational communities. For example, teachers learn through professional training how to infuse technology to improve pedagogical practice, participate in professional communities of practice, promote digital citizenship, remain current in technology education, and promote a digital culture.
- Ensuring that teachers have the attitudes, skills, and knowledge for effective use of technology in a student-centered environment requires articulation, collaboration and coherence between the K-12 education system and faculties of education. Consequently, strong professional development of educators may improve their outlook and comfort in embracing a technology-driven learning community.

Alberta research projects showed that leadership is critical to school improvement and attested to the power of a distributive and dynamic blend of formal and informal leadership. Effective leadership, both formal and informal, consists of distributive power that is less centralized by distributing leadership among formal and informal leaders, who may contribute to capacity building. In addition, formal leadership is critical to the successful implementation of change and innovation. Finally, a shift in thinking about learning is often required in order to leverage the full potential that technology brings to learning and teaching.

The BYOD program provides schools with many benefits and challenges. One of the challenges is cost. The San Diego school district, for example, spent $15 million as part of its massive iPad plan that included nearly 26,000 devices (Faas, 2012). The BYOD concept is very popular according to Faas (2012), especially in business, for a range of reasons, including perceived cost containment, increased productivity, and improved employee satisfaction. On the contrary, there are several serious concerns that should be forefront in the minds of school IT staff, administrators, teachers, and parents about BYOD in schools. For example, Faas (2012) described how BYOD would create a very uneven education playing field for students, ranging from students who may have access to new technology to those who may not even have broadband access in their homes. Additionally, Faas (2012) noted that schools must observe federal and state regulations regarding Internet filtering and content blocking as well as enforcing the code of conduct issues regarding students' privately-owned devices.

Accordingly, the BYOD seems to be the best solution for the on-a-budget school districts that want to promote mobile learning (Wegner, 2016). However, Wegner (2016) noted that if every student, staff member, and teacher wants to access a wireless network, it may cause major issues, such as security and performance. For example, schools have to consider how BYOD devices connect securely and keep students from accessing private files on the internal servers. The challenge, according to Wegner (2016), is in today's school environment where there are one or two devices per student.

In summary, very few wireless networks have the ability to handle the new requirements. The subject of the BYOD program has rapidly become a growing topic amongst educators. Giving students access to their own devices is inevitable in today's society.

Theoretical Framework

The study's theoretical framework was Connectivism, which is a learning theory that explains the type of learning BYOD programs provide. Correspondingly, Connectivism may be regarded as a theory of digital learning.

The leading theorist in Connectivism is Stephen Downes, who is a well-published commentator in the fields of online learning. An aspect of the phenomenon of Connectivism is Downes' belief that learning a simple fact (e.g., Paris is the capital of France) or an entire discipline (e.g., chemistry) requires becoming like a person who already knows the fact or practices the discipline. Additionally, Downes (2011) defined Connectivism as a thesis that knowledge is distributed across a network of connections; therefore, learning may consist of the ability to construct and traverse those networks. Accordingly, BYOD programs allow students to practice a form of Connectivism by being able to have access to newly discovered knowledge that is up-to-date. The learning occurs when information is distributed within a social network that is technologically enhanced, capable of recognizing and interpreting patterns. A review of the mobile learning literature showed that mobile phones made up 75% of the devices used in education (Wu et al., 2012). Constructivism suggests that learners create knowledge as they attempt to understand their experiences (Driscoll, 2000, p. 376).

Connectivism can be applied to a classroom setting. Brown (2012), a researcher specializing in organizational studies with a particular focus on computer-supported activities, presented an interesting notion that the internet leverages the small efforts of many with the large efforts of few, which may stimulate comfort due to the notion that less work or resources can be instrumental in enhancing academic achievement. He provided the example of Maricopa County Community College system project that linked senior citizens with elementary school students in a mentor program. Specifically, children listened to these grandparents, whose contributions seemed small but complemented the large efforts of the teachers. The amplification of learning, knowledge, and understanding through the extension of a personal network is the embodiment of Connectivism.

In addition to Connectivism, the study also benefitted from the Student-Centered Learning Theory (SCLT), which promotes students learning with and from each other (Barnes, 2013). Existing understanding of the SCLT suggests that students gain knowledge through gathering and synthesizing information and integrating it with the general skills of inquiry, communication, critical thinking, and problem solving. The SCLT is different from the Teacher-Centered Leaning Theory (TCLT). In a TCLT classroom, knowledge is transmitted from teacher to student and students passively receive information. Mark Barnes, an expert in the SCLT, described how students and teachers are making the shift from traditional student-centered learning to a new one that uses mobile devices and social media. Barnes has written five books on educational technology, student-centered learning, the use of mobile devices and social media in the classroom, global learning, and 21st-century assessment. For the purpose of this study, the BYOD schools served as an example of a student-centered leaning approach that utilizes mobile devices. Barnes (2013) described a student-centered classroom by the use of interactive lessons that integrate technology and engage students in project-based learning experiences. As a result, in the context of a BYOD program, the outcome measure for student-centered learning in a student-centered classroom can be students' academic achievement.

Another SCLT researcher is Saomya Saxena, who has written about integrating technology into everyday instruction. According to Saxena (2013), the student-centered learning approach is constructivist in nature, enabling students to visualize a problem with multiple perspectives and allowing them to participate in their own learning process. She also described how students can be challenged to develop problem-solving skills and exercise analytical, critical, and creative thinking in an attempt to achieve experiential learning. A progressive teacher acts as a facilitator and a consultant, supporting students throughout their learning process, rather than just being a dictator in the entire process.

A key variable in this study is the historical value and present day use of the SCLT and its practical implications in today's classrooms. Connectivism emerged from the parallel theory of the Humanistic Approach. Among the founding fathers of the Humanistic approach is Carl Rogers, an influential American psychologist, best known for his person-centered approach, client-centered therapy, student-centered learning, and Rogerian argument. Scholars have addressed how to improve academic achievement with the use of the Student Centered Learning Theory. For example, focusing on the instruction from the teacher to the student and placing responsibility for learning in the hands of the student is consistent with Carl Roger's Humanistic Approach. The educational situation, which most effectively promotes significant learning, is one in which (a) threat to the self of the learner is reduced to a minimum and (b) differentiated perception of the field is facilitated (Rogers, 1951). Altogether, Connectivism and leading theorist in the SCLT, such as Stephen Downes, Mark Barnes, and Carl Rogers, advocate for connecting students to subject matters as an effective strategy in improving the learning process.

State of Texas Assessments of Academic Readiness (STAAR)

Dillard (2010) explained how the STAAR replaced the Texas Assessment of Knowledge and Skills (TAKS), which was the criterion-referenced assessment program that had been in place since 2003. The redesigned tests focus on readiness for success in subsequent grades or courses and, ultimately, for college and career rather than basic skills for older students. The STAAR measures a child's performance, as well as academic growth, and represents a more unified, comprehensive assessment program that incorporates more rigorous college and career readiness standards than did the TAKS (Dillard, 2010). Furthermore, the history of the Texas testing program has evolved three different times prior to the STAAR test.

For example, Texas Assessment of Basic Skills (TABS) was the first state-mandated test from 1980 to 1985, administered to students in grades three, five, and nine in reading, mathematics, and writing. Texas Educational Assessment of Minimum Skills (TEAMS), in use from 1986 to 1990, tested reading, mathematics, and writing in grades one, three, five, seven, nine, and eleven; was the first required state test to earn a diploma. Texas Assessment of Academic Skills (TAAS), in use from 1990 to 2002, tested reading, mathematics and writing in grades three to eight and ten; additionally, science and social studies at 8th grade; Spanish-language tests were available for students in grades three to six, and four end-of-the-course examinations provided optional method for meeting graduation requirements. Texas Assessment of Knowledge and Skills (TAKS), in use from 2003 to present, assesses mathematics, reading, writing, English language arts, science, and social studies in grades three to elven; promotion is dependent upon test results in grades three, five, and eight; and graduation requirements have expanded to include English language arts, mathematics, science, and social studies.

As of late, one perspective is that the STAAR test has created problems for Texas students and schools (Save Texas Schools, 2013). For instance, one complaint according to Save

Texas Schools (2013) is that tests are written in language beyond grade level. Educators have determined that end-of-course (EOC) assessments are written in a language that is three Lexile levels higher than TAKS tests for the same grade level (Save Texas Schools, 2013). Overall, it is suggested that students may know the subject matter but may not understand what is being asked because test questions are phrased in a language beyond grade level (Save Texas Schools, 2013). Not only are the test questions a concern for Texas students, but also the STAAR and how school districts receive the assessment has raised many concerns throughout the state. It should be noted that the tests were being administered for the first time in 2015-2016 by a new vendor, Educational Testing Service (ETS). Thus, some Texas superintendents blame ETS for the many glitches that occurred in 2015-2016 school year. Respectfully, others may perceive that there is nothing wrong with Texas schools or the STAAR test.

Ayala (2016) described how nearly 50 superintendents felt that Texas' STAAR standardized testing system deserved an "F" for widespread problems, ranging from a question on a test that had no correct answer to tests being delivered to a church. The fear surrounding these widespread problems and the accountability ratings based on them is that they hurt student scores and affect district ratings (Ayala, 2016). Under these circumstances, many have begun questioning whether scores can be trusted at all. In fact, one educator reported 7,000 student results had been included in another district's data. In general, the TEA acknowledged that widespread computer glitches had affected 14,220 students across the state and it had been left to districts to decide whether to retest students or not (Ayala, 2016). All things considered, the part of the STAAR tests' inadequacies is that students in 5^{th} and 8^{th} grades can be held back if they fail certain subjects of the STAAR test and high school students are required to pass three of the five end-of-the-course examinations to graduate.

Thereupon, families of Texas students are opting out of taking the STAAR test. According to Smith (2016), the increasingly unpopular assessment has continued to take its lumps with test flaws, computer glitches, and delivery hiccups angering parents and administrators around the state. Regardless of the negativity surrounding the STAAR test, students still have to take the test. As few as 2,000 refused to take the test in 2015-16, which is small in comparisons to other states and the number of students who declined to take their states' standardized test. In Texas, there are laws that make skipping the STAAR an arduous process, especially in grades where student advancement is tied to STAAR performance (Smith, 2016). Skipping the STAAR can be done, but parents must be willing to put their children at the risk of losing electives, going to summer school, or being held in a grade.

Notably, a backlash against 2016 STAAR examinations escalated when a group of parents sued the state in an attempt to keep schools from using 2016 test scores to rate students and decide whether they should advance to the next grade or attend summer school (Collier, 2016). According to Collier, the lawsuit, filed against the TEA in Travis County district court, argued that the test scores were invalid because the examinations were not administered under parameters laid out in House Bill 743. The legislation, passed in 2015 with bipartisan support, requires the state to design STAAR examinations so that a majority of elementary and middle school students could complete them within a specific period of time (i.e., two hours for 3rd through 5th graders; three hours for 6th through 8th). By and large, how can public school educators use the STAAR assessment to benefit student success? All things considered, is the STAAR test a good measure to incorporate when evaluating teachers?

Teacher evaluations have become a matter of debate across the country, as the federal government requires states to tie evaluations to the test performance of their students (Taboada, 2016). According to Taboada, there was significant resistance, including lawsuits from teachers' groups. You cannot have equity amongst different school districts and communities when it comes to students' learning advantages and disadvantages. Critics say judging teachers based on test scores punishes those who work in high-needs schools or with students who struggle to meet standards, while giving undue rewards to those working with students who already excel (Taboada, 2016). Although this may be true, it is imperative that students and teachers have accountability measures. The STAAR test is one piece that needs to be coupled with equally important factors that support student achievement. The reality is that it is difficult to guarantee that students are being taught and exposed to high quality education that would prepare them for a complex competitive global society.

