CULTURE, CLASS, AND CONNECTIONS: USING INQUIRY BASED LEARNING TO PROMOTE CULTURALLY RESPONSIVE INSTRUCTION

A Record of Study

by

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ABSTRACT

During this action research study of Algebra I teachers at a high school in the Dallas/Fort Worth Metroplex, I have presented information related to the implementation of inquiry-based learning (IBL) and the findings from classroom observations and a focus group interview. The purpose of this study was to identify the effect of IBL instructional practices on the cultural and academic environment in mathematics classrooms. I sought first to understand teachers' perceptions of the usefulness of past professional development sessions, the climate and culture of their classroom, and their perceptions about how African American students learn. Teachers then participated in professional developments to learn to implement IBL practices effectively. After observing teachers utilizing the methods in their classrooms, teachers provided feedback on their experience and changes to their perceptions, modifications, and improvements to professional development, and providing culturally responsive teaching. The researcher utilized descriptive statistics to analyze data quantitatively, and additional data were analyzed qualitatively through inductive analysis. My school administrators will use the results to inform improvements and modifications to future professional development.

DEDICATION

This Record of Study is dedicated to my children, Rayne, Armad, and Ali. Everything I do and will do is for you. You all are my reasons. I hope to make you proud and am someone you want to emulate. I would also like to dedicate this work to my father, James Jones, Sr. I miss you immensely and I pray that I have made you proud since you've been gone. You are my hero, and I am grateful for the example you provided of being a father and a by any means mindset.

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CHAPTER I

INTRODUCTION: LEADERSHIP CONTEXT AND PURPOSE OF THE ACTION

The Context

In 1900, all the world's mathematical knowledge could be stored in roughly 80 books. Today, 120 years later, the world's mathematical knowledge would fill over one million books. The source of this information is unknown and might even be false; however, what is factual is the depth and breadth of mathematical information have increased exponentially as technology has advanced. What about mathematics has changed in such a relatively short time to cause such a dramatic increase in knowledge? This increase could be represented by the elaboration and explanations which help simplify the concepts of mathematics. Math possesses an artistic beauty encapsulated in creativity, embodied in patterns, solutions, and consistency. One plus one will always equal two. The associative property will always allow us to change the order of terms in a problem, and the sum of the angles of a Euclidean triangle will always equal 180 degrees. The importance of mathematics to the success of students matriculating through school also remains unchanged. The way mathematics is instructed has had variations and influences on the success of students.

The overall success of African American students in mathematics remains relatively unchanged. African American students continue to lag all other demographic groups in mathematic achievement. Early success in mathematics has proven to predict success in later grade levels (Denton & West, 2002). Building an early foundation accompanied with necessary interventions can ensure achievement. High school mathematical outcomes are strong indicators

of postsecondary success. Rose and Betts (2002) reported a clear connection between a student's highest level of mathematics completed in high school and the highest degree conferred ten years later. African Americans are under-identified and underrepresented in advanced coursework of any kind.

National Context

The global employment outlook is rapidly changing. Changes in the global economy as the result of rapid increases in technology has increased the demand for workers in science, technology, engineering, and mathematics (STEM) related careers (Tyson, Lee, Borman, & Hanson, 2007). Students who complete more challenging courses increase the probability of enrolling in postsecondary institutions to pursue those careers (Schneider, 2003). African American students are not enrolling or completing the advanced level courses to afford themselves opportunities to obtain STEM careers. The persistent achievement gap attributes to the disparity. The most common achievement gap is that between groups who perform at higher levels (White and Asian Americans) and those who perform at lower levels (African and Hispanic Americans). The topic is often discussed when examining the disparity in standardized test scores. African American students consistently perform below all other demographic groups. The lower level of achievement is not only relegated to standardized tests but all areas of achievement including, but not limited to, the completion of advanced level mathematics classes and pursuing STEM pathways.

The move to online learning exaggerated the problem. The COVID-19 pandemic has forced schools across the nation to provide virtual learning opportunities. State to state and district to district varies in the level, efficiency, and experience of online learning

implementation. Prior experience and confidence in the use of online tools impact student performance with online learning (Kuo et al., 2013). African American students are identified as at-risk of online learning attrition (Xu & Jaggars, 2014). They also generally possess a more pessimistic view of online learning (Du, Zhou, Xu, & Lei, 2016). Online education for K-12 students might very well be an ongoing option. Teachers and students adapted to the dramatic change in instruction in pursuit of continuing students learning. The change has been fluid for some. Others have found the transition difficult for reasons stemming from technological deficiencies for all parties, or lack of experience in online learning environments. This situation has exhibited what learning might resemble soon.

Situational Context

In Southwest Independent School District (ISD), a pseudonym for a suburban school district in the Dallas and Fort Worth Metroplex, there is a lack of evidence to support the effectiveness of inquiry-based learning (IBL) and the time and resources committed to applying these practices in Algebra I courses. The district mandates incorporating, for example, numeracy routines daily to begin class. Administrators and curriculum leaders in Southwest ISD also strongly encourage the use of station activities designed to promote critical thinking and develop problem-solving skills for students to be successful not only in Algebra I but for the rest of their academic and postsecondary careers. The district provides multiple professional development opportunities on how to and when to implement these activities in the classroom. Extensive research has been conducted, which highlights the benefits of IBL. However, there exists no data detailing the effectiveness of teacher perception of the practices for African American students when implemented with fidelity. The efficacy of these strategies is essential as students'

successes in Algebra I can be used to project how well students will do in courses after completion.

As with most of the nation, Southwest ISD transitioned to online instruction in response to the COVID-19 pandemic. Before the shutdown of schools, Southwest had an extensive technological infrastructure in place with an emphasis on incorporating technology into everyday instruction. Southwest ISD is a one-to-one district, which means every student is provided with an electronic device. Students were not required to acquire their own device, and if a student did not have a device prior to schools closing, they could acquire one from the technology department. The regular incorporation of technology combined with the availability of electronic devices made the transition to virtual learning relatively seamless.

The Problem

Algebra is a foundational course and is one of the few areas of mathematics students learn from as early as preschool and focuses primarily on one area of mathematics. Algebra is described as a gate-keeping course that propels students to a higher track of mathematics courses or limits access for students' academic and professional futures (Singh & Granville, 1998; Silva et al., 1990). African American students are afforded fewer opportunities to enroll in such gate-keeper courses in eighth grade. This initiative is demanding in nature; however, it increases postsecondary opportunities in schools where African American students are in the majority (Ladson-Billings, 1997). The foundational (Walker & Senger, 2007) and sequential nature of mathematics courses emphasize the importance of examining the factors associated with enrollment in algebra among African American students' futures (Singh & Granville, 1998). African American students have difficulty recognizing the importance of enrolling in

mathematics classes (Walker & Senger, 2007). Lacking this recognition, which translates to higher underperformance, ultimately requires an increased enrollment rate into remedial and developmental courses (Berenson et al., 1992). Students fail to understand the implicit skills developed in mathematics classes, and developing those skills are imperative to their success in the future.

Success in Algebra is vital as the course leads to success in subsequent higher-level courses and also postsecondary mathematics courses. The lack of success for African American students is apparent in Southwest ISD as they enroll in fewer advanced mathematics courses and score lower on the mathematics portions of college entrance exams. African American students are not mastering Algebra I at the same rate as the district. As a district, Southwest had 70% of students perform at the Meets Grade Level performance category of the STAAR Algebra I EOC in the spring of 2019, which indicates those students are highly likely to succeed in the next grade level but might require targeted academic intervention. The Masters Level indicates students require little to no intervention, and 50% of Southwest ISD students performed at this level. African American students' data show that they perform 63% and 39% respectfully according to these measures.

Relevant History of the Problem

A study by Duncan et al. (2008) showed that early math skills are one of the best predictors of later success. Furthermore, a predictor of postsecondary success is the completion of mathematical courses beyond Algebra II (Adelman, 2006). Furthermore, according to Complete College America (2016):

- 70% of African American students enrolled in community college, and almost half enrolled four-year institutions must complete at least one remedial course their first academic year.
- 59% of those students enroll in remedial math courses.

Tate (2017) discovered that nationally, 62.4 percent of students entering a four-year public university received a degree or certificate. African American men completed their degrees at the lowest rate of 40 percent. Students beginning at a two-year public institution received a credential at a rate of 39.2 percent. Starting at community college and then continuing at a four-year public institution improved outcome, depending on race and ethnicity. After six years, about one in 12 African American students finished their degrees.

Statistics indicate that campuses with a high percentage of minority students are more likely to have students who perform poorly in mathematics. Unfortunately, as the demographics of high school campuses in Southwest ISD have changed, and the minority population has increased, the statistics have reflected this statement. Many studies explore the factors causing low performance of students with low socioeconomic background. However, the low performance of African American students is not exclusive to those from low-income homes but materializes across all income levels and socioeconomics statuses of African American students. These students overall are not achieving at high levels, despite socioeconomic status. A myriad of factors causes this issue. They include but are not limited to (Moon & Singh, 2015) teachers' perception and expectations of students, cultural awareness, family educational background, parental involvement, students' self- concept and abilities towards mathematics.

Lower achieving students display difficulty with language skills and reading comprehension. Wyner et al. (2009) suggested instead of being recognized for their excellence and encouraged to strengthen their achievement, high achieving African American students enter the "achievement trap," a situation in which educators, policymakers, and the public assume they can fend for themselves when the facts show otherwise.

According to data retrieved from the Texas Education Agency (TEA) for 2015-16, African American students are performing well below state averages in all mathematic and success indicators:

- Across all students participating in STAAR assessments for math, 76% of students passed at the "Met Standard" indicator. African American students had a 63% passing rate at the same performance level.
- The state rate for postsecondary readiness is 46%, while African American students had a rate of 26%
- Statewide, 19.4%% of graduates are college-ready. The number dropped to 15.6% for African American students
- Students participating in Advanced Courses statewide for mathematics was 43.8% while decreasing to 36% for African American students.
- Texas students score an average of 482 on the mathematics portion of the SAT. African American students had an average of 422.
- The state graduation rate for the class of 2015 was 89%. For African American students, 85.2%

The only statistic which Southwest ISD does not align with is the state trends in the graduation rates. African American students are graduating at a higher rate than the district average.

Mathematics is fundamental in building skills students will need in the 21st century. Wan and Gut (2011) described those as:

- Critical thinking and using information to make judgments.
- Solving complex, multidisciplinary, open-ended problems.
- Creativity and entrepreneurial thinking
- Communication and collaboration across cultural, geographic, and language boundaries
- Making innovative use of knowledge, information, and opportunities to create new services, processes, and products.
- Making sound decisions about finance, health, and civic responsibilities.

Significance of the Problem

Implementing traditional teaching practice will not develop 21st-century skills necessary for students to be successful. Rote teaching strategies require students to memorize formulas and identify cues or keywords for when to apply them (Bransford et al., 2000) rather than identifying a problem and implementing developed skills to solve them. The US News and World Report (2012) suggested that even with unemployment at historically high levels, numerous jobs are going unfilled because of the lack of critical thinking and problem-solving skills. Many of these jobs require the need for an educational background in science, technology, engineering, and

mathematics. Jobs will require skills in these areas, collectively known as STEM. The National Council of Teachers of Mathematics (NCTM) president Matt Larson (2017) stated that Math IS STEM education.

The goal of offering professional development sessions is to train teachers to create meaningful and permanent learning experiences over more difficult topics. Designing lessons within a constructivist framework allows students to construct their knowledge and understanding. Students must reconcile new information with previous ideas and experiences. Teachers need to allow students to be active in their learning and create their own knowledge as much as possible. Furthermore, the training helps teachers understand how to raise their expectations for their students and incorporate aspects of student culture into their lessons. Infusing culture, combined with IBL, is a version of culturally responsive instruction.

Providing students with a point of entry creates access for them and encourages students to try no matter how little they might know, building their mathematical confidence. Several numeracy routines and launch activities assist in creating access to learning. Teachers must make every effort to build on not only prior knowledge but prior experiences as well.

Making connections to the interests of the students can be an essential strategy. Learning about students' interest adheres to culturally responsive pedagogy. Culturally responsive pedagogy is teaching and learning that empowers students "intellectually, socially, emotionally, and politically by using cultural references to impart knowledge, skills, and attitudes" (Ladson-Billings (as cited by Ware, 2006) p. 447). To maximize student success, they need to be actively involved in their learning (Boaler, 2008). When students are actively engaged, they are forming conjectures, using and applying methods, and representing and communicating ideas (Boaler,

2008). When taught in this manner, the information becomes more meaningful, and students can retain and apply the information.

When examining the achievement gap in math education, educators must understand that it is not only a low socioeconomic status problem, but the issue lies within the Africa-American community as a whole for urban, rural, or suburban; upper-, middle-, and low-class students; and parents with or without degrees. African American students are underachieving despite favorable or unfavorable circumstances. Implementing IBL strategies is a step toward eradicating the achievement gap. Inquiry-based learning empowers the student to take control of their learning and provides them with the support to do so. This learning paradigm also assists in changing classroom culture and expectations. All students have something to offer to the classroom. Teachers have to create space to encourage them to do so. In raising achievement with students within the lowest demographic range, I believe it will reflect throughout the learning community. Helping African American students achieve their full potential in mathematics not only provides them with opportunities later in life, but it will add value to their communities and hopefully rewrite the narrative for future generations.

Research Questions

The question which guided this study was: Does the implementation of inquiry-based learning strategies by teachers help improve the classroom learning environment for African American students in Algebra I? African American students continue to be the lowest performing demographic group. I used this research study to examine factors from the instructional perspective, which contribute to the narrowing of the achievement gap for African

American students. Therefore, the questions developed specifically for this study ask the following:

- What were the teacher participants' perceptions of their classroom environment and culture before and after the professional development sessions?
- What were the characteristics of the instruction teachers designed and delivered as they received PD sessions emphasizing the role of inquiry-based learning?
- To what extent the instruction teachers designed and delivered were culturally responsive to African American students?

Through this research, I examined the effectiveness of professional development sessions provided to train and demonstrate various teaching and implementation strategies. The outcomes offer insight into the efficacy of the training and how they can be improved. The results provided data for fellow teachers to consider when planning and for instructional purposes. The goal is to decrease the achievement gap of African American students and their peers, ensuring they will have an equal opportunity in their postsecondary careers.

Personal Context

Researcher's Role and Background

My journey through education has been a mixed blessing. I once thought I would never be a teacher. There was no way I could be responsible for someone else's child development. My first assignment was to make video recordings of teachers presenting their lessons at various elementary schools for a study contracted to the organization I for which I was working. For this same company, I became a tutor for first through fifth-grade students. However, it was when I became an AVID (Advancement Via Individual Determination) tutor that I entertained the idea

of becoming a teacher. The idea of the AVID program was one that I could relate to. I was a student who had all the potential but did not have an AVID to pull it out of me. I was the quiet kid who never got into trouble but also did not excel at anything. These characteristics followed me to college, where I struggled to do well. It was not a matter of cognitive ability, but I was never trained to work hard. My grades always came easily. I began at Southern Methodist University with the intent of majoring in computer science and completed my undergraduate degree in economics and finance. I planned to become a personal banker or financial advisor. I took the AVID tutoring job as a stopgap measure.

After working with those students, building relationships, and seeing myself in them, I decided to pursue my teacher certification. I am certified to teach 8-12 Mathematics. I received my master's degree from SMU in mathematics education. I have been a teacher of record for ten years and in the field of educations for roughly 15 years as a tutor and observer. I am currently the eighth-grade Pre-AP Algebra I teacher at a middle school in Southwest ISD. I hope to improve instructional practices and have them become more students centered and inclusive of all demographic backgrounds. My experiences have exposed me to all age groups and grade levels of students in an array of educational environments. I am also a college math adjunct professor, which furthers my experience and deepens my perspective. I believe teaching upper mathematics provides me with an invaluable perspective as I know how certain topics are taught and am better able to guide students in the direction which prepares them for the next level of mathematics. I began my career in low-performing schools in which traditional teaching methods were not effective. Learning and discovering student-centered methods to improve my students' outcomes has been a personal goal. My personality and background have been a great asset to

my career as I can build relationships with students, which makes them more open to trying different things and allows them to be open and honest about their education.

