SOCIAL JUSTICE MATHEMATICS: CLASSROOM PRACTICES THAT GIVE STUDENTS RIGOR WHILE BUILDING AGENCY

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ABSTRACT

Social Justice Mathematics Classroom Practices that Give Students Rigor While Building Agency

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The purpose of this study is to examine the impact of a social justice approach to mathematics instruction. While many students have math aversion, students in low socioeconomic communities exhibit this to a higher degree putting them at a disadvantage as they progress through their educational career. More than 3.4 million K-12 students in the United States come from families that earn less than the median income yet achieve scores in the top percentile (Wyner et al., 2007). This raises the question of why so many students in low-socioeconomic settings are not given rigorous content that will keep them competitive on the national stage. The present study draws from a population of low-socioeconomic status, all participants are from a district of low- socioeconomic status (94% are designated by the state as economically disadvantaged), therefore demonstrating a need for this study. In most research done on social justice math, the discussion focuses on the impact of student performance and not the actual teaching methods. Of the research done on the topic, it is frequently pointed out that there are very few known methods to teach social justice math (Leonard, J., Brooks, W., Barnes-

Johnson, J., & Berry, R. Q., 2010). Therefore, it is imperative to research what methods are successful for the implementation of social justice in a math classroom.

DEDICATION

I dedicate this work to my students,

Throughout this academic journey, you have been my greatest source of inspiration and motivation, driving my commitment to social justice in education. Your curiosity, resilience, and dedication to learning have continually reminded me of the profound impact education can have on individual lives and the potential it holds for fostering a more just and equitable society.

This work is dedicated to you, my students, both past and present. Your thought-provoking questions, strength in the face of challenges, and enthusiasm for knowledge have fueled my own passion for research and teaching. It is my earnest hope that the findings and insights within these pages contribute, although in a small way, to the collective pursuit of a more enlightened and equitable world for all learners.

Thank you for the countless moments of learning, growth, and shared discovery. You have been my constant reminder of the transformative power of education and the imperative to strive for social justice within our educational systems. I am forever grateful for the privilege of being your teacher.

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CHAPTER I

INTRODUCTION

Mathematical Marginalization

In many low-income schools, especially schools with high Latinx populations, students are mathematically marginalized by their lack of resources (Chen & Horn, 2022). The term Latinx is used to describe persons of Latin American descent as a nonbinary alternative for Latina or Latino in order to be inclusive of all students. Many of these children learn early on that they do not matter in the bigger picture of society because that is what they are subliminally taught their whole lives in school (Domina et al., 2017). More than 3.4 million K-12 students in America come from families that earn less than the median income yet achieve scores in the top percentile (Wyner et al., 2007). This raises the question of why so many students in low-socioeconomic settings are not given rigorous content that will keep them competitive on the national stage.

Similarly, in subtractive schooling, students from diverse cultural and linguistic backgrounds can be encouraged or required to adopt the language, values, and norms of the dominant culture (Valenzuela, 1999). This is often at the expense of their own cultural and linguistic heritage. Subtractive schooling can result in students feeling alienated from their own identity and heritage, which may negatively impact their self-esteem and overall well-being. Teaching math using social justice provides grade-level appropriate and rigorous content to students and informs them of the injustices students in low-socioeconomic settings face. In most research done on social justice math, the discussion focuses on the impact on student performance rather than the actual teaching methods. It is frequently pointed out that very few known methods to teach social justice math are known (Leonard et al., 2010). Therefore, it is

imperative to research the successful methods for implementing social justice in a math classroom.

Social justice mathematics is an approach to teaching and learning mathematics that seeks to redistribute resources and recognize marginalized groups as equals through the lens of mathematics education (Kokka, 2015). This teaching method is used by students and teachers to empower marginalized communities inside and outside of the educational setting. Education inequalities are characterized by low student achievement, non-rigorous material, educator quality, and unjust disciplinary practices (Flores, 2007). Meanwhile, outside of the classroom, a plethora of civil rights injustices, such as racial profiling, police terrorism, food deserts, and many more, are affecting the daily lives of students who live in low-socioeconomic neighborhoods (Kokka, 2015). With all of the injustices happening inside and outside of the classroom, teaching math using social justice plays a critical role in education for a better future. Social justice math is a concept that has been introduced previously in education. Teaching oppressed populations about the injustices they face has been around for decades. Paulo Freire was an educational theorist from Brazil whose principal philosophies revolved around freeing oppressed people through liberatory pedagogy. In his most famous works, Freire explained that the banking model of education must be relinquished to free the oppressed successfully. The banking model is teacher-centered and non-critical. Freire explains that this can be done by using dialogue in the classroom so that the teacher can also take on the student role. Through conversation, teachers and students can build intersubjectivity (Hayes & Matusov, 2005). Social justice math allows students to engage in dialogue with their teachers and peers. Conversational discourse not only allows the teachers and students to build their relationship, but it also helps both see the world through the other's eyes, opening them up to new perspectives

(Freire, 1970).

Freire claims that to liberate the oppressed, teachers must unveil the truth of the oppression of people to students giving them the means to become a part of civilization to help the greater good (Cortina & Winter, 2021). Freire uses the Brazilian word conscientização to explain that teachers must build conscientization within their students. Conscientização is an act of knowledge that liberates the learner. Through conscientização, students become cognizant of the reality of their oppression or that of others. "These processes of helping students understand, formulate, and address questions and develop analyses of their society are critical components of teaching for social justice" (Gutstein, 2003, p.40). Conscientização and praxis are vital for liberating the oppressed (Freire, 1970). According to Freire (1970), "Problem-posing education, as a humanist and liberating praxis, posits as fundamental that the people subjected to domination must fight for their emancipation" (p.86). Freire equates problem-posing learning as a way for students to think critically while also building the agency needed to have the courage to emancipate themselves. Social justice math uses the Pedagogy of the Oppressed as a framework for building agency in students while teaching them to be critical scholars.

Fostering social justice in mathematics education involves more than encouraging students to seek agency beyond the confines of the classroom and the broader world. Social justice mathematics requires students to develop positive social and cultural identities in their language and culture (Murrell, 1997). Culturally relevant pedagogy plays a significant role in social justice mathematics. Ladson-Billings (2014) explains that on top of academic success and sociopolitical consciousness, a significant component of culturally relevant pedagogy is cultural competence. Cultural competence is the ability to help students appreciate and celebrate their cultures of origin while gaining knowledge of and fluency in at least one other culture (Ladson-

Billings, 2014, p.75). Students are to be exposed to a variety of different cultures within the classroom in order to appreciate them and to recognize the importance of their own culture. Social justice mathematics and culturally relevant pedagogy are two educational approaches that share a fundamental commitment to equity, inclusivity, and meaningful student learning experiences. Although each concept is distinctively different, the two methods are deeply intersected and are seen as complementary in the mathematics classroom. Social justice mathematics emphasizes using mathematics as a tool to analyze and address social issues and injustices (Kokka, 2015). It encourages students to explore wealth inequality, environmental justice, and racial discrepancies through a mathematical lens. Culturally relevant pedagogy, on the other hand, centers on acknowledging and validating students' diverse cultural backgrounds and identities within the educational context (Ladson-Billings, 1995). It seeks to make learning more relevant and engaging by connecting curriculum content to students' cultural experiences. Social justice mathematics and culturally relevant pedagogy are unified in providing students with an equitable and inclusive mathematics education. These methods encourage educators to foster learning environments where all students' cultural identities are honored, and mathematics is used as a tool for social justice. Through the combined effort of social justice math and culturally relevant pedagogy, critical thinking and empowerment are central to the educational experience.

Critical consciousness refers to the awareness and understanding of societal and systemic inequalities within the educational system (Valenzuela, 2016). Valenzuela (1999) denotes the term " subtractive schooling " as an educational approach that, rather than adding value to students' existing cultural and linguistic backgrounds, tends to subtract or devalue their cultural assets. When teachers instill critical consciousness into their classes, students are encouraged to

question the subtractive aspects of their educational experiences. Critical consciousness allows students the agency to analyze the power dynamics at play in education and in the outside world, teaching them to demand a more inclusive and equitable learning environment for their future (Valenzuela, 2016). It involves understanding the inequalities and actively working towards transforming the system that oppresses them to serve the diverse needs of all better.

