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FLORIDA INTERNATIONAL UNIVERSITY

Miami, Florida

DOMINANT AND CRITICAL MATHEMATICS: A MULTI-CASE STUDY
EXAMINING MATHEMATICS TEACHERS' EQUITABLE TEACHING PRACTICES

A dissertation submitted in partial fulfillment of the

requirements for the degree of

DOCTOR OF PHILOSOPHY

in

TEACHING AND LEARNING

by

Laura Zamudio-Orozco

2019

To: Dean Michael R. Heithaus
College of Arts, Sciences, and Education

This dissertation, written by Laura Zamudio-Orozco, and entitled Dominant and Critical Mathematics: A Multi-Case Study Examining Mathematics Teachers' Equitable Teaching Practices, having been approved in respect to style and intellectual content, is referred to you for judgment.

We have read this dissertation and recommend that it be approved.

Maria L. Fernandez

Maria Lovett

Sarah Mathews

Barbara King, Major Professor

Date of Defense: November 6, 2019

The dissertation of Laura Zamudio-Orozco is approved.

Dean Michael Heithaus
College of Arts, Sciences and Education

Andrés G. Gil
Vice President for Research and Economic Development
and Dean of the University Graduate School

Florida International University, 2019

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DEDICATION

This dissertation is dedicated to my parents, Armando Zamudio and Maria Rosa Zamudio Orozco, and my sister, Janeth Zamudio, for their unconditional support throughout this journey and for introducing me to the joy of learning. Because of you, I learned that the most meaningful learning happens when we stop negotiating who we are. Thank you for believing in my decision to move across the country and never questioning (even when I questioned) my ability to earn my PhD. Completing this program was a family project. I want you to know that every moment we spent together working, dancing, crying, and laughing, fueled my energy to keep going. I dedicate this dissertation to you three. I love you all so much.

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ABSTRACT OF DISSERTATION

DOMINANT AND CRITICAL MATHEMATICS: A MULTI-CASE STUDY
EXAMINING MATHEMATICS TEACHERS' EQUITABLE TEACHING PRACTICES

by

Laura Zamudio-Orozco

Florida International University, 2019

Miami, Florida

Professor Barbara King, Major Professor

In the field of mathematics education, it is common for studies to use test scores to examine racial and socio-economic achievement gaps. The results of such studies have influenced mathematics teachers to address issues of equitable access and achievement as part of closing existing gaps (Gutiérrez & Ezekiel Dixon-Román, 2011). However, closing achievement gaps¹ does not mean that equity has been addressed if marginalized students continue to express a cultural disconnect from the field of mathematics (Lubienski & Gutiérrez, 2008).

The present qualitative multi-case study seeks to attend to these issues by exploring the understandings of equity and equitable teaching practices of five elementary mathematics teachers in Miami public schools. Data consisted of three, semi-structured interviews and was analyzed using Gutiérrez's (2002, 2007, 2009) conceptual framework of equity, which encompasses dominant mathematics (access and

¹ The term achievement gap is used to attend to discourse of equity in mathematics education, however, it is necessary to understand that term is problematic because it does not account for inequities that transpire through teaching and learning practices in the mathematics classroom and that attending to it "moves us toward short-term solutions that are unlikely to address the long-term underlying problem" (Ladson-Billings, 2006, p. 4).

achievement) and critical mathematics (identity and power). The conceptual framework was used to examine how the four dimensions were represented in the classroom of each mathematics teacher and to identify themes across all cases.

Findings revealed both similarities and differences across mathematics teachers as related to four major themes: (a) understandings of equity, (b) justification for equitable teaching in the mathematics classroom, (c) prevalence of dominant mathematics, and (d) scratching the surface of critical mathematics. For all participants, dominant mathematics played a major role in their teaching practices as they identified access and achievement as instrumental given the current system of accountability associated with testing and feared the consequences students could face if not exposed to those dimensions. Additionally, when highlighting teaching practices that attended to identity and power, participants did not encompass the criticality described by Gutiérrez (2002, 2007, 2009), which is centered on the marginalization of students based on their identities and the need to use mathematics beyond the classroom walls. Findings suggest a need to develop research and curriculum for pre-service teachers and in-service teachers, which is informed by questioning the prevalence of dominant mathematics and attending to the importance of critical mathematics as part of equitable teaching.

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CHAPTER ONE

INTRODUCTION

The purpose of the current multi-case study was to examine mathematics teachers' understanding of equity and how they describe their use of equitable teaching practices, as well as investigate the challenges teachers experience with the culture of testing. Chapter one begins with the background to the study, problem statement, purpose of the study, and research questions. Next, the conceptual framework and significance of the study are discussed.

Background to the Study

Although there has been substantial interest in addressing issues of educational equity through mathematics, the lack of consensus about the definition of equity has led to an unclear understanding of what it is and how it can be achieved (Gutiérrez, 2002). During the education reform in the 1980s, the National Commission on Excellence in Education (NCEE; 1983) published *A Nation at Risk*, a frightful report declaring the downward trajectory of American education and the jeopardizing effects it would have on the country's economy. In the report, NCEE (1983) highlighted declining test scores, low evaluations of problem-solving skills on national exams, and existing disparities between the mathematical achievement of students from the United States and Japan. *A Nation at Risk* (NCEE;1983) prompted national interest to ensure the success of all children, with great emphasis on students who were historically marginalized in the field of mathematics, science, and technology (Reed & Oppong, 2005), and led to reforms in mathematics education.

Taking root in the evidence provided by *A Nation at Risk* (NCEE, 1983), the National Council of Teachers of Mathematics (NCTM, 1989) developed the *Curriculum and Evaluations Standards for School Mathematics* and highlighted the underrepresentation of students of color and women to warrant the call for reform. In the report, equity was put into effect as creating equal opportunities for different racial/ethnic groups and women to participate in mathematics, as the country could not afford a mathematically illiterate population (NCTM, 1989). The call for action transformed equity from an issue of justice to an issue of self-interest defined by students' success in school and tied to the economic prosperity of the United States (Secada, 1989).

In 2000, NCTM updated their standards in *Principles and Standards for Teaching School Mathematics* and listed equity at the top of their six principles. Although the National Council of Teachers of Mathematics (2000) differentiated between equity and equality by suggesting that teachers make reasonable accommodations and strong support for the success of all students (Schoenfeld, 2002), the standards did not allude to teachers' responsibility to acknowledge the role that race, racism, and social justice played in the field of mathematics (Martin, 2003). Thus, equity remained a goal associated with the economic survival of the United States by providing strong support for all students to succeed in mathematics, as defined by test scores, and less about the responsibility to acknowledge how students have been marginalized in the field.

Equitable Teaching in a Culture of Testing

Practicing equitable teaching in a culture of testing presents challenges for mathematics teachers, especially as testing season approaches. In 2001, the enactment of *No Child Left Behind* (NCLB), an education law enforcing high standards and tangible

measurable goals, took place. Following the policy, educators spoke of equity concerning student outcomes and the need to close socioeconomic and racial achievement gaps (Gutiérrez & Ezekiel Dixon-Román, 2011). Although NCLB (2001) identified outcome inequities that were relevant to marginalized students, the statistical information used to show achievement disparities offered little information about how inequities transpired within schools. Instead, NCLB (2001) pushed forward a culture of testing shaped by accountability measures that fundamentally changed how schools viewed teacher effectiveness and student achievement. As a result, the primary goal of schools became one of boosting test scores as their success would be measured by students' performance on tests.

Equity in the mathematics classroom is typically defined by requirements of high expectations, accommodations, and support for all students (NCTM, 2000). However, accountability measures such as Adequate Yearly Progress, an arbitrary mathematical formula measuring school and district performance (NCLB, 2001), have placed pressure on teachers to teach to the test, often leading them to narrow visions of teaching and learning. These narrow visions can be seen in the use of one-size-fits-all teaching practices that are solely focused on test preparation (Guisbond & Neil, 2004; Schoen & Fusarelli, 2008). Teachers align instruction with testing standards as a way of ensuring all students have access to the same knowledge and are able to meet grade-level proficiency. While teachers have reported their desire for greater autonomy to help students learn meaningful concepts, their obligation to prepare students for testing has created a culture of learning how to take tests (Hargrove et al., 2004). The obligation teachers perceive create many challenges for them as they may have no say in chosen

textbooks and may feel forced to follow curricula that does not support students' backgrounds, cultural experiences, and traditions.

Even when equitable teaching is characterized by teachers' responsibility to pay special attention to students' backgrounds, with one of those being non-native English speakers (NCTM, 2000), research shows that perceptions of language have changed since the enactment of NCLB (2001). Once the NCLB (2001) policy was in place, teachers felt forced to provide all students with the same learning material even if it hindered students' ability to engage in the classroom. Menken (2006) reported the changes that occurred in New York schools that entirely changed English as a Second Language (ESL) curriculum to reflect the content covered in standardized tests. Similarly, Lee and Oxelson (2006) found that teachers developed resistance to students' heritage language because they felt pressured to attend to the material on the test, which was presented in English. Teachers felt forced to confine their energies to English-language acquisition in the classroom because they knew that was the standard for which students were held accountable. Teachers' resistance to students' first language sends out powerful messages about who participates in the field of mathematics. Thus, in an English-only classroom setting, English language learners (ELLs) have to negotiate between their language-acquisition identity and their identity as mathematicians (Gutiérrez, 2009; Martin, 2007), often neglecting the former.

As we can see, the system of accountability emphasized by mandated testing sets up many challenges for teachers to practice equitable teaching in the mathematics classroom. These challenges emerge from accountability measures, where success is defined by students' performance on tests. Although research has documented the

negative impacts testing has on teachers and students (Menken, 2006; Lee & Oxelson, 2006), it is not likely that testing will go away soon. Therefore, there is need to examine mathematics teachers' equitable practices in the classroom and develop an understanding about the challenges presented by the culture of testing.

Statement of the Problem

Studies examining equity in mathematics have relied primarily on bridging racial and socioeconomic status (SES) achievement gaps. To examine such differences, test scores have been used to highlight discrepancies between students from different backgrounds and the results have influenced schools to tackle issues of equitable access (e.g., rigorous curriculum, classroom supplies, quality teachers) and achievement (e.g., standardized tests, entering STEM fields) to close existing gaps. However, closing achievement gaps does not mean that equity has been achieved if marginalized students continue to feel culturally disconnected from the field of mathematics; in fact, inequities inside the classroom would remain even if achievement gaps were closed (Lubienski & Gutiérrez, 2008).

When searching for studies examining the intersection of equitable teaching practices and the culture of testing in the mathematics classroom, there is a void and need to understand how mathematics teachers conceptualize and address equity while negotiating the system accountability measures. Although access and achievement play a significant role when examining equity in the field of mathematics, is it critical to also attend to dimensions of identity and power. That is, while access and achievement are part of, "preparing students to participant economically in society and privileging the status quo" (Gutiérrez, 2009, p. 9), identity and power ensure that the teaching and

learning of mathematics is centered on students' identities and mathematics is used as a tool to create change (Gutiérrez, 2009; Gutstein, 2006).

Purpose of the Study

The purpose of the present multi-case study was to examine mathematics teachers' understanding of equity and use of equitable teaching practices and how their equitable teaching practices are associated with the culture of testing. Thus, the present study sought to expand the existing literature on equity, as defined by dimensions of access, achievement, identity, and power (Gutiérrez, 2002, 2007), and how the culture of testing is related to the way mathematics teachers address equity in the classroom.

Research Questions

The following research questions provided guidance and structure as the researcher conducted the study:

1. How do mathematics teachers describe their understanding of equity?
2. How do mathematics teachers describe their use of equitable teaching practices in the classroom?
3. How are dimensions of access, achievement, identity, and power represented in mathematics teachers' descriptions of equitable teaching practices?
4. How is state mandated testing related to mathematics teachers' descriptions of equitable teaching practices?

Conceptual Framework

To move beyond addressing equity from an achievement gap perspective, Gutiérrez (2007) conceptualized of equity as the inability to anticipate mathematics participation and achievement merely upon student characteristics (e.g., race, ethnicity,

class, proficiency in the dominant language, sex, learning disability). In Gutiérrez's (2007) definition of equity, notions of participation and achievement move beyond traditional ideas of success, as identified by test scores and encompass students' identities and the distribution of power in the teaching and learning of mathematics. Further, the conceptualization of equity is framed within ideas of fairness that include both dominant mathematics, which address dimensions of access and achievement, and critical mathematics, which address dimensions of identity and power (Gutiérrez, 2002, 2007, 2009).

Dominant mathematics is related to the overall goal of student participation in the economy and privileging of the status quo (Gutiérrez, 2009). Referring to the axis as "dominant" extends the values that have been placed on mathematics, which are assessed through mandated testing (Gutiérrez, 2007). Gutiérrez (2009) argued that equitable practices in dominant mathematics can be seen through the access dimension, which are the resources available for students to engage in mathematics (e.g., quality teachers, technology, classroom supplies). The other dimension is achievement, which describes how student outcomes are measured at many levels (e.g., standardized tests, course-taking patterns, entering STEM fields). As can be seen, dominant mathematics require teachers to be conscious of the access students receive as it relates directly to student achievement (Gutiérrez, 2007, 2009).

Critical mathematics play an essential goal in achieving equity by attending to students' cultural experiences and centering those experiences in the teaching and learning of mathematics and using mathematics as a tool to create change (Gutiérrez, 2007, 2009; Max, 2017). In critical mathematics, the identity dimension works to create

positive relationships between ourselves and others and serves to acknowledge how students are racialized, classed, and gendered (Gutiérrez, 2007). Further, the identity dimensions requires that teachers recognize how marginalized students have been excluded from the field of mathematics and is part of creating an environment where students do not have to negotiate between their identities (e.g., race, gender, class, disability) and their identities as mathematicians (Gutiérrez, 2009; Martin, 2007). The power dimension of equity is a way to socially transform constructions of the classroom, society, and mathematics (Gutiérrez, 2009). To attend to power, teachers must work to transform ideas of classrooms by giving students opportunities to share their voice and knowledge and contribute to decision-making in the curriculum. Similarly, attending to power means that it is not enough for students to achieve at different levels in mathematics, they should also be aware of how mathematics can be used to critique society as part of building critical citizens (Gutiérrez, 2002, 2009).

Gutiérrez's (2007) conceptualization of equity is one that strives for teachers' inability to anticipate mathematics participation and achievement derived from students' characteristics by engaging in practices that positively address access, achievement, identity, and power. Thus, a lens that is inclusive of dominant and critical mathematics is necessary to challenge the belief that there is a one-way relationship with mathematics. That is, a relationship where mathematics serves as key in the success of people and not the other way around, where people's contributions, especially marginalized people, are pivotal to the field of mathematics (Gutiérrez, 2007).

Significance of the Study

The findings and implications of the present research have potential to create meaningful change in the areas of mathematics education research, teacher education programs, and professional development for practicing teachers. The study adds valuable contributions to understand equity through critical and dominant mathematics. Further, the study provides insight into the challenges that practicing teachers are currently facing to practice equitable teaching when confined by the culture of testing.

At the academic level, the findings suggest a need to reexamine equity through research with mathematics teachers. The research can take many forms, one being the use of current literature as elicitation tools to engage mathematics teachers in reflection and reexamination of their current understanding of equity. Through the use of data elicitation tools as part of mathematics education research, participants and researchers come together to create knowledge that is reflective of their context and current literature.

The study also has implications for teacher education (e.g., pre-service and in-service). The findings suggest a need to develop courses and professional development that is informed by questioning the prevalence of one axis (dominant mathematics) over the other (critical mathematics) and attending to the importance of critical mathematics as part of equitable teaching in the mathematics classroom.

CHAPTER TWO

REVIEW OF THE LITERATURE

Equity in Mathematics Education

Attention to equity in the field of mathematics began with *A Nation at Risk* (NCEE; 1983). While NCEE (1983) was not vocal about issues of equity in their call for improved education, they did make a small remark by stating that, “all regardless of race or class or economic status are entitled to a fair chance and to the tools for developing their individual powers of mind and spirit to the utmost” (p. 8). As a result, *A Nation at Risk* (1983) prompted national interest among educational organizations to ensure the success of all students, with emphasis on historically marginalized students in the fields of mathematics, science, and technology (Reed & Oppong, 2005).

In 1989, the National Council of Teachers of Mathematics (NCTM) published the *Curriculum and Evaluation Standards for School Mathematics* to push forward standards of teaching and learning mathematics that would be available to all students in the United States (NCTM, 1989). To justify their call for reform, NCTM (1989) highlighted the need to enhance the learning experiences of students who were marginalized in the fields of mathematics and science (Secada, 1989). The National Council of Teachers of Mathematics (1989) created new societal goals for education and stated their concerns for equity as,

The social injustices of past schooling practices can no longer be tolerated. Current statistics indicate that those who study advanced mathematics are most often white males. Women and most minorities study less mathematics and are seriously underrepresented in careers using science and technology. Creating a just society in which women and various ethnic groups enjoy equal opportunities and equitable treatment is no longer an issue. Mathematics has become a critical filter for employment and full participation in our society. We cannot afford to

have the majority of our population mathematically illiterate: Equity has become an economic necessity (p. 4).

In the report, NCTM (1989) shared their awareness of the problem, however, they overlooked the need to help teachers think critically about the role that race, gender, and SES played in students' everyday experiences in the classroom (Apple, 1992; Reed & Oppong, 2005). Further, NCTM (1989) established a hazy understanding of equity as equality and pushed forward an agenda of achieving equity by providing students with equal educational access (e.g., quality teachers, rigorous standards) and less consideration of student outcomes (Gutiérrez, 2002). And while equity is an issue of justice, it transformed equity to a concern associated with the country's economic well-being, also defined as self-interest (Secada, 1989).