As a teacher, I have been required to attend many professional development sessions. A common concern is the application of the sessions to a teacher's classroom. I would like to move beyond rote practices filling requirements and obligations. Time is a precious commodity that cannot be replaced. Teachers should leave professional development sessions with a feeling of fulfillment and anxiousness to try what they learned in their classrooms. I hope to provide real research-based feedback to identify if professional development is, in fact, effective when teachers apply their newly learned practices in their classroom.

Journey to the Problem

As mentioned before, I have been an educator in schools which varied greatly in demographics and levels of performance. For the first four years of my career, I taught in schools that were lower-performing and in need of significant improvement in mathematics. Most research identifies low-socioeconomic backgrounds, parental involvement, and their environments as factors that contribute to the achievement gap. Those schools were Title I campuses with the majority of students receiving free or reduced lunch and coded "at-risk." The surrounding community offered few economic opportunities for the families it served. Therefore, the low performance of students on achievement tests was more easily understood because of those factors.

My next teaching assignment brought me to a school that was recently built in a rapidly developing area of the metroplex. The median home price was approximately $275,000, and the average family income was in the six-figure range. Most of my students' parents were college-

educated and many held advanced degrees. Their parents were very involved. To my surprise, my students experienced the same mathematical deficiencies as students in my prior assignments. This fact led me to believe that to understand the achievement gap requires one to examine other factors that do not receive as much notoriety as those previously mentioned.

No educational situation is perfect and presents its own set of problems. However, this was a near-perfect environment, one in which the school possessed and provided students with the tools necessary to be successful. Families appeared to have the means and attitudes to support their children. The staff was encouraging and committed to supporting the school in its mission to be admirable. I was shocked and intrigued why my African American students still performed below their peers. My studies during my master's program focused on factors contributing to the achievement gap and how to improve student outcomes. I learned the importance and effectiveness of student-centered learning and developing lessons and tasks to maximize student performance. While working in underperforming schools, I also attempted to address the factors outside the school's control, such as increasing parent involvement by providing them with tutorials and suggesting activities parents could do together with their children at home. Because those problems were not as widespread in Southwest ISD, and because these factors are beyond the control of what occurs outside of our school, I looked to examine factors within the school's control. Student-teacher relationships, classroom environment, and instructional strategies were a few of those factors and have been the focus of my doctoral studies.

Significant Stakeholders

The teachers participating in this study are the essential stakeholders as they are the individuals who deal directly with the students and, therefore, have the most influence in their

classrooms to effect change. They possess a desire to create classrooms in which all students feel safe, encouraged, and grow cognitively and emotionally. Understanding discrepancies in achievement, teachers need to be aware that by improving the educational outcomes of African American students they will be able then to increase the overall academic outcomes of all their students. Teachers were the recipients of professional development sessions and were exposed to sessions that focused on effective pedagogical strategies.

In addition to teachers, various administrative personnel have a stake in the results of this study, including the principal whose school will benefit from improved mathematics instruction. Also, individuals in the mathematics department, including the secondary coordinator and the Algebra I instructional coordinator who assisted in the planning, creation, implementation, and oversight of the professional development sessions provided in this study. These individuals benefit from the feedback on the effectiveness of the training supplied to teachers.

The parents and, most importantly, the students are the largest benefactors of this study. We (teachers and researchers) exist because they (students) exist. The goal of any educator and education system is to provide the students in that system with the best instruction possible to provide the optimal opportunity for success. As the students succeed, faculty and staff succeed. Student success, and failure, reflects the environment they matriculate through.

Important Terms

Achievement gap -- the disparity in academic outcomes between various groups of students.

Culturally responsive teaching—a pedagogy in which teachers display cultural competence and recognizes and includes cultural aspects of students into their learning.

Inquire-based learning (IBL) -- a learning approach that emphasizes the student's role in the learning process. Learning is student-centered rather than the teacher dominating the learning process. Students explore new material, inquire, and collaborate as the teacher facilitates.

State of Texas Assessment of Academic Readiness (STAAR) – the Texas state assessment that measures what students have learned in the state content standards

Student-centered learning – instructional practices that address various learning differences and relinquish some control of learning to the students.

Texas Essential Knowledge and Skills (TEKS) – the Texas state standards outlining what students should know and be able to do at a particular grade level in a particular content.

Closing Thoughts on Chapter I

Our leaders understand the importance of educating our students in STEM-oriented fields, and there have been policies to support and move education in that direction. To be successful in the global economy in the foreseeable future, it is imperative to educate and prepare our students to be qualified potential employees to fill the positions which will be available. Though jobs that require pushing off buttons or mindless tasks are still around, they are becoming more automated. How long will they be available? A robust mathematical education is the foundation of science, technology, and engineering and is more than a score on standardized tests or applying algorithms. Mathematics provides us the ability to think critically and logically across multiple fields. Mathematics develops skills to hypothesize, design experiments, analyze data, recognize patterns, formulate conclusions, and solve problems, skills necessary across many facets of life.

Though mathematics education is improving, the achievement gap for African American students in mathematics is not getting smaller. If it is not getting smaller, then African American students are not acquiring the skills needed to be successful or productive in the 21st century. The

current conversation about equality and justice for African Americans in America must include improving the educational trajectory for African American students, specifically in mathematics. The data presented above constructs a bleak outlook for the success of African American students and their future. Methods and practices to improve education for African American students are beneficial for all students.

Many methods of instruction are focused on memorization, exhaustive practice, calculator tricks, and test-taking skills. I believe those practices have their place in education; however, they should not dominate classroom instruction. A teacher lecturing their class has its place in education but should not dominate classroom instruction. Teaching students to understand and interact with the content is a more efficient and beneficial method of instruction. Inquiry-based learning practices makes the student the center of the learning process. IBL promotes engagement and sparks their interests. It gives students the keys to drive their learning while being culturally responsive and developing the skills of students to be productive citizens.

CHAPTER II

REVIEW OF SUPPORTING SCHOLARSHIP

Introduction

The achievement gap is a highly debated issue in U.S. education. The term refers to the evaluation of the constant disparity in standardized test scores, grade point averages, dropout rates, and college enrollment and completion rate between minority and White students. Underperformance among African American students is an ongoing problem, and mathematics serves as a predictor for postsecondary success.

The review of supporting scholarship in this chapter centers on circumstances that help create and preserve achievement gaps, and factors which cause the underachievement of African American students in mathematics. It focuses on the differences in family and school environments, setting expectations, cultural misalignment, pathways created through algebra, and instructional practices, specifically implementing inquiry-based learning. These efforts are discussed by examining literature that identifies socioeconomic and cultural issues that examine the community and are closely associated with school achievement. At times the literature reveals no agreement to the causes, and because of the complexity of the issue, there appears in the literature to be no single solution. However, continued effort and discussion must be done to produce the desired results.

Relevant Historical Background

Though improved in recent years, African American students continue to fall behind in mathematics. Many studies identify the issue of low achievement and performance in mathematics as an issue for students with low socioeconomic backgrounds. However, the matter of low production of African American students is not exclusive to those from low-income homes (Hughes, 2010). African American students overall are not achieving at levels comparable to their peers, despite socioeconomic status (Hughes, 2003). The achievement gap in education is a complex problem in education. The varying degrees of achievement between White students and African American students are massive and ongoing (Burton & Jones, 1982; Crain, 1971; Cohen et al., 2006; Diemer et al., 2016). The topic of low African American achievement is a consistent discussion. Factors generating low levels of performance include social-psychological, cultural identity and mistrust, parental involvement, and expectations (Irving & Hudley, 2008). Historically, environmentalists attribute this deficit to a deprived environment, and nativists believed the deficiency was genetically inherited. (Ginsburg & Russell, 1981). Researchers in neither area accounted for cultural differences. Currently, the average African American student's achievement is equivalent to the average White student's lowest quartile of achievement (Thompson et al., 2006). These differences cause dismal concerns after students graduate from high school. There is a smaller probability that African Americans will graduate from high school, receive a college or advanced degree, or be classified as a middle-class family (Berenson et al., 1992). Furthermore, African Americans are much more likely than Whites to suffer social complications, such as unemployment, dependency on welfare, and lack of resources that affect those with low income. Reducing the achievement gap not only increases

the performance of African Americans, but the social and economic differences that deepen the country's cultural strains would also be improved.

Researchers have long studied the underrepresentation of African American students in STEM (Science, Technology, Engineering, and Mathematics) oriented subjects and fields of study. Mathematics course enrollment, achievement, and career choice are highly disproportionate. Personal, family, and school factors affect the level at which students participate and achieve in mathematics (Singh & Granville, 1998). Past studies have primarily focused on variables such as mathematics course enrollment, peer and family influences on course enrollment decisions, and other school experiences with school personnel. However, discrepancies in mathematics course enrollment and achievement can be traced back to enrollment in algebra, which sets the course for enrollment in higher-level mathematics courses (Marrett & Gates, 1983). Since the inception of the STAAR series of exams, Texas has failed to raise its standards. Though students should acquire the prerequisite skills for placement in Algebra I from seventh and eighth grade, many are not entirely prepared as a result of the passing standard of the State of Texas Assessments of Academic Readiness (STAAR) exam being deficient. The minimum passing standard, the approaches grade-level standard, states that students are likely to succeed in the next grade level with targeted intervention. This level required a percentage score of 37%, which is well below a grade of 70% to pass the course (Texas Education Agency, 2017). The current study focuses on the underperformance in algebra among African American students and factors that operate to influence their participation in algebra. The literature presented established the theoretical and conceptual framework on which this study is grounded, and discusses the current trends of academic achievement in Algebra

among African Americans, the factors that affect that achievement, and concluded with strategies and suggestions that would assist raising this level of achievement.

Alignment with Action Research Traditions

Practitioners utilize action research to identify and solve problems within their local system to improve their practice and refine their actions. Action research is a "participatory process concerned with developing practical knowing in the pursuit of worthwhile human purposes" (Ivanka, 2014, p. 28). Action research seeks to unite action and reflection, theory, and practice while seeking real-world solutions to problems of pressing concern to people close to the situation. Ivanka continues to describe action research as a living process which cannot be forecasted but changes and evolves as an understanding of the issue is deepened for those involved and empowers them to inquire and collaborate solutions. The essential features of action research include a focus on practice in an actual scenario in which the practitioner has an active role. It is also essential for those involved to exhibit self-evaluation and reflection in pursuit of social change.

Though there are many iterations and interpretations of the action research process, Lewin (1946), who is credited with creating the action research term, supplied the first model which involves four stages: reflecting, planning, acting, and observing. The process can be repeated as needed to revise and improve until the issue is resolved.

The initial reflection step involves identifying and understanding the problem. The problem focus of this study is the need to decrease the achievement gap of African American students in Algebra I. My district wishes to have all students master Algebra I. African American students are the lowest performing demographic group. To improve the academic outcomes for

all students, it is necessary to improve those for African American students. First, the researcher must plan an intervention to address the problem. Improving instructional practices will improve student performance. Inquiry-based learning practices have been shown to improve the education of all students, especially African American students. Professional development sessions were prescribed to provide teachers with options to ensure their classrooms are student-focused, and teachers use pedagogical strategies to optimize student learning. The next stage was acting. Teachers used the skills acquired in the professional development sessions with their classes, and while observing, the final stage, their progress, was tracked for academic and classroom environment improvements. Teacher feedback and classroom observations provide the information for the cycling of the reflection stage in which the results were analyzed for revision and further implementation.

In addition to improving the scenario of the organization being researched, action research provides the opportunity to inform the development of theory, with the exploration of the phenomena observed in the organic setting of the environment being studied (Forrest, 2007). The application of the treatment can be explored further and possibly be used in other settings.

Theoretical and Conceptual Framework

Research problems are addressed with theoretical frameworks. A theoretical framework is the perspective through which the problem is viewed (Roberts, 2010). The framework for this study consists of a constructivist approach, culturally responsive teaching, and the model of teacher change. Constructivists endorse the idea of the existence of multiple realities. The natural setting or situation gives context to what is known (Creswell, 2014). Researchers desire to

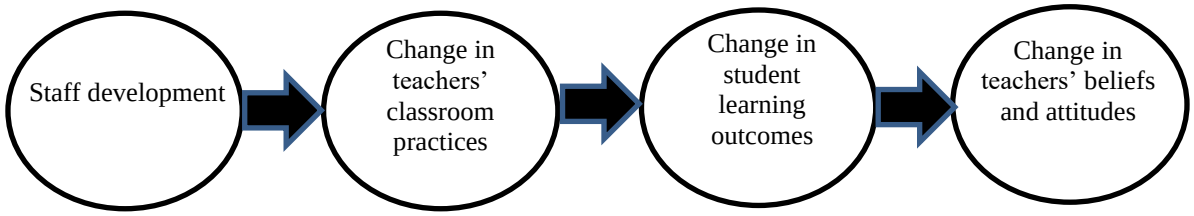
understand the situation and focus on the participants of the situation. They build understanding through multiple perspectives of the individual involved, imperative to discovering deep and meaningful understanding. The participants in this study are the teachers of Southwest High School. The teachers offer various backgrounds and experiences that have created their worldview. Researchers simply observe participants in their setting and seek little to no control over the events within a study (Merriam, 2009). For this study, it was imperative to understand teachers' perspectives of their instructional practices and classroom environment and if they were effectively closing the achievement gap. The analyses of teachers' perceptions of IBL for improving instruction and the environment were essential to this research.

Classroom demographics are ever-changing. Not only are the students changing, but teachers are also, both groups with their cultural perspectives. Culturally responsive teaching, also referred to as culturally relevant teaching, is a pedagogy that acknowledges and even celebrates the differences of classroom participants. It recognizes the necessity of recognizing the culture of students and incorporating it into all aspects of their learning (Ladson-Billings, 1994). When teachers incorporate ethnically and culturally diverse material into the curriculum and develop knowledge about cultural diversity, instruction is more effective (Garcia et al., 2010; Seidi, 2007). Students appreciate and respect authentic relationships with their teachers. They often make it a priority not to disappoint their teacher when they have a positive relationship. Appreciation and respect allow teachers to be more effective. When teachers display that they care and focus on building relationships with students, families, and the school-community, instruction is positively impacted (Applin, 2010). Furthermore, as teachers can respond to a diverse student population and their unique needs with differentiated, student-centered, and

culturally corresponding instruction, student engagement, teacher effectiveness, and student results can benefit positively. Learning becomes cooperative, collaborative, and community oriented as students direct their leaning (Goldstein, 1999). Students develop self- confidence and become proactive as the teacher serves as facilitator.

The instructional practices teachers implement in their classrooms are primarily predicated on their own experiences, be it their own classroom experiences or their practice as a teacher. Guskey's (1986) teacher change theory, illustrated in Figure 2.1, assumes teachers implement or change their instructional practices to alternate ones that have been proven to be effective.

Figure 2.1
A Model of the Process of Teacher Change



Note: Adapted from Guskey, T. R. (1986).

Professional development sessions are a means to introduce, plan, or rehearse new instructional practices. Teachers are more likely to implement new practices if they perceive them as useful or if there has been prior success utilizing practices, and student learning is affected positively. Practices that are deemed effective are retained and then added to a teacher's new instructional repertoire. As teachers remain in their positions longer, and demographics shift, continuing high-quality professional development becomes a central component to alter professional practices and improve student learning.