Mathematics Crisis

It is not uncommon for people to question if schools are doing a good job in preparing students for science, technology, engineering, and mathematics (STEM) courses in college. Bertram (2014) asked educators to abandon the mindset that second grade is a preparation for third grade or of teaching content merely to prepare for a test. In other words, students need to be taught that life would be easier if they had the appropriate skills aligned with the greatest opportunities (Bertram, 2014). Likewise, *Forbes* highlighted the most in-demand college majors as being engineering and mathematics fields (Bertram, 2014). To illustrate, by 2018, STEM jobs are expected to grow at a rate nearly double that of other fields, 17% versus 9.8%, and the alarming issue surrounding this increase of STEM jobs is that they may remain unfilled because the workforce would not possess the required skills (Bertram, 2014).

One could say the state of our nation's STEM preparation is not good. To demonstrate this issue, *The Nation's Report Card* revealed that only 26% of our nation's 12th graders were scoring at or above proficient in mathematics (Bertram, 2014). In fact, by eighth grade, the numbers were even worse: 27% of the nation's eighth graders were performing at the proficient level while 26% were scoring below it or failing; accordingly, it is the STEM fields where the need is most urgent for mathematics proficiency (Bertram, 2014).

Fred Smith, the founder and chairman of FedEx, stated a solution to our nation's STEM problem is for the federal government to restrict its funding of education grants and loans to science, mathematics, and engineering because of their values (Bertram, 2014). Having a support system to help navigate students towards STEM fields should derive from all educators. In fact, students must be told that the chance of one being unemployed in a STEM field are exceedingly rare as such employment opportunities tend to outnumber unemployed people (Bertram, 2014). Overall, Bertram (2014) referred to McKinsey's findings as one solution to our nation's STEM crisis and lack of student achievement, advocating for enhancing classroom instruction, turning around underperforming high schools, and introducing digital learning tools in K-12 classrooms.

Another resolution to our nation's STEM crisis may be programs like the NASA'S BEST (Beginning Engineering, Science, and Technology) project. This program was designed to introduce students to the principles of engineering through hands-on, inquiry- and project-based lessons conducted within the framework of the Engineering Design Process (Krutchten, Robbins & Hoban, 2014). The NASA's BEST curricula have been implemented in numerous informal education settings across the United States and, more recently, internationally at the Abu Dhabi Science Festival in the United Arab Emirates. At NASA's BEST, students explore the logistical, preparatory, and management efforts necessary to provide such educational opportunities to young learners, identify challenges to broad-scale implementation of informal STEM education programs, and examine the potential benefits of using such programs to help build strong STEM literacy skills and practices (Krutchten, Robbins & Hoban, 2014).

According to the U.S. Department of Education, all young people should be prepared to think deeply so that they may have the chance to become the innovators, educators, researchers, and leaders who can solve the most pressing challenges facing our nation and our world. Presently, not enough of our youth have access to quality STEM learning opportunities and too few students see these disciplines as spring boards for their careers. The goal, as articulated by president Obama, is that within a decade, American students must move from the middle to the top of the pack in science and mathematics (US Department of Education, 2015).

Women's underrepresentation in high-paying IT and engineering jobs, which likely contributes to the gender wage gap, could be traced back to high school subject choices, according to a new study (Pascual, 2016). Pascual and his colleagues at the University of Melbourne found that girls are less likely to choose one of the STEM subjects than do boys, despite many testing better in these areas. A summary of their findings follows. Female students tend to have better grades in core classes such as, mathematics, science, history, and reading than do males. In the United States, women hold less than one-quarter of all STEM jobs, a figure that is still quite higher than it is in the United Kingdom, where women comprise less than 15% of all people in the industry. The gap is attributed to women's lack of desire to study STEM subjects, as well as motherhood and family obligation. Mothers are believed to suffer a so-called motherhood penalty, where they are perceived to be less committed and competent in their work. How do they breakthrough the stereotypes and injustices? Even girls performing well at mathematics emerged less likely to select the said subjects than do their equally skilled male counterparts. The researchers concluded that those who did choose the subjects outperformed the boys on average.

The transition from elementary (typically ending in grade 6) into secondary school (typically beginning at grade 7) has been identified as a point where engagement in mathematics can decline somewhat markedly. However, alongside this transition are other factors, including socio-demographic, psycho-educational, home, classroom, and school factors, that contribute to declines in mathematics engagement. Bobis, Martin, and Way (2015) examined these factors in their investigation of shifts in mathematics engagement across three transition points in the middle years: grades 5 to 6, grades 6 to 7 (the typical transition point from elementary to secondary school), and grades 7 to 8. In so doing, they explored the role of transition and other socio-demographic, psycho-educational, home, classroom, and school factors in predicting shifts in students' mathematics engagement.

According to Weiss (2014), most Texas public school students started the 2014 -2015 school year behind in mathematics, even if their grades and STAAR scores were fine the previous year. Much of what is now required had been presented in later grades or not at all. In fifth grade, for instance, 46% of the standards stayed the same; 10% and 18% were moved down from the sixth and seventh grades, respectively. Weiss reported some teachers had less flexibility to spend time on particular topics to cover the lesson plans and that as part of a regular review of the mathematics TEKS, the TEA produced a report recommending major shifts to meet college and career readiness standards.

Up to the present time, different United States presidents have created different national goals and acts for public schools. Examples of educational acts, according to Klein (2017), are the Every Student Succeeds Act (ESSA), which is a U-turn from the current, much-maligned version of the Elementary and Secondary Education Act (ESEA) law, and the No Child Left Behind Act. To illustrate, states would still have to test students in reading and mathematics in grades three through eight and in high school, and break out the data for whole schools, plus different "subgroups" of students (English-learners, students in special education, racial minorities, those in poverty). Mathematics is a human endeavor; it is about thinking creatively, exploring patterns, explaining structure, and solving real problems (Global Math Project, 2016).

Summary

Research indicates that technology in schools is resulting in the most transformational time that K-12 education has seen in decades. Technology in schools evolving into BYOD programs gives students opportunities to learn in a digital way. Currently, 21st century students use their mobile devices for most of their day-to-day information. Linking how students communicate finding resources relevant to classroom instruction, and improving academic achievement are the major outcomes of BYOD programs.

Too much is at stake for Texas students to ignore the challenges they face. The STAAR test for the 2016 school year was not without its flaws and created challenges and disruptions to student success. By the same token, teachers are concerned that their careers could be jeopardized due to student achievement that is tied to STAAR Scores. However, what other measure could Texas schools use to support teacher growth and student success? One intuitive Texas schools is taking that is creating attention and receiving support is the use of student portfolios as well as pre and post yearly testing for all subjects to measure student growth and the use of Student Learning Objectives (SLOs). Implementing SLOs as a tool to evaluate teachers include selecting a focus that reflects important content in the course and identifies a set of standards that are partially aligned to the focus statement. In addition, SLOs include a single data source used to determine initial level of student learning.

Society questions whether students are prepared for STEM courses in college and careers. As a result, for example, One Nation under Taught Solving America's Science, Technology, Engineering and Math Crisis by Dr. Vince M. Bertram has been a resource for educators for years. Another issue that was reviewed is girls and mathematics, which showed that women hold less than one-quarter of all STEM jobs even though they perform better than do their male counterparts in mathematics. For this reason, it is important to focus on grade seven mathematics, because transitioning into middle school is when engagement in mathematics declines. Another key point is that grade seven mathematics standards have had a large change within the last two years that has taken tremendous time.

In conclusion, the following major topics were reviewed, BYOD programs, learning theories, STAAR testing, and mathematics crisis, focusing on their influence on students, educators, and our global community. The better educated we are on helping students learn in a rapidly changing world, the better off we are in the future. Today's students are our future; they will be the innovators that help mold the civilization. The integration of technology in schools, along with standardized testing, such as the STAAR, and our nation's mathematics crisis are crucial themes that, if ignored, may prevent today's youth from meeting their full potential.

CHAPTER III

METHOD

Introduction

The purpose of the study was to test the hypothesis that 7th graders who attend middle schools that implement BYOD programs score better than those who attend middle schools that do not implement BYOD programs on the basis of academic achievement in mathematics. The perspectives of grade seven (7) mathematics teachers were documented regarding the impact of the BYOD program. The study was guided by the following research questions:

1. To what extent does participation in a BYOD program impact 7th grade academic achievement in mathematics?
2. What are the perspectives of 7th grade mathematics teachers and educational leaders regarding the impact of the BYOD program?

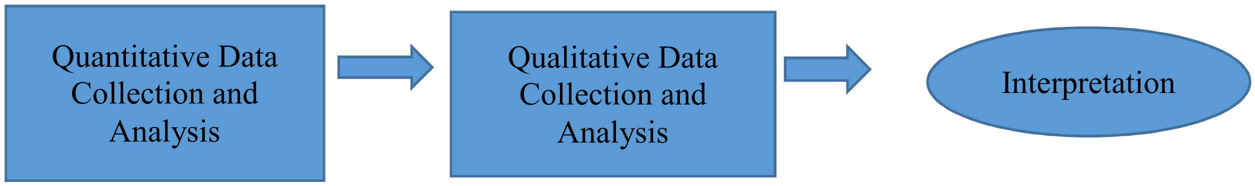
Permission to conduct the study was obtained from the Institutional Review Board at Texas A&M University-Corpus Christi and the school districts in which the middle schools are located (Appendix A).

Research Design

The study employed a mixed methods design, employing an Explanatory Sequential model, which is a two-step process (Creswell &Clark, 2011). In the first step, quantitative data are collected and analyzed. The second step involves the collection and analysis of qualitative data to better understand the quantitative results. At the end, the quantitative and qualitative results are synthesized. The mixed methods model is depicted in Figure 1.

Figure 1

Explanatory Sequential Design



Quantitative

The study's independent variable was the BYOD program, which was not manipulated by the researcher. Thus, no causal inferences were drawn. The quantitative portion of the study used a causal-comparative design (Gall, Gall, & Borg, 2007). The characteristic-present group consisted of grade seven (7) students who had attended a middle school with a BYOD program. The comparison group consisted of 7th graders who had not attended a middle school with a BYOD program. The dependent variable, academic achievement in mathematics, was measured by the State of Texas Assessments of Academic Readiness (STAAR).

Qualitative

The qualitative phase of the study employed a focus group. A typical focus group is a group interview that is led by an interviewer and relies primarily on the interaction within the group and not between the interviewer and the group. The goal is to come up with a collective, rather than an individual, view of the subject from the participants' perspectives (Cohen, Mansion, & Morrison, 2007). Interpretivism (Crotty, 1998), which is the umbrella term for theoretical perspectives that attempt to understand and explain human experiences, guided the conduct of the focus group. Interpretivism is designed to understand individuals' social reality by focusing on how they see the world.

Subject Selection

Quantitative

The study's setting consisted of two school districts in south Texas. The existing data for the middle school with the BYOD program and the comparison middle school were obtained for 297 and 313 7th graders, respectively. Sixteen 7th graders from the comparison school were selected at random and removed from the study to have equal sample sizes of 297.

Qualitative

A minimum of five to eight participants is a recommended sample size for a focus group (Krueger, 2009). The participants for the qualitative component of the study consisted of a non-probability sample of three teachers who had taught 7th grade mathematics, four teachers who had taught 8th grade mathematics, one special education teacher who had taught both 7th grade and 8th grade mathematics, and five campus administrators. Six were of Hispanic origin and seven were Anglo-Saxon. The letter of invitation is in Appendix A.

Instrumentation

Quantitative

For the purpose of the study, academic achievement in mathematics was measured by the STAAR test, which is the state of Texas's standardized tests for all public school students. The STAAR test assesses students' level of mastery of the Texas Essential Knowledge and Skills (TEKS), which are the standards for what students should know and be able to do (Texas

Education Agency, 2015). The TEKS in mathematics are guided by college and career readiness standards, which are the indicators of how successful Texas students will be in a competing and complex global society. The STAAR grade seven mathematics consisted of four categories: (1) probability and numerical representations (9 items), (2) computations and algebraic relationships (20 items), (3) geometry and measurement (16 items), and (4) data analysis and financial literacy (9 items) (Texas Education Agency, 2015). Psychometric properties of the STAAR are documented (Texas Education Agency, 2015).