In 2000, NCTM updated mathematics standards in the *Principles and Standards for School Mathematics* and listed equity as one of their core principles. The NCTM (2000) defined equity as,

High expectations and strong support for all students...Educational equity is a core element of this vision. All students regardless of their personal characteristics, backgrounds, or physical challenges, must have opportunities to study – and support to learn – mathematics. Equity does not mean that every student should receive identical instruction; instead, it demands that reasonable and appropriate accommodations be made as needed to promote access and attainment for all students (p. 12).

With equity being a core principle in the updated standards, which reflected more than ten years of experience after the publication of *Curriculum and Evaluation Standards for School Mathematics* (Schoenfeld, 2000), there was an implied promise that reform-oriented mathematics were part of improving and ensuring the success of marginalized students (Martin, 2003). However, Martin (2003) argued for the need to critically reflect

on the language and rhetoric of “mathematics for all” as it served as a blanket statement that, “signals an uneasiness or unwillingness to grapple with the complexities and particularities of race, minority/marginalized status, differential treatment, underachievement in deference to the assumption that teaching, curriculum, learning, and assessment are all that matter” (p. 10). Thus, such statements continued to push forward understandings of equity that were informed solely by access and achievement in mathematics, with no attention to how students were being marginalized in the field.

In 2014, NCTM released *Access and Equity in Mathematics Education*. In the 2014 report, they asked: “What is required to create, support, and sustain a culture of access and equity in the teaching and learning of mathematics” (p. 1)? The NCTM (2014) answered the question with their position:

Creating, supporting, and sustaining a culture of access and equity require being responsive to students' backgrounds, experiences, cultural perspectives, traditions, and knowledge when designing and implementing a mathematics program and assessing its effectiveness. Acknowledging and addressing factors that contribute to differential outcomes among groups of students are critical to ensuring that all students routinely have opportunities to experience high-quality mathematics instruction, learn challenging mathematics content, and receive the support necessary to be successful. Addressing equity and access includes both ensuring that all students attain mathematics proficiency and increasing the numbers of students from all racial, ethnic, linguistic, gender, and socioeconomic groups who attain the highest levels of mathematics achievement (p. 1).

At the same time, NCTM (2014) addressed the difference between equality and equity by asking teachers to hold high expectations and make reasonable accommodations for all students to have access to reform-oriented mathematics and achieve at high levels.

Examples of accommodations that could be made by mathematics teachers were listed by NCTM (2014) as:

- Paying special attention to non-native English speakers to allow them to engage in classroom discussions
- Conducting assessment modifications for non-native English speakers to accurately assess their mathematical proficiency
- Providing students with disabilities increased time to complete assignments
- Allocating time and resources for students who are struggling in mathematics (e.g., after-school programs, tutoring)
- Supporting and nurturing the exceptional talent of students by engaging them and challenging them with additional resources
- Providing students with adequate technological tools to explore mathematical problems and ideas

Although the report (NCTM, 2014) did address educators' responsibility to design and implement curriculum that is responsive to students' backgrounds, experiences, and cultural perspectives, the message again was clouded by what Martin (2003) defined as blanket statements (e.g., all students attain mathematics proficiency). While NCTM (2014) listed examples of accommodations to distinguish equity from equality, conceptualization of equity through notions of access and achievement persisted.

Reform Mathematics

Achieving educational equity has also been related to the debate of traditional versus reform mathematics. In the debate, researchers have focused on what it means to do mathematics (Boaler, 1997a, 1997b) and who has access to reform-oriented teaching

and learning. An argument made by those supporting reform mathematics is how even the highest performing students are treated inequitably because they are not experiencing meaningful mathematics, characterized by problem solving, analyzing data, communication, connections, and reasoning.

After conducting a longitudinal case study to compare the experiences of students in a traditional school and a project-based school, Boaler (1997a) found that the school with the traditional teaching practices led to gender differences on the national exam, with the girls performing lower than boys. The results were different for the project-based school, which showed no gender differences (Boaler, 1997a). Further, Boaler (2009) stated,

Phoenix Park school [project-based school] is not the only example of an environment that encourages equitable attainment (Silver, Smith, & Nelson, 1995), but it is one site that may provide insights into the ways in which teaching and learning practices may promote equity (pp. 136-137).

On the other hand, those disagreeing with reform-oriented have focused on the shortcomings of reform-oriented mathematics to meet the needs of all students (Delpit, 1988; Lubienski, 2000).

Delpit (1988) argued that the problem should not be centered on instructional methodology, but rather grounded in communication “across cultures and in addressing the more fundamental issue of power, of whose voice gets to be heard in determining what is best for poor children and children of color” (p. 296). Delpit’s argument emerged from her extensive work with teachers who served Black and poor students in writing instruction. When working with Black teachers who Delpit (1988) described as “the most skillful at educating Black and poor children” (p. 296), she shared how teachers did

not place themselves in boxes of “skills” or “process”, but rather understood the need to attend to both approaches to help students establish their own voice and be heard in society. Delpit (2006) also connected the argument to mathematics education by emphasizing and demanding that all methodological approaches help students develop and explore critical thinking about what they are learning and about the world (Delpit, 2006).

Lubienski (2000) reported differences in her reform-oriented classroom between the confidence of her middle-class students and working-class students. After interviewing students, Lubienski (2000) found that her working-class students described their lack of success in the classroom in relation to the open-ended nature of instruction. These findings led Lubienski (2000) to question the argument of reform mathematics being equitable for all students. And while these findings should not be generalized to all working-class students, Lubienski (2000) stressed the importance of examining SES when addressing issues of equity in reform mathematics.

The debate of traditional versus reform mathematics is common among educators when addressing issues of equity. Although there are valid arguments on both ends of the debate, it is necessary to ask oneself, what is the ultimate goal of the debate and how does it relate to equity beyond access and achievement in mathematics education? Gutiérrez (2002) argued that,

The debates about whether we can have an excellent and equitable mathematics education and whether all students can benefit from reform-oriented curriculum-pedagogy are clearly important for the future of mathematics as a field, for the teaching of it in schools, and for understanding the kinds of student outcomes we might expect in different arrangements (p. 150).

However, essential to the argument is the need to address issues of power distribution in reform-oriented mathematics (Gutiérrez, 2002). One way the power dimension may be seen in the classroom is by giving students the opportunity to use mathematics as a tool to understand and question society (Gutiérrez, 2002; Gutstein, 2006). The learning that takes place through the power dimension is different from one that engages students in solving real-world problems, which are often framed within a world that is politically neutral. As such, reform-oriented mathematics in itself does not attend to issues of power, which is a critical component of equity (Gutiérrez, 2002).

No Child Left Behind

Following the enactment of NCLB (2001), theoretical framings of equity as equality prevailed as educators placed excessive attention on the achievement gap between White, middle-class students and that of African American, American Indian, Latinx, and low SES students, and spoke of equity concerning student outcomes and the need to close the gap (Gutiérrez & Ezekiel Dixon-Román, 2011). The enactment of NCLB (2001) changed schools' responsibility to one of providing students with equal access (e.g. rigorous standards, qualified teachers, technology) in attempt to close racial, gender, and SES achievement gaps on standardized tests. The goal of closing achievement gaps had great impact for schools as students' scores determined the success of individual teachers and school districts.

Although NCLB (2001) was developed to improve education for students who were traditionally left behind in U.S. schools – emphasizing students of color, students from low SES backgrounds, ELLs, and students with disabilities, this policy did not account for the inequities that existed prior to its enactment. For example, when

accounting for access available to students, one must examine inequities that exist between the amount spent on each student in the wealthiest and poorest schools in the United States— a spending ratio of 2 or 3 to 1 (Darling-Hammond, 2004). When looking more closely at the inequities of resources available to students, Darling-Hammond (2004) noted that,

More recent analyses of data prepared for school finance cases in Alabama, California, Massachusetts, New Jersey, New York, Louisiana, South Carolina, and Texas have found that on every tangible measure—from qualified teachers and class sizes to textbooks, computers, facilities, and curriculum offerings— schools serving large numbers of students of color have significantly fewer resources than schools serving mostly White students (p. 215).

Thus, it is necessary to help educators understand that measuring schools' success with test scores does not mean that schools have the necessary resources to provide a quality education for all students to succeed.

Despite NCTM's (2000) call for reform in mathematics education shaped by problem solving, collaboration, and discussions, the system of accountability that was established following NCLB (2001) challenged teachers' ability to engage in student-centered practices. Some teachers have reported using teacher-centered practices that ask students for "just the facts" caused by the pressure of producing good test scores (Volger & Virtue, 2010, p. 56). Such actions may be representative of the attitudes created by testing, which assumes subjects are comprised entirely of factual knowledge. Herman and Golan (1993) shared the effects of testing on the instructional planning and delivery of elementary schools; teachers reported that they planned their instruction by looking at prior tests to confirm that all test content and objectives were covered. As such, the

culture of testing has forced teachers to develop instruction directly aligned to the test as a way of achieving success, even when the practices they use are known to be unhelpful.

Similarly, accountability mandates associated with testing have challenged teachers' use of equitable teaching practices in the classroom. For instance, Menken (2006) reported curriculum and pedagogy changes in ELL instruction, which took place after schools were required to submit ELLs' test scores as part of their accountability system. Menken (2006) reported that several New York schools changed their ESL curriculum to mirror the content covered in standardized tests. Some teachers in these schools reported feeling like English teachers instead of ESL teachers because their teaching consisted of "drill and kill" practices to prepare students for exams. While these practices may be aligned to NCTM's (2000) equity principle in terms of providing access for students to succeed, Menken (2006) stated, that these "practices prevent them [ELLs] from receiving pedagogy appropriate for their level of language proficiency" (p. 532). Educational reforms emerging from NCLB (2001) are troubling because they have led to homogenized instruction driven by the need to improve scores on standardized tests (Harper & Jong, 2009) and they challenge teachers' ability to engage in equitable teaching.

Four Dimensions of Equity

For the present study, I examine mathematics teachers' use of equitable teaching practices using Gutiérrez's (2002, 2007, 2009) conceptualization of equity, which addresses dominant mathematics (access and achievement) and critical mathematics (identity and power). Both axes (dominant and critical) are necessary to the field of mathematics education to move away from examining equity from perspectives of access

and achievement, which are ultimately defined by students test scores. Further, by combining dominant and critical mathematics, equity becomes characterized by students' participation and success in the field, which are related to students' ability to culturally connect with the field and the development of positive relationships between teachers, students, and mathematics.

Dominant Mathematics (Access and Achievement)

Dominant mathematics is related to the general goal of student participation in the economy and is reflective of the status quo (Gutiérrez, 2002). Referring to the axis as “dominant” extends values that have been placed on mathematics, which mirror Western culture and are assessed through standardized tests. Dominant mathematics consists of two dimensions, access and achievement. Access is directly related to the resources available for students to participate in mathematics. Gutiérrez (2007) listed examples of access as:

- Rigorous curriculum
- Quality teachers
- Classroom environments that encourage participation
- Reasonable classroom sizes
- Outside resources to support learning

The achievement dimension is described by student outcomes, which are measured at many levels, such as (Gutiérrez, 2007):

- Participation in mathematics class
- Standardized test scores
- Course-taking patterns

- Math-related careers
- Majoring in mathematics

In essence, dominant mathematics attends to students' ability to perform and succeed in mathematics, or in other words "how well students can play the game called mathematics" (Gutiérrez, 2009, p. 5).

Dominant mathematics relate to educational reforms that began with *A Nation at Risk* (1983). The access dimension of equity is aligned to early educational reform movements that acknowledged how students were affected by their "opportunity to learn" (Nasir & Cobb, 2007). The achievement dimension is related to equity concerns that emerged in the late 1980s and early 1990s, which relied heavily on standardized test scores and eventually developed into the "achievement gap." Attending to dominant mathematics requires teachers to be conscious of the access students receive to participate in mathematics as it relates directly to student achievement (Gutiérrez, 2007; 2009). Further, the examples of access and achievement presented in the next section will demonstrate the severe social and economic ramifications students face when they do not have enough mathematics (e.g., graduation, college acceptance, test scores).

Upon examining nine high schools that served a large population of Latinx, African American, and working-class students, Gutiérrez (2007) found that four of the schools showed significant success in terms of course-taking patterns and student outcomes. Gutiérrez (2007) looked closer at the four schools and observed several components that led to the schools' success. In one high school, teachers addressed access in their classrooms by relying heavily on the use of rigorous curriculum and by organizing their mathematics department to offer little to no lower-level classes where

students could get bored or become disengaged with the subject. The teachers in these high schools acknowledged mathematics as a gatekeeper, which Moses and Cobb (2001) attributed to algebra and defined as “the gatekeeper for higher math and the priesthood who gained access to it, now is the gatekeeper for citizenship” (p. 14), and organized to provide students who would traditionally be tracked into lower-level classes with access to the highest levels of mathematics. These high schools are examples of thinking about equity through dominant mathematics as Gutiérrez (2007) argued that the organization of mathematics teachers provided students with access to high-level mathematics, which resulted in evident achievement among students’ participation in mathematics and test scores.

Another way communities of mathematics teachers have attended to dominant mathematics is by holding positive beliefs about students’ abilities and holding them accountable to high expectations at all times (Gutiérrez, 2007). Gutiérrez (2003) reported these findings after she investigated a successful mathematics department within a school that served 67% Latinx students, 15% African American students, and 98% qualifying for free and reduced lunch. Part of the success of the department was defined and measured by students taking more mathematics classes than required, large number of students in calculus classes, and a large percentage of students in calculus being college bound (Gutiérrez, 2003). Although the schools’ test scores indicated that many freshmen performed below grade level in mathematics, this community of teachers attended to issues of access by offering three calculus classes instead of business math, consumer math, and one AP calculus class. Each class was taught by a different teacher with his or her own teaching style; however, they were all reflective of reform-oriented mathematics,

which promoted students' conceptual understanding of mathematics and their ability to apply procedures, concepts, and processes (NCTM, 2000).

Similarly, when examining equity-directed instructional practices in a large urban school district, Rubel (2017) presented the case of three teachers (two high-school teachers and one elementary teacher) who excelled in enacting dominant equity-directed instructional practices but struggled with critical mathematics. All three teachers attended to dominant mathematics through their focus on teaching for understanding, which aligned with NCTM's (2000) reform-oriented mathematics standards. More specifically, teachers attended to the relationship between access and achievement by centering their lessons on high-demand tasks, active student participation, making connections across representations and sensemaking, and the use of various resources (e.g., Smartboards, physical materials).

Dominant mathematics have been part of educational equity for decades. When one examines NTCM's stance on equity, issues of access and achievement are the focal point to address teachers' role in advancing equity. In the latest report, *Access and Equity in Mathematics Education*, NCTM (2014) stated:

To increase opportunities to learn, educators at all levels must focus on ensuring that all students have access to high-quality instruction, challenging curriculum, innovative technology, exciting extracurricular offerings, and the differentiated supports and enrichment necessary to promote students' success at continually advancing levels (p. 1).

Although access and achievement are necessary for students to succeed in the school system, these dimensions alone do not attend to issues of students' identity and power in the field of mathematics. As a result, students often find themselves downplaying their

backgrounds, experiences, and cultural perspectives in order to participate in the field of mathematics.

Critical Mathematics (Identity and Power)

Critical mathematics play an essential goal in achieving equity by attending to identity, students' cultural frame of orientation, and power, the use of mathematics to create change in the world (Gutiérrez, 2007, 2009; Gutstein, 2006; Max, 2017).

Although NCTM (2001) highlights teachers' responsibility to be responsive of students' backgrounds (e.g., culture, experiences, knowledge), critical mathematics require teachers to view the classrooms from historical perspectives to understand how students have been marginalized and how they can engage in teaching practices that help students embrace their identities and power in the classroom, leading to greater participation and change in the field of mathematics. The identity dimension refers to creating positive relationships between ourselves and others and teachers' responsibility to acknowledge how students are racialized (Delpit, 1988, 1995; Martin, 2007), classed (Lubienski, 2000), and gendered. Teachers can attend to identity by (Gutiérrez, 2009):

- Drawing on students' ethnic culture and language as resources for teaching and learning mathematics
- Paying attention to school context
- Examining whose perspective is valued and practiced in mathematics and challenging that narrative
- Embracing students' ethnic backgrounds and rethinking student participation in the classroom

- Creating a classroom environment that values discussion, questioning, reasoning, justification, and peer learning
- Setting a classroom culture of high expectations for all students

The power dimension of equity addresses the social transformation of classrooms, society, and mathematics (Gutiérrez, 2009). Examples of how power can be addressed by teachers are:

- Allowing students to make decisions about curriculum
- Becoming a facilitator and allowing students to share their voice and understanding of mathematics
- Using peer learning to help students learn from each other
- Creating opportunities for students to use mathematics as a tool to question society and create change

Together, identity and power create critical mathematics, where students' identities are acknowledged in ways that empower students to be critical citizens so that they can change the game of what is known to be mathematics (Gutiérrez, 2009). Although mathematics may be seen as a universal language, teachers must recognize how marginalized students have been excluded from the field and create environments where students do not have to negotiate between their identities (e.g., race, gender, class, disability) and their identities as mathematicians (Gutiérrez, 2009; Martin, 2007).