Most Significant Research and Practice Studies

The Achievement Gap

High achievement can be described as performing at a level beyond that of one's peers. Mastering material beyond grade-level demonstrates proficiency. Creative problem solving, rapid learning, and complex thinking are characteristics of high achievers (Burney & Beilke, 2008). There have been roadblocks measuring and identifying high achievers. The states established standards for learning and what they should know. Therefore, when students are tested, the test is aligned with these standards that comply with No Child Left Behind legislation, which does not measure achievement beyond the current grade level. Levels beyond basic proficiency may not show advanced or more in-depth knowledge (U.S. Department of Education, 2003). For instance, the most advanced level of the State of Texas Assessment of Academic Readiness (STAAR), masters grade level, stated "performance in this category indicates that students are well prepared for the next grade or course. They demonstrate the ability to think critically and apply the assessed knowledge and skills in varied contexts, both familiar and unfamiliar" (Texas Education Agency, 2017). Students in this category are presumed to be highly successful in the next grade or course with little or no academic intervention. Not measured or even addressed is the level of postsecondary success a student might exhibit.

An achievement gap continues to exist. There is a considerable discrepancy in patterns of achievement between African American and White students (Whaley & Noel, 2012; Hughes, 2003). African American students tend to have lower grade point averages and lower aptitude scores than White students. The 2007 National Assessment of Educational Progress showed

higher rates of readiness for White children than for African American students. African American students have higher dropout rates, and even when they complete high school, they are less likely to enroll in college. Academic preparation for postsecondary educational pursuits should weigh heavily in predicting achievement (Thompson et al., 2006). The ACT, SAT, or Advanced Placement tests, used for college admissions, provide a measure of higher levels of achievement (Lorah et al., 2013). Findings have also shown that high school experiences, such as course-taking patterns, participation in advanced level courses, grade point average, and involvement in school-related activities, are associated with high achievement (Burney & Beilke, 2008). Lower-achieving students often display difficulty with language skills and reading.

In comparison to higher-achieving children, they are not as accurate when completing mathematical tasks such as word problems or addition and subtraction. Students are often designated to lower school pathways as schools become aware of low student performance and are forced to take lower-level courses or vocational courses that do not necessarily prepare them for higher education. Lower socioeconomic status ultimately contributes to lower academic performance and lower rates of academic progress.

Family Environment

Economic deprivation among children is a significant influence on various educational and social-emotional outcomes and risk factors for achievement difficulties (Irvin, 2012). Families from lower socioeconomic backgrounds struggle to provide academic support for their children. Lack of time and finances afford limited options to create a learning environment in the home. These households cannot provide adequate reading material, technological opportunities, or tutoring (Ocampo & Bascos-Ocampo, 2015). However, finances are not the primary factor. In

a book titled The Gift of Education: How a Tuition Guarantee Program Changed the Lives of Inner-City Youth (2006), Newberg displayed the complicated relationship between poverty and being persistent in education. The students were offered a free college education if they graduated from high school. Of the 112 students, 65% of them were from families in poverty, and 100% were African American. The students were offered extensive counseling, remediation, and other support, but despite the incentive offered far fewer graduated than expected. The lack of response proved that money could not solve the problem of poverty, and finances were not an underlying factor. Students' academic achievement is negatively affected when there is not a positive learning environment at home.

African American children with backgrounds from other cultures outside of Western American culture had more parental involvement ranging from school visits to practices regarding education, such as assisting students with homework and conversing about academic issues resulted in support for those students. The result of such communication was increased student success in light of reinforcement and active interest from parents in the home and at school (Pinder, 2010). Parental involvement deals with parental expectations, parental investment, parental participation in schools, and family community (Fisher, 2005; Kotok, 2017). These findings were inversely stated regarding African American students in Lee and Bowen's (2006) study, which argued that academic achievement suffered when parents were not involved with their children's schoolwork. Parents also contribute mathematical failure to their struggles in mathematics (Kotok, 2017). Teachers involved in the study confirmed that parents who were less involved in their child's academic studies resulted in children with lower academic

achievement. The link is that involved parents produce enhanced academic performance, whereas uninvolved parents are associated with underachieving students.

Setting Expectations

Closing the academic achievement gap and raising student and parent expectations are and have been a daunting task. The complexity of the problem makes solving it challenging to explain from any one direction, therefore, requiring an array of solutions. Cohen et al. (2006) administered self-affirmation interventions created to reduce threat and attempted to improve the academic achievement of negatively labeled students. These researchers found that allowing the students to reaffirm their self-integrity and alleviating psychological threats can improve achievement. One other possible solution found was avoiding positive feedback bias. Harber et al. (2012) examined a positive bias of Whites' feedback to African Americans. Students who frequently received positive feedback might have been misled to believe their efforts in a poorly executed assignment are enough, undermining academic achievement. Instead, offer genuine praise and constructive criticism when it is deserved, which will increase expectations and show more academic growth. Another solution is to increase parental involvement. Pinder (2012) found that students that had highly involved parents displayed higher academic success. Involvement included assisting students with homework, attending school meetings and events, and speaking with teachers and the student consistently about academic issues. These parents also held their children to higher expectations, for instance, encouraging their children to take extra science classes and then motivating them to be successful in the classes. Schools and teachers can expect much from students, but the same expectations can be undermined if they are not expected at home first.

Teachers raise expectations when teachers become warm demanders. These teachers provide a tough-minded, no-nonsense, structured, and disciplined classroom environment for students whom society has psychologically and physically abandoned (James Vasquez (as cited by Irvine, 2016)). Warm demanders expect much from their students. However, they provide environment and support for students to meet those expectations and increase their level of achievement. According to Ladson-Billings and Siddle-Walker (as cited by Bonner, 2014, p. 378), successful teachers of African American students maintain high expectations for their students, "fostering not only essential skills and understanding but also critical perspectives and understanding of students of color" (p. 378). These teachers believe that all students can be successful. They foster cultural identities and integrate the students' "funds of knowledge," which derive from cultural and community customs.

Cultural Misalignment

Seeing oneself as good, honorable, and successful is a primary human motivation. Self-integrity is often measured by membership in valued social groups. A resilient, constructive cultural identity is consistent with academic achievement (Cohen et al., 2006). When negatively characterized, one's group might feel threatened. Cultural mistrust, the tendency for African Americans to distrust institutional, personal, or social contexts that are controlled by Whites, and oppositional cultural attitudes significantly predicted academic achievement (Irving & Hudley, 2008). The presence of these undermines educational expectations and, therefore, lowers academic achievement. Most African Americans do, in fact, value education (Barnett, 2004). However, poorly maintained, underfunded schools, unprepared, and undertrained teachers give African Americans reasons not to trust schools to provide them with a good education (Jordan &

Cooper, 2003). This distrust, in turn, directs a child's attention to non-academic activities that conflict with academic achievement.

Theories suggest that African Americans' academic achievement has undermined. Whaley and Noel (2012) refer to one cause as identifying African American culture with the cultural incompatibility theory. Pinder (2012) analyzed the educational achievement gaps among students of African descent and believed African American children achieved less academically than children of other African cultural backgrounds due to the differences in cultural values, attitudes, norms, and traditions. One primary factor included the idea that academic success equated to "acting White," and the belief that White students are generally more academically successful (Pinder, 2012, p. 120). African American students who were unable to release "racial and ethnic stereotypes and beliefs" and transition into "self-acceptance of one's race and identifying positively with acceptance of others different from oneself" achieved less academically (p. 124). African American students' ideology does not align with the "American achievement ideology," making them a higher risk to disassociate themselves from the school and decline using academic success as motivation (Brown & Jones, 2004). Those able to move into a more "mature ethnic identity level," while accepting others' cultures, experienced more academic success, so the idea of more adaptable assimilation on the part of the African American student was also a variable in academic success (Irvin, 2012). It is the task of educators to make academics more motivating and culturally relevant.

School Environment

The environment of the school contributes to academic achievement. Racism in the school and larger society negatively affects academic achievement and motivation among

African American students (Brown & Jones, 2004; Helmrich, 2010). Teachers, at times, have low expectations for African American students while also grading them more harshly. Teacher differential impacts how teachers disperse discipline (Diemer et al., 2016). As African American students receive a disproportionate amount of discipline, teacher-student relationships become more negative.

Furthermore, high teacher turnover, few resources, and teachers with little experience are characteristics of schools with a negative environment. Factors such as these discourage more qualified teachers from offering their services, further weakening a school's climate and leaving them with less experienced and less effective teachers (Podolsky et al., 2019). Students feel the effects of an ineffective teacher for years after they are no longer in their class (Hughes, 2003). Creating a positive environment learning environment helps ensure that not only students are in a position to achievement, but also entices teachers to see those students succeed.

Instructional Practices

The lower the level of the student success rate in Algebra I, the less focus teachers place on their instructional practices. Teachers revert to traditional practices of lectures and teaching to the test (Ciaccio, 2004). Teachers are less likely to use data to inform their instructional decisions and interventions as the number of students needing intervention increases, especially because the benefits of transitioning to more student-centered instructional methods are not realized immediately (Kogan & Laursen, 2014). It is imperative to investigate and operationalize the constructs, which influenced curriculum and instruction to assist minority populations in achieving their full potential (Brown & Jones, 2004). Traditional methods of instruction present mathematics as a collection of rules and procedures which students memorize and practice

passively at the teacher's direction (Romberg, 1992). Low performing students benefit more from untraditional teaching practices (Vigdor, 2013). Student-centered or reformed-based techniques, such as inquiry-based learning, improves content knowledge. Inquiry-based learning emphasizes conceptual knowledge of mathematics while connecting students' prior knowledge to new experiences and interests (Jong et al., 2010). Relevant mathematics instruction by teachers can improve the self-concept of African American students' mathematics abilities (Diemer et al., 2016). When mathematics is relevant and incorporates the students' interests, they are better able to make connections to the material.

When mathematics is connected to the student's experiences and interests, they are more inclined to be motivated and complete mathematical tasks. Implementing inquiry-based learning approaches involves students engaging in rich mathematical learning (Tang et al., 2019). Participation in authentic mathematical experiences is necessary when doing mathematics (Cook et al., 2016). Students perform at optimal levels when they are actively involved in their learning by forming conjectures, using and applying methods and representing and communicating ideas (Boaler, 2008). Inquiry-based learning invites and encourages students to engage in meaningful, multidirectional discourse.

Student confidence increases as students find content more applicable to their lives and interest. The impact of these pedagogical strategies needs to be examined and changes made if they are not sufficient. Small meaningful activities can be implemented by teachers as self-affirmation intervention exercises. These short-written exercises probe students by asking them to reflect on their values. Researchers (Cohen et al., 2006) believe these interventions work by helping students become more resilient and self-assured. Cohen et al. (2006) tested a self-

affirmation intervention created to reduce the threat, and whether it would enhance the academic achievement of negatively stereotyped students. These researchers found that allowing the students to reaffirm their self-integrity and alleviating psychological threats can improve achievement.

Closing Thoughts on Chapter II

Both factors at school and factors outside of the classroom affect achievement in mathematics. Furthermore, the circumstances that increase learning in school and out of school are interconnected. For example, affluent populations with families that place a higher value on education are likely to have better schools, appeal to good teachers, and have effective communications among parents and teachers. Communities described as families with low incomes are likely to have schools with fewer resources to attract highly qualified teachers. These schools are also more likely to use traditional teaching approaches as the primary method of instruction. Cultural differences among African Americans affect mathematics achievement despite their level of income or quality of the school. Inquiry-based learning presents the opportunity to improve mathematical education while making cultural connections simultaneously.

The importance of mathematics to the trajectory of students' lives makes doing more to close the gap and raise achievement imperative. Closing the gap is multi-faceted. Educators must hold themselves responsible for enhancing school environments when and where possible. While doing so, there must be some recognition that the achievement gap has deep origins. The responsibility to generate situations that eradicate obstacles to cognitive development and

support learning in the home belongs to the government, communities, neighborhoods, and families. It takes a village to raise a child.

There has not been a concentrated effort in building the expectations and closing the achievement gap for African American students in Southwest ISD. Southwest has already begun using accelerated courses to bridge the gap for those students entering high school but did not do well on in eighth-grade mathematics. Students and teachers would benefit from training focusing on culturally responsive instruction. Also, a parent support program would provide parents tools and information to be adequately supportive of their children.

CHAPTER III

SOLUTION AND METHOD

A guiding statement in Southwest Independent School District's Vision 2020 suggests students will demonstrate mastery of Algebra I by the end of the ninth grade. The district uses the Meets Grade Level standard as the criteria for students mastering Algebra I. Since the 2014-15 school year when I began working in Southwest ISD. It has continued to improve towards that goal. Currently, the goal is to have 85% of students score at the Meets Grade Level performance standard by 2021. Though continually improving overall, African American students are not keeping pace with this goal. At the current rate, African American students will not meet the district's aspired goal. Cultural differences, student expectations, instructional practices, and low mathematics confidence are issues contributing to the slower increase in achievement for African American students. Inquiry-based learning has been shown in previous literature to address some of these concerns by creating a challenging but supportive classroom environment. The district has encouraged and required the implementation of more inquiry-based and student-centered learning. These strategies have not been explicitly measured for their effectiveness.

Outline of the Proposed Solution

I designed professional development sessions to improve teacher efficacy when using IBL strategies. The *Panorama Teacher Survey* was conducted to gather information on teachers' perspectives of their classroom instructional methods and the environment they have created for their students. The survey results provided insight into factors that affected their classroom

environment. The results also revealed how teachers perceived the effectiveness of district-sponsored professional development, and their willingness to implement the skills from the training in their classroom, while also understanding student-teacher relationships and connections with students of different cultures. The results of the survey provided a baseline of the teachers' perceptions of their classroom before implementing the professional development sessions and the content and direction of the focus group interview. My goal was to understand teachers' thoughts behind the numbers, and this was accomplished through the focus group interview.

Over four weeks, professional development sessions were provided to equip teachers with the necessary skills and guidance to create an IBL environment. As the district has moved to online learning, various platforms and applications were discussed to assist with IBL from a distance due to COVID-19 restrictions. Teachers used Microsoft TEAMS to conduct live learning sessions and Canvas to host discussions on the discussion board. The results of the *Panorama Teacher Survey* revealed their perspectives of their classrooms and school environment. After analyzing the survey data, I used the information to design professional development sessions that incorporated areas with less favorable responses. During the professional development sessions, informal discussions were assessing to solicit feedback from teachers of the usefulness and engagement of the sessions. Teachers also voiced their standpoint of district-provided training and its effectiveness during these informal discussions. I also probed teachers about their classroom structure and environment during these informal discussions.

After the professional development sessions were conducted, I used the *Reformed Teaching Observation* protocol to observe the classroom instruction and environment of the

teachers. I debriefed with teachers concerning their inquiry-based lessons and exchange feedback. After all professional development sessions and classroom observations, teachers participated in a focus group interview, which enabled me to analyze their perspectives and determine if there was any change from pre to post.

Justification of Proposed Solution

During my time in Southwest ISD, I have observed the instructional practices of various teachers with an array of backgrounds and experiences. Teachers with more experience tend to have more traditional, teacher-centered teaching methods. In contrast, younger teachers, though they might still be more traditionally oriented, are more open to learning effective methods of instruction. After speaking with district-level administration, it was determined that some Algebra I teachers insist on using the methods in which they have been successful. Their success was predicated on "approaches grade level" STAAR performance standard, which requires students score about 37% on the Algebra EOC assessment. The district made the "meets grade level" category the standard. African American students are the lowest performing demographic in this category. I wanted to understand from a teacher's perspective why African American students are the lowest performing, and if implementing IBL practices would be effective. The district administration desires to identify if classrooms are truly student-centered and wants to determine if, as IBL practices are implemented in the classroom, the classroom orientation will also shift and increase student achievement.