Qualitative

The qualitative component of the explanatory sequential mixed methods model (Creswell & Clark, 2011) was utilized for the purpose of addressing the study's second research question and explaining the quantitative results in greater depth. The quantitative results were used to formulate the lead questions for the focus group which was conducted to obtain the qualitative data. The lead questions were:

- In what ways do you believe the BYOD program may impact the mathematics achievement of grade 7 students?
- How many times per week was the BYOD program used?
- Did you have to alter your teaching methods to accommodate the BYOD program?
- What were the advantages of using the BYOD program?
- What were the disadvantages of using the BYOD program?

Data Collection

Quantitative

For the purpose of the study, the 2015-2016 STAAR scores in mathematics for 7th grade students were used. The data were obtained from the TEA. The raw data included the number of items answered correctly in each of the four STAAR 7th grade mathematics categories. Data on gender, ethnicity, socioeconomic status, and risk status of the students were also obtained. The data were electronically sent to the researcher in Excel data files.

Qualitative

The focus group was conducted on December 15, 2016, at a middle school campus in Corpus Christi, Texas. The principal investigator explained to the participants the purpose of the focus group, assured them of the confidentiality of their responses, informed them that they could opt out of the study at any given time, and answered their questions. All agreed to be audio-taped and signed a consent form (Appendix A). The researcher served as the recorder, note-taker, and facilitator. The transcript of the focus group, done by the researcher, is in Appendix B.

Data Analysis

Quantitative

The quantitative data were coded, entered into the computer, and analyzed by using the Statistical Package for the Social Sciences (SPSS). The proportion of the total number of test questions answered correctly to the total number of questions was used to measure achievement in mathematics in each STAAR category. Descriptive statistics were used to summarize the data. Specifically, means, standard deviations, frequency tables, and percentage tables were employed. The level of significance was set, a priori, at the 0.01.

series of Chi-Square Test of Independence (Field, 2013) was performed to compare the characteristic-present and comparison groups on the basis of categorical variables of gender (female or male), socioeconomic status (not economically disadvantaged or economically disadvantaged), at-risk status (yes or no), and ethnicity (Hispanic or non-Hispanic).

The mathematics category scores were not correlated with each other. A series of t-test for Independent Samples (Field, 2013) was performed to test the group differences on the basis of each of the four mathematics category scores. Due to equal sample sizes, all tests were considered robust with respect to the homogeneity of variances assumption.

The mean difference effect size, Cohen's d, was used to examine the practical significance of the findings. Specifically, it was computed by dividing the mean difference by the pooled standard deviation and characterized as 0.20 = small effect, 0.50 = medium effect, and 0.80 = large effect (Cohen, 1988).

Ethnicity and at-risk status were treated as a confounding variables, because they were associated with the outcome measures and did not interact with the independent variable. The data were re-analyzed, employing a series of analysis of co-variance (ANCOVA), using at-risk status and ethnicity as the co-variates. Adjusted means were computed by: Adjusted mean = Unadjusted mean for level j – b (the mean of the covariate for level j – the grand mean of the covariate), where b is the common regression coefficient (Stevens, 2009).

Qualitative

The transcripts of the focus group interview were content analyzed. Specifically, the following steps were performed: 1) getting a sense of the whole by reading the transcription carefully; 2) identifying text segments with brackets; 3) assigning a code word or phrase to describe the meaning of the text segment; 4) making a list and grouping the code word; 5) reviewing the transcription; and 6) reducing the codes to themes, which are similar codes put together, forming the major ideas of the transcription (Creswell, 2005). "A code in qualitative inquiry is most often a word or short phrase that symbolically assigns a summative, and attribute for a position of language-based or visual data" (Saldana, 2009, p.3).

In accordance with the explanatory sequential mixed methods model, the quantitative and qualitative results were synthesized to draw the conclusions, discuss the findings, and propose theoretical and practical implications.

Chapter IV

Results

Introduction

The purpose of the explanatory sequential mixed methods study was to examine the impact of the BYOD programs on academic achievement in mathematics among seventh grade students. The study was delimited to (1) seventh graders, (2) predictor variable of participation in a BYOD program, (3) the student outcome measures of academic achievement in mathematics, and (4) perspectives of seventh grade mathematics teachers and educational leaders regarding the effectiveness of the BYOD program. The setting consisted of two different middle schools in south Texas. Standardized mathematics achievement was measured by the STAAR. The study's hypothesis was that students who attended a middle school with the BYOD program would score higher on the seventh grade standardized mathematics achievement than did the students who had attended a middle school without the BYOD program. The study was guided by the following questions:

1. To what extent does participation in a BYOD program impact seventh grade academic achievement in mathematics?
2. What are the perspectives of seventh grade mathematics teachers and educational leaders regarding the impact of the BYOD program?

Quantitative Results

The quantitative data were obtained from the school district with the BYOD program and from the Texas Education Agency for the school district without the BYOD program, coded, entered into the computer, and analyzed by using the Statistical Package for the Social Sciences (SPSS). The demographic data were obtained for the following variables: gender, socioeconomic status, at-risk status, and ethnicity (Hispanic or Non-Hispanic). Descriptive statistics, Independent Samples t-tests, mean difference effect sizes, and analysis of co-variance were used to analyze the data. The level of significance was set, a priori, at the 0.01.

A Profile of Subjects

The data for the middle school with the BYOD program and the comparison middle school were obtained from 297 and 313 7^{th} graders, respectively. Sixteen 7^{th} graders from the comparison school were selected at random and removed from the study to have equal sample sizes of 297. Due to equal sample sizes, robustness with respect to the homogeneity of variances assumption was assumed. The majority of the participants was female (58.80%), and group differences on the basis of gender were statistically significant, $X^2(1, N = 594) = 8.44$, $p < 0.01$. The majority of the students was not economically disadvantaged (57.10%) and group differences were not statistically significant, $X^2(1, N = 594) = 3.23$, $p = 0.07$. Although the majority of the students in both schools were not at-risk, there were more at-risk students in the comparison school than were in the BYOD school and the difference was statistically significant, $X^2(2, N = 594) = 7.64$, $p < 0.01$. Group differences on the basis of ethnicity, coded as either Hispanic or non-Hispanic, were statistically significant, $X^2(2, N = 594) = 28.43$, $p < 0.01$, and showed that there were more Hispanics in the comparison school than were in the BYOD school. Results are summarized in Table 1.

Table 1

A profile of Subjects

	BYOD Group (n=297)		Non-BYOD Group (n=297)	
Demographic Characteristic	F	%	F	%
Gender [a]				
Female	189	63.60	153	51.50
Male	108	36.40	144	48.50
Socio-economic Status [b]				
Not Economically Disadvantaged	158	53.20	181	60.90
Economically Disadvantaged	139	46.80	116	39.10
At-Risk [c]				
Yes	102	34.30	136	45.80
No	195	65.70	161	54.20
Ethnicity [d]				
Hispanic	121	40.70	186	62.60
Non-Hispanic	176	49.30	111	37.40

[a] $X^2(1, N = 594) = 8.44, p < 0.01$

[b] $X^2(1, N = 594) = 3.23, p = 0.07$

[c] $X^2(1, N = 594) = 7.64, p < 0.01$

[d] $X^2(1, N = 594) = 28.43, p < 0.01$

Mathematics Achievement

Academic achievement in mathematics was measured by four reporting categories. The reporting categories were: (1) Probability and Numerical Representations (9 items), (2) Computations and Algebraic Relationships (20 items), (3) Geometry and Measurement (16 items), and (4) Data Analysis and Financial Literacy (9 items). The means and standard deviations are shown in Table 2.

Table 2

STAAR Mathematics Achievement Measures

	BYOD Group (n = 297)		Non-BYOD Group (n = 297)	
STAAR Reporting Category	M*	SD	M*	SD
Mathematics Category 1	0.57	0.22	0.54	0.26
Mathematics Category 2	0.59	0.19	0.57	0.22
Mathematics Category 3	0.48	0.21	0.49	0.26
Mathematics Category 4	0.44	0.23	0.51	0.27
Total Score	0.53	0.17	0.53	0.22

*Proportion of correct answers

Note: Mathematics Category 1: Probability and Numerical Representations, Mathematics Category 2: Computations and Algebraic Relationships, Mathematics Category 3: Geometry and Measurement, Mathematics Category 4: Data Analysis and Financial Literacy

The four mathematics category scores were not highly correlated with each other. Thus, the use of a multivariate analytical technique was ruled out and a series of t-test for Independent Samples was performed to test the group differences on the basis of each of the four category and the total scores. Other than the mathematics category four scores, which favored the comparison group, none of the differences was statistically significant. Mean difference effect sizes were computed to examine the practical significance of the findings and ranged from 0.03 to 0.28. The effect sizes favored the BYOD group on the basis of categories one and two, and favored the non-BYOD group on the basis of categories three, four, and total scores. Other than category four scores, all effect sizes were negligible. Results are summarized in Table 3.

Table 3

Mean Difference Effect Sizes, STAAR Mathematics Achievement Measures

STAAR Reporting Categories	Mean Difference	t	Effect Size*
Mathematics Category 1	0.030	1.49	0.12[a]
Mathematics Category 2	0.020	1.02	0.08[a]
Mathematics Category 3	0.020	0.89	0.07[b]
Mathematics Category 4	0.070	3.42**	0.28[b]
Total Score	0.005	0.33	0.03[b]

*0.20 = small effect, 0.50 = medium effect, > 0.80 = large effect

**p < 0.01

[a] Favoring the BYOD group

[b] Favoring the non-BYOD group

Note: Mathematics Category 1: Probability and Numerical Representations, Mathematics Category 2: Computations and Algebraic Relationships, Mathematics Category 3: Geometry and Measurement, Mathematics Category 4: Data Analysis and Financial Literacy

Co-variate Analysis

As reported earlier, the differences between the BYOD and non-BYOD groups were statistically significant on the basis of gender, at-risk status, and ethnicity. Furthermore, analysis of the data showed that ethnicity and at-risk status were correlated with all outcome measures. Specifically, non-Hispanics and the not-at-risk students outperformed their counterparts on all measures and the differences were statistically significant.

Data were re-analyzed, using ethnicity and at-risk status as the co-variates to adjust the outcome measures. The differences on the basis of category one, $F(1, 590) = 0.28$, $p = 0.60$, and category two, $F(1, 590) = 1.35$, $p = 0.25$, were remained statistically non-significant. The group differences on the basis of category three, $F(1, 590) = 8.20$, $p < 0.01$, and the total score, $F(1, 590) = 8.23$, $p < 0.01$, which were not statistically significant became statistically significant, favoring the non-BYOD group. The group differences on the basis of category 4, $F(1, 590) = 31.18$, $p < 0.01$, remained statistically significant, favoring the non-BYOD group. The observed and adjusted means are reported in Table 4.

Table 4

STAAR Mathematics Achievement Adjusted Measures

	BYOD Group (n = 297)		Non-BYOD Group (n = 297)	
STAAR Reporting Category	M1*	M2*	M1*	M2*
Mathematics Category 1	0.57	0.55	0.54	0.56
Mathematics Category 2	0.59	0.57	0.57	0.59
Mathematics Category 3	0.48	0.46	0.49	0.51
Mathematics Category 4	0.44	0.42	0.51	0.53
Total Score	0.53	0.51	0.53	0.55

*Proportion of correct answers

Note: M1 = Observed mean, M2 = Adjusted mean on the basis of ethnicity and at-risk status

Mathematics Category 1: Probability and Numerical Representations, Mathematics Category 2: Computations and Algebraic Relationships, Mathematics Category 3: Geometry and Measurement, Mathematics Category 4: Data Analysis and Financial Literacy

Qualitative Results

The qualitative component of the explanatory sequential mixed methods model (Creswell & Clark, 2011) was utilized for the purpose of addressing the study's second research question and explaining the quantitative results in greater depth. The quantitative results were used to formulate the lead questions for the focus group which was conducted to obtain the qualitative data. The lead questions were:

- In what ways do you believe the BYOD program may impact the mathematics achievement of grade seven students?
- How many times per week was the BYOD program used?
- Did you have to alter your teaching methods to accommodate the BYOD program?
- What were the advantages of using the BYOD program?
- What were the disadvantages of using the BYOD program?