Examples of critical mathematics in the classroom are seen in the Algebra Project, a national U.S. mathematics literacy effort supporting underserved students to develop mathematical literacy as an organizing tool for educational and economic success (Moses & Cobb, 2001). In the Algebra Project, curriculum draws on students' identities by

attending to their cultural backgrounds and experiences. For example, when developing understanding of integers, the Algebra Project designed sixth-grade curriculum that built on students' experiences with public transportation (Moses & Cobb, 2001). The Algebra Project also attends to dimensions of power through their pedagogical practices. Rather than creating a classroom environment where teachers stand in front of the board and lecture through numerous mathematical concepts, students in the Algebra Project participate in classroom environments where they hold the power in the room and can at any moment hold a position of authority when learning rigorous mathematics (Moses and Cobb, 2001). Thus, the curriculum and pedagogy of the Algebra Project attends to power and mathematical identities, which Martin (2009) described as “the dispositions and deeply held beliefs that individuals develop about their ability to participate and perform effectively in mathematical contexts and to use mathematics to change the condition of their lives” (p. 3).

Another example of using critical mathematics involves the use of languages and algorithms that are unique to ELL and bilingual students. Moschkovich (2002) documented equitable practices of identity in a sixth-grade mathematics classroom to show how teachers shifted their views of student competence by focusing on students' perspectives to communicate mathematically. When students were asked to describe a comparison between rectangles and their perimeters, an ELL responded by tracing her finger along the rectangle and saying “the longer the “rángulo” [rangle], you know the more perimeter” (Moschkovich, 2002, p. 201). Rather than correcting the student for her failed attempt to use the correct mathematical word, the teacher analyzed the student's response by focusing on the mathematical description (Moschkovich, 2002).

Culturally relevant pedagogy, which encompasses teaching and learning practices that are grounded in students' cultural backgrounds, academic success, and recognition and critique of social inequities (Ladson-Billings, 1995), has also has large implications in the field of mathematics education. At the elementary level, Gutstein, Lipman, Hernandez, and Reyes (1997) have examined and reported the culturally relevant teaching practices of elementary teachers that reflect critical dimensions of identity and power. Teachers attended to identity by constructing curriculum that built on students' informal knowledge and by validating and empowering students' experiences as bilingual students through their focus on students' culture, language, and knowledge. Teachers' practices also reflected power as they emphasized the importance of helping students develop critical thinking skills through problem solving as a way of preparing students to be leaders in their communities and society (Gutstein et al., 1997).

The construct of identity has also been used to examine equity as it captures the experiences of mathematical learners within different settings. Scholarship examining identity has conceptualized of identity as students' understanding of their relationship with mathematics and students' understanding of their assigned position within the field of mathematics. These two dimensions of identity are often referred to as narrative and positional and together are helpful to understand students' mathematical interest and ability (Holland, Lachicotte, Skinner, & Cain, 1998; Horn, 2008).

Mathematical identity formation has been examined within classrooms to understand how pedagogical practices and classroom interactions create different opportunities for students to develop positive relationships with mathematics. For example, when interviewing students who were taking Advanced Placement calculus

courses in high school, Boaler and Greeno (2000) found differences among students' relationship with mathematics. Students who were placed in classrooms where discussion and peer learning were valued, described their role as active participants of knowledge creation and development, whereas students in classrooms that were centered strictly around individual work and memorizing mathematical procedures, expressed their roles as having little agency and instead being obedient and compliant to engage with mathematics (Boaler & Greeno, 2000).

Similarly, differences in mathematical identities have emerged from the organization of curriculum within and across classrooms. Upon interviewing two students, Horn (2008) found that the student who was in a school where students were tracked expressed greater challenges to her confidence with mathematics. Such challenges emerged from her understanding of the teaching practices in her college preparatory course and failing the course. The other student who was part of a de-tracked program had a different relationship with mathematics, expressing higher sense of mathematical competence. In the de-tracked school, the teachers' collective commitment to high expectations and students' success in high-level mathematics led to this student's determination and perseverance to succeed in her classes and be ready for college level mathematics. Thus, attending to mathematical identity formation is vital to understanding how students construct ideas of what it means to do mathematics and what success looks like in the field of mathematics, and how these constructs are created in the classroom and over time.

Mathematics departments have also attended to issues of identity and power by offering calculus classes that are reflective of the student body (mentioned in dominant

mathematics section; Gutiérrez, 2003). In these calculus classes, identity was addressed by teachers being responsive to students' culture and language. Throughout the school year, teachers gathered information about students' use of Spanish in the classroom and leadership styles to create a classroom atmosphere where students felt comfortable using Spanish or code-switching to engage in the classroom discussions (Gutiérrez, 2003). In turn, acknowledging students' identity also positively addressed issues of power. The most powerful example of the relationship between identity and power was when Gutiérrez (2003) followed the students from the calculus classes into college and students reported using 'the calculus card' to challenge professors' negative stereotypes of urban schools and "change the power dynamics" (Gutiérrez, 2007, p. 10).

Although teaching is about creating relationships with students, Freire (1999) argued that one cannot deny teachers' position of authority in the classroom given the prominence of what he described as the banking system, where "knowledge is a gift bestowed by those who consider themselves knowledgeable upon those whom they consider to know nothing (p. 53). Often, teachers are seen as the most influential person in the room when accounting for voice and decision-making. Such observation is not specific to mathematics as Nokes (2010) found that among eight high school history teachers, the ratio between "teacher-controlled activities to student-controlled activities was 193 to 76 or less than three to one" (p. 532). Attending to power is a way to socially transform ideas of how classrooms are set up (Gutiérrez, 2009). Further, to positively address issues of power, teachers must work to transform the idea of classrooms by giving students opportunities to share their voice and knowledge and contribute to decision-making in the curriculum.

Gutiérrez (2009) argued that, “it is not enough to learn how to play the game; students must also be able to change the game” (p. 6). Therefore, attending to power also means that it is not enough for students to achieve at different levels in mathematics (e.g., scoring high on standardized tests or entering the STEM field), they should also be aware of how mathematics can be used to critique society, which is part of becoming critical citizens. Gutstein (2006) attended to power in his classroom by creating lessons that were centered around issues affecting students (e.g., gentrification, house affordability, being labeled a minority) and implemented the use of mathematics as a way of understanding “relations of power, resource inequities, and disparate opportunities between different social groups to understand explicit discrimination based on race, class, gender, language, and other differences” (p. 25). The power dimension ensures that teachers acknowledge students as creators of knowledge who can help raise critical awareness of our society with the use of mathematics (Gutiérrez, 2002).

Critical mathematics are crucial as they challenge prevailing narratives of achieving equity by closing achievement gaps. The goal of addressing identity as part of equity is not to substitute traditional mathematics, but rather to create a meaningful balance between student reflections of self and others as part of the learning experience in mathematics (Gutiérrez, 2007; 2009). Similarly, the power dimension pushes teachers to rethink the construction of classrooms and their role in creating critical citizens.

The conceptualization of equity through dominant and critical interpretations may seem impractical, yet there is hope as Gutiérrez (2007) argued that teachers should strive to find a balance where both are achieved instead of placing both forces in opposition. Also, Gutiérrez’s (2002, 2007) conceptualization of equity works to challenge the belief

that there is a one-way relationship with mathematics, where mathematics serves as a key in the success of people and not the other way around, where people's contributions are pivotal to the field of mathematics.

Addressing Equity in a Culture of Testing

Although pressure associated with testing has influenced teachers' practices in the classroom, there are many teachers who describe a resistance to the culture of testing as a way of addressing equity. Teachers who have resisted the culture of testing have described their profession as a balancing act between accountability pressures and their beliefs on teaching and learning mathematics. These teachers (Gutstein, 2006; Reese 1998) understood their inability to be removed entirely from the testing because of its prominence in education and its ability to measure students' success in society.

In *Reading and Writing the World with Mathematics*, Gutstein (2006) described the challenges he faced while using a pedagogy for social justice and attending to high-stakes accountability measures. While preparing for the state test went against all his beliefs, Gutstein (2006) had no choice as it was vital for students' futures. The question was,

How to do it in a way that prepared students to pass both the test and at the same time better understand the political nature of the whole stratified education system as which the test was the most immediate and draconian part for students (Gutstein, 2006, p. 144).

Gutstein (2006) found a balance by organizing test preparation sessions for his students and creating math lessons where students analyzed test scores by race, gender, and class. Gutstein (2006) attended to dominant and critical mathematics by creating a balance between accountability measures and teaching for social justice; he provided students

with access (e.g., test preparation sessions) to achieve on the test, while also attending to power by using math as a tool to understand discrimination based on race, gender, and class.

Similarly, Reese (1998) considered how he could teach mathematics to his American Indian students through a liberatory instruction approach that attended to culture, linguistic, and ideological meanings (Frankenstein & Powell, 1994), while making sure his students understood the concepts that were being tested. While Reese (1998) was able to help students develop a relationship between their culture and language in lower level mathematics classes, he described the difficulty in using a liberatory instruction approach in his advanced classes (e.g., calculus, trigonometry). The difficulty faced by Reese (1998) led him to use teacher-centered practices in his advanced classes, which involved traditional teaching and little discourse, to help his students prepare for standardized tests as they all expressed great interest in college. Struggling between two different teaching approaches, Reese (1998) was able to positively address students' identities during the first years of mathematics and later on provide them with access to rigorous trigonometry instruction to help them achieve on mandated tests.

Although there is an urge to resist the culture of testing, the stories of Gutstein (2006) and Reese (1998) help us understand that it is impossible to be removed entirely from testing. If teachers dismiss the testing in their classrooms, they affect students' access to and achievement on mandated tests. Alternatively, teachers (Gutstein, 2006; Reese 1998) have interpreted their role of attending to equity by describing an act of balancing between progressive teaching practices and their duty to prepare students for standardized testing.

The balancing act described by Gutstein (2006) and Reese (1998) is significant to the field of mathematics education because it is related to Gutiérrez's (2002, 2009) conceptualization of equity, as teachers are balancing between dimensions of access and achievement (dominant axis) and identity and power (critical axis). As such, teachers report the difficulty of attending to dominant mathematics while developing critical understandings of the relationship between students, society, and mathematics.

Application to the Mathematics Classroom

Gutiérrez's (2002, 2007, 2009) conceptualization of equity has been a significant contribution to the field of mathematics education. While equity can be addressed at many levels (e.g., district, school), understanding how mathematics teachers address dominant and critical mathematics while being confined by a system of accountability that is informed by testing is vital to the field of mathematics education. Ball and Bass (2002) argued for the need to think of teaching practices as more than cognitive demands of teaching (e.g., teachers' subject-matter knowledge) or actions (e.g., pedagogy).

Similarly, Gutiérrez (2002) exclaimed that,

Equity practice refers to the practice enacted between teachers, students, and mathematics that empowers students to (a) develop proficiency in dominant mathematics, (b) develop critical stances and new perspectives on the relationship between mathematics and society, and (c) contribute toward a positive relationship between mathematics, people, and society in ways that erase inequities (p. 174).

With these relationships in mind, the present study examines equitable teaching practices and will advance the understanding of dominant and critical mathematics in the classroom. Further, the study explores how the culture of testing is related to mathematics teachers' equitable teaching practices.

CHAPTER THREE

METHODS

Purpose of the Study

The purpose of the present qualitative multi-case study was to examine mathematics teachers' understanding of equity and use of equitable teaching practices. The study sought to expand the existing literature on equity, as defined by dimensions of access, achievement, identity, and power (Gutiérrez, 2002, 2007, 2009), and how teachers attend to equity in the classroom when they have to negotiate the importance placed on testing.

Research Questions

The following research questions provided guidance and structure:

1. How do mathematics teachers describe their understanding of equity?
2. How do mathematics teachers describe their use of equitable teaching practices in the classroom?
3. How are dimensions of access, achievement, identity, and power represented in mathematics teachers' descriptions of equitable teaching practices?
4. How is state mandated testing related to mathematics teachers' descriptions of equitable teaching practices?

Case Study Framework

Because I sought to understand mathematics teachers' understanding of equity and equitable teaching practices, which are complex and often abstract concepts, a qualitative study design was used. Merriam (1998) defined qualitative research as, "an umbrella concept covering several forms of inquiry that help us understand and explain

the meaning of social phenomena with as little disruption of the natural settings as possible” (p. 5). Thus, the present study was designed to explore participants’ understanding of equity and use of equitable teaching practices and required the use of “how” questions to focus on each participant’s experience and the meanings they have constructed about equity.

For the qualitative study, I chose case study research design to gather and understand research data and answer the research questions proposed above. Tellis (1997) described case study as an exemplar methodology to conduct a comprehensive, in-depth investigation. Further, case study methodology has been described as an approach to research that enables the examination of a phenomenon within its context (Baxter & Jack, 2008). The philosophical foundation of case study lies in constructivist paradigms (Stake 1995). Such paradigms recognize the importance of human knowledge as subjective and created through our own experiences. However, it is important to note that the subjectivity in constructive paradigms does not dismiss the notion of objectivity. Baxter and Jack (2008) argued that an advantage of case study methodology is the close collaboration between participants and researchers that invites participants to share their stories. As far as case study design, Baxter and Jack (2008) described single case, single case with embedded units, and multi-case studies.

The present research study was conducted as a qualitative multi-case study and was chosen to provide rich and thorough data for each participant (Stake, 1995). An objective for my research study was to understand the story of each participant and how they understood equity and equitable teaching practices within their contexts. Further, it was important for me to use a research design that allowed me to examine several cases,

with a goal of understanding similarities and differences between all cases. Such aims assisted in choosing a multi-case study design as it allowed me to engage in analysis that considered the setting of each case (within) and the settings of all cases together (across) (Baxter & Jack, 2008; Stake, 2006).

To report the findings of the study, Merriam's (1998) descriptive case study was chosen to present, "a rich, "thick" description of the phenomena under study" (p. 29). I followed several aspects of a descriptive case study described by Merriam (1998) as: "illustrating the complexities of a situation," "showing the influence of the passage of time on the issue," "include vivid material," and "spelling out differences of opinions on the issue and suggesting how these differences have influenced the results" (p. 31). The case study form was fitting for my research study as I set out provide a thorough and descriptive analysis of participants' understanding of equity.

Researcher Autobiography

It is important for researchers to document their own lived experiences as they relate to the context of their study. Tracy (2010) described the documentation as self-reflexivity, which is, "honesty and authenticity with one's self, one's research, and one's audience (p. 842). The documentation can reveal researchers' understanding of the subject, their appreciation towards participants, and their ability to connect to participants' experiences. Further, the documentation is essential to understand the researcher's interest in a topic, their assumptions, and the challenges they have faced. Next, I share my story with you.

My Lived Experiences with Mathematics Education

My participation in the field of mathematics has been a process of struggle, change, acceptance, and resistance. The process has informed my understanding of mathematics education and developed my perseverance to change the way we conceptualize and address equity in public schools.

My struggle with mathematics started when I entered elementary school as an ELL. I was immersed into the world of mathematics while trying to build relationships between a new language, my culture, and the numbers I was learning. The struggle was visible when I started learning about fractions and experienced isolation while seeking support at school and at home. It was then, that I realized I had no one to ask for help because my teachers could not understand the challenges I was experiencing as an ELL and my family could not relate to way mathematics was being taught at school. My struggle with fractions resulted in my drive to find the assistance I needed to navigate more effective ways of learning mathematics as an ELL. During that time, the assistance I found most useful was my transition to speaking only English to engage with mathematics in the classroom and show success on standardized tests. Although I was successful on various tests, the transition between languages led me to accept mathematics as a subject comprised of people who spoke English. Such change and acceptance allowed me to pursue higher-level mathematics classes and become a mathematics teacher. However, I often questioned how different my experiences would have been if I had not accepted an English-only identity in mathematics that was not welcoming of my Mexican culture and my experience as a developing bilingual student.

Then, when I reached high school, I started to find answers to my question. I realized that some of my friends, who were also developing bilingual and bicultural students, completely disengaged with the field of mathematics for various reasons. Many of them described that their disengagement with mathematics was associated with their low mathematical ability, which was highlighted by teachers and their test scores. Others described the irrelevance of mathematics to their careers, which was perpetuated by teachers and counselors. At one point, I remember asking one friend why he was taking two mechanic shop classes and not more mathematics or science classes and he responded by sharing how his counselor suggested he take classes that aligned to his career, as if his career was certain. Another reason that students disengaged with the subject was their inability to make drastic changes to who they were in order to learn mathematics in classrooms that were centered on a Euro-centric academic culture of mathematics, frameworks that they felt did not take into account their learning needs as multilingual and multicultural students.

When I started my education program at Eastern Washington University (EWU), I realized that most of my classmates, who were preparing to teach elementary and middle-school mathematics were not thinking of students who approached mathematics from different backgrounds. For my classmates, success in mathematics was entirely measured by students' test scores and little attention was given to how students would engage in the class. As a result, the culture of standardized testing informed the way my classmates planned their lessons and the formal assessment they would use to measure students' learning of mathematics, which directly aligned to the material they believed was covered on standardized tests. During my third year at EWU, I remember asking one

of my professors what accommodations could be made for ELLs to create supportive environments and to motivate students to engage with the mathematics regardless of their English-proficiency. There was a moment of silence between us, but when our professor posed the question back to us, I realized that most of us had no idea or were ignorant to the impact we would have on every student and their participation in the field. Then, as we started brainstorming ideas together, we realized the little importance we gave to students' backgrounds in our attempt to meet testing standards.