Teachers have the most significant influence on students within an education system (Alton-Lee, 2003) and directly impact student achievement (Rowan et al., 2002). As teacher instructional strategies improve, student achievement will follow. The professional development

provided during this study was designed to improve teacher instruction and the overall classroom environment. Past researchers (Goldstein, 1999) have shown that teachers gained confidence by implementing strategies that shifted their classrooms to a more student-centered one. This professional development was created to focus on developing a more student-centered classroom in order to narrow the achievement gap. Inquiry-based learning was promoted to encourage active learning to enable their students to ask questions and make connections. We discussed how students develop self-direction and initiative, skills which are often deficient in lower-achieving students (Goldstein, 1999). Inquiry-based learning empowers and encourages students to take control of their learning (Timperley et al., 2007). Students understand their learning as teachers transitioned to facilitators. We discussed how students retain information more efficiently, which can aid them in mathematics classes in the future.

Study Context and Participants

Southwest High School (SWHS) is the designated campus for this study. This school is chosen as it has a diverse population of students enrolled in Algebra I and a diverse staff teaching it. The racial make-up of SWHS consists of 37.1% African American, 26.2% White, and 24.7% Hispanic students (TEA, 2019). The socioeconomic background of the students is also diverse, including 24.7% of students receiving free or reduced lunch.

Eight Algebra I teachers (Teachers A- H) participated in the study. The identities of the remained anonymous and Table 3.1 displays their profiles. The district Algebra I Instructional coach assisted in overseeing PLC professional development and classroom observations. Each teacher participated and completed the *Panorama Teacher Survey*. Informal discussions were

held during the during PLC meetings and were asked follow-up interview questions in a more informal setting.

Table 3.1
IBL Instruction Teacher Profiles

Identity	Age	Gender	Ethnicity	Years of Experience
Teacher A	33	Male	White	10
Teacher B	56	Male	White	22
Teacher C	47	Female	White	18
Teacher D	28	Female	Hispanic	7
Teacher E	42	Female	White	15
Teacher F	37	Female	African American	13
Teacher G	42	Male	African American	13
Teacher H	44	Female	White	17

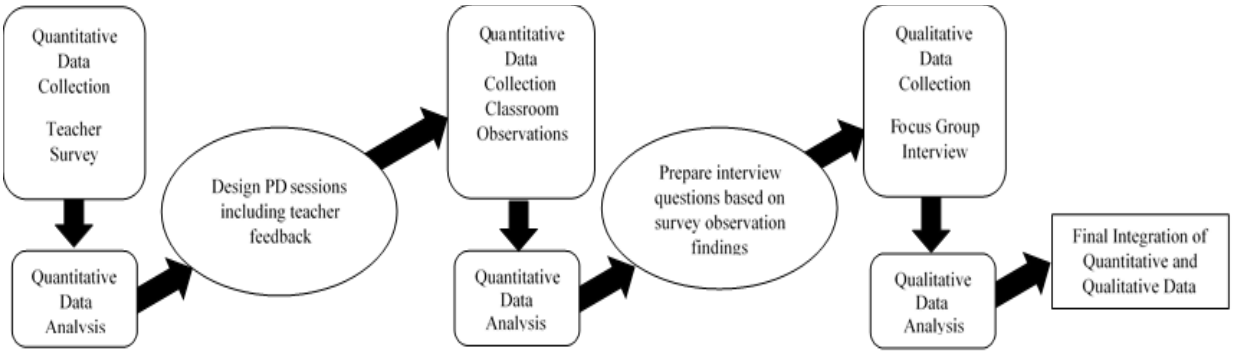
The teachers chosen to be observed were chosen to provide feedback from teachers of various backgrounds and experiences. In addition to demographic differences, the teachers' instructional styles varied, ranging from novice to IBL strategies to those who are well-versed.

Research Paradigm

The purpose of this study was to identify the effect of IBL instructional practices on the cultural and academic environment in mathematics classrooms. This mixed methods study consisted of both quantitative and qualitative data collected sequentially. Figure 3.1 displays the flowchart of the research paradigm. The initial strand was the collection of data from the *Panorama Teacher Survey,* which was analyzed quantitatively. The goal of the survey was to identify teachers' attitudes and perceptions of their classroom environment and teaching strategies concurrent quantitative strand included classroom observations using the *Reformed*

Teaching Observation Protocol (RTOP), which measured how student-centeredness of classroom instruction. The qualitative strand was collected via a focus group interview to provide holistic feedback from everyone representing various demographical backgrounds. I also wanted to understand their cultural connectedness. Furthermore, teacher input for current professional development effectiveness and needs were sought.

Figure 3.1
Flowchart of Research Paradigm



Data Collection Methods

This mixed methods study was first introduced to the Southwest ISD mathematics department and the Southwest High School Algebra I team during the Fall of 2018. I discussed with the mathematics team the purpose of the study, which was to identify if implementing IBL strategies with fidelity could effectively improve the classroom environment and culture, thereby increasing student achievement. All data and information collected remained anonymous, as well as pseudonyms used in the place of nominal identifiers. This study was determined as not involving human subjects (Appendix D).

The school can only control what happens on campus. Therefore, the focus of the study was the teachers and their perspectives. During this sequential mixed methods study (Figure 3.1),

data were collected with a survey and were analyzed quantitatively. Both quantitative and qualitative data were collected with classroom observations, which was followed by a focus group interview that collected additional qualitative data. The choice of administering a survey allowed each teacher on the SWHS Algebra I team an opportunity to share their perspective and experiences as teachers in SWHS. The nature of the survey questions also provided an opportunity for the teachers to share insights into their classroom environment and connection to other cultures. Lastly, participation in the survey offered teachers a chance to express their satisfaction with the district's provided professional development options.

The feedback from the informal discussions during the professional learning committee (PLC) meetings provided instructional, developmental feedback from the teachers and discussed the effectiveness of the IBL practices and topics to be covered. Table 1 summarized a portion of the topics covered in meetings.

After the meeting ended, when teachers taught their students during the semester, data were collected through classroom observations using the Reformed Teaching Observation Protocol (RTOP) (see Appendix C) to measure classroom change or "reform" (Sawada et al., 2002). This observation tool was created by the Evaluation Facilitation Group of the Arizona Collaborative of Excellence in the Preparation of Teachers. Data were collected from classroom observations to understand further the utilization of the intervention in a natural classroom setting. The RTOP also served as an affirmation of the effectiveness of the professional development sessions focused on administering student-centered instruction.

The teacher focus group interview was administered to engage in the discourse of the results of implementing IBL strategies and offer insight from various demographic groups

represented at SWHS. The focus group interview allowed teachers to share their perceptions of their classroom environment and their familiarity and comfort with IBL strategies. At the same time, identifying changes in the teacher's perceptions of their classroom, the effectiveness of the professional development in implementing more student-centered instructional practices, and if the instructional practices were more culturally responsive.

Data Sources and Analysis

I implemented a mixed methods study to measure the fidelity of implementation and effectiveness of IBL. Measuring the effectiveness of implementation is necessary to identify areas of strength and weakness in teaching strategies. Data were necessary to find areas of strength which can then be implemented district-wide in not only Algebra I courses, but in other mathematics courses as well. Recognizing teaching aspects in which teachers demonstrate weakness provides an opportunity to create professional development options made to improve teacher instruction and classroom environment. Preliminary data were collected through the *Panorama Teacher Survey* (see Appendix A) with the Algebra I team. The *Panorama Teacher Survey* was created by Gehlbach and Brinkworth (2011) using a six-step design. The design of each question adheres to the science of best survey practices (Dillman et al., 2014). The survey consists of 10 scales from which a researcher may choose from depending on the needs and information they are seeking. The survey can be customized using only the scales which are pertinent to their research purposes. The main contents of this study are centered around: teachers' perceptions of professional development opportunities, classroom confidence, relationships with colleagues, school leadership, and cultural awareness. Therefore, the five

categories I used for this survey included: classroom climate, professional learning, teaching efficacy, educating all students, and testing.

The data collection utilized the *Panorama Teacher Survey* as a panel survey and the categories were chosen specifically for this study. Panel surveys collect data from the same population multiple times (Loghi & Nandi, 2015). The smaller population for my study allowed for each teacher to participate in the survey and share their experiences from similar content and student demographics, but different personal teaching characteristics and varying perspectives of IBL. I designed this survey to understand the attitudes and perceptions of the teaching environment for the Algebra I teachers at SWHS. The initial findings created a baseline with which to compare at the end of the study. A benefit of panel surveys is the ability to observe changes over time to the same group of respondents (De Keulenaer, 2008). To this end, the survey provided me information about the effectiveness of the professional development sessions on the teachers' instructional practices and how they felt their classrooms benefited.

The data collected from the surveys were analyzed using descriptive statistical analysis. Descriptive statistics is the most common method of analyzing and presenting quantitative data in action research (Ivankova, 2014). Responses to individual questions within each category were coded on 5-point Likert scales. For instance, the professional learning category included the range "not at all supportive," "slightly supportive," "somewhat supportive," "quite supportive," and "extremely supportive." The last two were favorable responses. A question's score consisted of the percentage of teachers selecting a favorable response; the mean was calculated to produce favorability scores for each question to produce overall scores for each category. The feedback from the survey generated specific instructional, developmental needs of the teachers. It

determined what practices and topics to be covered in the professional learning community (PLC) meetings seen throughout Table 3.2.

Table 3.2
Timeline for the Study

Mo	Wk	Contact/Activity	Collect
March	3	Administered Panorama Teacher Survey with high school Algebra I team	Qualitative data
	4	PLC Meeting- demonstrated and discussed the use of a unit launch.	
	5	PLC Meeting- demonstrated the implementation of a discovery lesson covering key quadratic attributes.	
		Completed classroom observation	
April	1	PLC Meeting- Discussed previous lesson effectiveness and worked through transformations discovery activity and tied transformations to prior knowledge.	
		Completed classroom observation	Qualitative data
	2	PLC Meeting- demonstrated the use of technology to explore graphing quadratic functions.	
		Completed classroom observation	
	3	PLC Meeting- Discussed students' prior experience with solving polynomial functions and the connection to quadratic functions.	
		Completed classroom observations.	
	5	Conducted focus group interview.	Qualitative data
May- July	1	Analyzed collected data	Qualitative data and Quantitative data
	2-4		

Additionally, data were collected through classroom observations using the *Reformed Teaching Observation Protocol* (RTOP) (see Appendix B) to measure classroom change or "reform" (Sawada et al., 2002). This observation tool was created by the Evaluation Facilitation

Group of the Arizona Collaborative of Excellence in the Preparation of Teachers and is used to characterize any classroom on a quantitative scale of reform. The purpose of the classroom observation component is to gain an overall view of the level of cognitive demand of instruction and variability between each classroom (City et al., 2009). The structure of the RTOP consists of 24 items divided into three sections: Lesson Design and Implementation (n=5), Content which is divided into the two subsections of Propositional Knowledge (n=5) and Procedural Knowledge (n=5), and Classroom Culture also containing two subsections of Communicative Interactions (n=5) and Student/Teacher Interactions (n=5) (Piburn & Sawada, 2000). The second and third sections are each divided into two smaller groups of five items. The first section described a lesson that recognized students' prior knowledge and preconceptions, attempted to engage students as members of a learning community, valued a variety of solutions to problems, and was guided by ideas generated by students. The second section evaluated the content and was divided into two parts. The first measured the quality of the content of the lesson. The second attempted to capture the understanding of the process of inquiry. The final section, consisting of ten items, assessed the climate of the classroom.

The authors of the observation instrument had the intention of capturing every aspect of reformed teaching with the 25 items. The five items in each section were described on a five-point (0-4) Likert scale and then tallied. Summing the 25 item scores result in an RTOP lesson score ranging from 0–100. Classrooms are characterized on a spectrum that describes the degree of reformed teaching present from instruction, which ranges from traditional to reformed-based. Category descriptions of the spectrum can be seen in Figure 3.2. Typical scores of lessons which

are traditional are <30, instructive <40, transitional <50, responsive <70, and a reformed based lesson scored above70 (Macisaac & Falconer, 2002)

Figure 3.2
Category Descriptions of RTOP

Category	Description
Traditional	Focus on information and transmission; teacher role is to deliver information.
Instructive	Focus on providing experiences, teacher focus, or teacher decision; teacher organizes instruction.
Transitional	Focus on student/teacher relationships, subjective decisions, or affective response; teacher guides students in understanding.
Responsive	Focus on collaboration, feedback, or knowledge development; teacher organizes classroom so students can take charge of their own learning.
Reform based	Focus on mediating student knowledge or interactions; teacher modifies instruction on the basis of student learning.

Note: From Luft and Roehrig, 2007.

The RTOP included a section for field notes which the authors of the instrument described as a means of placing the observation instrument into context. This section included a description of the classroom setting, the topic covered, the activities utilized, and any interesting feedback which occurred during the observation. This information was not used in the final tabulation of the RTOP spectrum. However, inductive analysis of the observation notes was used to provide a picture of events that occurred during the instructional segment (Ivankova, 2014). Using this approach allowed me to locate connections to the qualitative data from the observations and the focus group interviews which occurred subsequently. The steps to analyze the data included (Creswell & Plano Clark, 2018):

- Organizing the data,
- Reviewing the data to establish a general understanding,
- Coding and developing a codebook,
- Using the coding to describe the setting and themes for analysis

- Deciding how to represent the data
- Interpreting the meaning of the results.

The process of analyzing qualitative data, referred to as theorizing, enables researchers to make meaning of the data and enables a general understanding of the problem being studied while preserving the intricacy of experiences and their practical and personally relevant explanations. The product of the process a set of themes and categories with connected codes and descriptions that provide an effective method to communicate the results to pursue further action (Stringer, 2014). Using an inductive thematic approach to qualitative data analysis is consistent with the methodological features of mixed methods action research designs (Ivankova, 2014). The practitioner-researcher can connect the qualitative findings in the form of themes, categories, or even codes, to the quantitative test results.

The SWHS Algebra I teachers also participated in a focus group interview. This group interview was conducted in a semi-structured manner to elicit discussion about the change in teachers' perception of their classroom environment, the effectiveness of training and development, and identified improvement in their teaching practices after receiving and applying IBL professional development. Focus groups encourage participants to discuss their opinions and experiences openly, especially with controversial topics (Ivankova, 2014). This focus group interview enabled all the teachers to participate, and I was the moderator during this process. The questions asked were open-ended (See Appendix C) to encourage discussion among the group.

Data collection during the interview included primarily handwritten notes documenting the teachers' response and possibly their emotional reactions. The data were again analyzed inductively in a similar manner as the qualitative observation data. The themes and categories

used during the observation data collection were used to analyze the focus group data and identify any connections in addition to new patterns and themes.

Timeline for Study

Data collection began in the spring of 2020 after Spring Break and concluded during the third week of May 2020. The *Panorama Teacher Survey* was administered in the third week of March 2020. The results were analyzed and used to direct the intervention, the five weeks of professional development sessions. The classroom observations occurred between April and May of 2020. The focus group interview was administered in May 2020. Lastly, the final data analysis of the classroom observations and focus group interviews continued through the end of the school year (Table3.2) and into the summer.