The intersected themes of social justice math, critical consciousness, subtractive schooling, and Paulo Freire's Pedagogy of the Oppressed unite to emphasize the ever-urgent need for transformative education. The widespread marginalization of students, particularly those in low-income schools, emphasizes the detrimental effects of subtractive schooling on students' identities and self-esteem (Valenzuela, 1999). The call for social justice math emerges as a solution, aligning with Freirean principles of liberation through education (Freire, 1970). By fostering critical consciousness and engaging students in dialogue, social justice math becomes a means for conscientization. It empowers students to reveal the truth of their oppression and actively participate in their liberation. Freire's emphasis on problem-posing education and praxis further reinforces social justice math's role in building students' critical thinking skills and agency (Freire, 1970). Additionally, integrating culturally relevant pedagogy complements social justice math, highlighting the importance of cultural competence in creating inclusive learning environments (Kokka, 2015). The combined efforts of these approaches stress the importance and connectedness of equity, inclusivity, and meaningful learning experiences.

In this mixed methods research study (Mertler, 2022), a classroom of middle school students has been immersed in the world of social justice mathematics for one unit of study. The unit's curriculum remains the same; however, the researcher has adjusted the examples and scenarios with the unit to meet the social justice mathematics criteria. The students were interviewed

before and after implementing the social justice mathematics materials, and the interviews were transcribed and coded by a transcription service. Students were asked their opinions regarding mathematics, including their perceptions of representation within the classroom and the curriculum. The quantitative data gathered from the students has been compared to the non-researched class to see if the social justice aspect of math impacted the class's test scores. The results of the qualitative data are analyzed according to the emergent theme analysis (Mertler, 2022) and coded into the respective themes.

Research Question

This study will address the following question: What mathematical pedagogical methods can be used to decrease the mathematical marginalization of Latinx students in South Texas?

Positionality

I am a secondary math teacher at a Title 1 school in south Texas in a district where the demographics are 95% Latinx, 3% white, and 2% black (National Center for Education Statistics 2022). As a teacher of Latina-white heritage, I have spent nearly my entire life residing in South Texas, except for inside the district where I am currently employed. I was trained to teach at Texas A&M University–San Antonio, a Hispanic-serving institution. In this program, I took a social studies methods class where my professor opened my eyes to social justice and the lack thereof in classrooms nationwide. I have been a secondary math teacher for three years and am certified to teach math for grades 4-8. As a Latina woman who was raised by a Latina woman who was oppressed in her education, I have a duty to my fellow Latinas, their mothers, and their children to research social justice in mathematics classrooms. This personal and cultural background informs this research. My research is also informed by a duty to my students to open them up to the world of math around them while allowing them to build pride in their

community.

CHAPTER II

REVIEW OF LITERATURE

Social justice mathematics will help students with math aversion find themselves within the curriculum because it empowers them to connect mathematical concepts with real-world issues, promoting a sense of relevance, inclusivity, and cultural representation. Math, being a fundamental subject for students in the United States, can serve as a means for low-socioeconomic students to enhance their education, opening up numerous opportunities that might otherwise be beyond their reach. In his famous work, *Pedagogy of the Oppressed*, theorist Paulo Freire (1970) poses problem-solving learning as a way for students to think critically while also building the courageous agency needed to emancipate themselves from the oppression happening in their communities. Because of this, students must be represented within the content taught to them. When students can relate themselves and their lives to the content they are learning, even in math, they are able to connect to the curriculum on a level of liberation from ignorance. When students do not see themselves in the math content, math aversion and math anxiety arise. Students develop math anxiety at an early age due to timed tests and repetitive forms of learning in their beginning years of schooling (Geist, 2010). Math anxiety is just one of the reasons why it is critical that researchers study methods of teaching social justice mathematics. With these methods, we can ease student anxiety toward the subject while helping them find their place in the content of math itself.

Representation Importance

Low-socioeconomic communities are underfunded while given high expectations, which helps maintain the injustices and keep the reproduction of oppression alive (Labaree, 2012). Unfortunately, math is also a subject that bestows students in low-socioeconomic regions with

even more injustice than they already face (Chen et al., 2022). When you look at math in the classroom it may seem to appear “black and white,” because teachers are feeding the students the content and the students are regurgitating the knowledge that they learned in a cyclical matter. Looking at how math is taught in a classroom, one notices the pedagogy is made for a specific type of student. As in social studies, the most common math textbooks are full of examples of people who do not resemble the students in low-socioeconomic classrooms or the problems they face in real life. Hadar (2017), explains students’ learning experiences can be limited by what textbooks offer. In an online news article, Battey (2017) echoed this idea, “how whiteness operates in classrooms and schools, leaving black, Latino, and indigenous students disenfranchised mathematically” (Benjamin-Ficken et al., 2017). The students are underrepresented in the content area making it difficult for students to comprehend and connect to the material. Providing students with examples that they already see in everyday life can not only help students learn the math, but it can give them the ability to see themselves in the world outside of their neighborhood. Math places students very early on in their academic careers into groups based on skill and the further they advance in school the more polarizing the groups become. This is especially true when teaching in a low-socioeconomic region, where there are few people who are impartial to math. Typically, students fall into one of two groups: they either love math or they hate it. When we teach math for social justice it helps alleviate some of the injustices these students already face. The concept of teaching math for social justice is relatively recent, and ongoing research is emerging. However, the limited existing research indicates that employing this approach has the potential to significantly elevate students' academic development. The students in this study will add a voice to the oppressed classroom. By gathering the thoughts of the students who experience the injustices, a point of view is

maintained displaying the student perspective.

Pedagogy of the Oppressed

Pedagogy of the Oppressed (Freire, 1970), discusses a method of education that is commonly referred to as the "Banking Method," because teachers are supposedly depositing knowledge into the student's mind. It is a one-way interaction that is very straightforward. In this scenario, the student is rendered as knowing nothing while the teacher knows all, justifying their existence as superior over the student (Freire, 1970). Keeping the classroom teacher-centered maintains the subordination of the students. "Banking model of education tries to control thinking and reduce the creative and critical powers of the students and transforms them into passive objects" (Alam, 2013, pg.28). Teaching students that their teachers know all and are never wrong inserts the idea that they should never question authority figures, which in turn makes them easy to oppress. Without discussion and reflection in pedagogy, teachers are creating minds to manipulate. Freire analyzes the banking model of education as a microcosm to society given that there are both oppressors and the oppressed in society and in education (Govender, 2020). It is because of this that author Govender claims *Pedagogy of the Oppressed* contributes to critical theory. The solution to this banking model is not to integrate students into the structure of oppression, but to change the structure itself so that students may be able to think for themselves (Freire, 1970). When students learn how to think for themselves, they can make informed decisions based on their experiences and what is best for them rather than what is best for the oppressor.

Both *Pedagogy of the Oppressed* and social justice mathematics emphasize the development of a student's critical consciousness through learning. Freire's approach encourages oppressed individuals to critically analyze their socio-political conditions and engage in

transformative action. “A teacher who approaches teaching from a social justice paradigm has made a commitment to instruct in a revolutionary and counterhegemonic fashion” (Valenzuela, 2016, p.45). When teachers use critical consciousness in their classroom, they place the students’ lives at the center of their education. In social justice mathematics, students are encouraged to critically examine and challenge systemic injustices through mathematical reasoning (Gutstein, 2003). These frameworks work hand-in-hand to empower students to question and confront social inequities. Similarly in this study, students will challenge the system in which they did not realize they are a part of. By giving students the power of knowledge, they learn to question the way of doing things simply because it has always been done that way.

Math Anxiety

As stated above, there are few people who are impartial to math; they either hate math or love it. Math anxiety is the fear of being unsuccessful in the math classroom and has an especially damaging effect on students from low socioeconomic communities (Geist, 2010). Researchers measured anxiety over three stages: 1) the emotional response to homework and challenges, 2) the attitude towards math through confidence and enjoyment, and 3) using standardized Likert type scales to analyze feelings of anxiety. Their empirical findings showed that student anxiety levels directly affect their academic performance (García-Santillán, Navarro-Ibarra & Tejada-Peña, 2022). Anxiety in math can hinder students from reaching their full potential, whether it be the students’ future employment or their success in higher education (Geist, 2010). Research shows that there is a recurring failure among underserved groups that contributes to a negative mathematical identity that is reinforced over time (Bonner, 2014). Exposing students to social justice through math can help them feel represented in the work, while building their confidence in their ability to do math.