As an ELL myself and now a mathematics teacher, I have taken these experiences to persevere against the way we conceptualize and address equity. Although the culture of testing has had large implications for the way we teach and how we measure success, it is necessary for our ideas of addressing educational equity in mathematics to move beyond closing achievement gaps. While these ideas of equity have tackled issues of access and achievement, it is evident that inequities remain even if achievement gaps are closed (Lubienski & Gutiérrez, 2008). Therefore, there is a need to explore equity from a critical lens that involves issues of students' identity and power in the classroom. Such exploration would attend to the inequities that transpire inside classrooms when marginalized students express a cultural disconnect from the field of mathematics. Some questions that have driven my resistance against a view of equity that only attends to issues of access and achievement are:

- What are teachers doing in the classroom to help students from different backgrounds (e.g., Latinx students, African American students, ELLs, students with disabilities) see themselves as mathematicians?

- What resources are teachers providing students with to motivate their engagement with mathematics?
- How is success in mathematics measured by teachers?
- How do teachers measure success in mathematics beyond the testing?
- What expectations are teachers holding for students in the classroom?
- What history of mathematics are teachers presenting to their students (e.g. White dominated field, male dominated field)?
- How is power (e.g. curricular decisions, voice in the classroom) distributed among teachers and students in the classroom?
- What ideas are teachers communicating to their students about the way mathematics can be used?
- How does students' engagement with mathematics move beyond standardized tests?

I am aware that every teacher has a unique experience and that our experiences lead us to be critical about issues that pertain to our lives. Therefore, I understand that as teachers we may be unaware or afraid to acknowledge how students are marginalized in field and how we perpetuate a cycle of disparities for our students. However, it is important that teachers become aware of their responsibility to create supportive classroom environments where students can embrace who they are while engaging with mathematics. Students should not have to negotiate who they are to participate in mathematics. Further, students should not have to neglect their identities (e.g., Latinx students, African American students, ELLs, students with disabilities) or feel that their identities limit their ability to persist in field of mathematics.

My experiences as a Latina and ELL have shaped my understanding of equity. At a young age, I had to negotiate my culture to feel successful in mathematics and later when I was becoming a mathematics teacher, I listened to my classmates dismiss their responsibility to create supportive environments for multilingual and multicultural students. With these experiences in mind, I relate my drive to create change in the field to the work of Paulo Freire (1999), who persisted that, “looking at the past must only be a means of understanding more clearly what and who they are so that they can more wisely build the future” (p. 85). I am now a doctoral candidate who wants to explore mathematics teachers’ understanding and use of equitable teaching practices that address dominant and critical mathematics. Consequently, my own experiences with mathematics bring certain assumptions that I have about the experiences of others. Next, I will discuss those assumptions.

Assumptions

Upon critical personal reflection, I realize that assumptions I have about the process of teaching and learning mathematics include the following:

1. Students that come from different backgrounds (e.g., Latinx students, African American students, ELLs, students with disabilities) have unique mathematical experiences.
2. Teaching mathematics through an equitable perspective can create positive learning experiences for all students.
3. The culture of testing impacts teachers’ understanding of success and equity. In fact, I believe the culture of testing shapes teachers’ understanding of mathematics achievement. For example, teachers may align their instruction to

the test for students to have access to the same information and have passing test scores. Then, when teachers examine success based on students' test scores, there is a belief that equity has been addressed.

Sampling Methods

For the present qualitative multi-case study, purposive sampling was employed. In purposeful sampling, "you choose particular subjects to include because they are believed to facilitate the expansion of the developing theory" (Bogdan & Biklen, 2007, p. 73). Further, the researcher goes through the process of choosing participants by specifying the characteristics of a population of interest and then seeking individuals who have those characteristics (Johnson & Christensen, 2008). The next section discusses the selection criteria that was determined by the characteristics I looked for in participants.

Participant Selection

As stated earlier, the present study was conducted as a qualitative multi-case study. I chose the design because working with multiple participants would give me the best opportunity to answer my research questions. Further, collecting and analyzing data from several cases has been described as a common strategy to "enhance the external validity or generalization of your findings" (Merriam, 1998, p. 40). To select five as the number of participants in my study, I used Stake's (2006) advice of, "two or three cases do not show enough of the interactivity between programs and their situations, whereas 15 or 20 cases provide more uniqueness of interactivity than the research team and readers can come to understand" (p. 22). Given that I was conducting my own data as a novice researcher, and my goal was to examine mathematics teachers' understanding and

use of equitable teaching practices within the context of their school as well as examining similarities and differences between all five cases, I chose five cases for my study.

A concern with participant selection, is identifying participants who have experiences with the phenomenon being studied (Stake, 2006). For the present study, the participant selection used the following criteria: (a) the participant was a fourth, fifth, or sixth-grade mathematics teacher, (b) the participant was teaching in Miami-Dade County Public School District, and (c) the participant had a background in equitable teaching and/or was part of a community or task force at the school level, which focused on equitable teaching practices for a group of students (e.g., ELLs, students with disabilities, marginalized students). The grade level criterion was chosen because by fourth grade most teachers are teaching specialized subjects, such as mathematics, reading, history, music, or science. The selection provided an in-depth exploration of the participants' understanding of equity and use of equitable teaching practices in the classroom as they focus specifically on mathematics. The criterion of public schools was put forth to understand how equitable teaching practices were addressed in schools that are funded by the government and have set standards and testing mandates in place. The final criterion was of great importance to the multi-case study because it required participants to have some experience in equitable teaching practices for different groups of students. The five participants in the study were recommended and described as equitable teachers by teachers, mathematics coaches, and professors. Prior to meeting with participants, we had a conversation to go over my focus on equitable teaching and to learn about the students they were serving in their school. Table 1 provides a brief overview of the five participants in this study.

Table 1
Participant Information

| Pseudonym | Gender | Teaching Grade-Level | Teaching Experience | Background Information | School/Classroom Context (based on their descriptions) |
|-----------|--------|----------------------|---------------------|--|--|
| Natalie | Female | Fourth | Five years | Born in the U.S., identified as Hispanic with Colombian roots. | School served a large percentage of marginalized students and classroom reflects school student body. |
| Maria | Female | Fifth | 17 years | Born in Cuba and raised in Miami, FL. | School served a large Hispanic population. Her afternoon class was mostly ESL students. |
| Sarah | Female | Fifth | 19 years | Born in Washington D.C. and raised in Miami, FL. Identified as White Hispanic. | School served a large Hispanic population. Sarah had extensive experience as a special education teacher and was teaching an inclusion class and a gifted class. |
| Jessica | Female | Fourth | 22 years | Born in the U.S., identified as Cuban-American. | School served a large Hispanic population. Her afternoon class had nine level one ESL students. |
| Adriana | Female | Fourth | 19 years | Born and raised in Cuba until the age of 15. Identified as Hispanic. | School served a large population of Latin American students (many from Venezuela) and Vietnamese students. She taught an inclusion class and a gifted class. |

Data Collection

For the present study, data were collected via in-depth interviews with practicing mathematics teachers. All participants were asked to sign an informed consent document before the first interview (See Appendix A). Each participant participated in three, one-hour, semi-structured interviews. The use of semi-structured interviews allowed me to start each interview with a topic in mind, a list of main questions, and a list of follow-up questions (Rubin & Rubin, 2011). Further, I chose semi-structured interviews for the study because I was aware that questions could change depending on participants' responses and semi-structured interviews allowed me to make design decisions throughout the study (Bogdan & Biklen, 2007). All semi-structured interviews in the study were guided by the following characteristics (Rubin & Rubin, 2012):

- I treated each participant as a conversational partner, where “each interviewee is an individual with distinct experience, knowledge, and perspective, not interchangeable with anyone else” (Rubin & Rubin, 2012, p.7).
- I conducted each interview with open-ended questions, which allowed the interviewees to answer in any way they choose. For example, the interviewee may have chosen to elaborate upon answers, challenge a question, or bring up new issues.
- The questions that were asked in each interview were not fixed. Although I had a list of questions to guide each interview, changes were made in the wording of questions, skipping questions, or adding follow-up questions where they fit in the conversation.

Each interview was conducted as a purposeful conversation. Thus, it was important for me to use responsive interviewing to build trustful relationships with participants (Rubin & Rubin, 2012). For the study, responsive interviews were built around main questions, follow-up questions, and probes that together drew out rich data that spoke to the research questions for the study (Rubin & Rubin, 2012). The main questions were used to begin a discussion about each research question(s), and they ensured that the conversational partner was able to answer the questions from their own perspectives. The follow-up questions were used to gather more detailed information about themes, concepts, and events that were highlighted throughout each interview. Probes were used to help manage each conversation by staying on topic, asking for examples or clarification, or inquiring for more in-depth information. In addition, each interview served to inform future interviews.

Interviews took place at one of the following locations: Florida International University (FIU) in classroom ZEB101, the participant's home, or the participant's work location. Interviews were recorded on the researcher's iPhone, which provided a clear recording of each conversation interview. To maintain the participants' anonymity, I removed any personal information and used pseudonyms in all documents to protect participants' identity. The document containing participants' name and their pseudonyms was saved on my password protected laptop. After each interview, I personally transcribed the recordings verbatim and saved the transcripts on my personal password-protected laptop.

Interview Themes

Interview themes included the following: (a) the first interview took place in late January/early February and covered background information of the participant in relation to their understanding of equity, (b) the second interview took place in March and included information about participants' teaching practices, and (c) the third interview took place in late April and included reading the article, "Framing Equity: Helping Students 'Play the Game' and 'Change the Game'" by Gutiérrez (2009), along with a discussion regarding the four dimensions of equity. Appendix B provides an example of the interview protocols for each interview.

Phase One: Initial Interview

In the first phase of data collection, I interviewed each of the participants individually to learn about their personal and professional journeys, their current school context, and their overall understanding of equity in the mathematics classroom. During the first interview, participants were asked about their understanding of equity and equitable teaching practices by going over their lesson structure, communication during lessons, and support for students. At first, the goal was to collect mathematics lesson plans at the end of each interview to explore how participants' lessons changed as testing got closer and to triangulate across artifacts. However, after conducting the first interviews, I noticed that all participants were using the district pacing guide to structure their lessons and most of them had their lessons and use of resources planned out for the rest of the school year. For example, when asked to provide lessons, some participants pulled out their binders and showed me a document in the form of table. Each row represented the subject material that would be covered, and each column represented a

day of the week. For mathematics, each row had the topic and standards for the week, vocabulary, activities, procedures, assessments, and home learning. When flipping through the binders and looking at prior and future weeks, it was clear that the pacing guide was used as a primary resource in the mathematics classroom and there was little room for teachers to create their own mathematics lessons. Therefore, mathematics lessons were not collected, and instead I used participants' lesson planning as data elicitation artifacts. Although the data elicitation technique commonly involves the use of art (e.g., photographs, drawings) as part of participants interacting with artifacts to express their understanding of abstract concepts (Bangnoli, 2009; Douglas, Jordan, Lande, & Bumbaco, 2015; Eyerman, Hug, Mcleod, & Tauer, 2018), I found it useful for my study because participants were able to reflect on their lesson planning and emphasize key points related to their lesson structure, classroom environment, and how they transitioned from one lesson to another. Similarly, the use of data elicitation gave me an opportunity to ask questions about their lessons that would have been difficult to assess by only looking at their lesson plans. Thus, the aim for the first phase of data collection was to learn about participants, their understanding of equity, and to explore participants' equitable teaching practices in the mathematics classroom.

Phase Two: Second Interview

The second set of interviews took place in March. After engaging in an early analysis of the first set of interviews, I realized that there were differences in participants' understanding of equity and most participants described their understanding solely in relation to dominant mathematics. Although there were instances when participants attended to teaching practices that related to dimensions of identity and power, I

recognized the need to ask more clarifying and probing questions about how they related their teaching practices to students' identities and how they related their teaching practices to equity.

I created a document for each participant summarizing things that stood out in their understanding of equity and things that I wanted to expand upon. The document consisted of highlighted and summarized words, phrases, and paragraphs that were essential to the interview along with things that were not clear and needed to be part of the following interview. Then, I met with my major advisor and we went through each document along with transcripts. In the meeting, we concluded that I needed to provide participants with scenarios that would encourage participants to elaborate on their use of equitable teaching practices and how they related to the four dimensions of equity.

In an attempt to employ content-validity (Merriam, 1998), I created scenarios and questions that were related to the information provided by participants in the first interviews (See Appendix B for scenarios). The scenarios I created were used to help confirm comments made in the first interview and create a space for participants to reflect and elaborate on previous responses in relations to their understanding of equity. For example, in the first interview Natalie provided little information about the role she took during classroom discussions. There were times when she described the use of open-ended questions to guide discussions and other times when she shared a more traditional approach, where she did most of the talking. The differences in Natalie's described roles led me to create a scenario of a teacher taking on a lecturer role in the classroom. In the second interview, I posed the scenario to Natalie and asked her questions that led her to share her initial thoughts, how the scenario related to equity, and similarities and

differences between the role of the teacher and her own role in the classroom. It is important to note that scenarios and questions used in the second set of interviews varied across participants and were related to comments made in the first set of interviews.

Further, the end of the interview concluded with participants' thoroughly describing their mathematics lesson from that day. Like the first interview, participants were encouraged to share their overall goals for the lesson, how it was structured, and how they felt about the lesson overall. Thus, the purpose of the second phase of data collection was to understand the relationship participants made between their understanding of equity and their use of equitable teaching practices in the classroom in relation to the four dimensions.

Phase Three: Third Interview

The last set of interviews took place at the end of April. April was a hectic time for participants as they were preparing for the mandated mathematics test that took place the first and second week of May. After engaging in a similar process of analysis for the second set of interviews and looking across interview one and two for each participant, I prepared a document to share with my major advisor. Professor King and I used the document and interview transcripts to discuss participants' primary focus on practices that were representative of dominant mathematics (access and achievement). Although most participants did describe teaching practices that attended to identity and power, Professor King and I went through the descriptions and concluded that they did not reach the criticality described by Gutiérrez (2002, 2007, 2009).

With teachers' descriptions in mind, our conversation led us to think about how I could bring that awareness to participants while still attending to their understanding of

equity and their teaching practices. Therefore, the third phase of data collection involved the use of data elicitation, an interviewing technique that involves the use of artifacts (e.g., writings, photos, diagrams, videos, lessons) to draw out meanings, conversations, questions, and reflections, which are all part of participants' understanding of an abstract concept (Bangnoli, 2009; Holstein & Gubrium, 2003). In each interview, both the participant and I read the article, "Framing Equity: Helping Students 'Play the Game' and 'Change the Game'" by Gutiérrez (2009). The rationale for presenting the article to participants and having them read it was to create a learning space where participants could share their initial thoughts and reflect on the four dimensions of equity, especially as it related to their own understanding. Also, after questioning the resources available for participants to continue learning about equity, especially as it related to identity and power, I felt that the article would encourage participants to reexamine their understanding of equity and build connections between dominant and critical mathematics.

Once participants read the article, I conducted a semi-structured interview to ask about their understanding of the four dimensions and how they attended to them in the classroom. For most participants, the reading helped them produce knowledge about equitable teaching as it made them reexamine their current understandings of equity. The third interview also served to employ content-validity (Merriam, 1998) as participants continued to elaborate on teaching practices that they described in interview one, interview two, or in both. Similar to the second interview, I concluded the third interview by asking participants to describe their mathematics lesson that day. Thus, the purpose of the third phase of data collection was to expose participants to current literature on equity

and engage them in a meaning-making experience, while still focusing on their understanding of equity and their teaching practices in the classroom.

Data Analysis

Merriam (1998) described qualitative descriptive case-study as an end product that involves, “rich ‘thick’ description of the phenomena under study” (p. 29). To effectively present a descriptive account of the phenomena being studied, I organized, analyzed, and presented my findings in a cohesive manner to show how all phases of data collection were used to answer the guiding questions (Merriam, 1998). Herein, I describe my data analysis process and how I sought to obtain reliable findings.

From the beginning, I organized a file on my password-protected laptop for each participant (using their pseudonyms). The file had sub-folders to separate all three phases of data collection and within each phase of data collection, I saved consent forms, audios, transcripts, and other related documents. The organization scheme allowed me to analyze the data for each case (Patton, 2015) before starting a cross-case analysis. My goal for using single-case reports was to examine each participant individually to capture their background, experiences, and context prior to looking across participants.

Although the study involved a conceptual framework of equity (Gutiérrez, 2002; 2007, 2009), I started data analysis by engaging in a step-by-step process of category construction. The process of category construction aligned with Glaser’s (1978) description of open coding, a process in which the researcher codes the data in every way possible or in other words, “running the data open” (p. 56). After each interview took place, I immediately completed a contact summary sheet (please see Appendix C for example) to summarize questions and observations highlighting each contact with

participants (Miles & Huberman, 1994). The contact summary sheet was saved and used to inform following interviews.

Once I transcribed each interview verbatim, I read the transcript without taking any notes. I followed the step by rereading the interview transcript and I wrote comments, notes, questions, and observations in the margins (Merriam, 1998). Next, I listened to the audio of each interview and added more notes. By listening to the interviews, I had an opportunity to hear participants' voices to get "a sense of the whole" and jot down marginal notes to capture "the intonations, the emphasis, and the pauses" (Hycner, 1985, p. 281). I then created a document where I typed up my marginal notes and copied verbatim quotes for each participant, which was also used to inform following interviews.