A Profile of Subjects

The focus group consisted of three teachers who had taught seventh grade mathematics, four teachers who had taught eighth grade mathematics, one special education teacher who had taught both seventh grade and eighth grade mathematics, and five campus administrators. Six were of Hispanic origin and seven were White, Non-Hispanic.

Participate number one, in her 40s, was an eighth grade teacher who had been teaching for approximately four years and was of Hispanic heritage. She had taught high school Geometry and Algebra two for one year, and eighth grade mathematics for three years.

Participant number two, in hers 30s, was an assistant principal who had been in the field of education for approximately 13 years and was of Hispanic heritage. She had taught pre-kindergarten for five years, was a curriculum supervisor for grades pre-kindergarten through 12th for five years, and an assistant principal for three years.

Participant number three, in her 40s, was a seventh grade teacher who had been teaching for approximately 13 years and was of Hispanic heritage. She had taught seventh grade mathematics for 13 years.

Participant number four, in her 40s, was an eighth grade teacher who had been teaching for approximately 14 years and was of Hispanic heritage. She had taught seventh grade mathematics for 13 years, and eighth grade Algebra for one year.

Participant number five, in her 50s, was a school principal who had been working in the field of education for approximately 25 years and was White, Non-Hispanic. She had taught high school English for 15 years, was a curriculum supervisor for five years, and a campus principal for five years.

Participant number six, in her 60s, was a campus curriculum supervisor who had been working in the field of education for approximately 38 years and was White, Non-Hispanic. She had taught seventh and eighth grade mathematics for 20 years, was a high school and junior high curriculum supervisor and assistant principal for 10 years, was a district mathematics curriculum supervisor for three years, and directed the Student Development Center for two years.

Participant number seven, in his 40s, was a seventh and eighth grade Special Education mathematics teacher who had been teaching for approximately 16 years and was White, Non-Hispanic. He had taught seventh and eighth grade Special Education mathematics for seven years, second grade reading for two years, and was the lead teacher in a behavior intervention classroom for seven years.

Participant number eight, in his 40s, was an eighth grade mathematics teacher, Academy Mathematics sponsor, and mathematics department chair who had taught for approximately 22 years. He was White, Non-Hispanic.

Participant number nine, in his 30s, was a seventh grade mathematics teacher who had taught for approximately two years and was White, Non-Hispanic. He had taught third grade for one year and seventh grade for one year.

Participant number ten, in her 30s, was a seventh grade mathematics teacher who had taught for approximately three and a half years and was White, Non-Hispanic. She had taught sixth grade social studies for one year and seventh grade mathematics for one year.

Participant number eleven, a White, Non-Hispanic in her 20s, was an eighth grade mathematics teacher who had taught for approximately six years. She had taught pre-kindergarten for one year, seventh grade mathematics for three years, and eighth grade mathematics for one year.

Participant number twelve, a Hispanic in her 50s, was a seventh grade school counselor who had been in the field of education for 33 years. She had taught elementary school for 15 years, had been an elementary school counselor for 13 years, and a junior high school counselor for five years.

Participant number thirteen, a Hispanic in her 40s, was an eighth grade school counselor who had been in the field of education for approximately 18 years. She had taught elementary school for 12 years and been a junior high school counselor for six years.

Focus Group Process

The focus group was conducted on December 15, 2016, at the Flour Bluff Junior High School campus in Corpus Christi, Texas. The principal investigator explained to the participants the purpose of the focus group, assured them of the confidentiality of their responses, informed them that they could opt out of the study at any given time, and answered their questions. All agreed to be audio-taped and signed a consent form. The researcher served as the recorder, note-taker, and mediator. She encouraged open discussion. The transcript of the focus group, done by the researcher, is in Appendix B. The researcher began the focus group by asking the participants if they believed the BYOD program could positively impact academic achievement in mathematics. Five said, yes, and the other eight did not feel that achievement in mathematics could be affected by the BYOD program. The focus group participants were provided with a summary of the study's quantitative results and asked if they could comment on the findings that the BYOD group did not outperform the non-BYOD program. They did not offer any specific reason; however, the majority of the participants' belief that the BYOD program could not positively affect academic achievement in mathematics supported the study's findings.

The Coding Process

The qualitative data were transcribed. The second step was to read the transcribed notes, decipher them, and assign codes. "A code in qualitative inquiry is most often a word or short phrase that symbolically assigns a summative, and attribute for a position of language-based or visual data" (Saldana, 2009, p.3). The derived codes are presented in Table 5.

Table 5

Codes for the Bring Your Own Device Program Qualitative Data

Code 1	BYOD Capability
Code 2	BYOD Supervision
Code 3	BYOD Deficiencies
Code 4	Extraneous Variables

Focus Group Results

The first theme, *Access to BYOD*, was developed as a result of comments regarding the impact of the BYOD program on academic achievement. The BYOD program provides a filtered public Wi-Fi in school campuses. Students may bring a personal device to school and use it for educational purposes. Students are expected to connect to the filtered public Wi-Fi to ensure access to the best online resources. According to participant 8, "their phone provides instant access information." Participant 5 responded by saying, "it allows students access to check their webpages that teachers provide, access to utilize books and things at home, google, and YouTube things they don't understand in math and the internet." Participant 10 said that she allowed student to access assignments online. Participant 2 thought that the BYOD program benefited students with instant access to curriculum, tutoring, and the like. The following participants used the term *Access* in response to the advantages of the BYOD program. For instance, participant 11 stated that it gave students instant access to information. Participant 10 and 3 reinforced that idea, because they believed it provided the students with access to tutorial videos whenever they may need them. Theme 1 is summarized in table 6.

Table 6

Theme 1: Access to BYOD

Theme 1 Access to BYOD
"instant access information and no one is paying for any of it"
"it allows them access to check their web pages, it provides them access to utilize books and things at home, to also Google things and look at YouTube videos about things they don't understand in math"
"students are able to access assignments online"
"it benefits students with instant access, to curriculum, tutoring, etc."
"provides students access to tutorials, websites where they can manipulate concept themselves"
"provides access to parents as well as students"
"instant access to information"
"being able to access tutorial videos whenever they may need"
"students are able to have instant access to tutorials, definitions…"
"having access for all students"

As the researcher continued to review and analyze the transcript, the second theme, *Distractions Due to BYOD*, was derived. The theme originated from participants responding to the BYOB program and how many times a week they used it. Participant 8 responded with "it's a distraction sometimes, but the more it becomes part of the class, the less it becomes a toy." None of the other participants interjected with responses about distractions until conversation about altering teaching methods began. Participant 11 stated that she allowed her students to listen to music while working to lessen distractions. The highest number of participants that discussed distractions came from responding to the disadvantages of the BYOD program. One participant who had been a campus principal during the beginning stages of the BYOD program stated that, "using the phone for other things, then what they are supposed to be, like math."

Participant 1 was the first respondent to the BYOD's disadvantages and felt it was a distraction. Participant 3 stated they can be as big of a distraction as a help. Participant 11 responded with, distractions from social media. Overall, participants' reaction to the BYOD program being a distraction was limited to what the researcher had expected. Theme 2 is summarized in Table 7.

Table 7

Theme 2: Distractions Due to BYOD

Theme 2
Distractions Due to BYOD
"it's a distraction sometimes, but the more it becomes part of the class, the less it becomes a toy"
"listen to music while working to lesson distractions"
"distractions, you know, kids being distracted by utilizing other things, using the phone for other things than for they are supposed to be, like math, but that's a distraction"
"they can be as big of a distraction as a help"
"distractions from social media"

As the content analysis of the transcripts continued, the third theme, *Cost of BYOD*, was derived. The reason that this theme came about was the numerous responses provided by the focus group regarding personal experiences with the cost of technology on a campus and classroom level. Participant 8 was the first one to express that years ago, he was constantly trying to buy technology for kids. Also, as a campus goal, they were trying to purchase a laptop for every student. He explained that within five years, this was no longer a personal or campus wide goal or concern. Participant 8 stated "having their phone for instant access to information and no one is paying for it other than the parents and the kids." Participant 8 also responded to how the BYOD program may affect academic achievement by stating "why buy technology when kids have great tech already?" Participant 8 concluded by discussing his personal journey with the cost of technology for his students by remembering how he once purchased cell phones at *Best Buy* for his students. He stated that he regretted his purchase because "every kid had a phone or you know an Amazon Fire or something, their laptop, whatever." When the researcher asked what the advantages of the BYOD program were, the first response was related to the cost. Participant 5 acknowledged "the BYOD for just the school setting is the fact that it takes some of the pressure for the school to buy devices." Table 8 depicts the third theme.

Table 8

Theme 3: Cost of BYOD

Theme 3 Cost of BYOD
"buy technology for kids"
"no one is paying for any of it"
"no one is paying for it, other than the parents and kids"
"why buy technology when kids have great tech already"
"pay as you go phones"
"they sell them dirt cheap"
"buy the phones and don't activate them"
"bought a few of those"
"not sure if I should have bought those"
"you can get them for ten dollars now"
"stupid to buy every kid a laptop"
"two million dollars"
"write a grant to get these clickers"
"it takes the pressure form the school to buy devices"

Theme 4, *Monitoring BYOD*, was transpired from responses that were in reaction to the concepts of supervision, security, protection, management, and disciplinary issues such as cheating. Participant 2 stated “teachers have to be very pro-actively monitoring how the students’ are using it, because, if you are using it in the classroom, awesome, a teacher can watch and know what you are doing and how you are using it and that you are not just going for Google to get an answer.” In addition, participant 2 said “using the technology in the classroom under close supervision is always going to impact the students highly as long as they are doing it right.” She also believed that as a teacher monitoring the use of the BYOD program, it is important to assure students that they are doing what they are supposed to and can show the work. Participant 13 had noticed an increase in security, when asked about how many times a week the BYOD program was used, her response was “there is better security now, and filters that the district is using to help kids stay away from things that may be inappropriate.” Participants felt strongly about students having their phone out, no matter whether it is known or not. Participant 8 felt the security set up for the BYOD program results in technology not working like it should and slowing it down. Participant 2 responded to BYOD’s disadvantages with “I can see where someone may have trouble managing their students on their phones” and “I have heard as a complaint that it’s hard to manage.” Participants 2 and 5 agreed that the BYOD program causes disciplinary issues when it is not utilized correctly and that it could be a problem with students taking snap shots of their homework and sending it to a friend. Theme 4 is summarized in Table 9.