Student Relationships

A large part of teaching in any classroom is the relationship that students have with their teacher. If the student does not feel emotionally safe in your classroom, it will be immensely hard to get them to trust you to teach them. Building relationships with students in the classroom is crucial because it creates an environment of trust, respect, and support. When students feel valued and connected to their teacher, they are more likely to engage in learning, ask questions, and seek help when needed. Effective teachers of underserved students across populations are able to foster students' cultural identities and capitalize on students' funds of knowledge because they are driven by their deep-seated beliefs that all students can be highly successful (Bonner, 2014). This is only possible through norms and practices established in the classroom. A key starting place for educators to learn how to develop the critical elements necessary for relationships that create successful teaching is for teachers to define what this classroom looks like (Edwards & Edick, 2013).

Teachers must focus on building relationships with their students by learning about their culture and individual lives. This also means teacher involvement in home life. The teacher must be in constant communication with the parents/guardians of the students in order to provide any and every opportunity to learn. One way to do this is by acknowledging and growing parent "funds of knowledge" at home for the students. Because math is so important for students in the future when applying for college and standardized testing, it is easy for historically low achieving students to stay in the low achieving category and in turn gatekeeps more favorable opportunities (Civil, Bratton & Quintos, 2005). It is vital that parents be involved in their children's academics early on because of this. When the teacher bridges the academics at school to the students' home life, they are teaching the students how to have agency.

Social Justice Math

Research on in-service professional development programs throughout America do not directly instruct you on teaching with a social justice mindset (Gates & Jorgensen, 2009). Unfortunately, in our current political climate, it is hard to directly teach any kind of social justice without getting some push back. In recent news, the Florida department of Education has made public the rejection of many math textbooks because they contain critical race theory while not providing examples of how the math textbooks are teaching critical race theory (Bump, 2022). Critical race theory refers to a framework that emerged in the field of legal studies in the late 20th century. In education, critical race theory is used to investigate the educational experiences of the largely marginalized students across the United States (Ledesma & Calderón, 2015). Ladson-Billings & Tate (1995) argue that Critical race theory Because of the way in which some conflate social justice math as critical race theory and use the term social justice as a hot button issue to make parents anxious, teachers must be mindful of their incorporation of social justice in math. Therefore, we must inform teachers of ways they can integrate social justice ideologies in their curriculum. Starting small is the best way to introduce teachers to the idea of empowering students in the classroom. Current research on social justice math shows that integrating social justice into math pedagogy aids in the equity of education (Gutstein, 2003). Building equity in education builds agency in students.

Kokka (2015) examined social justice math, exploring both the challenges encountered in teaching this approach and potential strategies for mitigating these issues. In her article, Kokka explored social justice math by simplifying it to three main topics. The first topic is ensuring that teachers are using mathematics to empower those who are marginalized by the system of oppression. Kokka described a dominant paradigm which is essentially the systems or structure

that contribute to the inequities found inside and outside of the classroom (Kokka, 2015). She relayed that the students must be able to learn math but also be able to use what they've learned in the math classroom to change the world. The second topic is supplying all students with active rigorous math instruction. Kokka argued that students must actively be given rigorous courses because we must be providing rigor in all grades of math from kindergarten to high school to best prepare students. She explained "a school cannot expect to achieve equity and success by suddenly offering all high school seniors the opportunity to enroll in Advanced Placement Calculus if the students' kindergarten through high school mathematics instruction did not prepare them for such a course" (Kokka, 2015, p.15). Lastly, the classroom where social justice math is taught must be a co-constructed space where teachers and students hold power together. Students must be able to hold some power in the classroom if they are to be empowered by the classroom. The goal of giving the students power is "to create a space where students develop their own ways of knowing and understanding mathematics" (Kokka, 2015, p.15).

In this same article, Kokka also provided three dilemmas for social justice math. First, making sure all the formal teacher requirements are met along with the social justice math requirements required by state standards. Districts place a significant emphasis on teachers aligning their instructional practices with state standards, and when integrating social justice into mathematics education, teachers must consistently ensure that their pedagogical choices remain in accordance with these standards. The second dilemma is the lack of curriculum provided for social justice math. We already know most textbooks are Eurocentric, so finding curriculum for social justice can be particularly difficult, especially in math. Kokka's solution to this is having students choose to make their own math problems based on things they see in their community. For example, using coordinate grids to see if their community is a food desert. Finally, the

teacher must possess the sociopolitical consciousness needed to show awareness of all students lives. Based on statistics we know that many teachers are white women, so if you teach in an area where there are not a lot of white students in general it can be hard to for you to grasp just how difficult living in poverty is. Kokka encouraged teachers to go on community tours to see how your students live and to get a sense of the cultural make up of your school's demographics. Kokka's research brings to light problems that are not frequently discussed in articles and it brings a refreshing perspective to the research topic.

Examining teaching and learning mathematics for social justice, authors Larnell, Bullock, and Jett study the scholarship and pedagogy of teaching and learning mathematics for social justice using the principles of critical race theory. They explained that the teaching and learning of mathematics for social justice method is not directly teaching students about racism, rather it is bringing to light the injustices of marginalized groups using mathematical content. The work must be cognitively demanding in order to be using the teaching and learning mathematics for social justice model correctly (Larnell et al., 2016). According to their findings, educators should explicitly connect the instruction and comprehension of mathematics for social justice with critical race theory. In this article, it is inferred that we can advance critical race theory in math using teaching and learning mathematics for social justice in our classrooms. The authors claimed, "whether inside or outside of school, mathematics is political" (Larnell et al., 2016, p.26) concluding that learning mathematics for social justice is critical in the development of our students.

In a 2013, Tonya Bartell conducted a research study that showed significant data that when teachers were given a course about teaching math using social justice, they acknowledged the difficulty in supporting math and social justice goals. Teachers were given professional

development to help them teach math using social justice. During the professional development, the teachers were instructed to examine their lesson plans and determine different ways they could include social justice ideologies in the lesson. In the conclusion Bartell discussed how after conducting the research she would alter the experience further by “changing the grain size in teacher professional development from one lesson to a focus on continued integration” (Bartell, 2013, p.159). The conclusion also stated that teachers must be supported in choosing the appropriate data that aligns with their goals. Bartell suggests that showing teachers what institutionalized racism looks like in data can help teachers better understand how to interpret the data of their school. The professional development documents were collected over time throughout the semester by Bartell listening to the teachers' interactions and conversations change as the professional development went on. The discussion states that while the professional development only took place over a short amount of time, it still had a noticeable impact on teachers’ mindset.

Social justice mathematics is a way to teach math to students without changing the curriculum, but instead changing the way in which it is taught. Providing marginalized students with increased access and mathematical learning opportunities, or bolstering their sense of identity and belonging, matters immediately for the millions of students currently sitting in mathematics classrooms (Chen & Horn, 2022). Leveraging social justice math as a resource in the classroom can cultivate students' sense of agency and empower them to discover their voice. Once students are able to successfully learn the math, they can use it to change their future and the future of others (Kokka, 2015). For students to be properly represented and seen in their math classroom, they must be understood by their teacher. Taking community walks and getting to know your school’s neighborhood will help foster a sense of understanding within the

community which your school lies. Teacher preparation programs must also be able to prepare college students who are training to become teachers for the future of their career. “Learning to teach for social justice will not happen in one graduate course; it is a “lifelong undertaking” and complex process requiring effort, perseverance, and reflection” (Darling-Hammond, 2002, p. 201). Because of this, it is imperative that teacher preparation programs which are designed for math teachers are rooted in the idea of social justice mathematics.

Community Connections

Being a well-rounded teacher requires having a connection with the community in which the school resides. This connection can include local businesses, parents, and government. Civil, Bratton, and Quintos (2016) emphasized parental involvement in their qualitative study exploring the inclusion of parents in core content areas to prepare students from low-income communities for the future. They collected the data by videotaping, taking field notes, and conducting evaluations of workshops they host for the parents. One focus is on Math Awareness Workshops (MAWS) where the parents relearn vital math skills such as multiplication and division. Secondly, the parents participated in leadership training where they can then then host the same MAWS they attended. The parents claimed they learned differently because this study was “designed to engage parents in the exploration of standards-based mathematics” (Civil et al., 2005). Lastly, the same parents who participated in the leadership training hosted Math for Parent (MFP) trainings where they got to dive deeper into the math, using the general knowledge they learned earlier as a group. Many parents who started in the program and took leadership classes advanced to the point where they were becoming instructors to other parents. The program these parents experienced not only helped them advance in their knowledge of math, but it boosted their agency in their communities (Civil et al., 2005).