Following Spring Break, the district provided an altered pacing calendar to account for the COVID-19 pandemic and the suspension of traditional school days. We reviewed topics covered throughout the school year and learned of two additional topics in exponent rules and simplifying radicals. This transition introduced no effect on this study but benefited it by allowing teachers to create environments in which many students engaged as twenty-first-century learners. Furthermore, reviewing previous material allowed teachers to practice implementing IBL strategies with prior knowledge as support and access to some students. It allowed them to implement those strategies while covering new topics. An outline is included in Table 3.3

Table 3.3
At-Home Learning Pacing Calendar

Algebra I **At-Home Learning Pacing Calendar Spring 2020**		
Week of	**TEKS**	**Concepts**
March 23	A.3C	The student will graph a linear function to ● Identify key features including ○ x-intercept ○ y-intercept ○ zeros ○ slope
March 30	A.7A	The student will graph a quadratic function to ● determine domain and range from relations, graphs, or equations ● identify key features including ○ x-intercept ○ y-intercept ○ zeros ○ maximum value ○ minimum values ○ vertex ○ equation of the axis of symmetry determine the effect on a parent function of a transformation
April 6 April 13	A.10E	The student will factor trinomials of degree one or two. ● including GCF ● with a leading coefficient of one and other than one ● perfect squares and difference of squares
Week of	**TEKS**	**Concepts**
April 20	A.2B	The student will write linear equations in the forms ○ Point slope ○ slope-intercept ○ standard form may include parallel and perpendicular
April 27	A.5A	Students will solve linear equations (in one variable) that include ○ variables on both sides multi-step equations with Distributive Property
May 4	A.11A	The student will use the properties of radicals to simplify numerical expressions.
May 11	A.11B	The student will simplify numeric and algebraic expressions using the Laws of Exponents. ● Product of Power ● Quotient of Power ● Negative Exponent ● Power of a Power

Reliability and Validity Concerns

The results from this study are not intended to be generalized to a larger population. The intent is to study the effects of implementing IBL practices in SWHS and how to modify and improve those practices based on observer and teacher feedback to better serve the students, and more specifically, African American students. The survey instrument gathered information on teachers' perceptions of their classroom environment and culture at a point in time, presenting validity and reliability constraints. These constraints were alleviated first by having each of the Algebra I teachers at SWHS participate in the survey. They were informed that the survey was voluntary, and their input would be anonymous, ensuring I would not be aware of their responses. I also constructed the survey in a manner that would cause as little inconvenience as possible by making the survey accessible through a link with no required login or signup and completion of the survey possible on a mobile device. The restraints of the content validity were addressed in the development of the survey by Panorama Education using a rigorous, error minimizing, six-step design process (Gehlbach & Brinkworth, 2011). Each item adheres to best survey design practices.

Trustworthiness was assessed to capture the interpretative nature of the classroom observations and focus group interviews. The criteria used as an indicator of the rigor include credibility, transferability, dependability, and confirmability. The findings from the focus group interviews were also observed during the classroom observations. Furthermore, if the study was conducted again, I believe that the results would be similar if not identical, both providing the study's credibility and dependability. Though the study is not being generalized to a larger population, if conducted in a similar context, the results have been similar, showing

transferability. The focus group interviews provided confirmability as each teacher was able to share their perspective without the influence of the researcher.

The focus of this study was to observe changes using IBL practices and improve professional development provided to educate and train teachers on the implementation of those practices. The values of the teachers and their perspectives are what framed the study, and they are the individuals who will use the results to inform further action.

Closing Thoughts on Chapter III

Though the district has encouraged teachers to move towards student-centered learning, many teachers have resisted this suggestion and continued to use practices which "work," such as test-taking strategies and calculator tricks. In contrast, others feel the training the district has provided has not sufficiently trained them in implementing student-centered practices. This study informed teachers and administrators of SWHS about the effectiveness of IBL practices in changing classroom environments and cultures while improving the academic outcomes for African American students. I wanted to discover with fidelity the effectiveness of IBL. The methods were chosen to produce a professional development instrument that trained teachers on implementing IBL practices and then observed teachers while implementing the practices in their classrooms.

CHAPTER IV

ANALYSIS AND RESULTS

Introducing the Analysis

The purpose of this research study was to answer the following questions:

- What were the teacher participants' perceptions of their classroom environment and culture before and after the professional development sessions?
- What were the characteristics of the instruction teachers designed and delivered as they received PD sessions emphasizing the role of inquiry-based learning?
- To what extent the instruction teachers designed and delivered were culturally responsive to African American students?

All eight teachers completed the *Panorama Teacher Survey* on the Algebra I team at Southwest High School to help understand the teachers' perception of their classroom environment and culture. The survey also established the teachers' comfort and relatability to students of other cultures. The data collected from the survey informed the professional development sessions and what topics and activities should be covered to make the sessions more relevant and beneficial. The professional development was an opportunity to introduce IBL practices to some teachers who had not had prior experience and to demonstrate the practices to increase confidence and effectiveness with implementation. During the implementation of the IBL practices, classroom observations were conducted using the *Reformed Teaching Observation Protocol* in order to identify the orientation of the classroom learning environment. The data collected from the classroom observations were used to answer the final two questions

regarding the characteristics of the instruction and the extent to which the instruction was culturally responsive to African American students. The focus group interview with the Algebra I team was conducted to revisit the first question and identify any changes in perceptions after implementing the IBL practices. The interview also induced discussion about the last two questions about the benefits of IBL and the changes to the cultural responsiveness for African American students.

Presentation of Data

Research Question 1

What were the teacher participants' perceptions of their classroom environment and culture before and after the professional development sessions?

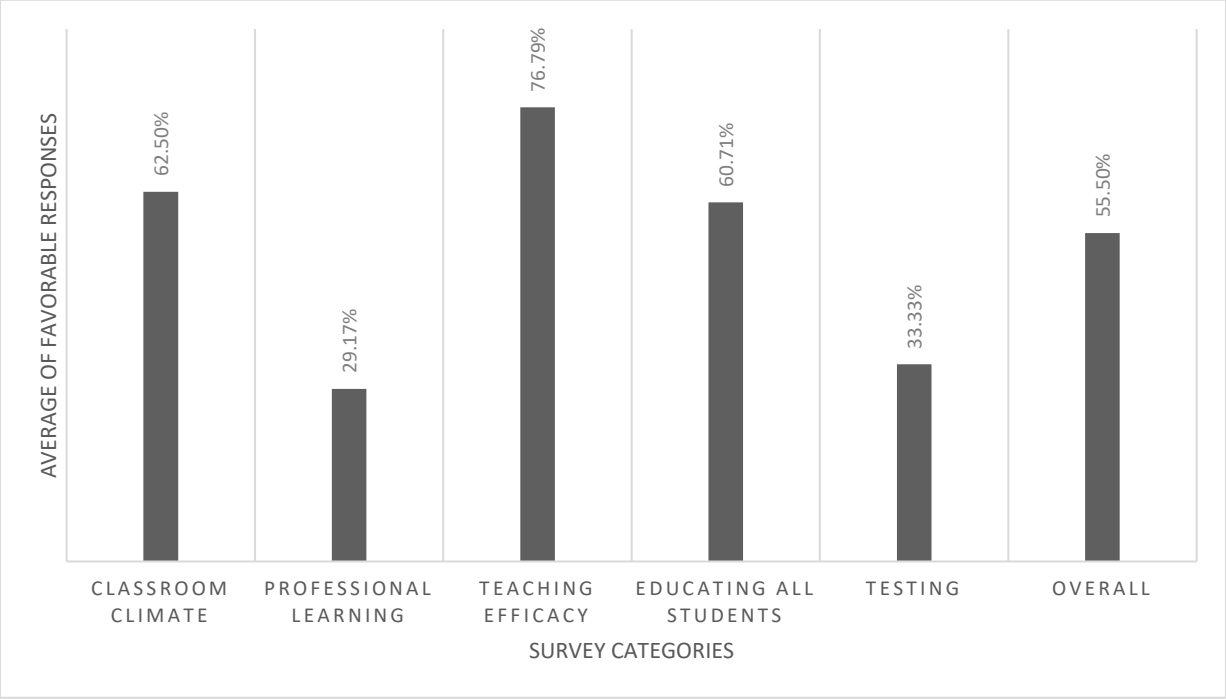
The *Panorama Teacher Survey* was used to answer question one. The process of conducting a survey seeks to collect the opinions and attitudes of a group (Ivankova, 2014). The survey was used to collect quantitative data and was analyzed using descriptive statistical analysis. Descriptive statistics is the most commonly used method to analyze and present data and gives less priority to generalizing the findings to a larger group. The survey is customizable to the needs of the researcher, and the categories chosen were classroom climate, professional learning, teaching efficacy, educating all students, and testing. The survey questions were entered onto the online platform Qualtrics and disseminated with the provided survey link via email and text message. The recipients were informed that the survey was voluntary, and the results would remain confidential and anonymous. Each of the eight members of the Algebra I team completed the survey. The feedback from this survey allowed me to design materials and activities, more specifically for our professional development sessions. For instance, if teachers

had a less favorable perception of educating all students, which pertains to educating students of other cultures, more emphasis and ideas can be presented to help teachers feel more confident in that area.

Responses to individual questions within each category were coded on 5-point Likert scales. For instance, the professional learning category included the range “not at all supportive,” “slightly supportive,” “somewhat supportive,” “quite supportive,” and “extremely supportive.” The last two were considered favorable responses. A question’s score on a given scale consisted of the percentage of teachers choosing a favorable response; favorability scores for each question were averaged to produce overall scores for each category. The results are displayed in Table4.1

Figure 4.1

Teacher Perception of Classroom Environment and Culture



The first category of the survey consisted of eight questions measuring the teachers’ perceptions of their classroom climate. Teachers’ perceptions of climate are a predictor of

student achievement in middle and high school (Brand et al., 2008). When teachers have a positive perception of the climate of their classroom, students usually perform higher. On the survey, 62.5% of the responses were favorable. From the results, all the teachers perceived themselves as having a respectful relationship between themselves and their students. The teachers, however, did not feel their students were enthusiastic about school, as only 37.5% had favorable responses.

The next section of the survey inquired about the relevancy and effectiveness of professional learning opportunities and consisted of four questions. Effective professional development will expand understanding and change habits and practices (Spark, 1998). Teachers' perceptions, experiences, and backgrounds affect their capacity to learn (Joyce & Calhoun, 2010). As with students, teachers also require differentiation. This section of the survey allowed me to realize those perceptions and the methods needed when presenting material during our staff development sessions. Teachers who had a less favorable view of professional learning tended to have experienced more traditional learning styles (i.e., sit and get).

In contrast, those with more positive experiences experienced more "student-centered" training. Professional learning received the lowest percentage of favorable responses, with 29.1%. Teachers did not feel prior professional development opportunities assisted them with exploring or learning new pedagogical strategies.

The third and fourth portions of the survey, both containing seven questions, contained questions about teachers' confidence in their teaching abilities and comfort in teaching all students. The first, teaching efficacy, contained seven questions. Teachers' beliefs in their abilities to effectively execute the responsibilities and challenges of the teaching profession will

influence academic outcomes (Barni, Danioni, & Benevene, 2019). Furthermore, it influences their ability to change with the needs of their classroom. A teacher with weak knowledge of methods may easily end up instructing dull, teacher-centered lessons (Bedir, 2015). In the survey, teachers displayed high perceptions of their efficacy, as 76.79% were favorable. Teachers perceived their abilities very highly to teach the most challenging students. Teachers are expected to engage students with various instructional strategies that help with the retention of information (Soylu, 2009). Engaging lessons assist with bridging the achievement gap and teaching across all cultures, which is addressed in the fourth section of the survey, educating all students. The favorable responses for this category were 60.71%, which is about average. About half of the teachers felt they could integrate material about people from different backgrounds into their instruction. However, 25% felt they knew to find resources for students with unique learning needs.

The final section of the survey, consisting of six questions, asked teachers their feelings of testing and the emphasis thereof. Teachers might feel a burden when test scores are emphasized more than teaching content. When test scores are the most important, poor teaching practices such as teaching to the test and reductions in the scope of the curriculum to almost exclusively feature subject areas that will be tested become classroom norms and hinder their abilities beyond the test (Welsh et al., 2019). When teachers believe testing is tied to their job performance, they are less likely to buy-in to school improvement policies. In this category, teachers reported 33.3% favorable responses. Teachers acknowledged they felt pressure to have their students perform well on the STAAR test and to make instructional decisions to increase performance on the test.

Research Question 2

What were the characteristics of the instruction teachers designed and delivered as they received PD sessions emphasizing the role of inquiry-based learning?

To address question two, classroom observations were performed after the professional development intervention sessions. Observations can be used to explore needs and the usefulness of an intervention while also informing any necessary modifications (Ivankova, 2014). Observations can also reveal details that might not be realized using other collection methods. The observations were implemented using the *Reformed Teaching Observation Protocol (RTOP).*

Six sixty-minute observations were conducted between April 2020 through May 2020. A purposeful sample of the Algebra I team at Southwest High School was selected for the classroom observations. The teachers observed represented various demographic characteristics, levels of experience, and level of Algebra I to provide a more holistic viewpoint. Two teachers were not available to be observed. Table 4.1 displays the demographics of the teachers observed and the level of their classroom.

Table 4.1
Reformed Teaching Observation Protocol Teacher Backgrounds

Identity	Algebra I Course Level Observed	Age	Gender	Ethnicity	Experience	IBL Strategy Observed
Teacher A	Pre-AP	33	Male	White	10	Lesson Launch
Teacher B	Intervention	56	Male	White	22	Problem String
Teacher D	On-Level	28	Female	Hispanic	7	Discovery
Teacher E	On-Level	42	Female	White	15	Discovery
Teacher F	On-Level	37	Female	African American	13	Problem String
Teacher G	On-Level	42	Male	African American	13	Problem String

The structure of the RTOP consists of 25 items divided into three sections: Lesson Design and Implementation (*n*=5), Content which is divided into the two subsections of Propositional Knowledge (*n*=5) and Procedural Knowledge *(n*=5), and Classroom Culture also containing two subsections of Communicative Interactions (n=*5*) and Student/Teacher Interactions (n=*5*) (Piburn & Sawada, 2000). The second and third sections are each divided into two smaller groups of five items. The first section described a lesson that recognized students' prior knowledge and preconceptions, attempted to engage students as members of a learning community, valued a variety of solutions to problems, and was guided by ideas generated by students. The second section evaluated the content and was divided into two parts. The first measured the quality of the content of the lesson. The second attempted to capture the understanding of the process of inquiry. The final section, consisting of ten items, assessed the climate of the classroom.

The authors of the observation instrument had the intention of capturing every aspect of reformed teaching with the 25 items. The five items in each section were described on a five-point (0-4) Likert scale and then tallied. Summing the 25 item scores result in an RTOP lesson score ranging from 0–100. Classrooms are characterized on a spectrum that describes the degree of reformed teaching present from instruction, which ranged from traditional to reformed-based. Category descriptions of the spectrum can be seen in Figure 3.2. Typical scores of lessons which are traditional are <30, instructive <40, transitional <50, responsive <70, and a reformed-based lesson scored above 70 (Madisaac & Falconer, 2002). Scores greater than 50 indicated a strong presence of reformed teaching within the lesson.

The RTOP included a section for field notes which the authors of the instrument described as a means of placing the observation instrument into context. This section included a description of the classroom setting, the topic covered, the activities utilized, and any interesting feedback which occurred during the observation. This information was not used in the final tabulation of the RTOP spectrum. However, inductive analysis of the observation notes was used to provide a picture of events that occurred during the instructional segment (Ivankova, 2014).

Permission was granted from each teacher to attend an instructional period. The teachers who were chosen to be observed were informed ahead of the observation. Information and guidelines of the RTOP were given to the teachers. They were reminded the observation was not for evaluation purposes and was not connected to their T-TESS. The purpose was to identify the student-centeredness of their classroom instruction and, if necessary, how to move instruction to one which is more student-centered.

Furthermore, feedback from the observations would also be used to improve professional development. Teachers were observed for one hour, followed by a short discussion about the lesson they presented. The data from the observations are included in Table 4.2.