The document described above also served to inform the first cycle of codes, which Saldaña (2009) defined as, "a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data" (p. 3). Next, I went through the list of codes to look for relationships between codes that attended to core meanings of equity and teaching practices in the mathematic classrooms. The similarities and regularities that grouped codes together lead to the development of categories (Saldaña, 2009). See Figure 1 for a visual of the coding and categorizing process for the individual case analysis, which was guided by *The Coding Manual for Qualitative Researchers* (Saldaña, 2009).

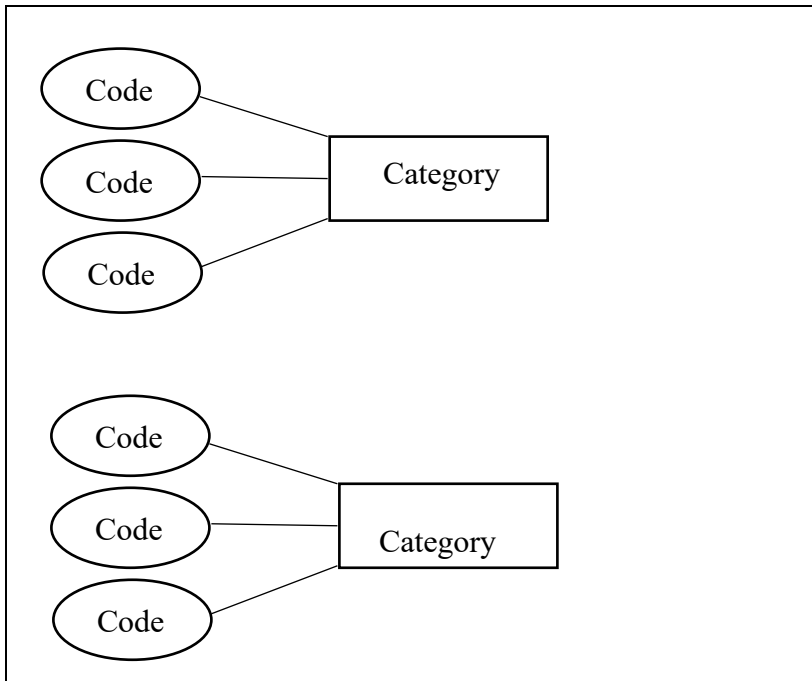


Figure 1. Data analysis for individual case study analysis

The process described above was completed for each phase of data collection and once data collection was finished, I used the documents of codes to compare across phases and to merge categories together to create a master list of categories. For example, when examining the category of *traditional lesson structure*, I went back to the transcript to examine context surrounding participants' description of such lesson structure. By going back to the transcripts, I observed connections between participants' lesson structure and students' access to information covered on mandated tests and refined the category of *traditional lesson structure* by merging it with the category of *access*. The process of merging categories together followed a similar pattern of going back to the transcript to look for relationships.

The following step involved the use of provisional coding to develop categories that were centered on Gutiérrez's (2002, 2007, 2009) conceptual framework of equity (Miles & Huberman, 1994). Once all interviews were conducted, data were coded a

second time using Dedoose (<https://www.dedoose.com/>), a web-based qualitative data organization tool and Gutiérrez's (2002, 2007, 2009) conceptual framework of equity, which included dimensions of access, achievement, identity, and power. Saldaña (2009) argued that researchers must be careful with provisional coding as they may allow their expectations to distort their interpretations of data, meaning "your preconceptions of what to expect in the field may distort your objective and even interpretive observations of what is 'really' happening there" (p. 122). Thus, to act against the distortion, I first coded the interview through an open-coding process and then I coded them a second time using the study's conceptual framework. Engaging in open-coding and provisional coding allowed me to build on the conceptual framework while also expanding on unique nuances that emerged from each participant (See Appendix D for codes and categories). The final step in this part of data analysis was comparing and refining categories from the two cycles of coding, which led to themes, which are phrases that illustrate "subtle and tactic processes" (Rossman & Rallis, 2003, p. 282). For example, when looking at the category of *changing students' relationship with math*, the participants related such change as part of their *understanding of equity*, which was another category. Both categories merged together to become one theme of *participant's understanding of equity*. The comparison of codes led to the final step of writing up individual case reports that were organized into themes on the basis of the coding process.

The next vital step in my data analysis was to conduct a cross-case analysis. For the cross-case, I coded the individual case reports and looked for similarities and differences across all cases using all the categories that were developed in the individual case analysis. Then, the analysis of similarities and differences across case reports was

used to create themes, which are described as “an outcome of coding, categorization, and analytical reflection” (Saldaña, 2009, p. 13). If, for instance, I found a consistent pattern in one participants’ report (e.g., participant defined equity through notions of fairness), I searched through all case reports to find supporting data from each participant and placed it within that theme to see if the theme could be supported across participants and data sources. These findings were written up using four major headings: two notions of equity – fairness and sameness, justification for equitable teaching varied, prevalence of dominant mathematics in the classroom, and scratching the surface of critical mathematics.

Integrity Measures

To enhance internal validity, I used Merriam’s (1998) strategies of (a) triangulation, (b) peer examination, and (c) researcher’s biases. Upon engaging in early analysis, I used the information from each interview to ask questions that would have participants elaborate or reflect on previous responses. The strategy was employed to confirm comments that were made in the first interview or to elaborate and reflect on their responses as part of creating a “holistic understanding” of the context (Mathison, 1988, p. 16). Similarly, when conducting data analysis, I met with my major professor, Dr. Barbara King to receive feedback as findings emerged (Merriam, 1998). To attend to my own biases, I documented my experiences that led me to my research along with my assumptions, as part of self-reflexivity (Merriam, 1998).

To enhance external validity, the findings of the present study were reported using thick description, informed by concrete detail and in-depth illustrations of participants’ context and understanding (Bochner, 2000; Geertz, 1973, Merriam, 2010). Thus, thick

description was used to report the findings in a manner that illustrated each individual case as well as presenting themes that connected cases together, while keeping in mind their varying details (Yin, 1994). The use of thick description was also part of research transferability, which is achieved “when readers feel as though the story of the research overlaps with their own situation and they intuitively transfer the research to their own action” (p. 845). It was my goal to provide the reader with a thorough description of each case and themes that connected cases for them to be able to determine how the findings are related to their own situation and if the findings are transferable (Merriam, 1998; Tracy, 2010).

Summary

The present chapter outlined the qualitative multi-case study research design that was used in the study. The focus of the study was to examine five mathematics teachers’ understanding of equity and use of equitable teaching practices and how they represent dimension of access, achievement, identity, and power (Gutiérrez, 2002, 2007, 2009). All participants were fourth and fifth grade elementary mathematics teachers in Miami public schools who were recommend by teachers, mathematics coaches, and professors and described as equitable teachers. Three semi-structured interviews were conducted during spring semester and all interviews were recorded and transcribed. Mathematics lessons were also used as data elicitation artifacts during all interviews. Analysis was applied to the data using open-coding and provisional coding, with the intention of finding categories that were unique to each participant as well as themes that connected all participants. Integrity measures were essential to the study and were applied throughout the entire study. The findings of the study are discussed in the next chapter.

CHAPTER FOUR

INDIVIDUAL CASE REPORTS

Introduction

The present chapter will provide the individual case report of each participant. Detailed information will be provided for each participant, which includes biographical information and participants' understanding of equitable teaching in the mathematics classroom. Additionally, this chapter will seek to provide a greater understanding of the challenges presented by the culture of testing as they are expressed by participants throughout data collection.

For each case, I will begin by presenting each participant's background and provide some context from their current schools and classrooms. Then, after a brief biography of each participant, I will report exclusive findings of each participant. This will be done through the following structure for each case report: (a) participant's understanding of equity, (b) descriptions of participant's equitable teaching practices and how they represent the four dimensions of equity, and (c) challenges presented by the culture of testing for each participant.

The first section will provide an overview of how participants described their understanding of equity overall, and more specifically their understanding of equity in the mathematics classroom. The overview of participant's understanding of equity will explain associations between their own experiences inside and outside of the classroom. The second section will thoroughly present each participant's use of equitable teaching practices in his or her classroom as described in all three interviews. Further, this section will be split into two subsections, dominant and critical mathematics, to show how each

participant's equitable teaching practices are representative of the four dimensions of equity: access, achievement, identity, and power. Lastly, the third section will attend to relationships expressed by participants when describing equitable teaching practices in the mathematics classroom and the culture of testing.

Given that this multi-case study set out to provide a thorough examination and report of each participant (Merriam, 1998; Stake, 2006; Tellis, 1997), sub-sections were added to individual reports when fitting. Whenever participants described a critical theme that was related to their understanding of equity, sub-sections were created to describe that individual experience. Also, it is important to note that although findings are organized in sections to present complex themes, the information within each section is not disconnected from other sections. Rather, the findings should be understood as building on each other to represent the story of each participant.

Natalie

Prior to the first interview, Natalie and I spoke on the phone to get to know each other and spend some time talking about her educational experiences. Natalie was almost finished with her fifth year of teaching fourth grade in Florida while also finishing her master's of science in curriculum and instruction with a specialization in mathematics education. Unlike other participants, this was Natalie's first year of teaching fourth grade in a different school, which was the same elementary school she attended as a child. When asked about the demographics of her school, Natalie shared how much change had occurred from when she was attending as a student. Natalie described the school in the past as serving predominantly White students and her being a "very small percentage of the minority" (Interview One, January 2019) to now her classroom reflecting a certain

percentage of the school, where “50% are minority and then the rest are your affluent maybe predominantly White or Jewish demographic” (Interview One, January 2019). Similarly, Natalie described differences between her morning and afternoon classes. In her morning class, she had students who were identified as having lower achievement test scores and her afternoon class was a combination of Special Education (SPED) students and English as a Second Language (ESL) students, which she shared was “kind of like an inclusion classroom” (Interview One, January 2019). Thus, Natalie expressed an appreciation for the diversity in her classroom because it encouraged her and her students to learn different understandings of mathematics, which extended from students’ ethnic and cultural backgrounds.

Experiences that Shaped Natalie’s Teaching Practices

Natalie was the only participant that mentioned her engagement in a committee that created chapter assessments for the whole district. When asked how she became part of this committee and how it contributed to her experiences in the classroom, Natalie shared how she volunteered to be a part of this committee after she received an invitation email. Although Natalie thought she would be one of many teachers on the committee, she was the only teacher among all mathematics coaches and some other school administration. Being a part of this committee changed Natalie’s view of the mathematics standards, she stated:

I don't think that I saw standards in the same way before. And so like I knew what they were and I did use them to guide my lessons, but when you're dissecting the standard and when you're breaking it apart and you're getting into it and yeah, you're creating the assessment but really you're kind of understanding like what the standard really means, and I really think that it helped me a lot... There were some standards that were subjective in a sense, well I'm reading it this way and the coach or even the head of the department was like well that really means this

and I really see it this way and I can see why my kids would see it this way. So, it opens a dialogue where you can interpret and you can understand and then you can address all of those all of those interpretations through the assessment, you know (Interview Two, March 2019).

Though this quote did not necessarily discuss how access to this knowledge led Natalie to practice equitable teaching, it does allude to the fact that her participation in the committee helped her understand what the standards meant and how differently they can be interpreted by her own students. In essence, the knowledge Natalie gained was imperative to her teaching practices inside the classroom, which will be discussed below.

Natalie's Understanding of Equity

Natalie's personal and educational experiences were essential to her understanding of equity. When asked how she defined equity, Natalie responded, "I think that it just has to do with providing access to information or to whatever it is that you're speaking about at the levels that each person needs it" (Interview One, January 2019). On multiple occasions, Natalie attended to students' background experiences to share her responsibility to provide access. In the first interview, Natalie noted, "if a child comes from a home where maybe they don't have English speaking parents, then you try and reinforce that in a classroom where you help them learn English a little bit more. Maybe you give them a little bit more extra resources so that they're able to meet that where they're not getting it at home" (Interview One, January 2019). In this quote, Natalie associated students' home experiences to their achievement to demonstrate the need to provide extra resources and access to instruction that reinforced English language acquisition.

When further prompting Natalie about her understanding of equity, Natalie expressed her commitment to enacting equitable teaching practices due to her own experiences as a minority in a school that served primarily White students. Natalie connected her own experiences to her teaching by noting:

I always felt like I was an outsider and I wasn't getting met halfway or maybe back then that whole equity conversation wasn't really there. I think that's always a constant reminder for myself that I need to do that for them. Also, when I do interact with my kids and I do see so many outside variables that are affecting them it even more so pushes me to continue that line and that equitable way of teaching (Interview One, January 2019).

Despite not being met halfway as a student, Natalie wanted to change that narrative for her own students by providing access to information at different levels. Further, Natalie vaguely mentioned the effects of outside variables on students' performance to justify her equitable teaching. In the second interview, Natalie elaborated on such variables by sharing:

A lot of the students that I have, their parents are doing everything that can to support their kids, but they don't really know the math curriculum or they don't understand it, they come from other countries and they don't speak the language, or they're just not there because they have double jobs...So I notice that those things truly affect them because they don't have that extra support at home at all...I'm there early in the morning so I bring my kids in early or I have them do whatever they want to do in the classroom while I'm there and if they have questions they can ask me you know, and so I kind of leave it a little bit more open for them to get that additional help if they're struggling with certain areas. And the kids that I know that don't have computers or that their parents can't help them, I tell them they can come in and they can get on and they can do their assignments so they can do their homework (Interview One, January 2019).

The quote above is reflective of Natalie's understanding of equity, where students are provided support at individual levels based on differences that exist between students' identities, home resources, and other factors that may affect their participation in mathematics (Gutiérrez, 2002).

Further, much of what Natalie expressed when talking about her understanding of equity related to the demographics of her classroom and the need to understand and address how factors inside and outside of the classroom affected their participation and achievement. At one point, Natalie mentioned the need to provide equitable access to her students because she understood that they were less privileged. Although Natalie did not elaborate on this idea in her response, she was the only participant that mentioned differences in privilege and established a connection between students' privilege and their success with mathematics (which will be explored in the next section).

Natalie's Teaching Practices and the Four Dimensions of Equity

When asking Natalie about her teaching practices in the mathematics classroom, the discussions were centered on constructing lessons, communication in the classroom, expectations for students, and support for students to participate and succeed in mathematics. Natalie's practices in the classroom attended to all four dimensions of equity.

Dominant mathematics (access and achievement). The knowledge Natalie gained from being a part of the CCSS committee led to equitable access for her students. When sharing how she used the pacing guide to construct lessons, Natalie brought out five different resources to explain the process she went through to create lessons that exposed her students to different ways of understanding the standards. Natalie explained how the school textbook rarely moved beyond skill-oriented problems and this being the reason for her incorporating different resources to have her students engage in word problems. At the same time, Natalie shared how she encouraged all

students (during their group work) to start with the word problems and then move towards skill-oriented problems. Natalie's stated her reasoning as:

That's what I initially...typically would like for them [students] to do...they don't always follow it but I do that so if I do run out of time, I have better content to go over than the multiple choice, which yes their tests are all multiple choice, but I don't want it to just be that. I want it a little bit more critical. I want them to think more and I think that through that they'll be able to get this stuff. I think that this is maybe where most teachers kind of get stuck because they think that you have to teach for them to understand this but if you do teach conceptual understanding then they will get this anyway, like they'll be able to pass their test anyways (Interview One, January 2019).

Here, Natalie attended to the type of access students have to participate in mathematics. Although both skill-oriented problems and word problems are related to the information covered on the test, Natalie's reasoning for providing access to both was centered on the critical thinking skills students develop when they are working through mathematical problems that have multiple ways of approaching and solving them. Furthermore, Natalie associated critical thinking skills with students' success on the test and although she did not expand on how those skills transpire through testing, she was conscious of the relationship between the access students received and how it related to their achievement in mathematics.

Another way Natalie attended to dominant mathematics, was through her way of creating a classroom environment that encouraged equitable participation among all her students. Natalie, in all three interviews, shared how she provided students with individualized formal and informal feedback for students to be able to see their own success. Natalie noted:

They'll [students] share things with me and I'll give them feedback. For example, I love that you found your own mistake or when we're doing stuff, I'm like, well, what do you think is missing there? It's more open-ended questions or I'll tell

them like well does it make sense? Why does it make sense? It's more of that kind of stuff as opposed to, you added wrong exactly there, I don't do that. I don't really point it out. I just try and get them to go back and understand where they went wrong on their own. So that's kind of the feedback I go through (Interview One, January 2019).

Although Natalie did not explicitly connect feedback and achievement, she stated the importance of students understanding where they went wrong, which may lead to greater student achievement. In addition, Natalie's use of open-ended questions as feedback may help students gain an understanding of their own mistakes and strengthen their participation in classroom discussions. By helping students embrace and have access to their individual processes, they were also able to participate in mathematics that reflect standardized testing, but also move beyond traditional notions of achievement, where students may not be challenged to understanding their own mistakes as part of learning. That is, Natalie's teaching practice encouraged students to use their moments of struggle to shift the conversation, focus on their mistakes, and rejoin the conversation with feelings of growth and success.

Critical mathematics (identity and power). While critical mathematics embody teachers' responsibility to recognize how students have been racialized, classed, and gendered in field of mathematics, Natalie mainly highlighted how her students' identification with mathematics has been affected by their educational experiences in the school system and gaps in their foundational knowledge. After reading "Framing Equity: Helping Students 'Play the Game' and 'Change the Game'" by Gutiérrez (2009), Natalie shared her understanding of identity in the classroom:

I know that like your identity has a lot to do with like, you know how the students identify themselves and it says like students' past and all that, but I'm going to look at it a little bit more personally...Like these kids...they identify with not

knowing information...They identify with not having a foundation or not being able to do this, or not being able to do that (Interview Three, April 2019).