A major goal of an educator is to serve the community in which the school resides and serve the school community in which they work. In order to do this, teachers must acknowledge the trauma their students and their families face on a day-to-day basis (Kokka, 2018). In a qualitative study, Kari Kokka used an ecological framework when impending the healing approach in mathematics. This approach to healing centered education encompasses three frameworks: multi-tiered trauma informed care, radical healing, and Social Justice Mathematics. The method of data collection for this case study was done by using purposive sampling. Kokka selected the students at random and there was a variety of ethnicities with a large percentage of them qualifying for free lunch. The class being observed was taught the same math curriculum as the rest of the grade; however, they were looking at the math through a lens of social justice. Examples of this include teaching students using scenarios that are familiar to their own lives such as: food deserts, single parent household budgeting, and the quality of life provided by minimum wage. Kokka explained that the purpose behind social justice math is to "invite students to identify and discuss emotions with great care taken not to re-traumatize students" (Kokka, 2018, p.1199). The classroom was observed for an entire school year duration having a total of 40 observations. The sources of data collected varied between observation field notes, interviews, task sheets, and student work. After observing the classroom, Kokka concludes that social justice math lets students learn the math they need to be successful while also participating in healing practices. The "intersection of Social Justice Math, radical healing, and multitiered trauma-informed care from an ecological perspective may offer a way for students to learn mathematics, gain sociopolitical consciousness, and improve wellness" (Kokka, 2018, p.1199). The students were interviewed, and the findings concluded that the students have many opportunities to self-regulate their emotions while being shown sociopolitical problems

happening in our world today in a math lens.

Effects of Social Justice Math

Teaching social justice using math is not only helpful in the teaching of math, but it helps students build agency and find a voice for themselves and their community. Eric Gutstein conducted a mixed methods research study in which he collected data on a group of Latino students for two years as they were taught math using social justice. Gutstein compared the students' writing samples to their math work and how it changed over time. He also collected qualitative data in the classroom by conducting informal observations of the students. He noticed that students were able to read the world using mathematics and "the students slowly but steadily began to connect mathematical ideas to their growing understanding of the sociopolitical context of society" (Gutstein, 2003, p.53). Almost every student grew to what he referred to as "mathematical power" meaning their scores improved and their grade improved too. Gutstein used social justice issues in the math class to help students understand the real world and this builds their math competency as well as their agency.

In a qualitative study that compared being a critical mathematics teacher to the epistemological stance that math is historically influenced by the idea of there being an oppressor and the oppressed, Hilary Povey argued that for a long time, math class has been a routine of strategies and memorization of the strategies to solve the same problems repeatedly with the teacher always being quintessential to the process. She argued that because of this system, it is hard for students to challenge the status quo in math education. Povey's studies linked the epistemology of new teachers to their awareness of equity issues. The new teachers' responses were then analyzed and sectioned into four premises: 1) their beliefs about the nature of mathematics, 2) how those beliefs affect their pedagogy, 3) how they explain student failure, and

4) their views on initial teacher education. The results of her case study showed that teachers who identity as critical math teachers correlate with a specific epistemological stance. Povey explained that there is nothing in the teacher preparation programs to help the students rethink the nature of math. “Within courses of initial teacher education which include a subject studies element, the integration of professional and subject studies can be used to provide rich opportunities for students to rethink their understanding of the nature of mathematical knowledge and their ways of knowing related to teaching and learning based on their own practices as learners” (Povey, 2002, p.199). If teacher preparation programs began to integrate general social justice pedagogical methods into their courses, then it would be easier for teachers to bring the methods into their classrooms after leaving the program.

Students learn math more effectively with a personal connection to the content. The findings of current research shows that students develop agency and free-thinking skills when they are taught about social justice using math in the everyday classroom. Despite being relatively new to education, research shows that concept of social justice in math has made an impact. The most prominent problem with the idea of social justice math is that it is difficult to keep the coursework aligned with the state standards (Leonard et al., 2010). Applying this research can aid in identifying key tactics for use in research and curriculum writing. One article (Kokka, 2018) is the inspiration behind the research I will be conducting. Knowing what problems are faced when teaching curriculum through the social justice lens will be helpful when rewriting math curriculum and helping my students develop a stronger sense of personal agency. sense of trust (Bonner, 2014).

Culturally Relevant Pedagogy

Using culturally relevant pedagogy in a math classroom has the potential of changing

students' attitude and anxiety towards learning math (Hubert, 2013). Culturally relevant pedagogy (CRP) was a term coined by Ladson-Billings in 1995 originally to aid in creating learning environments in which African American students could thrive. According to Hubert (2013), "CRP helps students to achieve academically by ensuring that a rigorous curriculum is implemented along with the culturally relevant instruction" (p.326). CRP can be used as a praxis for teachers to create the bridge between home and school for students. When students feel at home whilst they are at school, the comfort and freedom to learn expands. CRP and social justice math are the building blocks for enacting reform within the educational system in order to bring equity to low socioeconomic communities.

In the research done on mathematics classrooms, it is shown that although the successful implementation of a culturally relevant mathematics unit will require a great deal of content knowledge, pedagogical content knowledge, planning, and continuous reflection, through consistency, CRP can help balance the mathematical goals with the goals of CRP itself (Enyedy & Mukhopadhyay, 2007). The CRP approach recognizes that students from diverse cultural backgrounds may have unique ways of learning and relating to mathematical concepts. By building upon students' cultural experiences to enhance their learning experiences, CRP provides students with opportunities they may not usually get in the average mathematics classroom. In a study done by Hubert (2013), students stated that culturally relevant instruction was their preferred method over traditional instruction (p.334). CRP in mathematics education seeks to make math more accessible, engaging, and meaningful for students by acknowledging and incorporating their cultural backgrounds and experiences into the learning process (Enyedy & Mukhopadhyay, 2007). Everyone has a culture and we as educators must acknowledge and accept our students' culture into our classrooms with open arms.

Leonard, Brooks, Barnes-Johnson, and Berry (2010) conducted qualitative research in which they argued that culturally relevant pedagogy and social justice instruction provide meaning to the learning in a mathematics classroom like they have never seen before. This article discussed the engagement of cultural norms in the classroom with social justice instruction. The methods of this research were to examine case studies which involved critical race pedagogy and social justice instruction then analyze the pros and the cons. Once the authors evaluated the case studies, they provided insight for teachers who want to teach critical race pedagogy and social justice instruction in their math classrooms. The findings state that when you provide social justice instruction in a math classroom, you "help students interpret and apply mathematical knowledge to answer questions that will potentially empower their lives and their communities" (Leonard et al, 2010). Based on the results, it is recommended to provide current and preservice teachers with modelling of critical race pedagogy and social justice instruction in math classrooms as a platform to spark ideas to the students. The authors concluded that learning critical race pedagogy and social justice instruction in the math classroom helps students gain knowledge of rigorous content and build their identity.

CHAPTER III

METHOD

Mixed Methods Research Design

To study what approaches are best used to teach social justice through math, a mixed methods case study (Mertler, 2022) with action research was conducted. The curriculum was redesigned to include more representations of students within the community and social justice themes. Then, the new curriculum was used to collect data and embed both qualitative and quantitative methods (Mertler, 2022) to determine the effectiveness of this approach.

The design of the study starts with the curriculum of a sixth-grade math classroom in south Texas. The curriculum in the district being studied is split into ten different units throughout the year. For this study, one unit from the school year will be revamped by adding social justice math practices (Kokka, 2018). The Texas Essential Knowledge and Skills (TEKS) objectives were not changed for the unit, however the activities and learning methods had different scenarios embedded throughout to be linked to relatable situations which students may have experienced. The data informs the research on any improvement in score, attitude, or participation of the students in the case study (Mertler, 2022). After receiving IRB approval (Appendix A), this study was conducted as action research to ensure the progression of the process. Methods of the lesson may have changed to adapt to student interviews. While adapting to the data as it is progressing, the new curriculum continually improves (Mertler, 2022). The data from the 2023-2024 school year that is collected will be adapted to the next year to continually keep improvement in the math curriculum.