Table 9

Theme 4: Monitoring Associated with BYOD

Theme 4
Monitoring BYOD
"monitor how the students are using it"
"not just going to Google to get an answer"
"technology in the classroom under close supervision"
"monitor just to make sure they are doing, what they are supposed to be doing"
"better security now, and filters"
"they're going to use that phone no matter what"
"it never works the way it needs to work because of the way it has to be set up, you know with this security"
"protecting the kids from the world"
"trouble managing their students on their phones"
"it's hard to manage"
"hard to monitor and police it"
"disciplinary issues"
"snap shot of my homework"
"time management"
"it easier to cheat with technology"
"if a kid wants to cheat, he's going to cheat"

Theme 5 was named *BYOD as a Tutorial Tool*. Using the BYOD program to help tutor students that are struggling appeared in the focus group in its entirety. When the question of academic achievement was asked, Participant 5 was the first to respond with "Google things and look at YouTube videos about things they don't understand in math" and "it provides access to parents as well as students, because of the capabilities of the internet." Participant 1 used it to improve mathematics achievement in her class by allowing students watch videos to review and introduce concepts. According to participant 3, academic achievement was being impacted by the BYOD program because it provided her students access to tutorials and websites, where they could manipulate concepts themselves. Participant 10 allowed his students' access to assignments online. Participant 2 believed it benefitted students with instant access to curriculum and tutoring. During the discussion, the theme of *tutorials* was integrated again in participants' responses to altering teaching methods. Participant 8 stated "tutoring is my big one because when a kid comes in for tutoring, I don't sit and teach them anymore." Participant 8 also stated "they grab an IPad, they grab their phone, and I say go watch this video, I videotaped everything I've taught and then they go and do it and get a perfect lesson." Participant 11 allowed her students to Google things they did not understand in her seventh grade mathematics class. Participant 8 felt that tutoring was 100% different, due to the BYOD program. Participant 2 said "show me a video, instead of having to tutor and go over and over and over" and "how much more individualized are you getting in your classroom?" Participant 11 felt an advantage of the BYOD program was being able to access tutorial videos. According to participant 3, her students were able to have instant access to tutorials or definitions. Participant 8 created re-teach videos to support his tutorials. Theme 5 is summarized in table 10.

Table 10

Theme 5: BYOD as a Tutorial Tool

Theme 5 BYOD as a Tutorial Tool
“Google things”
“look at YouTube videos”
“things they don’t understand in math”
“provides access to parents as well as students”
“watch videos to review and introduce concepts”
“provides students access to tutorials”
“websites where they can manipulate concepts themselves”
“students are able to access assignments online”
“benefits students with instant access, to curriculum, tutoring, etc.”
“tutoring is my big one”
“when a kid comes in for tutoring, I don’t sit and teach”
“go watch this video”
“Google things you don’t understand”
“tutoring is 100% different”
“show me a video, instead of having to tutor”
“individualized”
“being able to access tutorial videos”
“instant access to tutorials”
“re-teach videos”

The participants in the focus group also noted some deficiencies in the BYOD program. There appeared to be some extraneous variables that were noted by the participants. Some of the responses included, it is hard to manage when students are on their phones, and access to the internet on their devices distracts them. The BYOD program makes it easy for students to cheat or google an answer. Also, it is too hard to submit mathematics assignments online because students cannot show the work. Another extraneous variable was the district's Wi-Fi signal, because access to it was not always accessible in various places on campus. Additionally, the firewalls the district provided slowed down the access, which became frustrating to teachers during a timed lesson and was very time consuming to trouble shoot. The deficiencies and extraneous variables are summarized in Table 11.

Table 11

Deficiencies and Extraneous Variables Associated with BYOD

"embrace technology or your fighting a losing battle"
"teachers have to monitor how they are using it"
"going to Google to get an answer"
"not knowing if students are doing their own work or not"
"monitoring just to make sure they are doing what they are supposed to be doing"
"not knowing the content"
"it's a distraction"
"get out of my comfort zone, when it came to technology"
"they will have their phones out no matter what"
"BYOD force me to know more about technology"
"technology will be there regardless"
"when you get technology involved, it slows everything down"
"I can't get on"
"did you send it to me"
"still in the baby stages"
"little checks and balances to protect kids, slows it down"
"never works the way it needs to work"
"stop protecting the kids from the world, because we are not"

Table 11 (cont'd)

"keeping it from happening in the classroom"
"slows my class down"
"slows it down, to the point that I don't want to use it"
"at first it is very time consuming"
"they live in a different world"
"hard to manage, depending on the teacher"
"kids abuse it and over use it"
"cultural of the classroom problem"
"hard to manage, or police it"
"distractions"
"until the Wi-Fi signal is everywhere"
"until it's so ubiquitous"
"we are not here yet"
"we don't know what this is going to look like in the next ten years"
"prefer phone to learning new calculator"
"cheating"
"photo math"
"they can be as big of a distraction as a help"
"hard to submit math assignments (Google Classroom)"
"distractions from social media"
"discipline issues"
"nothing works as it is intended"
"taking snapshots of homework and sending them to others"
"it's easier to cheat with technology"
"it's all going to go online at some point"

Summary of the Results

The adjusted quantitative data showed that the non-BYOD group outperformed the BYOD group on the basis of category three (Geometry and Measurement), category four (Data Analysis and Financial Literacy), and the total score. Analysis of the qualitative data resulted in five themes, namely, Access to BYOD, Distractions Due to BYOD, Cost of BYOD, Monitoring BYOD, and BYOD as a Tutorial Tool.

Chapter V

SUMMARY, CONCLUSIONS, AND DISCUSSION

Introduction

Nearly 15 years ago, not many among America's youth wished to become security analysts, cloud computing specialists, or social media managers, because there was not an abundance of such employment opportunities. Nowadays, there is a critical demand for such skills (Prosperity Requires Being Bold, 2016). For the next generation, knowing how to adapt to new technology or other advances will be as important as the knowledge and skills initially acquired to get a better job (For America's Divided Recovery, 2016, p. 4).

In 2015, in fourth-grade mathematics, Texas ranked 11th nationally, up from 27th in 2013. According to The National Report Card (NAEP,2015), "Texas fourth and eighth grade students taking the 2015 National Assessment of Educational Progress (NAEP) in mathematics posted scores higher than the national average. Scores for white, African American, and Hispanic students also exceeded scores by their national counterparts in NAEP fourth-grade mathematics. According to Prosperity Requires Being Bold (2016), these positive indicators provide more reasons to build greater links between mathematics education and technology to ensure a stronger workforce for Texas students" (p.7).

In this study, a mixed methods inquiry was designed and conducted which involved quantitative and qualitative data to examine the impact of a BYOD program on academic achievement in mathematics, using standardized grade seven (7) STAAR scores. The study was delimited to (1) seventh graders, (2) the predictor variable of participation in a BYOD program, (3) the student outcome measures of academic achievement in mathematics, and (4) perspectives of seventh grade mathematics teachers and educational leaders regarding the effectiveness of the

BYOD. The setting was two different middle schools in South Texas. The study's hypothesis was that students who attended a middle school with the BYOD program would score higher on the seventh grade standardized mathematics achievement test than would the students who attended a middle school without the BYOD program. The study was guided by the following research questions:

1. To what extent does participation in a BYOD program impact seventh grade academic achievement in mathematics?
2. What are the perspectives of seventh grade mathematics teachers and educational leaders regarding the impact of the BYOD program?

Summary of the Results

Descriptive statistics, Independent Samples t-tests, and mean difference effect sizes were used to analyze the quantitative data. The level of significance was set, a priori, at the 0.01. Due to equal sample sizes, robustness with respect to the homogeneity of variances assumption was assumed. The analysis the data showed that the majority of the students were not economically disadvantaged (57.10%) and group differences were not statistically significant, $X^2(1, N=594) = 3.23$, $p = 0.07$. There were more at-risk students in the comparison school than were in the BYOD school and the differences were statistically significant, $X^2 (2, N = 594) = 7.64$, $p < 0.01$. The majority of the participants was female (58.80%), and group differences on the basis of gender were statistically significant, $X^2 (1, N=594) = 8.44$, $p < 0.01$. After adjusting the data for the confounding variables of ethnicity and at-risk status, group differences on the basis of category three (Geometry and Measurement), category four (Data Analysis and Financial Literacy), and the total score were statistically significant, favoring the Non-BYOD group. With the exception of category four, all effect sizes were negligible.

The qualitative component of the explanatory sequential mixed methods was utilized for the purposes of addressing the study's second research question and explaining the quantitative results in greater depth. The quantitative results were used to formulate the lead questions which were used to collect the qualitative data from the focus group. The lead questions were:

- In what ways do you believe the BYOD program may impact the mathematics achievement of grade seven students?
- How many times per week was the BYOD program used?
- Did you have to alter your teaching methods to accommodate the BYOD program?
- What were the advantages of using the BYOD program?
- What were the disadvantages of using the BYOD program?

Analysis of the qualitative data resulted in five themes, namely, Access to BYOD, Distractions Due to BYOD, Cost of BYOD, Monitoring BYOD, and BYOD as a Tutorial Tool.

Conclusions

Academic achievement in mathematics was measured by the proportion of correct answers to questions in each of the four STAAR mathematics categories. Based on the quantitative results, the study's hypothesis was not supported and it was concluded that the students who used the BYOD program did not score higher on the seventh grade standardized mathematics STAAR test than did the students who had not used a BYOD program. There were 13 educators who participated in the qualitative component of the study of which, eight did not feel that achievement in mathematics could be affected by the BYOD program, complementing the quantitative results.

The qualitative findings showed that there were some advantages and disadvantages in using the BYOD program. However, the focus group participants seemed to think that the advantages in the years to come would be impossible to ignore and that it would be necessary to embrace student-owned technology in the classroom. The major setback to the program was that students lacked the desire to use their own devices for academic purposes and were only interested in their devices at school as a distraction. The other concern the participants expressed was the difficulty in managing all students and their devices. For example, the challenge imposed by students' efforts to cheat on assignments and the difficulty in preventing it. However, the participants felt that in time students would use their own devices for academic purposes instead of treating it as a toy. Overall, the BYOD program received favorable ratings by the participants in the focus group, stating that it offered access to many positive mathematics resources. Teachers also commented on how they were becoming dependent on the instant feedback and tutorials that were accessible to students through the BYOD program.

Discussion

Mathematics is generally thought to be multidimensional and teachers emphasize using activities that teach mathematics through creativity and inquiry. The National Council of Teachers of Mathematics (NCTM) reported that their position on access and equity in mathematics education was creating, supporting, and sustaining a culture of access and equity while being responsive to student's backgrounds, experiences, cultural perspectives, traditions, and knowledge when designing and implementing a mathematics program and assessing its effectiveness (Access and Equity in Mathematics Education, 2014). The BYOD program enforces Carl Roger's Student Centered Learning Theory by setting a platform for interactive lessons that integrate technology and engage students in project-based learning.

Access and Equity in Mathematics Education (2014) also concluded that to increase opportunities to learn, educators at all levels must focus on ensuring that all students have access to high-quality instruction, challenging curriculum, innovative technology, exciting extracurricular offerings, and the differentiated supports and enrichment necessary to promote students' success at continually advancing levels. Accordingly, Saxena (2013) elucidated on the topic of technology and education by taking the definite stance that technology improves education to a great extent and that it has become a need for revolutionizing education for the better. Over the past years, studies have shown the benefits from the use of technology in education. The role of technology in education is vital, and the question is no longer if technology enhances learning, but rather how do we improve our use of technology to enhance learning (Saxena, 2013)?

The study's results were not supported by the literature per se. The BYOD program in isolation is intended to integrate theories such as Connectivism in the classroom setting. For example, John Seely Brown (2012), presented the notion that even though contributions to technology may seem small, they would complement the large efforts of the teachers. More so, this could explain the results of the study by suggesting that if the teachers had used the BYOD program more often, it could have increased mathematics achievement.

Data Analysis and Financial Literacy was the STAAR category which meaningfully favored the comparison group. It may be possible if theories such as Connectivism are approached aggressively, with or without a BYOD program, students may benefit from connecting to real life approaches and experiences in an attempt to better understand the knowledge of interest. Data Analysis and Financial Literacy is a new category being tested in the state of Texas. As per the Common Core State Standards Initiative of 2010, data analysis and financial literacy are related to what the mathematics in the United States is set to strive. In mathematics, a goal is to strengthen the use of technology by paying attention to the specifics of the standards, providing a clearer explanation for the science, technology, engineering, and mathematics (STEM), and streamlining the learning progressions (Common Core State Standards Initiative, 2010). Theorists, such as Stephen Downes, infer that progress in learning requires becoming a person that already knows the facts. With programs such as the BYOD, students are capable of becoming experts at something without leaving their classrooms due to the instant access to the internet.