Table 4.2
SWHS Reformed Teaching Observation Protocol Data

	Categories					
	Lesson Design and Implementation	Propositional Knowledge	Procedural Knowledge	Communicative Interactions	Student/Teacher Relationships	Overall
Teacher A	13	16	11	11	10	61
Teacher B	11	12	9	9	12	53
Teacher D	10	11	12	11	13	57
Teacher E	14	12	12	11	11	60
Teacher F	11	10	10	11	9	51
Teacher G	13	12	10	12	12	59
Average	12.00	12.17	10.67	10.83	11.17	56.83

Each teachers' lesson was tabulated using the RTOP rubric, and an overall score was calculated. Then, the total RTOP scores were averaged for all 25 items and each category along with an average overall score. The average among all six teachers was 56.83, indicating responsive instruction with lessons. The scores ranged from 51 to 61. All the teachers observed had lessons that were responsive, meaning the lesson displayed a focus on collaboration. In these lessons, generally, the teacher created the environment for students to take charge of their learning. Among the five categories, Propositional Knowledge had the highest average score of 12.17 and Lesson Design and Implementation with 12. Teacher A received the highest score in Propositional Knowledge, which refers to the character and knowledge of the content during a lesson and their ability to present material. Student/Teacher Relationships was Teacher F's lowest score category with a nine. Teacher B had the highest RTOP score of 61.

The RTOP score of 50 or higher is equivalent to receiving a score of two on each of the 25 items in the protocol (Appendix B). Table 4.3 below displays each teacher's item scores.

Table 4.3
RTOP Individual Item Data

		Teacher A	Teacher B	Teacher D	Teacher E	Teacher F	Teacher G	Average
Item	Lesson Design and Implementation							
	1	3	3	3	4	2	3	3.00
	2	3	2	2	3	3	3	2.67
	3	3	1	1	2	2	2	1.83
	4	2	3	3	2	2	2	2.33
	5	2	2	1	3	3	3	2.33
							Item Average	2.43
	Propositional Knowledge							
	6	4	3	3	3	3	3	3.17

Table 4.3 Continued

	Teacher A	Teacher B	Teacher D	Teacher E	Teacher F	Teacher G	Average
7	3	2	2	3	2	3	2.50
8	4	3	3	2	3	2	2.83
9	2	1	2	2	1	2	1.67
10	3	0	1	2	1	2	1.50
						Item Average	2.33
Procedural Knowledge							
11	2	1	2	2	1	2	1.67
12	1	2	3	2	1	2	1.83
13	2	1	2	2	2	2	1.83
14	3	1	2	3	3	2	2.33
15	3	2	3	2	2	2	2.33
						Item Average	1.998
Communicative Interactions							
16	2	3	1	2	2	3	2.17
17	2	2	3	3	2	2	2.33
18	2	3	3	2	1	2	2.17
19	2	3	3	2	3	3	2.67
20	3	3	3	2	3	2	2.67
						Item Average	2.4
Student/Teacher Relationships							
21	2	3	3	3	3	2	2.67
22	1	2	3	2	2	3	2.17
23	3	3	3	3	2	3	2.83
24	2	2	2	2	1	2	1.83
25	2	2	2	1	1	2	1.67
						Item Average	2.234
Total RTOP Score	61	53	59	59	51	59	57.00

As stated previously, an average item score of 2 (out of 4) was equal to an RTOP score of 50 out of 100. A score of 50 indicated that the teacher is in the early stage of using reformed teaching practices. A score of 2 on any item indicates that the action described was observed more than once. The category with the highest item average was Lesson Design and Implementation, with an average of 2.43. Procedural Knowledge received the lowest average item score with an average section score of 1.998, which is just below the threshold of reformed teaching.

Research Question 3

To what extent the instruction teachers designed and delivered were culturally responsive to African American students?

To address this question, a ninety-minute focus group interview was conducted with the SWHS Algebra I team. The primary purpose of the focus group was to discuss how IBL practices affected the classroom culture and the cultural responsiveness to African American students. The focus group also addressed the use of IBL in the teachers' classrooms and the benefits and limitations therein. The focus group also made suggestions for changes to professional development opportunities in the future. A focus group interview guide (Appendix C) was created to guide the open-ended questions of the interview. Notes were taken to summarize answers, while some key and interesting points were written verbatim.

Following the interview, I reflected and recorded my thoughts and interpretations as they were still recent. The interview session sought to address cultural responsiveness, benefits and limitations, and improvements to professional development. Therefore, during the initial

analysis, I color-coded the notes from the focus group interview into these areas: Culturally responsive teaching, benefits, limitations, and improvements. The data were analyzed to identify themes from connections to the teacher survey and classroom observations.

The interview began with discussing the IBL practices and the benefits and limitations. These are displayed in Table 4.4.

Table 4.4
Benefits and Limitations of IBL Professional Development

IBL Focus Group Interview		
	Benefits	**Limitations**
Professional Development	• Teacher B: "Developed a better understanding of implementing IBL practices." • Teachers felt they were growing in their instruction • Teachers were more comfortable after seeing IBL activities modeled • Teachers were able to experience the issues and reactions they might face in real-time • Teacher G: Felt the training was useful and immediately applicable. • Teacher C: "We were able to reflect on IBL experiences with each other." • Teachers learned the importance of visualizing student thinking	• Teacher C: "Reflection and collaboration time were limited." • Teacher A: Time to complete full modeling was sometimes limited. • Teachers were uncomfortable modeling for the time • Teacher H: Did not catch every issue or consideration.
In the Classroom	• Teacher D: "Students were more engaged in the material." • Teacher E: "Provided opportunities of all students to participate in the learning process." • Teachers were able to connect to students of various cultures • Teacher H: Students utilized more critical thinking • Teacher F: A safer classroom was fostered and inviting despite their level of knowledge and understanding	• Teacher B: "There's no way to anticipate the direction of some activities." • Teacher A: "Students were resistant to participate at first." • Teacher E: "I had difficulty letting the kids control the class. • Time-consuming

**Note: Teacher credited with their input. If the teacher is not identified, then there was a consensus among all teachers.*

Most of the limitations were administrative and did not directly affect student learning. The limitations most of the teachers mentioned was the amount of time needed to implement an IBL activity. It was stated that there was no way to predict how long completing the activities would take, and it varied depending on the content that was being covered and the foundational knowledge required. Relatively new content required more time than, for example, an extension of previous content. They did come to the consensus that the time was worth spending to complete the activities thoroughly. Some teachers mentioned that limitations on time stemmed from the relative inexperience with implementing IBL practices. Those newer to an activity felt some time would be recouped through repetition and practice. Most of the teachers agreed that later as the testing time approached, they abandoned some of the activities as time became more of a factor. In addition to the time as an issue, teachers discussed comfort and control as a limitation. Some teachers mentioned having difficulty relenting some control of the instructional time to allow for students' questions and responses to guide the lesson. They struggled to be only facilitators. As with limitations on time, they agreed with more practice they would become more comfortable. Teachers also mentioned the disparity in participation initially. For example, with problem string, they had difficulty with students providing feedback, which would guide the activity should go if students offered any input at all. Often, the same students were the only ones offering any interaction, which prompted teachers to take more control of the lesson to save time and move the lesson along. Again, teachers understood completing the lessons similar over time would acclimate the students to the structure.

Teachers also identified the benefits of IBL practices. Most were excited about the participation of students who otherwise would not say anything. As mentioned before,

participation was minimal initially, but as more IBL lessons were utilized, students became more comfortable and offered feedback and suggestions. Some activities supplied access to all students no matter their level of knowledge and understanding. This also made for a safer classroom as students felt they could be wrong and not ridiculed. Furthermore, students were more open and willing to work with one another to collaborate. Some teachers mentioned that the level of enthusiasm increased, and students were more engaged. They recognized their minds working and wondering. The teachers said that modeling of the activities and working through them before using them during classroom instruction helped them anticipate some of the issues and questions they encountered in class. A final benefit pertained to the lesson launches. Teachers felt they intentionally built upon their prior knowledge and, most importantly, tied what they would be learning to something familiar.

The discussion also mentioned some improvements and modifications to be made to the professional development sessions, which can be seen in Table 4.5. Teachers overall believed the professional development sessions were beneficial. The sessions were so beneficial that they expressed the desire to have them more often, especially the modeling aspect. Therefore, they would like to incorporate more throughout the school year. Though time was an issue, they would also like more opportunities to reflect on what they experienced with implementation in class amongst each other. A portion of that reflection would be looking at numerical data to determine the improvement in student scores and understanding.

Table 4.5
IBL Professional Development Improvements

IBL Professional Development Improvements	
• Increase the frequency of modeling lessons • Differentiate the activities and lessons types during the session • Provide more opportunities to reflect. • Visit each other's classroom during an IBL lesson to provide feedback and recommendations • Record the sessions so teachers may reference them later • Create a repository of the activities used	• Discuss the benefits and connections to the content being covered • Discuss how to differentiate for various levels and when students struggle

I structured the focus group interview as such and saved the cultural aspect towards the end. Race and cultural relations are sometimes difficult to speak about freely, and I felt beginning with topics less divisive would allow teachers to be more open to discuss. Fortunately, I have had prior relationships with most of the teachers, which made the discussion more comfortable. Furthermore, I discussed my pursuits with them before, and some showed tremendous support and some of the same interests. While discussing the benefits of IBL in class, one teacher specifically mentioned the growth in, and engagement of her African American students, particularly with the lesson launches. After watching the video about diving, students had a concrete understanding of parabolas, which led to a discussion about other sports. She realized a large portion of her African American students were involved in sports and encouraged the conversation. The students were displaying how mathematics made sense to them (Manswell-Butty, 2001). As reported in the benefits previously, the culture of the classroom greatly benefited from the IBL practices as students were more eager to share their ideas openly and in collaboration. A safer environment allowed for cultural divides to diminish

and become more inclusive of all students. Inquiry-based learning is a practice that encourages culturally responsive teaching. Culturally responsive teaching recognizes students' cultural displays of learning, uses cultural knowledge as a scaffold, encourages effective information processing, all while building relationships, and having a social-emotional connection with students (Hammond, 2014). Table 4.6. lists five things evident in culturally responsive teaching, which, when implemented, should be displayed in the classroom. Along with each is an example from the teachers' perspective.

Table 4.6
Cultural Responsiveness of IBL for African American Students

Evidence of Culturally Responsive Teaching	
Culturally Responsive Teaching Goal	Teacher Evidence in Classroom
• Students are at the center of the learning process	• "I made it a point to let my students guide the lesson and assist when they got stuck. Even then, I did not simply give them the answer but rather guided them towards it."
• Existence of something relevant to spark curiosity and make connections	• "It was amazing to see how students related the diving video to quadratics. Identifying the characteristics of a parabola to a diver's path made sense to them."
• Opportunity for the authentic application of knowledge	• Students became teachers and had to explain the process of factoring
• Encourages collaboration	• "Students were really discussing and helping each other on the Match My Line assignment. There were many 'ah-ha' moments, and students wanted to share what they learned."

Table 4.6 Continued

• Empowers students to address social justice issues.	• Discussed with students the importance of Algebra as a gateway course to other higher-level courses not only in mathematics. Student success in algebra can predict their success after.

The focus group data were analyzed by color-coding the interview notes and identifying connections to the teacher survey and the classroom observations. Several themes were identified, including from the connections, including 1) implementation, 2) changes in the classroom environment, 3) cultural awareness, 4) mathematical identity, and 5) access by all students. These themes are displayed in Table 4.7, along with a descriptor and an example from the focus group interview.

Table 4.7
Identified Codes, Descriptors, and Excerpts from Focus Group Interview

Code	Descriptor	Excerpt from Data
Implementation	Comments related to the implementation of IBL	"Seeing the implementation of IBL was helpful."
Classroom Environment	Comments related to changes in the classroom environment	"IBL helped create a more inviting classroom environment."
Cultural Awareness	Comments related to the understanding of differences of various cultures.	"Watching the diving video connected to students from all cultures because everyone knows what swimming is."
Mathematical Identity	Comments related to noticeable shifts in mathematical identity	"Some of struggling students appeared more confident and more willing to participate."
Access by All Students	Comments related to providing access to all students.	"When making comparisons between the two graphs, I told them it could be the simplest detail down to different colors."

Implementation

The professional development sessions discussed the benefits of implementing IBL in the classroom. The discussion was accompanied by modeling and discussion of various activities that could be used in the classroom. Teachers were reminded that implementation might present itself differently in their classroom and might also be uncomfortable at first. Teachers were encouraged to share their ideas for and to ask questions regarding implementation. Modeling of implementation displayed mostly benefits, but one teacher did mention one aspect with which some agreed. When attempting the activity in class, particularly the problem string, the teacher explained she tried to emulate what was modeled in the professional development session exactly. When the feedback was not similar, she explained she was somewhat stuck for a moment before moving on.

While observing teachers' classrooms, implementation varied based on the teacher's classroom experience, their experience with IBL, and the actual lesson they were teaching. The lessons discussed having the most difficulty with thoroughly implementing were the problem strings. During the focus group, they discussed that allowing students to guide the lesson was challenging. The teachers mentioned that they knew where the lesson needed to end up and sometimes felt that direction was not being achieved. They then felt the urge to take over as an instructor and not a facilitator. They were always concerned with the amount of time needed to facilitate a problem string and allowing time to make a connection in the same class period to the content to be learned. However, they understood that, with practice, they would become better at asking questions to guide students, and that would effectively make the problem strings more efficient.

In contrast, they felt the most comfortable lessons to implement were the ones with some guiding aspect. One teacher mentioned the "Match My Line," which was computer-based. The assignment guided the students with on-screen prompts to have students discover transformations of parabolas. Teachers felt this was beneficial for all students as they could manipulate the graphs and have visual confirmation and feedback if they were completing it correctly. They then had an opportunity to reflect and formulate conjectures about each problem. Teachers monitored progress and facilitated as all the question prompts forced the students to do the thinking and the work.

Overall, teachers understood the benefits of IBL practices. They also expressed the need for more practice and reflection to improve their implementation of the practices. They experienced the benefits of implementation and appreciated, even more, the benefits for their students.

Classroom Environment

During the focus group interview, there was much discussion on the positive impact implementing IBL practices had on the classroom environment. Teachers said there were improvements in relationships between students, students and teachers, and even teachers and teachers. "It was as though we all were finding success together through struggle," said one teacher.

Teachers said overall student engagement increased and contributed to the positive change of the classroom environment. The lesson launches provided context to students to connect their learning. When a connection was established, students showed more interest in learning the material and then trying to relate the content to other aspects. An example is the

aforementioned quadratic parabolas lesson launch. Students saw the connection to swimmers and diving. They then applied the same concept to other sports and activities. “One of my students chimed in with the example of a rocket launcher! That discussion went into the explanation of zeros and was it possible for there to be multiple solutions!” a teacher exclaimed. The excitement in their learning added to the positivity of the classroom environment. Students also grew in their confidence and appreciation of mathematics.

The attitudes and emotions were not always positive for teachers and students. Two teachers mentioned feeling frustrated when attempting problem strings. One of them said their frustration was born from the lack of participation, and only a few students were involved in the inquiry process. The frustration led to the teachers just moving on through the lesson and not realizing the full benefits of the problem string. Another teacher stated that the students lost interest in the assignment while struggling through the problem string. They expressed this would be, and was, corrected through practice, watching others implement, and repeated instruction. As students displayed negative emotions, teachers wanted the students to express those emotions and provide avenues for doing so. Some of the teachers asked for feedback on the IBL strategy used and how to improve. A large portion of student frustration was derived from students wanting to know the right answer and being unsure in their knowledge. One teacher stated that “if there was no clear yes or no, right or wrong, students were hesitant in suggesting solutions.” The teacher said they reassured the class there were no wrong answers, “just opportunities for discussion and learning.” Negative feelings were invited and were encouraged to be resolved.

Support was a factor that changed the classroom environment. Having some level of support helps teachers and teachers. Teachers said as they felt supported in implementing IBL practices. Specifically, they felt they were able to make mistakes and not get it right at first. They also said that merely providing professional development for implementation was supportive, and they appreciated it. The lesson model helped them understand ways they might have to help and support their students. As mentioned prior, students were encouraged to share their feelings and suggestions about their classroom learning. They also wanted to make sure students knew they could be wrong, and it would be ok. A safe environment makes for a positive one.