In other words, Natalie's viewed students' identity as disassociated from identities that include race, ethnicity, and gender and instead described students' experiences with mathematics as part of their identification with the field. Further, Natalie attended to students' struggle with the subject and shared her role to help students' shift their identity, she noted:

They [students] identify with struggling...They identify with the fact that they came into fourth grade not knowing a lot of the information because whatever happened to them the year before...So like when they come to me, I try and flip their identity, I try and get them to identify with different, with uh, with little success, little successes, you know...and for them to see that they are changing and that they are growing (Interview Three, April 2019).

The sound in Natalie's voice and the pauses that she took as she described students' identification with failure was one of frustration. This frustration continued to transpire as Natalie shared stories of her students reaching fourth grade with such large gaps in their foundational knowledge. Such disparities pushed Natalie to create an environment where students are given individualized support and feedback to understand their own processes as a way of shifting their identification with not knowing mathematics. Although Natalie's practices are mentioned above in dominant mathematics, her practices also encompassed critical mathematics; Natalie positioned students to learn and focus on their individual growth, which helped build meaningful relationships between students and mathematics and build positive mathematical identities.

By engaging in practices that helped her students build positive mathematical identities, Natalie was also attending to the power students developed by learning to

express themselves and taking ownership of their own individual process. It is not clear if Natalie created a dichotomy between students' cultural identity and their identification with struggles in mathematics, however, it is important to question why so many of her students have developed poor relationships with mathematics. This questioning could bring to light the marginalization of students based on their race, class, gender, and other identities and create opportunities to address identity and power at different levels.

To demonstrate how she helped change students' identification with mathematics, Natalie also shared how she allowed students to use different strategies. Natalie noted:

For me it's like changing the fact that they identify with their learning, they're able to do this. Like I know that we look at more so like their cultural backgrounds and that's great because, you know, I'll have students that divide differently and I think I mentioned it last time, I'll let them do that as long as it makes sense to them and they can explain it (Interview Three, April 2019).

Natalie expanded on this practice in the first two interviews by sharing how she valued the different understanding of mathematics that students brought into the classroom.

More specifically, when asked why it was important to teach equitably in the mathematics classroom, Natalie brought forth an example of how students who recently moved from Latin America to the United States tend to divide differently than the traditional long division process. Natalie stated:

Instead of discrediting that form of division, I allow it. I want them to show it. I let them teach it or I let them express it. So then that way they know that it is valued...I can learn now that new form to teach someone else that they may not know or maybe they were confused with the traditional way of doing it (Interview One, January 2019).

Not only was Natalie allowing students to express their knowledge in different ways, she was also using this as an opportunity for students and herself to learn new ways to solve problems. Through this teaching practice, Natalie was attending to a different form of

identity by challenging mathematics that are reflective of Western culture and shifting the idea of what is considered mathematics by drawing on students' culture as resources for teaching and learning (Gutiérrez, 2009).

Challenges Presented by the Culture of Testing for Natalie

When talking about communication during mathematics lessons, Natalie shared how she organized all lessons to provide students with time to work independently without direct instruction from the teacher. Then, once students finished working independently, Natalie brought them together to discuss their solving processes and solutions. It was during this conversation that Natalie shared how she allowed students to use different methods from different countries as long as they could reason about their solution. Then, when asked how these students, which were all ESLs, would engage in classroom discussions, Natalie shared how she pushed for them to use only English in her classroom. At first Natalie justified her practice by sharing her high expectations for all students and their ability to learn the language, however, later she pointed out the consequences students could face if they did not learn the language. Natalie noted:

With our laws, ESL students in particular, you can't hold them back. If they've been in the country for two years, for less than two years, they have to keep going so if they're not getting the language, they're still getting content. It may not be great, but if we're not pushing them to learn the language within those two years then when that third year comes then they could be held back or they...you know, they could be put in a special program or something could happen. So it's important that within that time that they're here that they do focus in on learning the language, especially because the pressure is off of them when it comes to testing, which is a great thing (Interview One, January 2019).

Although Natalie did not explicitly connect students' English language acquisition with their success on tests, she did attend to the ramifications ESLs face when they do not know the language. Thus, the consequences Natalie mentioned, such as “being stuck”,

“put in a special education program”, and being “held back” are all related to students’ success on standardized testing. For this reason, Natalie’s understanding of the consequences students could face led her to enforce an English-only policy in her classroom. Such practices – which are influenced by testing – demonstrate how difficult it is to practice equitable teaching that positively encompass all four dimensions of equity. Although Natalie expressed value in students’ knowledge and students’ ownership of their own learning processes, enforcing an English-only policy can lead to students negotiating who they are in order to participate in the field of mathematics.

Another challenge that was presented to Natalie’s teaching was her school’s focus on exposing students to all the material covered in fourth grade. During our second interview, which took place at the end of March 2019, I asked Natalie what changes she would make to her teaching if testing was removed and she responded:

I think again it would just provide more time to work with them [students] at their level and their pace. And so like if I have a fourth grader that it's coming in at a kindergarten level then I can work with them to reach fourth grade and not have to get them to just get certain things, you know, I can really go back down to their level and go over their adding and their subtracting playing with numbers and knowing that they understand what it means to regroup and then we can move on as opposed to I can't give you too much time because we need to get to the stuff that I need to move on to the next standard...And so I think that would just help a lot and alleviate a lot of the pressure from the teachers where they can do the things that they know are truly important to help students individually then to be focused all the time on testing, which is what happened, you know, we're about to get into testing and we were already given packets about three weeks ago that we're supposed to be doing five a day, ten minutes, no helping, review and move on. And then we have to go back and still teach what we're teaching now (Interview Two, March 2019).

Such a quote represents the difficulty in practicing equitable teaching when teachers are confined by a system of accountability stemming from testing. For Natalie, there existed tension between her way of addressing equity and the pressure that was placed on her as a

teacher to fulfill what many teachers described as “crunch time.” Although Natalie described teaching practices that emphasized student engagement and participation beyond testing, it seems that those practices were often difficult to enact because she understood her inability to be removed entirely from the culture of testing due to its prominence in education and its ability to determine students’ success.

Maria

Maria has taught for 16 years in various grade levels from kindergarten through fifth. During data collection, Maria was finishing her 17th year of teaching as a fifth-grade teacher in a new school. Maria earned her bachelor's degree in elementary education and later earned her master's in reading education. When asked about the demographics of her school, Maria shared it was a title one school, which meant there was a large percentage of students on free and reduced lunch. Maria also shared that her school served mainly Hispanic students and had a large ESL population. Maria's students as a whole were reflective of the school demographics. In Maria's morning class, there were no ESL students, however, her afternoon class was all ESL students with the exception of five students who Maria described were exiting ESL students.

Experiences that Shaped Maria's Teaching Practices

After working for 16 years in schools that placed profuse pressure on teachers to keep up with the pacing guide, Maria described her current school as a place where she could spend more time helping students understand the mathematics standards covered in the pacing guide. Maria shared how the pressure from her old school was reflected on students' test scores at the beginning of the school year. Maria, while still being “under that pressure from my other school where you had to stay on the pace” (Interview One,

January 2019), started the new school year by moving quickly through all the material, which in turn affected students' access and comprehension. Even though Maria shared how far her students had come by showing their current test scores on district assessments, it was evident that her teaching continued to reflect the pressure she felt from her previous school. This will be discussed in the following section.

Similarly, Maria's personal experiences as an ESL student shaped her teaching practices and her understanding of testing. When asked what she would do differently if testing was removed, Maria immediately shared how she hoped that did not happen. This was due to Maria's push for teacher accountability. Maria, who came from Cuba at a young age and knew no English, felt that her teachers were not held accountable for her learning. This was a time when there "wasn't much testing and the testing that there was, was useless" (Interview Two, March 2019). Maria described her frustration with her needs being ignored, never understanding why she was getting C's, and how eventually her frustration led her to copy students work and create her own "survival mode". These experiences were reflected in the responsibility Maria felt as a teacher. Maria noted:

I know that what I'm doing is important to the community and to the structure of every...of families and life and if I fail a student then I'm making it harder for them next year and you don't know if they're resilient. I don't know what's going to happen. Are they gonna drop out? So then they're not going to have a good job? So then what happens to them after they leave me? No, it's a huge responsibility (Interview Two, March 2019).

Although Maria felt the pressure of testing and how it affected the amount of time she could spend covering material, Maria stood out among the five participants in that she did not want testing to be removed from our education system. Further, when asked about her teaching practices, they were related to her awareness of the ramifications that

students face when they do not have access to information to pass the test, get better grades, and understand their performance.

Maria's Understanding of Equity

From the first interview, Maria defined equity by highlighting ideas of fairness and equal outcomes. Maria stated:

Equity means that you're fair...That doesn't mean that you treat everyone the same way. That's because that's what you would think fairness to be fair you treat everyone the same way, but equity would mean that you are being fair in a way where maybe you have to do something different for a student to make it equal to another student who might not need extra in that area, but will need it somewhere else. So it's not that I have to treat everyone the same way. I'm being fair. But in doing that some like I said, some kids might need a little extra to be at that equal mark (Interview One, January 2019).

Maria consistently alluded to ideas of providing different support for students to get them to an equal mark. Moreover, when asked to expand on this idea, Maria shared how many of her ESL students needed more help than other students because they were coming in with mathematics that were taught in their home country. Maria, in two interviews, referenced differences between the curriculum taught in the United States, specifically the CCSS, and the curriculum taught in other countries. Although Maria shared that she did not know the specifics of curriculum outside the United States, she described disparities by sharing her experiences working with ESL students to help them “catch up”. Further, Maria understood equity as her obligation to provide support to meet students' individual needs as part of helping them engage with fifth grade mathematics content as well as show success with testing.

Although Maria primarily focused on meeting students' needs to help them achieve equally on the test, she also aspired to changing students' relationship with

mathematics. When further prompting Maria about the relationship she had established between equity and equal outcomes and the long-term impact that would have for her students, Maria shared:

If I'm being fair in the classroom and I'm doing things the right way and giving them what they need at a level where it's necessary and needed, hopefully they... In this year, I am able to give them a different way of looking at math all of a sudden change their view on math, they don't hate math any longer. They have a positive outlook on math. I built some confidence in them that they can see themselves differently as a math student and I've done my job to close the gap the best that I can... Their long-term is they're going to have a better chance of succeeding because attitude is very important (Interview One, January 2019).

Maria expanded upon this idea of being fair by expressing the importance of helping her students develop positive relationships and attitudes with mathematics, but also by understanding how changes in their relationships were part of students' success and "closing the gap". In the second interview, Maria shared that the gap she was working to close was that of the individual student. For example, Maria shared how students often arrived in her classroom below grade level, which was due to students not understanding the material, not having a good foundation, and forgetting the material. Maria, therefore, expressed students' frustrations when they have gaps in their knowledge and her responsibility to provide individual support to help them move past that frustration and enjoy mathematics. Maria further justified being fair by providing an example of two students, one who was on grade level and another who was below grade level. Maria shared, "if you're following, I can give you in enrichment...give you more depth, but let's step aside here and let's focus on let's take you where you need to be so that we can catch you up. So both of you when you look at the same test at the same time, both of you can answer appropriately" (Interview Two, March 2019). In this quote,

Maria attended to the different support that was needed for students to achieve at high levels. Further, Maria associated her teaching practices with students' success on the test. It is at least worth noting that Maria's understanding of equity somewhat reflects ideas of equality, where all students are given equitable support to reach equal outcomes. This is something I will elaborate on in chapter five.

Maria's Teaching Practices and the Four Dimensions of Equity

When describing teaching practices in the classroom, Maria primarily attended to dimensions of access and achievement. These practices were highlighted when Maria shared her lesson structure and her responsibility of providing students with access to information, which was tied to their testing performance. Although Maria stated some practices that relatively aligned with identity and power, her justification for such practices rarely moved beyond students' achievement on tests.

Dominant mathematics (access and achievement). Maria's personal and professional experiences in education were integral to her teaching practices. When asked about the role she played during mathematical discussions, Maria, in the first and second interview, pointed out how her lessons followed a similar pattern. Maria noted:

So first we start by reviewing last night's homework. I show the answers I use mostly the teacher guide so I'll put up the teacher guide and they check if they want to ask me on the spot they can or I give them the option of when it's time to work they can come visit me privately. They can circle or whatever take notes, whatever you want to ask me later. So then I read the essential question. I make very clear what we're about to learn. I remind them that they need to sit up straight and pay attention and learn it because if not, they're falling behind and they have to ask questions and be aggressive...So I make it very clear that I'm about to get started and to pay attention. Okay, and then I might show umm I might show the steps on how to do it or I might show the math textbook has technology that teaches the kids...I'll come right behind and I'll say it in my own, in different words so pay attention and take notes. So we do that and I give two or three examples. I may use the technology I may not...So then that's the exposure.

I do gradual release. So at the very beginning it's a lot of me (Interview One, January 2019).

Here, Maria shared her role at the beginning of each lesson and attended to the idea of exposing students to the material before they work independently. Such a quote demonstrates Maria's associations between students' access to mathematical information and their success of staying on track. Further, when asked to describe students' role, Maria shared how she saw them as active participants who are actively listening, "trying to soak it in", and being aggressive through their participation. Although Maria described how exposure to mathematical information was done through whole classroom instruction, she attended to access and achievement by making sure students could express any misunderstandings and ask questions (both during instruction and privately) about the material. Thus, Maria's interest in students being aggressive during instruction related to students' participation and achievement in mathematics. While Maria's teaching practices are aligned with traditional instruction of mathematics, they are part of dominant mathematics because she is providing students with equitable access to achieve on the test.

Much like other participants, Maria frequently emphasized the use of differentiated instruction as part of student access and achievement. Maria shared how she provided her students with different avenues to understand previously learned information and new information. For example, when going through students' chapter assessments, she provided individual feedback by using sticky notes. During our first interview, Maria grabbed a couple graded tests to show me examples of her feedback. In one test, a student got an incorrect answer for 10^3 . Maria placed a sticky note above the

test question and asked the student to think about the answer to $10 \times 10 \times 10$ and then relate it back to the answer they originally had. Even though that student was going to be part of the group that received differentiated instruction during group work, Maria provided feedback to the student to think about their mistakes prior to working with her on that topic.

Similarly, Maria attended to the importance of differentiated instruction as part of acknowledging and celebrating students' individual success. Maria noted:

I make sure that all students have the opportunity to be successful no matter what level they're at...Just knowing that...I don't know how to say it. Like yes, you're very behind but if we can focus on your growth and celebrate your growth then it makes it less painful as you come closer to meeting your goal. You celebrate the successes. I do that a lot in my class, I focus on what they're doing right. So whenever I do the DI (differentiated instruction) or they take a pass on I-ready at their level, that is celebrated up here by moving these cars every time they pass a lesson [Maria pointed to a wallpaper above in the center of the classroom. The wallpaper was a large street figure with the number 0 on one end and 9 on the other end. Each student was represented by a car with their name that was moving as they reached a new level]. (Interview One, January 2019).

The themes of individual growth and building persistently underlined Maria's justification for differentiated instruction. However, something that is important to point out is Maria description of students' participation in mathematics, which rarely moved beyond testing. Both differentiated instruction and the celebratory wallpaper were based on students' success on chapter assessments, with an end goal to understand all standards and move onto new information. Although Maria's teaching practices are essential to support students' access and achievement in dominant mathematics, it is important to consider their relationship to dimensions of identity and power. For example, when Maria expressed her celebration of students' growth as they get closer to "meeting their goal", one must ask how those assumed goals are related to students understanding of

their own goals. This attends to Gutiérrez's (2002) argument on addressing broader issues of mathematics and questioning how students' success in mathematics and in the mathematics pipeline is part of their happiness, interests, and identities. Thus, this questioning requires teachers to reconsider their teaching practices to help students embrace their identities while engaging with mathematics.

Challenges Presented by the Culture of Testing for Maria

Testing was an immense part of Maria's understanding of equity. When describing students' engagement in the classroom, Maria attended to different forms of participation that embraced or excluded students' cultural and ethnic identities, and ultimately reverted to testing. For example, when describing the participation of ESL students, Maria described the use of Spanish in the classroom. She noted:

I allow it because I'm not a reading teacher [laughing]. I'm not gonna let you fall behind in math. I'm not because you'll catch up...I'm not going to waste the time that we have present now and if I have to teach in Spanish, I could do it's a CCHL (Curriculum Content in the Home Language). I know how to speak Spanish, I can do CCHL. It's something I can offer them. It's a code on the report card. I can do CCHL and I can put it on the report card (Interview One, January 2019).

Though Maria did not discuss how students' first language can marginalize their participation in mathematics, this quote demonstrated Maria's interest in helping students' move forward as part of their mathematical achievement and English proficiency. This practice may be aligned with the dimension of identity, as it allows students to engage with mathematics using their home language, however, Maria tied it back to the pressure of "falling behind" and "catching up." Further, Maria expressed how she was "allowed" to do this as long as she put CCHL on students' report cards. Therefore, it seems that this practice, while good intentioned, was part of students

receiving access to information at their level as part of their engagement in class and overall success in testing.