The effectiveness of the BYOD program has been a challenge to prove due to its newness; nevertheless, students continue using their own devices at schools. One could only imagine the instant access and feedback students and teachers are receiving in the targeted areas focused on student learning. Notably, we are consumed with the notion that online learning is inevitable in today's world. For example, the BYOD program offers teachers supplemental intervention strategies which can be used with a student who is struggling on a certain mathematic objective.

Although the qualitative results showed that there were some advantages and disadvantages in using the BYOD program, the focus group participants seemed to think that the advantages outweighed the disadvantages. Some of the BYOD advantages, as suggested by the focus group participants, were anytime and anywhere online access to assignments, additional online guided practices, online teaching and modeling, and independent practices in each and every four STAAR mathematics categories.

The qualitative data showed that the BYOD program was being used by all focus group participants in their advisory classes. Advisory teachers may not have students in their core classes; therefore, it becomes time-consuming to check their weekly grades and progress. Checking weekly grades and monitoring student progress are the main roles of the advisory teacher. Thus, instant access to the internet on their own devices during advisory sessions becomes easier and students can be held responsible for it. Additionally, advisory teachers can access missing assignments on their own Google accounts through Google classroom. Teachers are required to post every lesson and assignment on Google classroom. It has become nearly impossible for students, parents, and teachers not to have access to student progress.

Finally, because the BYOD curriculum can be placed online, a reduction in the cost and use of paper is expected. Communication with parents and teachers may be improved, because parents have access to student grades, lessons, and assignments through their portal. Overall, the current study's BYOD program received favorable ratings by the participants mainly because it has been instrumental in enhancing student engagement.

Speculations

According to the assistant principal of the non-BYOD middle school, the school librarian had organized and assisted the mathematics department on gathering resources that targeted the four 7th grade STAAR mathematics categories. The librarian would meet with the district curriculum supervisors monthly to review materials and online resources that would be available through the library. The librarian would arrange for guest speakers to come and present real life application of STEM related careers and later teachers would integrate the presentations into their instruction. The librarian had many community and parent presentations on how to assist students on their academic success. The assistant principal commented on how the school librarian had devoted a great deal of time and effort into making STAAR-related resources a school wide effort. Even though the non-BYOD school had not yet set policy on allowing students to bring personally-owned devices to school, students were still in need of internet access. The school library provided a place for students to use computers and access the school district's filtered internet.

The assistant principal of the non-BYOD middle school remembered mathematics teachers taking students to the library to log onto online mathematics websites that helped them prepare for examinations. This became an intervention for students that were at-risk of failing the STAAR standardized test. The assistant principal said that in retrospect, the librarian had been one of the key stakeholders for students' success on the STAAR Test because she was a direct link to the internet for research and had created a digital environment. Thus, the non-BYOD middle school's outperforming the middle school with a BYOD program might have been due, in part, to the school's librarian who had provided additional resources for students' efforts in mastering the lesson plans. On the other hand, the librarian at the middle school with the BYOD program had spearheaded the initiative in teaching digital citizenship to all students, which might have left her with little involvement in preparing students for the mathematics STAAR test.

The assistant principal also noted that seventh grade teachers in the 2014-2015 school year had required their students log daily afterschool to online STAAR mathematics release questions. Students would receive credit for reviewing questions at home and those who did it outperformed those who had limited afterschool practice. In short, it became apparent that the 7^{th} graders in the non-BYOD school were performing well in mathematics even before the shift in standards.

Implications

The BYOD program is a research-based intervention that allows a filtered public Wi-Fi on campuses, allowing students to bring personally-owned devices to school for educational purposes. Students are expected to connect to the filtered public Wi-Fi to ensure access to the best online resources. The study was conducted because it was the first year in which the BYOD program had been implemented at the school and STAAR categories had also been changed. The newness of the intervention could have resulted in not following the required protocol correctly; thus, not positively impacting academic achievement in mathematics. The students were struggling in acquiring the much needed mathematics skills prior to the 2014-2015 school year, which caused worry and concern for most Texas educators. The middle school had found that numerous interventions provided by the BYOD program were available, however, they were not necessarily being used to help prepare students for their rapidly evolving mathematics curriculum.

On the basis of the study's review of the literature and results and her professional experiences as an administrator, the researcher recommends the following for a meaningful design and implementation of the BYOD program to help improve seventh grade achievement in mathematics. Establish a safe mobile learning program as an education priority and implement a philosophical change in the way educators deliver instruction. For example, the superintendent of the middle school campus with the BYOD program, at the early stages of implementation, had promised that the BYOD program was strictly optional for all teachers to implement. It was described as a privilege for students and not a right. The vision was to provide middle school instruction in mathematics that included student-owned devices in a manner that is familiar to them. Make sure the teachers know the correct implementation of the BYOD protocol.

Additionally, require of students to master the skills needed to use the device correctly and efficiently helps implement the long range plan for technology in the state of Texas.

The study also has implications for educational leadership. For example, leadership is considered to be one of the most influential factors on the practices at school (Hoy & Miskel, 2013). Anderson and Dexter (2005) stated that the literature on leadership and technology suggests that school leaders should provide administrative oversight for educational technology. One could argue that leadership may influence the way by which teachers and students utilize technology. For example, an educational leader with a fixed mindset may believe that the BYOD in schools causes problems while one with a growth mindset may argue that the program enhances students' academic performance. The two opposing beliefs may contribute to the overall success or failure of the BYOD program on academic achievement. The end result, nevertheless, may be that students fall behind the curve in technology, which could affect their college and career readiness.

More importantly, a technology leader should understand and manage the changes associated with technological advancements as well as supporting the teaching staff by developing their confidence in and capabilities of using technology at school (Akbaba, 2002). Without the freedom and support from educational leaders, it is hard for students and teachers to achieve the required skills to support and benefit from a BYOD program.

Hosting employee roundtables may be an effective way to allow teachers express concerns and utilize time to learn technology skills from one another. Schad (2014), an educational leader in the BYOD program, noted that the greatest value of roundtable meetings is the opportunity to learn about various perspectives, initiatives, struggles, and implementation processes. Exceptional leadership comes from a campus principal that heavily integrates the

BYOD framework and leads the effort, instead of sitting back and relying on central office to drive the BYOD plan. For instance, the study's campus with the BYOD program offers weekly online and free intervention to faculty and staff members in an attempt to improve classroom instructions.

Finally, it should be emphasized that BYOD programs may provide the students to practice Connectivism by enabling them to have access to newly discovered knowledge that is up-to-date. For example, if students own the tool or treat it as if it is theirs, it may make them eager to engage in active communication which may lead to meaningful and experiential learning.

Recommendations for Further Research

The study's delimitations, limitations, and assumptions offer opportunities for further research: (1) due to the non-probability nature of sampling, external validity was limited to study participants, (2) the study was delimited to two middle schools in two separate school districts in South Texas; (3) the study was delimited to the outcome measure of academic achievement in mathematics for one grade level; (4) it was assumed that the participating BYOD school followed the program accordingly. To enhance the generalization of the study's results, the researcher recommends: (1) the replication of the study in other school districts in Texas; (2) replication of the study in other grade levels; (3) replication of the study in other academic subjects; (4) replication of the study to examine academic growth from year to year; and (5) replication of the study for multiple years of STAAR. A qualitative study must be conducted to better understand the BYOD program and its realistic outcomes. In this study, the majority of the focus group participants did not believe that the BYOD program could affect academic achievement in mathematics. Why not? And if it cannot affect this particular outcome measure, what can be affected by it? It is important to have a keen understanding of this intervention's capabilities.

In replicating the study by conducting another causal-comparative investigation, careful attention must be given to identifying the characteristic-present and comparison groups. In the current study, although the comparison group's curriculum did not include the BYOD, it enjoyed other factors, unknown to the researcher at the time of selecting the schools, which could have impacted the outcome measures. A comparison group must be selected from a population which is similar to the characteristic-present group except for the variable(s)/characteristic(s) that are being investigated.

Final Remarks

The study examined the impact of the BYOD program on seventh grade standardized mathematics STAAR scores in a South Texas middle school setting. After adjusting for the confounding variables, the results demonstrated that the non-BYOD group outperformed the comparison group on the majority of the outcome measures. The educators in the focus group stated that the BYOD program, when properly used, helps students access the newest mathematics resources that may result in academic achievement. In non-BYOD schools, other factors that may influence the outcomes must be taken into consideration, which may include parent and community involvement, teacher assessments, teacher-made worksheets targeting specific objectives, daily in-school small group tutoring, and after school tutoring prior to the STAAR test. Additionally, teachers having sufficient planning time to develop the subject areas may be instrumental in increasing mathematics scores. Whatever the case may be, it can be informative to examine the effectiveness of other potential interventions. For the researcher herself, it has been an open-ended journey and with no end in sight to follow the evolution of the BYOD program and its impact on academic achievement.

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APPENDIX A

IRB APPROVAL LETTER

CAMPUS APPROVAL LETTER

DISTRICT APPROVAL LETTER

FOCUS GROUP LETTER OF INVITATION

FOCUS GROUP CONSENT FORM

OFFICE OF RESEARCH COMPLIANCE
Division of Research, Commercialization and Outreach

6300 OCEAN DRIVE, UNIT 5844
CORPUS CHRISTI, TEXAS 78412
O 361.825.2497
F 361.825.2755

Human Subjects Protection Program	Institutional Review Board

APPROVAL DATE:	May 20, 2016
TO:	Ms. Patricia A. Tijerina
CC:	Dr. Kamiar Kouzekanani
FROM:	Office of Research Compliance Institutional Review Board
SUBJECT:	Initial Approval

Protocol Number:	IRB # 57-16
Title:	The Impact of the Bring Your Own Device Program on Academic Achievement in Mathematics in a Sample of 7th Graders: An Explanatory Sequential Mixed Methods Inquiry
Review Category:	Expedited
Expiration Date:	May 20,2017

Approval determination was based on the following Code of Federal Regulations:

Eligible for Expedited Approval (45 CFR 46.110): Identification of the subjects or their responses (or the remaining procedures involving identification of subjects or their responses) will NOT reasonably place them at risk of criminal or civil liability or be damaging to the their financial standing, employability, insurability, reputation, or be stigmatizing, unless reasonable and appropriate protections will be implemented so that risks related to invasion of privacy and breach of confidentiality are no greater than minimal.

Criteria for Approval has been met (45 CFR 46.111) - the criteria for approval listed in 45 CFR 46.111 have been met (or if previously met, have not changed).

(7) Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies. (NOTE: Some research in this category may be exempt from the HHS regulations for the protection of human subjects. 45 CFR 46.101(b) (2) and (b) (3). This listing refers only to research that is not exempt.)

Provisions:

Comments: The TAMUCC Human Subjects Protections Program has implemented a post-approval monitoring program. All protocols are subject to selection for post-approval monitoring.

This research project has been approved. As Principal Investigator, you assume the following responsibilities:

1. Informed Consent: Information must be presented to enable persons to voluntarily decide whether or not to participate in the research project unless otherwise waived.

2. Amendments: Changes to the protocol must be requested by submitting an Amend me Application to the Research Compliance Office for review. The Amendment must be approved by the IRB before being implemented.

3. Continuing Review: The protocol must be renewed each year in order to continue with the research project. A Continuing Review Application, along with required documents must be submitted 45 days before the end of the approval period, to the Research Compliance Office. Failure to do so may result in processing delays and/or non-renewal.

4. Completion Report: Upon completion of the research project (including data analysis and final written papers), a Completion Report must be submitted to the Research Compliance Office.

5. Records Retention: All research related records must be retained for three years beyond the completion date of the study in a secure location. At a minimum these documents include: the research protocol, all questionnaires, survey instruments, interview questions and/or data collection instruments associated with this research protocol, recruiting or advertising materials, any consent forms or information sheets given to participants, all correspondence to or from the IRB or Office of Research Compliance, and any other pertinent documents.