Cultural Awareness

The teacher survey contained a section that asked teachers about culture. In general, it asked their level of comfort with teaching students of different cultures, their interactions, and sharing and incorporating various aspects of cultures in their classroom. In the initial briefing of the scope of this study, I explained that culture would be an essential aspect. One teacher expressed that she did not teach to a specific culture but all her students. This presented an opportunity to discuss what is a frequent sentiment, especially among White teachers. I explained that if what we were doing in our classroom has been effective and was reaching all students, there would not exist an achievement gap. The dominant culture will be successful despite the teaching orientation. However, student-centered instruction is beneficial and raises the level of achievement for all students. I explained that I understood what she was saying, but sometimes what we do currently is not enough. What if there were no special services for English language learners? We are not focusing on one culture but providing a practice that

optimizes the learning of all. If we can raise the level of learning of the lowest group, it will help everyone!

There were some negative connotations with teachers being culturally aware. I ensured them that I did not believe they meant harm, but some of our preconceptions of students affect how and what we teach them. For example, allowing students to meet high expectations. “My students won’t be able to do this because they don’t like to talk, and this looks hard,” one teacher stated. Yes, it might be challenging, but it is not impossible. Students need to be challenged. Maintaining high expectations is a pedagogical strategy that innately practices cultural awareness. Teachers reported not letting students simply stop a task because it was hard. They provided support to help them through the assignment.

Teachers understood the cultural benefits of IBL. “Inquiry-based learning provides students with the opportunity to take control of their learning. That on its own is being culturally responsive and encourages students to be independent,” stated one teacher. All students benefit from applying their knowledge and skills and not simply regurgitating facts and algorithms. The lesson launches presented opportunities to engage the cultures of students and allowed them to find ways to connect meaning in their way. Critical thinking was evoked by the problem strings and drew upon their prior knowledge. Through collaboration, students shared ideas and find solutions together. Each of these IBL practices is culturally responsive to students. A teacher stated, “I can foresee how I can incorporate aspects of different cultures with these practices. Maybe present a mini-lesson while working through them.”

Mathematical Identity

Inquiry-based learning is culturally responsive as it presents opportunities to change the mathematical identity of students in a positive manner. When students are actively engaged with each other's thinking, it can shift their identity (Gutierrez, 2009). Teachers discussed that some of the students who typically did not participate began contributing to the class discussions and group assignments. They were able to express their learning clearly and were comfortable sharing with other students.

Access by All Students

IBL invites and encourages all students to participate in doing, discussing, and seeing mathematics (Gutierrez, 2009; Civil, 2006). Providing opportunities for students to engage in the classroom actively, they are being provided with an access point to learning. These opportunities allow students to share their ways of thinking while also being exposed to other ways of thinking. While observing a comparison activity, Same/different, the teacher instructed the students to identify any differences between the two graphs. A student noted the differences in color, and though not necessarily mathematically related, this opportunity provided a point of access for that student. The teachers' support in the answer was equally as important. Though simple, the student was thinking.

Results of Research

The results and findings from other research on the effects of IBL were confirmed in this study. Additional findings specific to the teachers and professional development instrument resulted from the research. The results are not generalizable to a larger population as the context involves only the Algebra I team at SWHS.

Research Question 1

What were the teacher participants' perceptions of their classroom environment and culture before and after the professional development sessions?

The teacher survey utilized five categories that were used to measure teachers' perceptions of their classroom environment. Three of the five categories, classroom climate, teaching efficacy, and educating all students, received mostly favorable responses. The remaining categories, professional learning, and testing received mostly unfavorable responses. Overall, teachers had a positive perception of their classroom environment and culture.

The negative responses for professional learning indicated teachers did not help the grow professionally and in their classroom. Teachers did not find the professional development sessions provided by the district relevant or useful. This might be explained by the teachers' high percentage of favorable responses for teacher efficacy, which measured how confident teachers are in their ability to deliver quality instruction. If a teacher strongly believes their methods are effective or if they possess a great deal of classroom experience, they find many available professional development opportunities unbeneficial.

Furthermore, the other low scoring category, testing showed there are aspects of testing which teachers believe have a negative impact on the classroom environment and culture. Teachers feel the pressure of teaching only content that will be tested and scoring high on the tests have an adverse influence on classroom practices. The one positive aspect was test scores influencing what they would teach. Using data to drive lessons is a good teaching practice. However, only teaching what is to be tested is not.

Data indicated that teachers have a favorable view of their relationship with students of various cultures and their ability to teach them. They expressed they would be comfortable

incorporating aspects from various cultures into their lessons and were very comfortable with a culturally diverse classroom. Teachers did indicate they would have difficulty speaking on current issues involving cultures in class and addressing those issues.

Teachers' environmental and cultural perceptions were part of the teacher survey. A maybe obvious question that I should have asked was what were their perceptions of IBL and implementing the practices in the classroom. Also, if they are comfortable with incorporating other cultures into the lesson, have they? In today's current time, I would like to ask their thoughts on the phrase Black Lives Matters and how it pertains to the classroom.

Research Question 2

What were the characteristics of the instruction teachers designed and delivered as they received PD sessions emphasizing the role of inquiry-based learning?

Analysis of the teacher and student interactions during the classroom observations while implementing IBL practices displayed an array of benefits. Initially, during the observations in the earlier portion of the study, teachers had difficulty implementing the practices and wanted to revert to traditional or standard teaching methods. Though difficult, there were benefits found in their struggle. Teachers wanted to become better and sought to collaborate with suggestions and questions from the other teachers. According to the data collected with the observation tool, the teachers were teaching from the lower end of the reformed teaching spectrum. It was evident that teachers had difficulties withholding answers or only listening to answers and feedback from those students who frequently volunteered. Time influenced this also. As has been substantiated, teachers did grow in their implementation.

The students benefited from the implementation of IBL strategies. During my observations, most of the students participated in the activities. Teachers later expressed that some students never participated. The IBL practices encouraged all students to participate and take ownership of their learning. This then had a positive influence on the classroom environment and created a safe place for students to grow mathematically. As students explored and discovered various ideas and topics, their critical thinking skills were strengthened, and they developed a more in-depth understanding. All students had this opportunity as all students could, and did, contribute in some way, no matter how small.

Through this study, I focused on the teachers' perspectives concerning IBL effects on the classroom. I would like to know directly from students their perspectives. I would also like to know what would keep teachers from using strictly IBL practices in their classrooms.

Research Question 3

To what extent the instruction teachers designed and delivered were culturally responsive to African American students?

The benefits listed in the discussion of the second question partially answer this question. Increases in engagement, collaboration, and a student-centered classroom are culturally responsive aspects of teaching.

During the focus group interview, teachers answered this question while providing some examples. The core aspect of IBL is that it is student-centered. While observing classes, the average score was above average, and within the range of a classroom, which was student-centered. Teachers were intentionally focused on allowing students to engage directly with the concept topic. Even as students struggled, teacher-facilitated them through their difficulties as

opposed to directing them to the solutions. Teachers were successful in cultivating and producing independent learners.

Students had their curiosity piqued with the discovery activities, and the lesson launches, amongst other activities. Once their attention was gained, they were more open to learning. Furthermore, the leaning was connected to experience or something they were familiar with beyond the school, which makes the learning more relevant. The learning was extended to the authentic application of knowledge. Teachers invited and encouraged students to share how knowledge would work in their world.

Teachers created classroom environments in which students were required to collaborate. Students shared ideas and learned from one another. The teachers provided various options for students to collaborate and share their ideas. A student being shy and having a disdain of speaking in front of people was not an excuse as they had digital means to communicate. A positive rapport was evident between the teacher and students and students and students.

IBL pushes students to find solutions to some of the most challenging problems. It requires them to think as an obvious solution might not be present. Teachers must help their students by supporting them throughout this process while not lowering their standards. When students are successful, they are empowered. As they build their empowerment, they can translate that power to critical issues in their world.

Interaction Between the Research and the Context

During my EdD internship, I realized that African American students were the lowest performing demographic group in the district. When I was hired at SWHS and considered the families and the area the school was in, I did not expect African American students to be well

below their White counterparts. As I observed during my internship, few teachers were implementing student-centered instructional practices in their classrooms. The classes in which there were more African American and lower-performing students were primarily subjugated to traditional lecture-style learning and "drill and kill" assignments. When teachers did try student-centered methods, they did so in a manner that did not encourage student inquiry. Students were guided by the teacher at best. Furthermore, teachers focused on test-taking strategies and calculator tricks to perform and receive higher scores. I was the beneficiary of these practices as I was a geometry and precalculus teacher. I spent much time reteaching the basic concepts they should have learned in Algebra I. I knew getting a passing score, which at the time is a 37% percent, would not benefit any student, especially African American students. The district understood this also and chose to make the "meets grade level" performance standard the level in which students needed to reach without remediation. The district leaders also began to realize the importance of not simply teaching to pass the test but teaching to be successful beyond secondary education. Professional development began being offered for mathematics teachers focused on student-centered learning and critical thinking. There was, however, no evidence that it was effective and if it was effective in raising achievement for African American students.

How did the Context Impact the Results?

This study, in my opinion, fits perfectly into the district context. Much research has been conducted on the achievement gap, but there is little which addresses issues beyond socioeconomic factors. Much is attributed to low income, low parental participation, or low expectations. These common themes and deficit thinking contributed to the achievement gap. As

an action researcher, I was provided an opportunity to examine other factors, specifically those within the control of the school and the teachers.

When schools were forced to close because of the COVID-19 outbreak, I was worried I would not be able to complete the study because I did not know if I would be able to collect the data needed. Virtual learning made data collection possible and presented teachers with opportunities to implement IBL strategies virtually.

I thought the focus group interview might be more contentious than I experienced, given the racial tension present in our country and working with a team of teachers who are predominately White. The experience was insightful and provided more meaning to the teachers and even me in light of recent events. Those potential issues were not as volatile at SWHS. There existed no resistance to this study. District personnel expressed excitement with the idea I was completing this study within the district. These administrators were very supportive while providing resources and opportunities for me to complete the study. Teachers showed very little resistance in the beginning and were also very supportive and wanted to grow professionally.

How did the Research Impact the Context?

The research impacted the classroom context by providing teachers with evidence of how IBL strategies could have a positive effect on student learning and closing the achievement gap for African American students. The classroom observations allowed me to observe how well the practices were being implemented and provided feedback on their implementation. Teachers were able to grow and experience the benefits for their classrooms while engaging and implementing IBL strategies. Through this study, I encouraged teachers throughout the district who have not adopted or even attempted IBL practices and strategies in their classrooms.

Summary

I initially sought teacher perceptions of the classroom environment and culture from the Algebra I team at SWHS through a survey. Results demonstrated that teachers possessed a favorable perception of their classrooms, but not a favorable perspective of the professional development provided by administrators. These data were used to prepare beneficial professional development sessions, efficient to implement, and include providing support when needed. Through classroom observations, I was able to observe real-time the benefits of IBL professional development and its implementation. The focus group interview further confirmed those benefits from teachers and offered suggestions for improvement in both the professional development sessions and the classroom.

The use of IBL practice transitioned the classrooms to ones that were student-centered. Students were engaged and actively participating. Teachers encouraged the students to collaborate and create a safe environment for students to be able to be wrong. These environments were beneficial for all students and culturally responsive to African American students helping close the achievement gap.

CHAPTER V

DISCUSSION AND CONCLUSIONS

Summary of Findings

I started my teaching career in schools that were low performing by state standards. It was my lack of traditional training, which was my strongest attribute as I could unconventionally teach students, and I was more willing to try new things for students to be successful. These schools had the demographic composition of what we know of as typically low performing schools: low socioeconomic background, little parental involvement, and various other cultural and environmental factors. It was when I arrived at Southwest High School that I encountered a new problem. The background of these students was not typical, but my students still resembled those at my previous campuses. This study is an introduction to examining other factors. As there is a limit to what schools can do for students beyond the classroom, this study focuses on classroom instructional practices. Southwest ISD began implementing and encouraging student-centered teaching practices. I cannot say the district desires to teach beyond the test, but I can say with certainty that they wanted the content to be taught for understanding and not to the test.

This study reinforced that IBL strategies are not only best practices for all students but are culturally responsive to African American students as well. The survey gathered teachers' perceptions about their classroom environment and how the district professional development contributed to it. Data showed because teachers rated themselves high in the practice that professional development sessions were not beneficial. Most aspects of testing were revealed to have a negative impact on their teaching experience when not used to guide instruction.

I was able to observe classrooms using the observation instrument in which students were highly engaged when implementing IBL practices. I observed students highly engaged in mathematical content, especially when provided opportunities to connect the mathematical content to their own experiences or described in a manner that made sense to them. This was possible by teachers letting students' questions, and curiosities guide the lesson. Students were teaching and learning from one another in their discussions and collaborations. During the focus group interviews, teachers discussed having difficulties implementing IBL practices, but they improved throughout the study.

As with implementing anything new, it takes time to become accustomed to it and become well versed with it. This was one of the chief complaints discussed during the focus group interview. Teachers needed more time during the professional development sessions and class periods to fully understand and implement IBL lessons. They did agree that with more practice, implementation would become more efficient. They also discussed an overall positivity and connection in their classrooms and with their students. Again, students were engaged and discovering, even those who normally would not. Providing an environment centered around students that engages them provides them a point of entry at all levels, encouraging them to learn from one another, and providing opportunities to apply their knowledge are key aspects and contributors to culturally responsive teaching. As teachers continue implementing these practices, African American students will hopefully become more successful.

Discussion of Results in Relation to the Literature

Inquiry-based learning requires changes in teachers 'perceptions for effective implementation. Without the support of school administration due to test scores and passing rate

requirements, enforcing this change might be difficult. Results from transitioning to a more student-centered one might not be noticeable immediately, but the effects are long-lasting (Kogan & Laursen, 2014). The first summative assessment after implementing this change might not be reflected in the data. Maybe not the second. However, as Sam Cooke sang, "change is gonna come." Scores will change. Most importantly, students' mindsets and ways of thinking will change. Implementing IBL strategies requires students to engage in rich mathematical learning (Tang et al., 2019) deeply. Doing mathematics requires student participation in authentic mathematical experiences (Cook et al., 2016). To extract the most from students, they need to be actively involved in their learning by forming conjectures, using and applying methods and representing and communicating ideas (Boaler, 2008). During classroom observations, it was evident that students were actively engaged in their learning. The teacher asked questions to promote deeper thinking. Questions that require students to problem-solving allow the teacher to ask about the students' thought processes (Tang et al., 2017). Using the inquiry process and doing mathematics contributes to student-instructor relationships and improved classroom environments. When implementing IRB strategies, the role of the teacher becomes that of a facilitator.

Students become proprietors of their learning. Student ownership encourages learners to produce and develop their knowledge (Cook et al., 2016). This new knowledge is built upon prior knowledge and experiences. Having some prior knowledge or experiences, students can contribute to the learning, which, as stated before, makes the mathematics meaningful and personal. Teaching using IBL strategies allows mathematical concepts to become more meaningful, allowing students to more easily retain and apply the concepts. Students can then

speak the language of mathematics (Boaler, 2008). Teachers in my study provided an atmosphere for students to take ownership of their learning and make it personal. They invited students to share their experiences or things to which they could relate.

Students were also encouraged to share and collaborate. Students helped each other through the learning process, sharing each other's thoughts, and providing clarification when there was a misunderstanding. Students were able to explain their thought processes to their peers. Learning becomes cooperative, collaborative, and community-oriented as students direct their leaning (Goldstein, 1999). Sharing of knowledge contributes positively to the classroom, also improving their ability to work with others, seek help, and appreciate different viewpoints (Larsen et al., 2002). The classroom environment is improved by encouraging discussion and ensuring it is safe to be wrong by creating opportunities to learn.