Sampling

The data was derived from the researchers' sixth grade math results at a middle school

in a low-socioeconomic neighborhood in south Texas. For the quantitative data collected (Mertler, 2022), students' interim assessment scores were anonymously collected by student ID number from the teacher. Along with the quantitative data collection, a group of eight students were recruited (Appendix B) to be interviewed from the class twice during the study in order to provide qualitative data (Mertler, 2022). The students were chosen based on skill level shown on the previous year's State of Texas Assessment of Academic Readiness (STAAR) test. A fourth of the students chosen were of advanced high mathematical testing performance, a fourth of the students chosen were of advanced mathematical testing performance, a fourth of the students chosen were of satisfactory (or proficient) mathematical standardized testing performance, and a fourth of the students were of unsatisfactory mathematical testing performance. Parents of the selected students provided signed parental consent as well as the students themselves gave verbal ascent before every interview that takes place. The descriptive elements that are characteristic of this sample are students in the teacher's class, age, demographics, and 2022 5th grade Mathematics STAAR score.

Data Collection

Data collection occurred throughout the entire study. The first qualitative method of data collection was surveys (Mertler, 2022) issued to the students throughout the units exploring questions on attitude towards social justice math, reflections of student representation in the classroom, and if there are any noticeable differences in their comprehension of math with the new method being taught to them (Appendix D). The second method of qualitative data collection was student interviews (Mertler, 2022) conducted before and after the unit is taught to them (Appendix C). The questions that the student participants were asked to answer were solely attitudinal. The students also completed a pThe quantitative

method of data collection is the evaluation of student scores on the following data-based assessment taken after learning that specific unit (Mertler, 2022). This data was collected then compared to data-based assessment scores of the class that did not participate in the research study. All data collected during this study was analyzed for any trends or consistencies in comparison.

Qualitative Instruments

The eight student participants who have been chosen based on STAAR score were interviewed by the researcher (Mertler, 2022). The interviews conducted were attitudinal in that they inquired the opinion of the student on their views of social justice in the classroom and outside of the classroom. Interview questions asked to the students may include: When we are doing examples together and working out problems, do you feel like the word problems represent students that go to your school? When we are doing examples together and working out problems, do you feel like the word problems represent the culture of the students that go to your school? Do you feel like the examples we do together in class will help you in the real world outside of the classroom? What kinds of things would you like to see in our classroom that will help you feel more represented? What kinds of things would you like to see in our classroom that will help you learn (more) math?

Quantitative Instruments

The quantitative method of data collection is the evaluation of student scores on the following data-based assessment taken after learning that specific unit (Mertler, 2022). This data was collected then compared to data-based assessment data from the non-sampled class. All data collected during this study was analyzed for any trends or consistencies over time using the emergent theme analysis. The students have taken benchmarks every term of the

school year which are called data-based assessments (DBAs). The quantitative data is taken from the most recently taken from DBA #1 which was given on September thirteenth. The quantitative data was analyzed based on class average to determine if the class average was affected at all by the new method of teaching math.

Qualitative Analysis Procedures

The students were interviewed using a set list of questions which asked students to discuss their representation and math retention in the classroom setting. These student attitudinal interviews (Mertler, 2022) were analyzed using the emerging themes analysis. Student interviews were recorded, transcribed, and then coded to determine any early themes emerging from the first set of interviews. After the first round of interviews, an emergent theme analysis was employed to analyze the initial interview data. Students were given the same questions after the unit for the second set of interviews, and they were coded into their appropriate themes. The students' interview data was investigated for any trends particularly to do with the themes and the students' demographics. The purpose behind the interviews is to see how student interview answers change over time. The interviews indicate if students are more comfortable talking about the subject once they have learned about it. The interviews also are used to see if students can identify that the injustices that they see in their math lessons are the same ones that they deal with on a regular basis.

The student character trait reflection was to be analyzed by observing the reflection before and after the students learn about social justice math. The main qualitative data collection here was going to be to see how students' opinions are changed over time from learning about social justice through math. The student reflections were going to be transcribed and coded just as the interviews were using the emergent themes analysis

procedure. Unfortunately, there were some technology issues with this aspect of the research study and the student reflection data was lost.

Quantitative Analysis Procedures

The quantitative data (Mertler, 2022) collected in this research study is a comparison of the average student score from the given DBA #1 class average to the class average for the DBA #1 given to the non-sample class. The data that is collected is put into a Microsoft Excel spreadsheet where it was compared. The format of the data display will be a bar graph showing the average percentage. Because of this, the spreadsheet uses the average formula. The sample size for the data-based assessment student score data is one class from the teacher in the research study. The quantitative data is analyzed to determine any changes in class average score whether that is an increase or a decrease. The data is compared to a secondary sixth grade class taught by the researcher to compare scores where social justice math was taught versus scores where social justice math was not taught.

CHAPTER IV

FINDINGS

Social justice mathematics is one way of teaching and learning mathematics that has a goal that is to instill students the power to become critical thinkers and problem solvers in relation to social justice issues that surround them in school and in society. Gutstein (2003) writes a theoretical framework to use social justice pedagogy that includes goals of students reading and writing the world with mathematics. When students can interpret the world through mathematics, they build agency in themselves to become involved citizens. Social justice math involves using math as a tool to explore and address real-world problems related to social inequality, such as poverty, racism, and gender discrimination (Gutstein, 2003). Social justice mathematics seeks to challenge traditional notions of math as neutral or objective, and instead highlights the ways in which math can perpetuate or challenge systemic injustices. It also promotes a more inclusive and equitable approach to math education that supports all students, regardless of their background or identity.

This goal of this study is to determine the impact of the social justice mathematics methods on a class of sixth grade students in south Texas. Eight students out of a class of twenty have been selected to participate in interviews where they were asked different questions about how they feel about math in general and if they feel represented in their math content. The data was collected via audio recorder then transcribed from a third-party source and then coded using the emergent themes analysis (Mertler, 2022).

The structure of this chapter is according to prominent themes found through interviews and student test scores. The qualitative themes include rigorous material, lack of representation, and math in the real world.

Quantitative Findings

The quantitative data analysis was based on student results on the STAAR 2023 mathematics test and the fist DBA. In the Figure 1, the STAAR 2023 scores from the sample class and the non-sample class are pictured and compared based on percent score. The sample class had scores that are 0.59 percent higher than that of the non-sample class. It should be noted that the classes are the same size and of similar distribution of STAAR score. In figure 2, the sixth-grade math DBA #1 percent scores for the sample and non-sample class are compared. There is a 5.01 difference in scores between the sample class and the non-sample class. It should be noted that the STAAR 2023 test assessed all TEKS from the school year while the DBA #1 test assessed only the TEKS from units one and two.