6. Adverse Events: Adverse events must be reported to the Research Compliance Office immediately.

7. Post-approval monitoring: Requested materials for post-approval monitoring must be provided by dates requested.

From: Holder, Cindy [mailto:cholder@flourbluffschools.net]
Sent: Wednesday, April 20, 2016 11:45 AM
To: Kouzekanani, Kamiar
Subject: Focus Group Flour Bluff Junior High School

Patricia Tijerina has permission to conduct a focus group about our "Bring Your Own Device" campus. She will have permission to use our library and speak to teachers and staff that agree to the terms outlined by the university.

Respectfully,
Cindy Holder
Flour Bluff Junior High Principal
361-694-9395

Flour Bluff Independent School District

2505 WALDRON ROAD, CORPUS CHRISTI, TEXAS 78418-4798 **PHONE (361) 694-9220 · FAX (361) 694-9809**

Dr. Alicia Needham
Assistant Superintendent for Curriculum & Instruction

Texas A & M-Corpus Christi
6300 Ocean Drive
Corpus Christi, Texas 78412

February 17, 2017

To Whom It May Concern:

Formal permission is granted to Patricia Tijerina to conduct research entitled, The Impact of the Bring Your Own Device Program on Academic Achievement in Mathematics in a Sample of 7th Graders: An Explanatory Sequential Mixed Methods Inquiry in the Flour Bluff Independent School District. This permission indicates that the proposal meets all research and/or evaluation and FERPA standards.

This permission allows the campus administration identified in your proposal the opportunity to assist in the collection of data for analysis purposes.

It is a pleasure to allow this research with Flour Bluff ISD students and I look forward to reviewing the results at the conclusion of the work.

Should any additional assistance be needed during the study or if there are any changes in the proposal, please contact me at 361-694-9219 and/or via email at aneedham@flourbluffschools.net.

Sincerely,

Alicia Needham

Alicia Needham
Assistant Superintendent for Curriculum & Instruction
Flour Bluff Independent School District

Focus Group Letter of Invitation

Dear Colleague,

I am a doctoral student in Educational Leadership at Texas A&M University-Corpus Christi. My dissertation study focuses on the Bring Your Own Device (BYOD) program at the Junior High level and employs a mixed methods research design. For the qualitative component of the study, I will have to collect data regarding the perspectives of a group of educators of grade 7 students and their overall education of mathematics.

I would like to invite you to participate in a focus group to discuss the above. I would like to include a counselor, an administrator, a special education staff member, and several classroom teachers who all interact with grade 7 students and grade 7 mathematics on a daily basis. As a participant, your views and experiences are extremely valuable and helpful in better understanding school personnel's views of the BYOD program and grade 7 mathematics.

The focus group meeting is tentatively scheduled for Tuesday, May 17, 2016 from 4:30 to 6:00 pm at Flour Bluff Junior High School library. Refreshments will be served.

Although I hope you agree to attend the meeting, your participation is voluntary. Anything that you say during the focus group will be kept strictly confidential and no information will be linked to you personally.

Please complete the bottom portion and return to my faculty mailbox.

Sincerely,

Patricia Tijerina

_______ Yes, I agree to participate in your study's focus group.

_______ NO, I do not agree to participate at this time.

Name: ____

Signature: ____

FOCUS GROUP CONSENT FORM

The Impact of the Bring Your Own Device Program on Academic Achievement in Mathematics in a Sample of 7th Graders: An Explanatory Sequential Mixed Methods Inquiry

Introduction
The purpose of this form is to provide you information that may affect your decision as to whether or not to participate in this research study. If you decide to participate in this study, this form will also be used to record your consent.

You have been asked to participate in a research project studying grade 7 students in two different south Texas Junior high schools and the impact of The Bring Your Own Device Program (BYOD) on academic achievement (STAAR scores in grade 7mathematics). The purpose of this study is to test the hypothesis that grade 7 students who receive mathematics instruction on a campus with the BYOD program will score differently than students who receive regular instruction on the basis of academic achievement in mathematics. You were selected to be a possible participant because you have affiliation with grade 7 students and because you are an educator familiar with mathematics instruction, STAAR testing, and the BYOD program.

What will I be asked to do?
If you agree to participate in this study, you will be asked to participate in a focus group and be directly involved with an interview that would take approximately 30-45 minutes in length to complete. This study will take place as soon as it has been reviewed and approved by the University and upon IRB approval. Possible expected starting date could be mid May 2016. Your participation will be audio recorded. There is also a possibility that a follow-up interview could occur if needed.

What are the risks involved in this study?
The risks associated in this study are minimal, and are not greater than risks ordinarily encountered in daily life. Questions based on your perceptions of the effectiveness of the BYOD program and its impact on mathematics instruction could cause thoughts displeasing to you. Please understand that all questions and answers will remain confidential.

What are the possible benefits of this study?
You will receive no direct benefit from participating in the study.

Do I have to participate?
No. Your participation is voluntary. You may decide not to participate or to withdraw at any time without your current or future relations with Texas A&M University-Corpus Christi or Flour Bluff Independent School District.

Who will know about my participation in this research study?
The records of this study will be kept private. No identifiers linking you to this study will be included in any sort of report that might be published. Research records will be stored securely and only Patricia A. Tijerina, Dr. Kamiar Kouzekanani, and TAMUCC will have access to the records.

Whom do I contact with questions about the research?
If you have questions regarding this study, you may contact Patricia A. Tijerina at ptijerina@flourbluffschools.net or my cell phone (361)549-6303, mailing address: 3114 Briarhurst St., Corpus Christi, TX 78414 or you may contact Dr. Kamiar Kouzekanani (Dissertation Chair) at kamiar.kouzekanani@tamucc.edu, phone (361) 825-2318, mailing address 6300 Ocean Drive, Unit 5818, FC 223, Corpus Christi, TX 78412-5818.

Whom do I contact about my rights as a research participant?
This research study has been reviewed by the Research Compliance Office and/or the Institutional Review Board at Texas A&M University-Corpus Christi. For research-related problems or questions regarding your rights as a research participant, you can contact Caroline Lutz, Research Compliance Officer, at (361) 825-2497 or caroline-lutz@tamucc.edu.

Signature
Please be sure you have read the above information, asked questions and received answers to your satisfaction. You will be given a copy of the consent form for your records. By signing this document, you consent to participate in this study. You also certify that you are 18 years of age or older by signing this form.

________ I agree to be audio [/video] recorded.

________ I do not want to be audio [/video] recorded.

Signature of Participant:____ **Date:**______

Printed Name: ____

Signature of Person Obtaining Consent:___________________________ **Date:**______

Printed Name: ____

APPENDIX B

FOCUS GROUP TRANSCRIPT

Key-*(written response)

Researcher	Respondent
Okay. We are about to begin this focus group. Thank you guys all for participating, I truly appreciate this. This is a study I'm using for a doctoral research study and I am working on viewing the perspectives of educators in the areas of grade seven mathematics and BYOD programs for my dissertational study. The purpose of this focus group is for me to view the perspectives of 7th grade mathematics teachers, others in the field of mathematics, and educational leaders, regarding the impact of the BYOD program. Your responses are confidential, and you may opt out of the study at any given time. Does anybody have any questions? I encourage open and honest discussion and thank you guys again for all participating. So my first question is a raise your hand question if you think "yes" or raise your hand up if you think "no". **PI asks 1st question:** How many of you think the BYOD programs impacts achievement in mathematics? One, two, three, four, five. Okay. How many of you think it doesn't impact mathematics, BYOD programs don't impact mathematics? Okay, okay, thank you.	
	Five participants raised their hands for the BYOD program impacting mathematics achievement and eight participants did not raise their hand answering "no" for the BYOD program impacting mathematics achievement.
PI asks 2nd question: My second question, in what ways do you believe the BYOD program may impact the mathematics achievement of students in seventh grade? Does anybody have any feedback that they can give me about that?	
	Participant # 8: Well I mean it's the world that we live in, right? Technology is everywhere, so um either embrace it or you're fighting against a losing battle, that's only going to happen more and more, um it happen

	to us a couple of years ago, we were constantly trying to buy technology for kids, um you know like remember a few years ago we were trying to get a lap top to every kid. Well their phone is good a piece of technology as to anything these days, um, we do not need a word processor very often, so having their phone for the instant access information and no one is paying for any of it, so since no one is paying for it, other than the parents and the kids, why not use it, so yah.
PI: That's a great point, um anyone else, BYOD program and how it may impact mathematics achievement?	
	Participant # 5: I also believe that um, it it allows kids access, it allows them access to check their web pages, that the teachers provide on the, you know, main web page, I believe that it provides them access to utilize books and things at home, to also Google things and look at YouTube videos about things they don't understand in math, so I do feel like it provides access to parents as well as students, because of the capabilities of the internet.
	Participant # 2: And I am going to play devil's advocate and say that in the same breath we are doing good things with the math and the technology in the classroom. I think that it's very much a situation where teachers have to be very pro-actively monitoring how the students' are using it, because, if you are using it in the classroom, awesome, a teacher can watch and know what you are doing and how your using it and that you're not just going for Google to get an answer. So, um, you know, you send them home with a worksheet, their supposed to answer all the questions, but we really don't know if they are doing it on their own or not. So I think using the technology in the classroom under close supervision is always going to impact the students, highly, as long as they are doing it right, you know. That as a teacher is one of the things we monitor just to make sure they are doing what they are

	supposed to be doing and they can show work for it, but that would come out on their testing anyway, because if they are getting 100s on all their worksheets and going home and Googling the answers, the definite way you are going to find that out is when they take a 6 weeks test or unit tests or something you will be able to tell when students don't know the content.
	***Participant # 1: -**Watch videos to review and introduce concepts. -Online Textbooks -Review Vocabulary
	***Participant # 3:** Provides students access to tutorials, websites where they can manipulate concepts themselves.
	***Participant # 4:-**more engagement -tutoring -time management
	***Participant # 7:** It will assist the kids doing hands on work on their tablet; which will mean less worksheets.
	***Participant # 9: -**more visuals -more kinesthetic involvement
	***Participant # 10:** Students are able to access assignments online.
	***Participant # 11:** Can view textbooks and materials online rather than hardcopies. - online resources
	***Participant #8:** It's the world we live in so embrace it. Why buy technology when kids have great tech already.
	***Participant #2:** I think it benefits students with instant access, to curriculum, tutoring, etc.
PI asks 3rd question: How many times per week do, would you say you use the BYOD program? You utilize our capabilities with WiFi here on campus, students are logging in um, to their access, and students are using their devices in the classroom?	
	Participant # 8: Um, me personally, I kind of think that's the wrong kind of question to ask there because I mean it's not like a toy or something, you know like "O" look at this new , it's just there, right? You're using

	technology all the time, when it's convenient when you need it, you grab it. It not like "O" we're going to use our phones today, I mean they use their phones all the time, so I mean just use it when you need it. It doesn't um, I'm sure like you were saying a few minutes ago, it's a distraction sometimes, but the more it becomes part of the class, the less it becomes a toy. You know, just like calculators, when you first give a kid an Inspire calculator, he's going to sit there and type his name and all kinds of stuff, but after a while it just becomes a tool that sits there when you need it. So you kind of, if it becomes the culture of the classroom then, you know, it's not bring it out. It's do I need to use my phone? Don't even ask me to use your phone, go use your phone. You know, just make sure you are being consciousness about it, yah.
	Participant # 2: I also think the amount of time being used in the classroom has significantly changed from like our first year, to second year, and third year of implementation because teachers are getting more comfortable. We are finding better websites, we are finding better apps, we are learning ourselves with what good technology is and what the not so good is. So as we become more comfortable, with what we are wanting our students to use, I think the students are getting better at using it more often and being more honest about how they are using it to, you know.
	Participant #13: There is also better security now, and filters that the district is using to help kids, you know, stay away from those websites that are things that may be inappropriate
	Participant #6: And there is more teachers that use Google classroom, they are on them more often, so I'll probably say they log-in everyday, in some classes.
	Participant # 5: I think it's just a daily, you know, something they are used to, like Participant 8 said. It's part…

	Participant # 8: I have classes that their whole textbook is on their phone.
	Participant #12: That's a good point.
	Participant # 2: And parents are utilizing it to, I mean now we got parents involved in these websites and how to use them for their students, because they are checking Google classroom and all the stuff the teachers are posting on there for the students to watch. But now you have parents involved because it's so easy for a kid to move his phone over and say mom "look at that" this is what I've been working on, you know, whatever. So we are also impacting how parents know we're using, you know, technology in the classroom.
	Participant # 8: Like even think, like um you know, giving out kids progress reports now. It's almost ridiculous, if a kid doesn't know how he's doing anymore, it gets your phone out and if you are smart enough to get the app on your phone. You should never be, you know, "O my gosh" I'm flunking. "Baloney"! That's a choice now. You want to be ignorant, so then, even that idea, information is powerful so.
	***Participant # 11:** -at least once per week -varies greatly from week-to-week
	***Participant # 10:** It's used several times a week especially during Advisory when students are working one homework.
	***Participant # 7:** Daily
	***Participant # 4:** 1-2 per week
	***Participant # 3:** I don't use the program very often in class itself, students use it during advisory to look up things they need.
	***Participant # 1:** Whenever I feel the need and it fits.
	***Participant # 2:** 2-5 times
	***Participant # 8:** Daily although we don't necessarily use tech every day.
PI: Do you think we are at a point that, if a student doesn't have a device, their own device, I mean do you think they are behind the learning curve or…?	