Similarly, when asked about students' use of strategies that they learned at home or in their schooling in another country, Maria demonstrated some resistance towards this form of student participation. In the first interview, Maria mentioned how many Cuban students attempt to use different solution strategies when solving division problems. Although this way of solving division leads to the same answer as the long division method that is traditionally used in the United States, Maria insisted students use the long division algorithm. Maria's reasoning was:

I say to them can you please try to learn it this way though. Because the problem is that you're okay...you're great. You're doing it that way...but when I'm teaching this and I'm doing this and they're doing that, what is that? How do I tell them cover this number, what number? I don't get your way. Then, it's harder for me to teach my strategy on teaching with two-digit divisors. So that's why I'm like, you know what, I think you have to learn it my way because I'm going to continue using my way and it gets harder. And then when you bust out with a decimal here and then theirs is out here or up here, I don't know why...I don't know. They have to know this way. So although I respect that they came with their strategy, they kind of have to learn mine just because it builds (Interview One, January 2019).

Maria's resistance to students' using different solution strategies came from her understanding of the curriculum in her school, which she described as building overtime. To better understand how a solution building overtime affected students' participation in mathematics, Maria was asked if the traditional method of division was reflected on the Florida Standards Assessment (FSA). Maria's response to this question was, "Yes, and sometimes on these tests they might even do this [Maria created a division problem and solved it using long division] and then you're supposed to figure out like a blank somewhere in this strategy...So if you're not learning my strategy you're still

dividing like in Cuba, how do you find that missing box” (Interview One, January 2019)? Maria, therefore, saw her teaching practice as a way of helping students achieve on tests, while not recognizing how this practice may force students to downplay their backgrounds and identities in order to participate in the field of mathematics.

It is important to note that part of Maria’s reasoning for not allowing students to use a different solution strategy also stemmed from the disparities she saw between solution strategies. During the second interview, Maria was presented with a scenario where a teacher told a student that his way of solving the problem was incorrect because he used a different division solution (the solution strategy was one traditionally used by students in Latin American countries). When asked if she agreed or disagreed with the way the teacher handled the situation and why, Maria immediately started asking questions about the student’s solution. Using support from the compiled report, *Mathematical Notation Comparison Between U.S. and Latin American Countries* (Perkins & Flores, 2000; Lopez, 2006), Maria and I went through each step of the solution. Maria started making connections between the way she taught division and the student’s solution and said:

That's not right and you should build. It's not Incorrect. And in fact, you know what it's beneficial because I can definitely build now that I understand this because I didn't before, but now that I understand this, I can go ahead and teach. You know what let me teach you the way we do it, it is very similar to the way you do it, but let me teach you because later on next year you will have two digits here...And then I would go ahead and I would place them side by side and ask, see what do you first in your method? Okay, well in our method it's like this and compare and build on what the student brings to the classroom already. So what does that mean? A little extra homework for the teacher because then I would have to understand this. But the good news is you have that student who does know how to do it, you can stop and ask questions (Interview Two, March 2019).

At first Maria expressed resistance to different strategies, however, after learning about the strategy, Maria started making connections between strategies and shared how she would be able to “build now that I understand”. This response, although different from her first response, connected back to her understanding of equity, of being able to meet the students where they are and providing support at those levels. At the same time, the questioning Maria shared to help the student make connections between their own strategy and the one she taught, attended to dominant mathematics and the need for students to understand material that is covered on tests.

Sarah

At the time of the study, Sarah was starting her 19th year of teaching and was working towards her gifted endorsement. Unlike other participants, Sarah started her teaching journey after working at a telecommuting company for many years. After going through multiple scheduling conflicts with her previous job, Sarah decided to substitute teach and then decided to go back to school. Sarah, who is now a fifth-grade teacher, earned what she described as a modified master’s in special education; she described this as a time where there was a critical need for special education teachers. Once Sarah finished school, she started working as an inclusion teacher and traveled with students across all subjects. Since then, Sarah has received her general education teaching certificate and continues to work at the same school.

Given Sarah’s extensive time in her current school, she described many demographic changes that occurred over the years. When reflecting on her school demographics, Sarah noted that the student body was primarily Hispanic, and they served a large percentage of students from lower socioeconomic status backgrounds. The

demographics of Sarah’s two classes, which were an inclusion class in the morning and a gifted class in the afternoon, were reflective of her school’s demographics.

Sarah’s Understanding of Equity

Much like other participants, Sarah’s understanding of equity was one that highlighted ideas of fairness within the classroom. When asked to define equity, Sarah stated:

I have always said and I say it to my students all the time and I say to people that ask me it’s like if you're treating everyone fairly you're giving everyone what they need. What one student needs is not one another student needs, you know, and sometimes they’ll say well how come he gets to do this and I don't get to that I said, do you really need that? No, I go. That's why just meeting individual needs to me is equity (Interview One, February 2019).

Similarly, when describing her teaching practices, which will be discussed later, Sarah shared experiences of working with students and pointed out the necessity of meeting their individual needs to help them engage with mathematics. When asked to elaborate on her understanding of equity, Sarah responded by attending to knowledge she gained in her current coursework, which was part of her gifted endorsement certification. In her classes, Sarah was learning about special needs of gifted students² and how they vary across diverse populations. This pushed Sarah to recognize the varying needs of underachieving and achieving gifted students as part of equitable teaching in the mathematics classroom.

Experiences that Shaped Sarah’s Understanding of Equity

Sarah’s journey to becoming a teacher set her apart from other participants.

Although Sarah’s understanding of equity shared similarities with Natalie, Maria, and

² Florida’s definition of a “gifted” student is put forth by the current State Board Rule, 6A-6.03019 Special Instructional Programs for Students who are Gifted as, “one who has superior intellectual development and is capable of high performance.”

Adriana, she connected her understanding with her early and current experiences as a special education teacher. When asked to share her understanding of the relationship between equity and mathematics, Sarah noted:

Having students that are on both, they're just not in the middle and they're not just general ed students...Everything is not one-size-fits-all...I find that it [mathematics] tends to be the stronger subject for a lot of students with learning disabilities and sometimes we take that for granted and we expect them to perform and I have to stop and look at everybody individually because I'm teaching up there...and I'm thinking that everybody's getting it and they're moving along and then I'm careful, I stop and go wait, wait, they didn't get it you know. And they show me all the time throughout the years that they do have talents and ways of seeing things that I didn't see so I always have to make sure I let them go and let them teach me...I can't just teach them cookie cutter algorithms because they come at things different ways (Interview One, February 2019).

Here, Sarah associated equitable teaching and mathematics by attending to the knowledge she gained “throughout the years” by working with special education students. Given her experiences traveling with special education students to all subjects and the demographics of her two current classes, this association was vital to Sarah’s understanding of equity as being fair and meeting students’ individual needs. Thus, as evidenced by this quote, it seems that her experiences as a special education teacher were transformative to her teaching because they helped her understand that students have unique learning styles and instruction should not be narrowed down to one learning style. Thus, in relation to equity and being fair to students, Sarah described her responsibility to not make assumptions about students’ giftedness in mathematics, which pushed her to address equitable resources, support, and participation that allows all students to identify with mathematics.

Sarah's Teaching Practices and the Four Dimensions of Equity

Throughout data collection, Sarah tended to reflect on her teaching practices by sharing specific moments she had experienced in her two classes. Despite Sarah's certification as a general education teacher, her teaching practices were grounded in her experiences as a special education teacher. When sharing her use of resources to support students' individual needs, Sarah highlighted practices that positively addressed access and achievement. Similarly, Sarah's data highlighted the importance of attending to access as part of students' participation in mathematics. Sarah's teaching practices were also representative of critical mathematics. Such practices were highlighted when sharing her role and students' role in the classroom.

Dominant mathematics (access and achievement). Upon entering Sarah's room, I observed a variety of resources around the classroom. The use of these resources was highlighted in all three interviews with Sarah expressing the importance of providing students with access to technology, manipulatives, and differentiated instruction as part of their achievement. In the last interview, Sarah summarized how she attended to the dimension of access by noting:

I offer myself to stay after school, parents just need to communicate with me about pick up arrangements and they can come in for free tutoring if they need homework help...some other things are you know just looking at the way we do differentiated instruction and having the materials and going out and finding more materials. I mean, you know, the program gives us some things to use and I find they're inadequate so, you know this especially with my SPED class I have an extra SPED teacher in here so I can tell her look we need something else these kids need help with this and they're not getting it this way and so she can find resources. I can find resources from other books or things that we've done in the past, you know going online and looking for things that would be teaching to a different modality (Interview Three, March 2019).

In this quote, Sarah highlighted the use of different resources and support to meet students' individual needs. Sarah's practices were specific to the demographics of her classroom and mirrored conceptualizations of equity stated by NCTM (2000; 2014), where teachers are encouraged to acknowledge equitable access to resources that will help students achieve at high levels. When considering dominant mathematics, Sarah recognized her responsibility to provide individualized support as part of students' comprehension and engagement with mathematics.

Sarah also attended to the achievement dimension by breaking down language introduced through the standards and textbook. Sarah described the need to enact this practice given her students' struggle with mathematics due to confusing language. Sarah expressed how some students are able to automatically start their work by reading the textbook directions, however, others shared the same sentiment as the student who asked Sarah for help. Sarah noted, "I had one kid tell me, Ms. Sarah I just don't quite understand the directions and I feel like they're missing something here, they forgot to tell us something" (Interview One, February 2019). To attend to such confusion, Sarah described her responsibility to break down language to move students from that "stuck" place and get them to participate with mathematics. Sarah stated, "I always tell them what the objectives are, you know what the essential question is for that lesson. So I say when we finish this, you are going to be able to do this and I put it in their...I take it out of the language of the standards" (Interview One, February 2019). Sarah's data demonstrates a growing understanding of the association between access and achievement; she was aware of students' inability to approach mathematics due to

obscure language and recognized the need to rephrase the language to ensure students' comprehension of mathematics.

Another example of dominant mathematics was the way Sarah attended to student participation in mathematics. When asking about her expectations for students' during mathematics lessons, Sarah noted:

My first expectation is always for the child to try their best and always to move them and make sure that they're making gains somehow. I'm not going to expect somebody who's three years behind grade level to be at grade level. I think that's being unfair to them. I'm not and I'm also not capping them and saying they won't do it, but I just have to be really careful to let the child know that I have expectations. I expect you to move. I expect you to try your best, but I'm not going to pressure them to the point where it's going to give them anxiety (Interview One, February 2019).

This theme of moving was consistent in Sarah's practices as she described her responsibility to help her students "move ahead", "move forward", and "move them and make sure they are making gains". Further, Sarah associated notions of "moving" with students' achievement when asked to share her understanding of achievement. Sarah noted, "I'm talking mostly about their academic achievement or achievement in math, like overall that they're going to learn. It could be that they're not scared to ask questions and they're going to move ahead and feel comfortable" (Interview One, February 2019). Here, Sarah associated students' achievement in mathematics with their ability to engage and find comfort in their participation, which was tied to her expectations mentioned above. Thus, Sarah's understanding of equity as being fair and meeting students' needs played a large role in how she helped students move; Sarah first identified where students were in terms of their understanding and provided support at those level to help them develop mathematical knowledge and move forward.

Critical mathematics (identity and power). When sharing students' participation in the classroom, Sarah shared teaching practices that embraced student agency and ownership in the process of learning mathematics. Similar to Natalie and Adriana, Sarah acknowledged the importance of allowing students to use strategies from different countries as well as strategies that fit students' learning needs. When sharing her understanding of equitable teaching in the mathematics classroom, Sarah shared a recent experience she had with a student in her gifted class who was resistant to using the standard algorithm for division. At first, Sarah tried to force the student to learn long division by providing a problem that she thought could not be solved using partial products, which was the strategy the student preferred. However, after going home, Sarah was able to look up resources and solve the problem using partial products. Sarah then did the following:

I wrote it all down and I just took pictures of it and I sent it to his mom. I go look Jacob can do this. He can...he doesn't have to learn it the other way and so that's what he's been doing. This kid wants to do this, this way and there had to be a way and I know if I would have let him go he probably would have figured it out...This was something new that I didn't know and I learned because I was trying to find this fill this, you know, this need that this child had (Interview One, February 2019).

At first Sarah wanted to force the student to learn the long division strategy, however, she eventually understood that using partial products was part of the student's needs and participation in the mathematics classroom. Sarah provided another example by sharing the challenges her special education students face when learning the standard algorithm for multiplication. After talking with her students, Sarah learned that they were having hard time keeping all the numbers aligned, which stemmed from their individual needs. From this experience, Sarah described the necessity to teach multiple strategies to

provide students with options and the ability to choose strategies that were fitting to their learning style and would lead to their participation in class. Further, Sarah connected this practice to her understanding of equity by stating:

We do teach all different ways because people learn in different ways just like that child that could only do the division his way with, you know, doing the partial quotient. It's not fair to him to force him to do it a different way. He's going to arrive at the answer if he can do it faster that way and understands it better. I think we're being unfair by forcing him to do it another way because really in math you are looking for the answer even though they're not tested that way you are looking for the answer. You give them all the different strategies and show them that there's different ways to think about things, but everybody's going to pick their favorite and you know, unless there's a real specific reason why you have to multiply this way instead of this way in the real world, but differences make which one they choose (Interview Two, March 2019).

Here, Sarah mentioned inequities that exist when students are forced to learn strategies and perspectives that do not align with their needs. Sarah saw value in teaching multiple strategies, and in a sense, saw it as a way for students to have options and different perspectives to understand mathematics. Equally important is Sarah's understanding of the discrepancy between classroom instruction and how students are tested. These differences created challenges for Sarah to fully enact practices that address critical mathematics, which will be discussed in the next section.

Another way Sarah attended to critical mathematics was through her practices of positioning students as reflective beings where they were encouraged to be active participants in knowledge development. When describing practices that represented dominant mathematics, Sarah highlighted her value in peer learning by stating, "my best resource is probably each other like getting one that understands it to sit with the other to help them understand it" (Interview One, February 2019). Although the dimension of power was not clearly vocalized, Sarah described positioning students as both learners

and educators. Such practices to an extent, shift traditional idea of classrooms, where teachers are seen as the sole authority and students are expected to learn from the teacher.

Similarly, when asked about her role during mathematical discussions, Sarah described her role as, “Facilitator, I try to make sure that everybody gets a chance to say something” (Interview One, February 2019). Sarah elaborated on this in the second interview when asked about the importance of her role as a facilitator in the mathematics classroom. Sarah noted:

I don't want the children to just spit out everything that I say. I want them to have input. I want them to think about it. I want to challenge them to think on their own to come up to see that they can come up with answers on their own and they're not just sitting there to listen to everything...and I also feel that they learn more from each other. They listen to each other more than just the lady who's up there, you know in front of the room. So, you know, I like to hear where they go with it and then also by facilitating and letting them take off with it, sometimes it turns into a spontaneous lesson because they take me in a direction where wow, I didn't know they could do this (Interview Two, March 2019).

In this quote, Sarah attended to identity formation as she encouraged students to manifest agency in the learning process through the use of their own strategies to solve mathematical problems and learning from their peers. At the same time, Sarah attended to the power dimension by giving students the power to shift the course of instruction, which Sarah shared resulted from challenging students to think on their own and develop mathematical knowledge together. Sarah’s teaching practice is an example of how identity and power can build from one another. By acknowledging and addressing students’ identity, Sarah was able to positively address the power dimension and vice versa.

Challenges Presented by the Culture of Testing for Sarah

Despite her understanding of equity grounded in ideas of fairness and meeting students' individual needs, Sarah associated many of her teaching practices with testing, which created tension for her to address critical mathematics. For example, when Sarah was sharing her encouragement for students to use their own strategies when solving problems, she also described the need to teach specific strategies to ensure their success with testing. In the first interview, Sarah shared: "They [students] do come in saying mom taught me how to do it this way or this is how they do it in whichever country they learned it in. I let the kids do whatever they need to do to get to the answer, but they have to learn all the strategies that I teach because they're assessed on all the strategies" (Interview Two, March 2019). Similar to Maria, Jessica, and Adriana, Sarah described the need to enact a practice that was part of dominant mathematics. Though this practice addresses students' access to information, which in turn affects their achievement, it can be harmful to students' identity given the prestige placed on traditional algorithms in the classroom and on the test. Thus, students may shy away from taking on challenges, exploring new ways to solve problems, and being active participants in the learning process. Further, when asked about her justification for teaching multiple strategies, Sarah noted:

I have to teach it because they're going to be tested on it and that's not only my job that's at stake, but it's their education that's at stake because they're expected to know this moving on, you know, they're graded on and if they don't learn it they stay behind. So even if I disagree with that, I have to teach it to them (Interview Two, March 2019).

In this quote, Sarah recognized that her job could be affected by not exposing students to all strategies and identified the ramifications students could face, which included their

achievement beyond the classroom. This quote demonstrates Sarah's awareness of the negative effects testing can have on her career and students' educational trajectories. Thus, Sarah's awareness of such ramifications created tension between her teaching practices attending to dominant and critical mathematics, as she expressed feeling pressured to attend to dimensions of access and achievement to help support students' educational trajectories.

Another challenge that was presented with the culture of testing and is visible in the previous section is Sarah's role as a facilitator. Although Sarah emphasized the need for students to learn from each other, she also described practices that encompassed traditional teaching practices of mathematics, where students had little agency over their learning. In the first interview, Sarah described a lesson where she taught explicit content and at the same time provided space for students to use their own strategies and engage in a mathematical conversation. However, in the second interview, Sarah shared:

Today I was rushing to get a lesson in because I slowed down because the kids didn't understand something that was in the last chapter and I slowed down. So I want to test them tomorrow. I have to I just got to because I know that come Friday that half the kids are going to go home early in the afternoon and we're not gonna get the test. So it was a little bit rushed. It was easier with my afternoon class. They got it. And boom...it was me talking up at the promethean there wasn't anything creative going on...So today wasn't a good day for you know, to give you an example. Everything was done at the Promethean board. I walked around, you know, we all walked around to see who needed help with what (Interview Two, March 2019).