Table 1

STAAR 2023 Percent Data

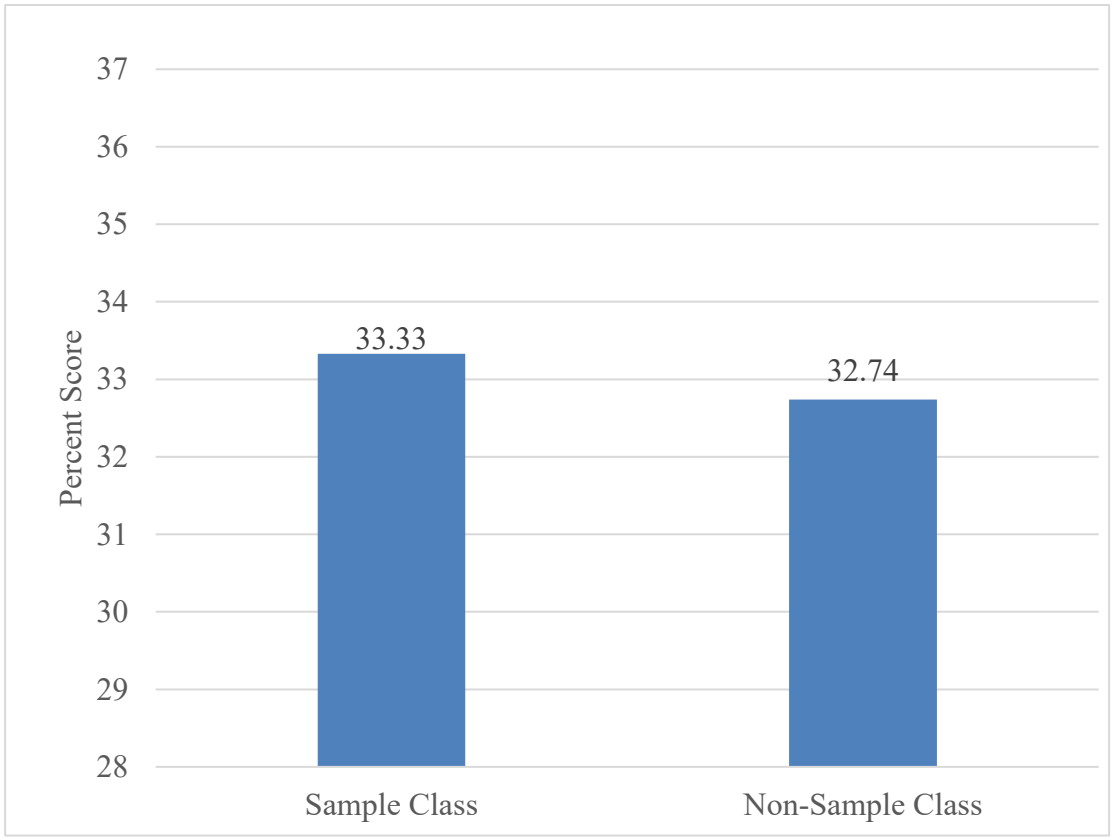
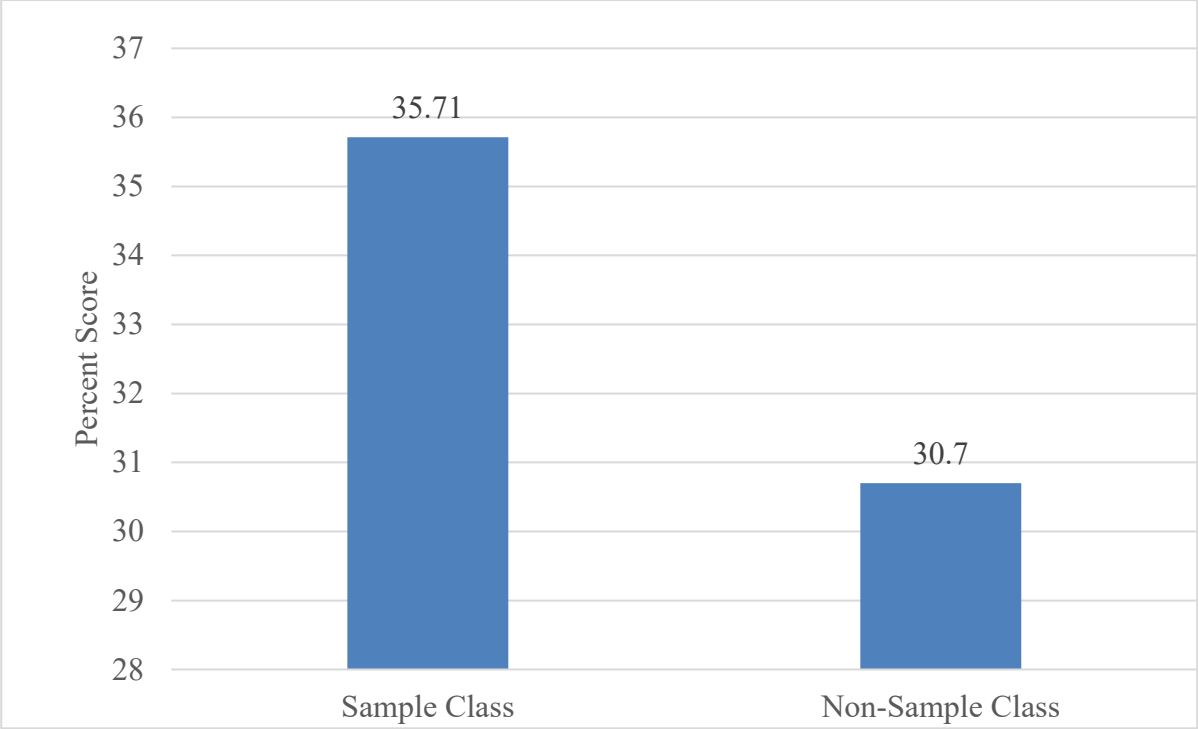


Table 2

MATH 06 DBA #1 Percent Data



Qualitative Findings

Rigorous Material

During interviews, participants were asked the question of why they enjoy math class. A notable number of students illuminated that they actually enjoy math class because they like being challenged. One student describes "it's just fun…I like doing things that are hard and when I get it right, it makes me feel good about myself". Research shows: "learning rigorous content and developing a strong mathematics identity are critical to achieving mathematics success" (Leonard et al., 2010, p.268). Many other students denoted that they enjoy being challenged in the school setting. If the classroom climate is equitable and comfortable, all students should be able to achieve mathematics success and empowerment while improving their sociopolitical consciousness and cultivating positive racial identities (Kokka, 2015). Students also noted that in

elementary school, they were traditionally unsuccessful in the math classroom. However, they claimed that they wanted to get better at math in middle school in order to be successful in the future. One student claims “I want to get better at it because last year I didn’t really pay attention in math class”. Another heavy influence on the feelings of the students was that they feel rushed. Students feel as if there is no time to practice the math they are learning- and they are correct. With the pacing of the district and the testing schedule, students are mainly learning things in one day and expected to achieve mastery the day of the lesson. One student explains, “math is actually my favorite subject…I just need practice on it”. The students want to learn and more importantly they want rigor. Teachers need to ensure the equity of providing the rigor necessary to be competitive on a national stage.

Lack of Representation

The lack of representation of students’ culture and as a whole was a major theme in the student interviews with the majority of them not feeling like they have a place in the content taught to them in math class. It was clear when conducting the interviews that the students feel unseen in the realm of mathematics. When asked what sorts of things students would like to see in the classroom to help feel represented, the majority of the students answered that they did not know how they could feel represented. This makes sense for students who have not felt representation in a classroom because it would be hard to know something you rarely see or feel. In the secondary interview, while some students answered yes to feeling represented in the classroom, most students still did not feel represented in the content of mathematics.

Math in the Real World

The shock of the interview was when students were asked if they believe what they learn in math class can help them in the outside world. Overwhelmingly, a large margin of the students

believe that math is important in real-world everyday life. Social justice math has the ability to teach students how to use math in everyday life while also teaching them how to be active citizens. “As students begin to address questions that have meaning in their lives, they begin to understand the forces and institutions that shape their world and to pose their own questions” (Gutstein, 2003). Through the math the students have the learn themselves and the world around them. Because of this, representation in the content is vital to the empowerment of students.

Summary

In the quantitative analysis, student performance on the STAAR 2023 mathematics test and the first DBA was scrutinized. Figure 1 depicts a comparison of the percent scores between the sample and non-sample classes in the STAAR 2023, revealing a 0.59 percent higher score for the sample class. Similarly, in Figure 2, the sixth-grade math DBA #1 percent scores show a 5.01 difference between the sample and non-sample classes. Notably, the STAAR 2023 test covered all TEKS from the school year, while DBA #1 focused solely on TEKS from units one and two. Meanwhile, in qualitative research, students expressed a preference for challenging math classes, citing the enjoyment derived from overcoming difficulty. Students emphasized the importance of an equitable and comfortable classroom climate to foster mathematics success, advocating for rigorous instruction. They also highlighted a sense of rushed learning due to the district's pacing and testing schedule, underscoring the need for more practice opportunities.

On the other hand, the lack of representation emerged as a significant theme in student interviews. Many students felt unseen and unrepresented in the content taught in math class, expressing uncertainty about how representation could be achieved. This lack of representation extended to the secondary interview, with most students still feeling unrepresented in the mathematical content. However, students overwhelmingly recognized the real-world importance

of math, believing it to be a crucial skill for daily life. The potential for social justice math to connect mathematical concepts with meaningful questions in students' lives was highlighted, emphasizing the importance of representation in the content for student empowerment and engagement.

CHAPTER V

CONCLUSIONS AND IMPLICATIONS

Social justice mathematics is an approach to teaching and learning mathematics that aims to empower students to become critical thinkers and problem solvers in the context of social justice issues (Gutstein, 2003). Through social justice math, students are using math as a tool to explore and address real-world problems related to social inequities like racial poverty, police brutality, and women's reproductive rights. Social justice mathematics seeks to challenge traditional methods of teaching math to educate students on how to build agency and challenge systemic injustices. While the research is still up and coming, teaching math using social justice has been shown to promote student agency while still keeping the rigor of the state standards. "[Social justice math's] use of mathematics to empower those who are marginalized by the dominant paradigm can be engaged in by both "historically marginalized" students and mainstream students"(Kokka, 2015). Social justice math can and should be utilized in all classrooms and universities nationwide.