	Participant # 8: So um, personally in my class um, a couple of years ago um, so when, in my class, when we first got text books online. I was worried about kids not having phones, right. So what I did, I went to Best Buy and you know these pay as you go phones, well they sell them dirt cheap because they are trying to get you on the plan so I'd buy the phones but don't activate them. So now they are just a quick way to get on the WiFi, right. I started with my own kids because they wanted to buy a camera but the camera is so cheap, so I was like buy them a phone, but they can't get on the cell lift but they can use it for all this other stuff. So I bought a few of those, right um. The kids would come into class, "hey I don't have my own phone" okay so I was like "grab one of those" and use them today. I even numbered them and whatever. Well this year, I still got them sitting there and they got dust on them, because every kid had a phone or you know an Amazon Fire or something, their laptop, whatever. But they really literally just sit there now, and I'm like I'm not sure I should have bought those at the time. They were so cheap, but it becomes, we are getting closer to that place. Five years when we were teaching, um no we weren't there. But it's almost, technology is almost throw away now. You know, to get on the internet is not special anymore. You can get that for ten dollars now, so.
PI: That's a good way to describe the evolution of it, kind of see where we came from and where we are going.	
	Participant # 8: Ya ya, it would be stupid to buy every kid a laptop now. That laptop would be obsolete in two years and you'd spend two million dollars on it or whatever on it, you know.
PI asks 4th question: Um and do you guys feel that you have to alter your teaching methods to accommodate the BYOD program?	

	Participant #2: I think that**,** um yes in a sense, only because we I had to learn things I didn't know. I had to get out of my own comfort zone, when it came to technology and how and I how to utilize it. They're going to use that phone no matter what, they are going to have that phone out no matter what, you know, whether I'm fully aware that it is out or not. So having this BYOD, and bringing this into the classroom, force me to know more about it, but I needed to anyways because it going to be there regardless like participant # 8 said. So we keeping coming and coming and coming, in waves and waves and waves. So as far as altering what I'm teaching, though…no, but I think I'm enhancing what and how they are getting the information and how…yes.
	Participant # 5: How do I it in math? How do I use this in math?
	Participant # 8: Well**,** ya similar to that, this um, I remember 5, 6, 7, I don't know maybe 10 years ago now. Um, I, I, write a grant to get these clickers, so I could take polling in my class, well there sitting, there dinosaurs now because you can poll on their phones in two seconds. So that's a great thing, right… instant feedback. But what I found I don't use it very often because, um, if you get technology involved it slows everything down. You know, I can't get on, oh did you send it in, did everybody, you know? It's we are still in the baby stages of it, um, and you talked about, you know more fire walls and you know protecting the kids. But I'd almost argue it does the exact opposite because all these little checks and balances in place slows everything down and if it slows it down. For example I have this great peace of technology, but it never works the way it needs to work because of the way it has to be set up, you know with this security that I don't use it and so it sits there, you know. Ten years from now they'll probably figure out how the, you know, stop um, protecting the kids from the world, because we're not. They

	can get on their phones and do the exact same thing, all we are doing is covering our butts about its happening at school. But we are not doing anything, really, you know they can still get there, all we are doing is keeping it from happening in the classroom, so it slows my class down um when we use it, but the opposite end is that they use it all the time for tutoring is my big one because um when a kid comes in for tutoring, I don't sit and teach them anymore. They grab an IPad they grab their phone, and I say go watch this video, I videotaped everything I've taught and then they go and do it and get a perfect lesson. When a kid is absent, he'll email me, hey which video should I watch? Hey watch this video and they come in the next day and their not behind, unless they want to be. (Laughs) You know, so, um, it's, there's good and bad about it, in a classroom setting of 47 minutes or whatever it is, um, it slows things down to the point that you don't want to use it. Outside of that when there is not a time issue, its great!
	***Participant #1: -**listen to music to focus -Google vocabulary
	***Participant #3:** At first it is very time consuming to prepare.
	***Participant #7:** No, I try to use the Smart Board to initiate student discussion while using websites; that they can use also on their devices.
	***Participant #9:** teaching methods-no preparation-yes, teacher webpage and resources
	***Participant #10:** We have created Google forms for students to complete quizzes.
	***Participant #11:** Google things you don't understand. Listen to music while working to lesson distractions.
	***Participant #8:** -yes it slows things down sometimes -tutoring is 100% different
PI asks 5th question: Those are great points. Um pros, what were pros of using the BYOD	

program and continuing to use the BYOD program?	
	Participant # 5: Well I think pros for the BYOD for just the school setting is the fact that it takes some of the pressure for the school to buy devices. We can spend it on other things that can be useful to the teachers and the students that we are not putting all of our money into trying to get every kid a laptop. That's, we, we are never going to keep up, with that kind of mentality.
	Participant #12: I think it's a pro to that the kids see, this is more than just a phone where I can talk to somebody. I can do everything on this phone and anything on this phone and that's starting at a junior high level because it's only going to get better or more intense with it. There, going to know what to do as the years come by.
	Participant #8: They live in a different world, I don't think education has embraced it yet that this is the world they live in and it's the world we live in even and we don't even take it for granted yet. That they are always on their phones, there always on their phones because that's how they communicate to the world, it doesn't make it bad or good or whatever else. You are always sending letters in the mail grandma, that makes you, no, that's just the way you communicate, now, right, so. It is what it is.
	Participant #2: And its fast, I think one of the pros to, I know it slows it down the way you were talking about but I also think it's a way to get fast immediate feedback if I need to like polling or you know submitting your answers, you know, real quick to a quiz, it's a lot, email me, whatever, show me a video, instead of having to tutor and go over and over and over. Watch this one, you watch, how much more individualized are you getting in your classroom when you can say, you need to watch video #44, you need to watch video #56 (laughs), you know what I mean, and then there you go, done. Now I got, once you are done lets go over, you know

	stuff, and it just makes it, I think faster. Easier, faster, for kids these days and they know it and it's not going away.
	***Participant #11:** Instant access to information.
	***Participant #10:** Being able to access tutorial videos whenever they may need.
	***Participant # 7:** Less worksheets more hands on activities.
	***Participant #3:** Students are able to have instant access to tutorials, definitions…
	***Participant #1:** Reinforce concepts with programs, games, and videos.
	***Participant #2:** -instant access -classroom management
	***Participant #8:** Instant feedback, re-teach videos, tech always available.
PI asks 6th question: Ya, cons, what were the cons, what are the cons of using the BYOD program?	
	Participant #2: Someone said that um they are hard to manage. I think that depends on the teacher. I can see where someone may have trouble managing their students on their phones but I think it comes down to a teacher issue not necessarily a BYOD issue, you know what I mean? Um but, I have heard that as a complaint before, that it's hard to manage, kids abuse it, and over use it, or whatever. Um but like I said, maybe I personally think that might be a teacher issue.
	Participant #8: That more of a cultural of a classroom problem then a technology problem.
	Participant #2: Sure, absolutely, I think that, but I'm just saying that because I'm trying to be devil's advocate to and say like I've heard teachers say it's kind of hard to monitor and police it, you know and the fact of the matter is you either let them or you don't, you know what I mean, but that that may be another issue for another day. But that's one of the things I heard management.
	Participant # 5: Distractions, you know, kids being distracted by utilizing other things,

	using the phone for other things then for they are supposed to be, like math, but that's.
	Participant #8: In along the same ways**,** when the books came out, um and we purchased all these books for all these books for kids to have their online books, well in less every kid has a piece of technology, that they can always get to, um then we are not there yet, until it's so ubiquitous, where it's just there, you know, the Wi-Fi signal is everywhere, no matter where you go, um we are not there yet, so that, um so we have kids like that. I don't have a phone, okay go grab one or you know use an IPad, or whatever else, but, but we are not there yet and we were definitely not there five years ago. Five years ago it's like 50% of the kids had a phone, now we are at 90%, maybe I guess or something like that, but we are still not there and it's in its infancy. I don't even think we know what this is going to look like in the next ten years.
	Participant #2: You have second graders**,** first graders who have phones, (laughs) I mean, you know what I mean, so I mean, the sky's the limit really when it comes to this. You know I know we are talking about cons, but it's like, I wonder if we pulled a first grade or second grader, how many of them would have a phone. Now do they get it out, no, but I mean they got it in their backpack, you know what I mean. That would be an interesting, you know, just because it's not going away and it's just going to keep coming and coming and we got to get better at it, so we can be better for them at it. I think.
	***Participant #1:** -Distraction -Prefer phone to learning new calculator -cheating -photo math
	***Participant #3:** They can be as big of a distraction as a help.
	***Participant #7:** Having access for all students. Each child should have a tablet.

	***Participant #10:** I believe it's hard to submit math assignments (Google Classroom) because there isn't work shown.
	***Participant #11:** Distractions from social media.
	***Participant #2:** Disciplinary issues when not utilized correctly.
	***Participant #8:** Nothing ever works as intended.
PI: Anybody experience any academic dishonesty or…?	
	Participant #5: Yes, that could be a problem to, just with people you know taking quick snap shot of my homework and sending to my friend, send it out viral, you know post it.
	Participant #2: It's easier to cheat with technology**.**
	Participant #5: It's faster.
	Participant #2: But if you're going to do it, I mean if you are going to cheat you are going to cheat, I had a kid who cheated on a piece of paper earlier today, you know what I mean. Didn't have anything to do with technology, just handed his paper over to somebody else, so I mean, if they are going to cheat or want to cheat they are going to cheat. This just makes it a little easier, faster to do it. Ya I think.
	Participant # 8: I think um, textbook companies will start, in teaching in general, because it's all going to go online at some point. They are going to have to address that and you start marking these dynamic, nothing is ever regurgitated kind of thing. Everybody gets individualized stuff and then that goes away and then you're back to square one again. You know, it's like teachers don't give back you know, professors at universities don't give back the test, and they want to use it the next year. Right and so they will have to address that, but I mean. Like you said if a kid wants to cheat he gonna cheat, so.
PI: All excellent points! Um well that comes to the end of our focus group. I appreciate everybody taking the time to meet with me, please help yourself to our refreshments and	

snacks that we have here. Again I appreciate your time and helping me pursue this research and I appreciate everybody's professional opinion. Thank you and have a great day!	