The goal of my study was to help reform classroom instruction by providing teachers with IBL strategies that allowed their students' opportunities to learn and perform at the maximum level. More specifically, to provide African American students with instructional IBL strategies, which would most likely allow their students to succeed and assist in improving their mathematical outcomes. The factors prior are those of instruction that is culturally responsive. These practices foster student-centered discourse, exploration of mathematical ideas, and consistent feed-back (Nasir et al., 2011). All students are provided an opportunity to access and engage in rich mathematical concepts (Civil, 2006). These characteristics were inherent in this study. The advantages of active learning experiences may be long-term and substantial for some student groups, with no harm done to others (Kogan & Laursen, 2014). Furthermore, cultural differences are understood and shared. Teachers use cultural knowledge as a scaffold to

recognize students' displays of learning and then respond positively and provide constructive criticism in a supportive environment (Hammond, 2014). As these practices are consistently applied, African American students will continue to improve.

Implications for Practice

Prior research literature supports the use of IBL strategies to produce culturally responsive teaching for African American students. These African American students have long been the benefactors of educational debt due to disparities in the education of African Americans, which has amassed over time (Ladson-Billings, 2006). Recent policies have brought a renewed focus on improving education for our students. These changes include implementing research-based practices in the nation's classrooms. Much research has been done on student-centered practices in mathematics and, more specifically, IBL. Many education programs have implemented IBL practices within their schools and have had much success.

Teachers in this study benefited from engaging in professional development sessions, which modeled these "best practices" and providing them with an example of what implementation might resemble. Also, through professional development, teachers were able to reflect and discuss the implementation processes and outcomes with one another to improve their classroom instruction using IBL strategies and practices. Results from my study indicated that it would benefit teachers, and ultimately students if teachers were provided additional time to learn and practice the IBL lessons. The district provides many suggestions and resources for student-centered lessons in the classroom. Teachers would benefit from reviewing data and research over IBL practices and becoming more culturally responsive teachers.

Connections to Context

I have been a mathematics teacher in the district for six years. During this time, I have taught a variety of courses and levels of mathematics. I have implemented various practices I believed to be necessary and beneficial to the success of my students. I have been able to produce not only numerical results but, to me, most importantly, I have built confidence and changed the mindset of my students. After my class, I do not expect my students to love mathematics but have a better appreciation for it. The differences in demographics in my on-level and advanced mathematics classes prompted me to investigate the numerical data on various measures. African American students were behind in every mathematical indicator of success. Further discussion revealed that many teachers were teaching to the test and teaching in a manner that was teacher-centered. This prompted me to volunteer to teach Algebra I and possibly influence change not only on my campus but throughout the district.

Connections to Field of Study

Through this Record of Study, I hoped to add to previous action research on IBL. The research conducted in this action research confirmed findings in previous research. Inquiry-based learning, when implanted throughout all levels and subjects of education, is seen to benefit most students (Larson et al., 2002). Much research has been conducted with IBL's connection to teaching, which is culturally responsive. Many educators who implement IBL are innately practicing culturally responsive teaching. However, many educators are unaware of the benefits and outcomes for African American students who perform at the lowest level. The purpose of this study was not to exempt any demographic of students but bring attention to one, which primarily benefits from IBL practices according to prior research literature.

Through this study, I provided descriptive statistics statistical, research-based evidence displaying when teachers are provided proper, relevant professional development over student-centered practices, classroom environment, and culture is improved. My colleagues were able to share and assist in these experiences and become advocates for those teachers who are reluctant to move away from more teacher-centered practices. Teacher-centered instruction does have its place in the classroom but certainly should not dominate.

Some concerns exist with the implementation of IBL strategies. One which was mentioned by the teachers and considered throughout this study is the use of time on multiple fronts. The amount of time initially to learn about different and varied student-centered strategies is significant. IBL practices also require time commitments when enacted during classroom lessons. However, these concerns are temporary. As teachers become more fluent in IBL implementation, they will also become more efficient. The benefits for students outweigh the concerns. Teachers will become better facilitators of learning, and students will hopefully become more engaged.

Discussion of Personal Lessons Learned

Though I knew the Record of Study process would require much time from me, I could not have imagined the amount of coordination, research, planning, and writing I have had to complete. This experience has revealed to me how specific and intentional all aspects of research must be. Of course, there are some things I can improve upon, but I also surprised myself in various aspects. One is that I am writing this paragraph.

I did not want to produce a Record of study to check off my list of requirements simply. I wanted to produce something I could share and maybe use to keep the discussion going with my

colleagues. The subject matter is one that I hold near and dear. I have always had a love and appreciation for mathematics. I have not always done well, not because of lack of knowledge or intelligence, but lack of proper vision and motivation. It is my academic experience that led me to my desire to improve the educational outcomes for African American students.

I learned during this study and in our current national context that speaking on the systemic shortcomings of African American students is uncomfortable for many people. It was even uncomfortable for me. I do not like to make people feel uncomfortable or portray myself as though I only care about students who look like me. The sentiments behind the Black Lives Matters movement are the same that must take place within our classrooms. I am not putting African American students above any of my students. Like my children, I love them all the same.

Nevertheless, as with any other demographic group that has disparities in learning and receive programming or accommodations, African American students have been lagging for far too long. Through this study, I present teaching practices which not only help African American students but for ALL students. I did appreciate the open and honest conversations I had with my colleagues. We may not all agree, but we do respect each other. This study, in conjunction with current events, has provided me with the courage to be an unapologetic advocate for African American students and their education and their future.

Recommendations

This study was conducted from the perspective of teachers and improving their practices. I would recommend conducting this study from an earlier point in the school year with teachers with little to no experience with IBL practices and conducted over a more extended period to measure how much teachers developed and grew throughout the study. I would also recommend

exploring various contexts and including different demographic backgrounds and at various grade levels, especially upper-level mathematics. As students advance through mathematics, the content increases in difficulty and becomes increasingly teacher-centered. Is it possible to implement student-centered practices beyond Algebra I? Are student-centered practices beneficial in advanced mathematics courses?

I would also recommend conducting a study involving more quantitative techniques using the same topic, however, incorporating student data and their perspectives. As noted throughout this study, the school personnel can only control a limited number of factors within its walls. The same considerations should be taken if the study was replicated in other districts. Researchers should try to focus only on possible other campus factors to gain more significant insights into the issues, but realizing this would also be much more labor-intensive.

Closing Thoughts

Today's child is engulfed with an array of technological entertainment options that they have at their fingertips. I have watched my children jump from activity to activity. It has proven challenging to hold their attention for long periods. This is a generational phenomenon. Unfortunately, this phenomenon has made teacher-centered practices not obsolete, but very difficult and less effective to be implemented as the primary method for instruction. Students require engagement. Students require collaboration. Students require an environment that caters to their habits. Inquiry-based learning provides students with those options. In this environment, students can be academically social and share their ideas and ask questions for better understanding. They can explore their thoughts and hypotheses and formulate conclusions. They can integrate and should integrate their knowledge and experiences into their learning. All these

factors make education relevant and applicable to them. It is up to us as educators to create and provide these opportunities. Doing so prepares them for not only classes through their academic careers but for pathways after they across the stage into the real world. Furthermore, they do not have to wait to leave school to experience real-world situations because it is our responsibility as educators to create real-world mathematical situations for students to pose and solve problems. It takes some work, as was shown through the results of my study, to present students with real-world situations through IBL strategies, but it is certainly worth it.

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APPENDIX A

PANORAMA TEACHER SURVEY

Data were collected from teachers using the *Panorama Teacher Survey* to identify teacher's perceptions of their classroom environment, training and development, and teaching practices. The survey questions will be on a scale ranging from Not at all likely to extremely likely. The last four are open response questions for reflection. Also, participants' demographic data were collected. The teacher survey included the following questions:

Classroom Climate

1. On most days, how enthusiastic are your students about being at school?
2. To what extent are teachers trusted to teach in the way they think is best?
3. How positive are the attitudes of your colleagues?
4. How supportive are students in their interactions with each other?
5. How respectful are the relationships between teachers and students?
6. How often do you see students helping each other without being prompted?
7. When new initiatives to improve teaching are presented at your school, how supportive are your colleagues?
8. Overall, how positive is the working environment at your school?

Professional Learning

9. How often do your professional development opportunities help you explore new ideas?
10. How relevant have your professional development opportunities been to the content that you teach?
11. Through working at your school, how many new teaching strategies have you learned?
12. Overall, how much do you learn about teaching from the leaders at your school?

Teaching Efficacy

13. How confident are you that you can help your school's most challenging students to learn?
14. How confident are you that you can move through material at a pace that works well for each of your students?
15. When one of your teaching strategies fails to work for a group of students, how easily can you think of another approach to try?
16. How effective do you think you are at managing particularly disruptive classes?
17. How confident are you that you can engage students who typically are not motivated?
18. How clearly can you explain the most complicated content to your students?

19. How confident are you that you can meet the learning needs of your most advanced students?

Educating All Students

20. How easy do you find interacting with students at your school who are from a different cultural background than your own?
21. How comfortable would you be incorporating new material about people from different backgrounds into your curriculum?
22. How knowledgeable are you regarding where to find resources for working with students who have unique learning needs?
23. If students from different backgrounds struggled to get along in your class, how comfortable would you be intervening?
24. How easy would it be for you to teach a class with groups of students from very different religions from each other?
25. In response to events that might be occurring in the world, how comfortable would you be having conversations about race with your students?
26. When a sensitive issue of diversity arises in class, how easily can you think of strategies to address the situation?

Testing

27. How much pressure from school leaders do you feel to have your students achieve certain testing results?
28. At your school, how often are you encouraged to teach test-taking strategies?
29. How much pressure do you feel to cover particular content in your teaching?
30. How many of your teaching decisions are made with the goal of trying to improve students' test scores?
31. How often do you teach topics you think are unimportant because of pressure around standardized tests?
32. How much pressure do you feel to cover a certain amount of content by a particular point in the year?

Background Questions

- For how many years have you taught?
- For how many years have you taught at your current school?
- If a friend or colleague were looking for a teaching job, to what extent, if at all, would you recommend this school?
- What is your gender?
- What is your race or ethnicity?
- In which decade were you born?

- Please select the highest level of education completed by your mother. If you are not sure, please take your best guess.
- Please select the highest level of education completed by your father. If you are not sure, please take your best guess.

APPENDIX B

REFORMED TEACHING OBSERVATION PROTOCOL (RTOP)

I. BACKGROUND INFORMATION

Name of teacher _____ Announced Observation? _____
(yes, no, or explain)

Location of class _____
(district, school, room)

Years of Teaching _____ Teaching Certification _____
(K-8 or 7-12)

Subject observed _____ Grade level _____

Observer _____ Date of observation _____

Start time _____ End time _____

II. CONTEXTUAL BACKGROUND AND ACTIVITIES

In the space provided below, please give a brief description of the lesson observed, the classroom setting in which the lesson took place (space, seating arrangements, etc.), and any relevant details about the students (number, gender, ethnicity) and teacher that you think are important. Use diagrams if they seem appropriate.

Record here events that may help in documenting the ratings.

Time	Description of Events

III. LESSON DESIGN AND IMPLEMENTATION

	Never Occurred				Very Descriptive
1) The instructional strategies and activities respected students' prior knowledge and the preconceptions inherent therein.	0	1	2	3	4

2)	The lesson was designed to engage students as members of a learning community.	0	1	2	3	4
3)	In this lesson, student exploration preceded formal presentation.	0	1	2	3	4
4)	This lesson encouraged students to seek and value alternative modes of investigation or of problem solving.	0	1	2	3	4
5)	The focus and direction of the lesson was often determined by ideas originating with students.	0	1	2	3	4

IV. CONTENT

Propositional knowledge

6)	The lesson involved fundamental concepts of the subject.	0	1	2	3	4
7)	The lesson promoted strongly coherent conceptual understanding.	0	1	2	3	4
8)	The teacher had a solid grasp of the subject matter content inherent in the lesson.	0	1	2	3	4
9)	Elements of abstraction (i.e., symbolic representations, theory building) were encouraged when it was important to do so.	0	1	2	3	4
10)	Connections with other content disciplines and/or real-world phenomena were explored and valued.	0	1	2	3	4

Procedural Knowledge

11)	Students used a variety of means (models, drawings, graphs, concrete materials, manipulatives, etc.) to represent phenomena.	0	1	2	3	4
12)	Students made predictions, estimations and/or hypotheses and devised means for testing them.	0	1	2	3	4
13)	Students were actively engaged in thought-provoking activity that often involved the critical assessment of procedures.	0	1	2	3	4
14)	Students were reflective about their learning.	0	1	2	3	4
15)	Intellectual rigor, constructive criticism, and the challenging of ideas were valued.	0	1	2	3	4

Continue recording salient events here.

Time	Description of Events

V. CLASSROOM CULTURE

Communicative Interactions

16) Students were involved in the communication of their ideas to others using a variety of means and media. 0 1 2 3 4

17) The teacher's questions triggered divergent modes of thinking. 0 1 2 3 4

18) Student questions and comments often determined the focus and direction of classroom discourse. 0 1 2 3 4

19) There was a climate of respect for what others had to say. 0 1 2 3 4

Student/Teacher Relationships

20) Active participation of students was encouraged and valued. 0 1 2 3 4

21) Students were encouraged to generate conjectures, alternative solution strategies, and ways of interpreting evidence. 0 1 2 3 4

22) In general, the teacher was patient with students. 0 1 2 3 4

23) The teacher acted as a resource person, working to support and enhance student investigations. 0 1 2 3 4

24) The metaphor "teacher as listener" was very characteristic of this classroom. 0 1 2 3 4

Additional comments you may wish to make about this lesson:

Source Reformed Teaching Observation Protocol (RTOP) reference manual (Piburn, & Sawada, 2000).

APPENDIX C

FOCUS GROUP INTERVIEW GUIDING QUESTIONS

There are eight Algebra I teachers at the high school being studied. The purpose of the interview questions is to identify areas in which the teachers would like to grow professionally and how to be culturally responsive to the diverse needs of their students. Some example interview questions include the following:

- What is inquiry-based learning, and how is it implemented in your classroom?
- Do you believe IBL is beneficial to students?
- What are some benefits and limitations you experience with IBL?
- Were there any surprises when implementing IBL?
- How are does a student's cultural background affect their learning?
- What are the cultural benefits of IBL?
- Are IBL practices effective in narrowing the achievement gap for African American students?
- Do you believe the professional development improved your instruction?

APPENDIX D

IRB NON-HUMAN RESEARCH DETERMINATIONS

DIVISION OF RESEARCH

NOT HUMAN RESEARCH DETERMINATION

October 15, 2019

Type of Review:	Initial Review Submission Form
Title:	The effect of inquiry-based learning on African- American students in Algebra I
Investigator:	Mary Margaret Capraro
IRB ID:	IRB2019-1262
Reference Number:	098772
Funding:	
Documents Received:	IRB Application (Human Research) - (Version 1.0)

Dear Mary Margaret Capraro:

The Institution determined that the proposed activity is not research involving human subjects as defined by DHHS and FDA regulations.

Further IRB review and approval by this organization is not required because this is not human research. This determination applies only to the activities described in this IRB submission and does not apply should any changes be made. If changes are made you must immediately contact the IRB about whether these activities are research involving humans in which the organization is engaged. You will also be required to submit a new request to the IRB for a determination.

Please be aware that receiving a 'Not Human Research Determination' is not the same as IRB review and approval of the activity. IRB consent forms or templates for the activities described in the determination are not to be used and references to TAMU IRB approval must be removed from study documents.

If you have any questions, please contact the IRB Administrative Office at 1-979-458-4067, toll-free at 1-855-795-8636.

Sincerely,
IRB Administration

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