Teaching for social justice in math helps develop sociopolitical consciousness, agency, and positive cultural identities (Gutstein, 2003). Implementing social justice math significantly deepens students' critical consciousness, fostering a nuanced understanding of societal issues, encouraging critical thinking, and empowering them to actively address injustices, thereby enhancing their agency. "Academic success is more than the acquisition of minimal skills to function in society at large; it is acquiring the tools to become a lifelong learner" (Leonard et. al., 2010, p.262). Based on the results of the data in this study, it is shown in the student test scores that using social justice math practices had a positive impact on the learning that took place over the unit that was taught. It is clear that all students should and can achieve successful

mathematics results at school while simultaneously being empowered with social justice mathematics.

The implications of social justice math are extensive and go far beyond the classroom setting. A primary goal of social justice mathematics is to ensure equal access to a quality education. “Teaching mathematics through collective discovery, discussion rather than teacher dissemination of knowledge, and open-ended problem solving – is also characteristic of the larger ‘reform’ and equity efforts in mathematics” (Gutierrez, 2002). A quality education is one where students are able to see themselves in the work. A more inclusive curriculum is something that is vital to the success of social justice math. Student interviews within this study indicated that students do not feel represented in the content they learn in their math classes daily teaching for social justice is not a matter of method but a process requiring teachers to adapt to the particular context of which they and their students are a part (Cochran-Smith, 1999). This underscores a critical aspect of student experience in the learning environment. The revelation from student interviews that they do not feel represented in the content of their math classes points to a fundamental issue of inclusivity. In the pursuit of social justice mathematics, which aims to empower students and connect mathematical concepts to real-world issues, the lack of representation becomes a barrier. Cochran-Smith's assertion that teaching for social justice is not a rigid method, but an adaptive process aligns with the dynamic nature of education. It emphasizes the need for educators to be responsive to the unique context of their students, acknowledging cultural diversity, and fostering an inclusive learning environment. Addressing the absence of representation in math content is pivotal for cultivating a sense of belonging, enabling students to engage meaningfully with the subject, and promoting social justice in education by ensuring equitable access and opportunities for all.

With the evidence being shown that teaching math using social justice has a positive impact on student learning, we can use this information to inform future practices for math classrooms. This research only took place over the span of one unit of study during a school year. Further directions for this research study would be to branch out the social justice math methodology into more than just one unit. The next step could look like incorporating these methods into a couple of units to see the impact on a semester worth of learning. If the positive growth continues, a whole school year of instruction could be planned for students. If the impact of social justice mathematics shows a big enough positive growth, this method may be moved to the district level and be mandated district wide. The power of teaching an entire school district social justice math would probably make national news.

Ideally, the long-term goal would be an entire curriculum redesigned for the teaching and learning of social justice math. A sort of playbook would be written where learning standards are broken up into the grade level. Each learning objective would come equipped with examples of social justice or culturally relevant pedagogy methods to incorporate for that specified objective. Using this, teachers would be able to plan high quality lessons while incorporating social justice themes and cultural relevancy at the same time.

As stated earlier, there has not been much research done on the specific methods in which to teach social justice math. Because of this, it is crucial for researchers to persist in their focus on social justice math to fully develop its potential. Further research on the topic would look like analyzing individual standards and outlining the different topics to highlight while teaching that specific learning objective. A roadmap of sorts to guide educators on the easiest route to teach social justice math would be helpful for many. Social justice math pioneer Kari Kokka is in the process of creating a helpful resource as a google document titled “Social Justice Mathematics

and Science Curricular Resources for K-12 Teachers". In this document are books, websites, premade lessons, and curriculum materials to use when teaching social justice math lessons. If more educators came together to streamline their resources into an easy to access document, it would be a social justice math researchers field day.

Social justice math has profound implications that researchers use to shape curriculum, teaching practices, and pedagogical methods. The exploration of social justice mathematics presented in this study highlights its transformative power in reshaping education and fostering critical consciousness, agency, and positive cultural identities (Murrell, 1997). By recognizing and embracing the implications of social justice math, the goal is to counteract subtractive schooling and empower all students, regardless of their backgrounds, to excel in mathematics (Valenzuela, 1999). As Gutstein (2003) argues, teaching math through a social justice lens empowers students to become critical thinkers and problem solvers by addressing real-world issues. The positive impact on student agency, proven in improved test scores, emphasizes that many students can achieve success while being empowered with social justice mathematics. However, the study also uncovers a significant challenge: the lack of representation in math content, as illuminated by student interviews, echoing the concept of subtractive schooling. Cochran-Smith's (1999) claim that teaching for social justice is an adaptive process supports the almost living nature of education, stressing the need for inclusivity and responsiveness to cultural diversity. The effects also extend beyond the classroom, emphasizing the role of social justice mathematics in providing equitable access to a quality education. The call for future research and the development of resources, focuses the ongoing commitment required to fully realize the potential of social justice math. As educators adapt and implement these principles, they contribute to the bigger vision of transforming education and promoting critical consciousness in

the pursuit of social justice.

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VITA

Emily earned her Bachelor of Science in Interdisciplinary Studies, specializing in 4-8 mathematics, from Texas A&M University - San Antonio. Commencing her teaching career in the Edgewood School District, she initially taught 6th grade and remains a dedicated educator in the district. Presently, Emily teaches both 6th and 8th grade while serving as the Mathematics Department chair. Additionally, she holds the role of chair for the Positive School Climate Committee (PSCC). Emily's commitment to education was recognized when she received the Edgewood Independent School District Teacher of the Year award for the 2021-2022 school year.

Appendix A

IRB Approval

TEXAS A&M UNIVERSITY
SAN ANTONIO

Graduate Studies and Office of Research
Central Academic Building, Suite 435
One University Way, San Antonio, Texas 78224
Phone: (210) 784-2317 | irb@tamusa.edu

To: Dr. Karen Burgard

From: Dr. Dawn Weatherford

Date: March 13, 2023

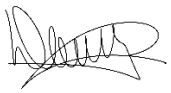
Re: Determination: Expedited Approval for Initial Protocol Application - 2023-07

The IRB application submitted by you titled **"Social Justice Mathematics: Classroom Practices that Give Students Rigor While Building Agency"** has been reviewed and approved. This application falls under the Expedited Review, Category 7 as listed under the Code of Federal Regulations, title 45 part 46. Any changes to the protocol must be approved by the IRB in advance of implementation.

This approval expires on **March 12, 2026.**

Before the original approval expires, the research will be due for renewal if it is still ongoing. Please submit an application for continuing review by **February 12, 2026,** to avoid a pause in data collection.

Upon completion of the research, a completion report must be submitted to irb@tamusa.edu.



Dawn Weatherford, PhD
IRB Chair

PLEASE NOTE: It is the responsibility of the primary researcher to amend their IRB protocol to add any future individuals who will be handling research data before they join the study. These individuals must be added to the approved protocol via a protocol amendment and must complete the CITI online course before they may handle research data or interact with human research subjects. If new individuals are not added to the protocol and trained PRIOR TO ANY HUMAN SUBJECTS CONTACT, the IRB may revoke the primary researcher's approval to conduct the research project.

IRB OFFICE USE ONLY
Last Name: Burgard (Marquise)
IRB Log# 2023-07

Texas A&M University- San Antonio

IRB Protocol Application

INSTRUCTIONS

1. Complete Training

- PI, Co-Investigator, and anyone interacting with potential participants and/or identifiable participant information or biospecimen must be listed in the protocol and complete necessary training.
- Refresher training must be completed every two years.
- More details can be found at: http://www.tamusa.edu/graduatestudiesandresearch/irb/index.html

2. Complete Form

- Form must be typed and free of typographical/grammatical errors. *Handwritten forms will not be accepted.*

3. Attach Documents to Application *(Be sure to label and reference material)*

☒ Training documentation: Social and Behavioral Research *and* The Revised Common Rule CITI completion report for all investigators
☒ Consent documentation *(as applicable)*: consent protocol, consent form, assent form
☒ Recruitment materials *(as applicable)*: flyers, letters, scripts, e-mail, etc.
☒ Procedural materials: Survey, Interview, Focus Group Questions, and/or Questionnaire
☒ Additional documentation *(as applicable)*: Any other documents referenced in this application
☒ Signature Assurance page signed by each listed investigator (e.g., PI, Co-Investigator, Additional Investigator)

4. Submit Application

Submit the complete IRB protocol (application and required documentation) to Graduate Studies and Office of Research by the following submission options:

- Email completed scanned copy to irb@tamusa.edu,
  or
- Deliver completed original copy of IRB Proposal Application documents to IRB in CAB #435

Please see Scheduled Meeting Dates for IRB proposal applications that require IRB Full Board Review.

Incomplete submissions will be returned and you will be notified of the missing material. Applications will not be reviewed until all required material is received.

If you have any questions or need assistance completing this application, please call The Office of Research at (210)784-2317 or e-mail irb@tamusa.edu

INVESTIGATOR INFORMATION

Principal Investigator's Name: Karen Burgard

☒ Faculty ☐ Staff

Department: Curriculum and Instruction College: College of Education and Human Development

Mailing Address (*if not A&M-SA)*:

Campus Phone: 210-784-2559 Office Location: Madla 261

Fax: NA Alternate Phone: 816-820-0708

Email: kburgard@tamusa.edu

Co-principal Investigator's Name: Emily Marquise

☐ Faculty ☐ Staff ☐ Doctoral Student ☒ Graduate Student ☐ Undergraduate Student

Department: Curriculum and Instruction College: College of Education and Human Development

Mailing Address (*if not A&M-SA)*: 2210 Rogers Road #6202 San Antonio, TX 78251

Campus Phone: NA Office Location: NA

Fax: NA Alternate Phone: 210-846-7588

Email: Emarq01@jaguar.tamu.edu

List additional Investigators: *(all investigators are required to sign the Signature Assurance page)*

Is this study part of a Thesis or Dissertation? ☒ Yes ☐ No

Is this study part of a Graduate Research Project? ☐ Yes ☒ No

PROJECT

Project Title: Social Justice Mathematics: Classroom Practices that Give Students Rigor While Building Agency

Anticipated Start Date: March 20th, 2023 Anticipated End Date: March 31st, 2023

Funding Status:

☐ Externally Funded* ☐ Internally Funded* ☐ Funding Under Review* ☒ Not Funded

☐ Other *(describe)*:

Funding agency: NA

Must include a draft of the grant application. Once grant is completed/submitted, a final draft must be submitted to the IRB.

Does this protocol require approval from multiple IRBs?

☐ Yes *(describe)*:

☒ No, only A&M-SA IRB

Indicate the review category. *You can visit the Electronic Code of Federal Regulations for assistance.*

☐ Exempt *(select one of the exempt categories below)* §46.104

- ☐ Category 1
- ☐ Category 2
- ☐ Category 3
- ☐ Category 4
- ☐ Category 5
- ☐

Category 6
Category 7 *N/A*

Texas A&M University- San Antonio

Signature Assurance

INVESTIGATOR RESPONSIBILITIES

Investigators assume the following responsibilities:

I have read The Belmont Report "Ethical Principles and Guidelines for the Protection of Human Subjects of Research" and subscribe to the principles it contains.

I accept responsibility for the scientific and ethical conduct of this research study.

I will obtain prior approval from the Institutional Review Board (IRB) before amending or altering the research protocol or implementing changes in the approved consent form and/or information sheet.

I will immediately report to the IRB any unanticipated effects on subjects, which may occur as a result of this study.

I will retain the consent forms and other research documents in a locked/secure manner for a minimum of three years. Students must turn over all documents to the primary faculty advisor upon completion of the study in most cases.

I will complete, on request by the IRB, the Continuation/Final Review forms.

I do not have a personal/financial conflict of interest and I have submitted my Financial Conflict of Interest Disclosure Statement in Maestro (if applicable).
(If you have a conflict of interest, you must specify - as an attachment - the conflict of interest and describe what safeguards are in place to ensure that the conflict of interest does not affect the experimental results.)

I have reviewed all forms and documents being submitted.

Date: January 16, 2023

Investigator Signature:
Print/Type First and Last Name: Karen L. B. Burgard

Date: January 19, 2023

Investigator Signature:
Print/Type First and Last Name: Emily Marquise

Date: _____

Investigator Signature: _____
Print/Type First and Last Name:

Date: _____

Investigator Signature: _____
Print/Type First and Last Name:

Date: _____

Investigator Signature: _____
Print/Type First and Last Name:

Date: _____

Investigator Signature: _____
Print/Type First and Last Name:

TEXAS A&M SAN ANTONIO UNIVERSITY
APPROVED
3/13/2023
INSTITUTIONAL REVIEW BOARD

Appendix B

Recruitment Email

To whom it may concern,

Good morning, this is Ms. Marquise, the 8th grade math teacher at Brentwood Middle School. I am reaching out to you because I have chosen your child to be a possible participant in my graduate research study. Currently, I am in my final year of graduate school and will be conducting research on your student's class during March and would like your child to participate in a few interviews and surveys involving the research study.

Purpose: The purpose of this research study is to examine the impact of a social justice approach to mathematics instruction. The math that the students will be learning is going to be the exact same, however the examples in which we complete in class are going to be more culturally and socially relevant to things your students would see in the community they live in.

Time Commitment: The time commitment associated with this study will be one in which students eat lunch in my classroom a total of two times in order to complete surveys/interviews. The dates in which this takes place will be flexible and students can choose whichever dates work best with them.

Compensation: There is no compensation for participating in the study. If you are interested in consenting to your child being involved in this research study, please reply to me at this email address emily.marquise@eisd.net.

Appendix C

Semi-Structured Interview Questions

Student Interviews

Emily: Hello, thank you for participating in this study. I am going to ask you ten questions with the possibility of clarifying and follow up questions. Please answer truthfully and all of your answers will be kept private. Feel free to not answer any questions at any time. Ready?

Interview One

1. Do you like math?
2. Why do you/do you not like math?
3. How do you feel when you come to math class every day?
4. What would make you excited to come to math class?
5. Do you feel welcome in Ms. Marquise's classroom? If so, what are some ways Ms. Marquise makes you feel welcome?
6. What would make you feel more welcome to Ms. Marquise's classroom?
7. When we are doing examples together and working out problems, do you feel like the word problems represent students that go to Brentwood?
8. When we are doing examples together and working out problems, do you feel like the word problems represent the culture of the students that go to Brentwood?
9. Do you feel like the examples we do together in class will help you in the real world outside of the classroom?
10. What kinds of things would you like to see in our classroom that will help you feel more represented?
11. What kinds of things would you like to see in our classroom that will help you learn (more) math?

Interview Two

1. When we are doing examples together and working out problems, do you feel like the word problems represent students that go to Brentwood?
2. When we are doing examples together and working out problems, do you feel like the word problems represent the culture of the students that go to Brentwood?
3. Do you feel like the examples we do together in class will help you in the real world outside of the classroom?
4. What kinds of things would you like to see in our classroom that will help you feel more represented?
5. What kinds of things would you like to see in our classroom that will help you learn (more) math?

Appendix D
Student Surveys

Student Surveys

I want to thank you again for participating in this study. I'm going to give you a short survey based on your feelings towards math and how you as a student are represented in the math curriculum. If you do not feel comfortable answering, you do not need to complete the survey. Ready?

* Required

* This form will record your name, please fill your name.

1. On a scale of one to five, how much math knowledge do you feel you have gained since the start of Unit 9? One meaning no knowledge has been gained and five meaning you feel very knowledgable about Unit 9. *

1	2	3	4	5

2. On a scale of one to five, how much do you feel represented in the math problems that have been given to you in school? One meaning you feel no representation and five meaning you can see yourself represented in the math problems. *

1	2	3	4	5

Student Surveys

I want to thank you again for participating in this study. I'm going to give you a short survey based on your feelings towards math and how you as a student are represented in the math curriculum. If you do not feel comfortable answering, you do not need to complete the survey. Ready?

* Required

* This form will record your name, please fill your name.

1. On a scale of one to five, how much math knowledge do you feel you have gained since the start of Unit 9? One meaning no knowledge has been gained and five meaning you feel very knowledgable about Unit 9. *

1	2	3	4	5

2. On a scale of one to five, how much do you feel represented in the math problems that have been given to you in school? One meaning you feel no representation and five meaning you can see yourself represented in the math problems. *

1	2	3	4	5

3. On a scale of one to five, how much do you feel your culture is represented in the math problems that have been given to you in school? One meaning none of your culture is represented and five meaning you feel that your culture is fully represented in the math problems. *

1	2	3	4	5

4. On a scale of one to five, how much do you feel the math you have learned connects to the real world? One meaning no connection to the real world and five meaning everything we learn in math connects to the real world. . *

1	2	3	4	5

5. On a scale of one to five, how connected do you feel to the adults at your school? One meaning you do not feel a connection and five meaning you feel very connected to the adults at your school. *

1	2	3	4	5