Sarah's role in this lesson diverged from that of a facilitator. Rather than creating a space for students to approach problems through multiple solutions and engage in peer learning, it seemed that there was minimal student participation. Sarah's use of "I have to" and "I just got to" may be related to the pressure she felt to provide her administration with her

students' test scores as she had reported a change in her district's policy during interview two. Sarah shared:

The sad thing is that this year they're pushing us with the new testing system where they're giving us dates and we have to have the sheets scanned and put in, otherwise they're not going to or they won't have the data so they can see who's not on time. So I feel really pressured to get these tests done now. See before I would just say look I'm behind and that's the way it's going to be but now they report it to the district. So test for chapter 7 has to be done by this day. They close the window and you can no longer scan the data sheets in (Interview Two, March 2019).

Ultimately, the pressure Sarah described was related to the practices she was able to enact in her classroom. Although Sarah shared how her best resource was students learning from each other and the importance of student input, she was unable to remove herself from the pressure of testing and depicted practices were centered on students' access to information and testing achievement rather than students' identity and power in the classroom.

Jessica

At the time of the current study, Jessica was starting her 22nd year of teaching and was working at the same school where she interned after earning her bachelor's degree. Jessica currently teaches fourth grade and has taught either fourth or fifth grade during her career. Jessica earned her bachelor's degree in elementary education, a master's in reading education, and an education specialist in administration and leadership. Jessica shared that she intended to pursue leadership at one point but was turned off by the amount of time it required. She shared that she would look into an administrative career once her children got older.

Given Jessica's extensive time at her current school, she had observed various school demographic changes. Although Jessica's school consistently served Hispanic students, she described major changes in students' nationalities. These changes led Jessica to characterize her school location as, "a very transient spot, sometimes I'll get students for four or five months and they leave" (Interview One, February 2019). At the beginning of Jessica's career, her school served a large population of immigrant students from Cuba. More recently, Jessica's school served a large population of Venezuelan students who were also fleeing their country due to political issues. These changes were mirrored in Jessica's classroom. Jessica's morning class was an ESL class, with ranging levels of English proficiency. Jessica noted:

My homeroom is an ESL class so I have ESL students from levels 1 through 4. Most of the ones are from Venezuela because now we're dealing with the issues in Venezuela. So I have nine Venezuelans in my morning class that are ESL level ones, two Colombians, and a few Cuban students" (Interview One, February 2019).

In her evening class, Jessica shared that there was one student from Asia, one African American student, and the rest of her students were of Hispanic descent.

Jessica's Understanding of Equity

What made Jessica's view about equity stand out from the other four participants stemmed from her experiences working with students who were relocating to the United States. When asked to define equity, Jessica noted:

That they all have the right to the same education regardless of where they come from and regardless of the levels that they're at because you get them with basically no knowledge or gaps in their learning because of all the moving they had and you have some students that are on grade level, so I think that they all have the right to receive the same education and if they're not there you build to get there...you build (Interview One, February 2019).

Unlike the other four participants who attended to notions of fairness to describe equity, Jessica's understanding was grounding in ideas of equality, where all students have access, or in her words, "the right" to the same education. However, similar to the other four participants, Jessica also recognized her responsibility to help students build given major differences in students' educational backgrounds. Jessica extended on her idea of building when asked to elaborate on equitable teaching in the mathematics classroom. Jessica shared:

When I assessed her [student] at the beginning of the year, she was working at a kindergarten level. Right now, she can't add or subtract fluently. We're doing multiplying and dividing fractions and decimals, we're doing all of that and she's down here. So it breaks my heart. She has to sit through the whole fourth grade lesson because I cannot, you know, just sit with her and build, however the programs that she's working on are catered to whole number addition and subtraction...She knows she's not there, she does everything, she's being exposed to it and then on the side we differentiate and that's where we build to meet her needs (Interview One, February 2019).

In this particular situation, Jessica was sharing the story of a student who had recently moved to the United States and was moving between different schools within the state. Due to all the movement, the student had missed critical foundational skills and was placed in a fourth-grade classroom. Through Jessica's assessment and observation of the student's work, she shared her obligation to help this student have access to the same education, which was represented in this example as fourth-grade content. At the same time, Jessica highlighted the theme of building by using phrases such as, "she's down here" and "she's not there" to address and justify the need to cater this student's work to addition and subtraction and provide differentiated instruction. As such, Jessica's understanding of equity was centered on differences in students' educational backgrounds

and notions of equality; she recognized the importance of providing resources to meet students' individual needs to provide them all with the "same education".

Jessica's Teaching Practices and the Four Dimensions of Equity

Throughout data collection, Jessica described teaching practices that were predominately centered on dominant mathematics. These practices were highlighted when sharing her use of resources and access for students to participate in the classroom and overall in the field of mathematics. There were a couple instances where Jessica shared teaching practices that mirrored critical mathematics, however, she related them back to students' access, which was ultimately tied to their achievement on tests.

Dominant mathematics (access and achievement). Jessica attended to dominant mathematics by providing students with access to resources and to instruction designed to fit their needs. Jessica's understanding for such practices were heavily influenced by her students' experiences and her awareness of how those experiences affected students' access and achievement. When describing how her lesson was structured the day of the first interview, Jessica shared:

I always start whole class, you know all of them and then when it's time to do our independent work, you know anybody that feels they don't understand, I tell them it's open door policy, come over here...So it's not the same group every day because every day it's something different, you know, it's not like reading that you're building on the same skill over and over. Every day I'm teaching a brand-new lesson and building a little bit. So they come and go and I also have students who are regulars. Sometimes they just need that, you know pat on the back, you got it, you can do it on your own. They really don't need my help, but I think they feel comfortable coming. She gave me the thumbs-up, I'm good (Interview One, 2019).

In other words, Jessica started mathematics lessons by instructing at the whole classroom level and then provided a space for students to receive individual help based on their

understanding of the content covered in that lesson. Although it was not clear if this was part of Jessica's differentiated instruction, she pointed out how it was part of her daily lessons and how the group of students changed every day. Rather than creating set groups to assist during this time, Jessica established an open-door policy to provide access for students who did not understand the material for various reasons as well as a way of providing reassurance to several students. When considering dominant mathematics, Jessica understood the need for students to have access to individual help as part of their comprehension and participation in the classroom. In relation to Jessica's understanding of equity, this individual support can be tied to her way of ensuring all students are working towards mastering fourth grade content, or in her words, "the same education".

Given that Jessica's morning class had a large group of level one ESL students (students who have been in her classroom less than 3 months and are new to English), her teaching practices during the time set aside for individual support were associated with ESL students' achievement in mathematics. Jessica described helping ESL students build during this time by providing instruction in Spanish and translating content material.

Jessica shared:

For the students that are ESL level one it has to be in their home language. I speak Spanish so I don't need a translator. So the Spanish-speaking students, the level ones have their book in Spanish. Everything is in Spanish. Now, the only thing that's not in Spanish is the test. So tomorrow I'll be sitting with my nine here and then like extensions here because it's a lot of us and I'm translating it for them one by one. So everything is in their home language" (Interview One, February 2019).

Jessica, on that note, understood that her students needed access to material and

instruction in their home language as part of their participation, and overall achievement in mathematics. More specifically, when addressing achievement, as defined by testing, Jessica understood her responsibility to translate all the content covered in tests for ESL students to be able to perform and show growth in their achievement. This again highlights Jessica's idea of providing all students with equal educational opportunities because if she did not enact this practice, her ESL students would be unable to take the test, which in turn affects their performance in the class and overtime.

Another way Jessica attended to dominant mathematics was through her use of technology to support students' learning. Throughout all interviews, Jessica mentioned multiple resources such as, Mathantics, Numberrock, Khan Academy, and Study Jams, and shared how they supported students' learning. At the beginning of Jessica's lessons, she described how she would use videos or tutorial to get students thinking about the concepts they were learning, which was also part of building their confidence with mathematics. In the first interview, Jessica shared:

I showed them a video from Khan Academy which focuses on that [comparing decimals] and then I did the lesson once they had some you know had some familiarity with it instead of just throwing the lesson and they're confused...that's what I usually do, I always give a preview. I tell them like a movie you get a preview. This is a short little video. I usually like to find videos or tutorials to present for about three minutes and then we dive into the lesson and then they feel more confident (Interview One, February 2019).

Jessica's use of outside resources to support students' learning was associated with students' prior knowledge and confidence during mathematics lessons. However, Jessica also justified the use of videos to provide students with access to different presentations of the mathematical standards, which ultimately led to their comprehension of the material and testing performance. In the second interview, Jessica noted, "they [videos]

really engage the kids...One of my students even told me, Sophia she struggles in math, she goes, you know Mrs. I was taking the test and I remembered the lyrics of the song (Interview Two, March 2019). As evidence by both quotes, Jessica associated dimensions of access and achievement, which involved building students' participation in the classroom and their performance on tests.

In addition, Jessica's use of resources provided students with access beyond the classroom. When naming multiple resources, Jessica shared her use of the "Remind" app to provide families with access to resources used in class. Jessica noted:

It's an app that I have and all parents are logged on to it. So when I send a message it goes to them as an SMS text. So every time I show a video to the kids of a concept we're learning, I'll copy that link and send the parents, we learned this lesson today, this is a good introductory, please practice with your child. They have access to it at home and for those that don't have computers at home because some of these families, you know don't have the financial means, I'm always here early like I tell you. So I tell them if your parents want to drop you off at 7:45, you have like 40 minutes. I have computers available. (Interview One, February 2019).

Here, Jessica attended to parental access to support students' learning. Although Jessica did not share potential language barriers when using such resources, she understood the importance of providing parents with resources to support their child's achievement in mathematics. At the same time, Jessica recognized differences in socioeconomic status and parents' inability to purchase technology and addressed access by giving students opportunities to come in before school. As for dominant mathematics, this was Jessica's way of providing different resources and support for students to develop comprehension.

Similarly, Jessica associated parents' access to information with testing when sharing her school's recent FSA night. Jessica shared:

The parents came to see what their kids are being assessed on this year and what the curriculum is in fourth grade. So what I did is I had samples of books that we're using, obviously the posters that are around with different ways that you know what we're being exposed to and I would show them samples of test items. I would show the parents, okay they're asking what are three different ways that you can get the answer to this multiplication problem, notice that your child has to select three answers. So I'll show them different test items and the parents ask questions. I'll show them videos on the test preparation and what their kids should be doing at home and how to help them which I constantly communicate with the parents so they know...But yeah I basically show them everything their kids are doing we expose them to that and then ways that they can help at home (Interview Two, March 2019).

The theme of exposure was central to Jessica's practices. Not only did Jessica want to expose students to grade level material, she also wanted to expose parents to the curriculum and the organization of the test as part of students' success. This relates to dominant mathematics because Jessica is helping parents, who feel "unaware", understand what is expected of their children and what they can do to support their learning, which is ultimately related to students' testing performance.

Challenges Presented by the Culture of Testing for Jessica

Jessica's understanding of equity as all students having the right to the same education was centered on students' testing performance. On a couple occasions, Jessica described teaching practices that could have been representative of critical mathematics, however, she justified them with the culture of testing. One example of this was Jessica's use of Spanish in the classroom. When considering equitable teaching through the identity dimension, this practice could have been part of embracing students' ethnic culture and using it as a resource for teaching and learning mathematics. However, Jessica solely spoke of this practice in relation to students' performance as she noted, "the only thing that's not in Spanish is the test. So tomorrow I'll be sitting with my nine

here...and I'm translating it for them one by one” (Interview One, February 2019).

Though testing is a major component of students’ success within the education system, it is important to consider teaching practices that are responsive to students’ identities and move beyond passing the test.

Another example of this was Jessica’s value of students’ prior knowledge, which embraced their ethnic backgrounds. Jessica shared:

I tell them math is math, it doesn't matter what language you're speaking, you know, we can all apply the knowledge that we bring from other countries or from strategies that we have. So in that aspect, you know, there's sort of all covered. They come with doubt sometimes because they divide in a different way, you know, and then I'll show them ok this is how you do it and you're getting the right answer, wonderful” (Interview Two, March 2019).

Here, Jessica attended to differences in students’ ethnic backgrounds and shared how she allowed students to use their own strategies to solve mathematics problems in class.

Further, Jessica rationalized about this practice by highlighting the universality of mathematics. While this practice may be part of addressing identity, Jessica did not provide evidence for how that knowledge was used to create meaningful relationships between students and mathematics. Rather, Jessica used the universality of mathematics to associate students’ own knowledge with the knowledge assessed in testing. Jessica noted:

Some students have brought with them, you know, the multiplication and division that they've already done and then here we teach them a different way...So I tell them don't stop doing it the way you do it, but you need to learn this method because when you take the test they’re going to present it to you this way because you're here and you know what you're doing but you need to learn this method, you know. And math always has so many ways of getting to the answer so many avenues like I tell them, it's just another avenue that you're learning. So that's the analogy I usually use with them (Interview One, February 2019).

The analogy described by Jessica was used to encourage students to use their own

strategies, while also attending to dominant mathematics. This quote demonstrates the conflict Jessica faced when enacting practices that valued students' ethnic culture in the mathematics classroom while also wanting to provide equitable access to information for students to achieve on tests. Thus, it seems Jessica understood the importance of valuing families' perspectives in the classroom but was also aware of how students would be assessed and the need to teach strategies for students to be able succeed.

In another interview, Jessica attended to the disparities between students' own knowledge and the knowledge covered on the test. Jessica shared, "You can do it that way, but you need to learn how to do it this way because when you get your test, your state tests, they don't know you, you know, so you need to show them I know how to divide. I know how to get the answer the American way but if you feel comfortable, go ahead and do it the way that you learned in Cuba" (Interview Two, March 2019). It is important to acknowledge Jessica's awareness of the test not knowing her students, which she also used as a justification for teaching and learning new strategies. In that sense, Jessica was restricted by testing and expressed her responsibility to teach students "American" strategies for them to be able to participate and show success within the testing culture.

Another challenge Jessica experienced with the culture of testing was her inability to enact the role of a facilitator during her lessons. After reading "Framing Equity: Helping Students 'Play the Game' and 'Change the Game'" by Gutiérrez (2009), Jessica shared her understanding of power as, "power to me was like this that I highlighted, voice in the classroom. Like, you know, maybe students taking some type of ownership. That's

how I interpreted it” (Interview Three, April 2019). Then, when asked how she addressed power in her classroom, Jessica shared her lesson as:

When they finally take ownership, look Mrs. I did it this way. Like I put on the board, I don't know if you see on the left that it says perimeter equals 322, so I just told them come up with two possible answers for length and width and then after you find give me the area for each and they can come up with so many combinations. So they were like, oh but hers is different than mine. It doesn't matter. Yeah yours is right and yours is right so sort of, you know, not every lesson can I do something like that, but every once in a while, I'll throw something out there and just you figure it out, you know that sounded constructivism (Interview Three, April 2019).

Here, Jessica associated students' voice and their individual knowledge with ownership, however, she also described only being able to do activities like these “every once in a while.” In this activity, Jessica positioned students to challenge themselves, find different solution strategies, and engage in collaborative learning. This was different than the lessons she described in interview one and two, where she used phrases such as, “So I tell them plug them in and go one by one when there's a difference, say which one is greater or less than there's your answer” (Interview One, February 2019), and “So basically I introduced a whole lesson. I told them okay, you see this chart we need to understand that one-hundred percent” (Interview Two, March 2019). When thinking about students' identity and the power they acquire in the mathematics classroom, there are clear differences between the way students are positioned in each lesson. In the activity mentioned earlier, Jessica positioned students as active participants by engaging them in questioning and building from their prior knowledge. However, in the other two lessons, Jessica positioned her students as recipients of knowledge with little agency. Thus, when considering Jessica's understanding of equity as students having “the right to the same education” and her notion of building to help students get there, it

seems that her main focus in the classroom is enacting practices that attend to students' access to information and their achievement in class and on testing.

Adriana

Adriana was a fourth-grade teacher with an extensive teaching career. During the time of the study, Adriana was finishing her 19th year of teaching, focusing primarily on science and mathematics from second to fifth grade. Adriana earned her bachelor's degree in elementary education, her master's degree in TESOL (Teaching English to Speakers of Other Languages) education, and her doctor of education in mathematics education. During the time of the study, Adriana was teaching at a title one school, serving a large percentage of students from low-income backgrounds. Adriana shared that most of the students in her school were coming from Latin American countries, primarily from Venezuela, and Vietnam. During this school year, Adriana experienced changes in her own classes. Last year Adriana was teaching what she described as an ESL class and a general education class, however, this year she was teaching a gifted and a special education class, with three ESL students across both classes.

Experiences that Shaped Adriana's Teaching Practices

When sharing her educational experiences, Adriana associated her doctoral work and teaching practices in the classroom. Adriana noted:

I do have a doctorate in math education. So that kind of prepared to bring in everything that's new and things that you don't really get taught in your bachelors. For example, strategies, grouping of students, new research that comes out, and you kind of view education in a different view, you know a different light because now I go and research things or read journals and find out what's new and what works and what doesn't (Interview One, January 2019).

In this quote, Adriana identified knowledge she gained from her coursework and connected it to her ability to enact different practices in the classroom. In other words, Adriana described the use of research to support her understanding of practices that worked in her classroom. The knowledge gained through her doctoral education was imperative to Adriana's instruction in the classroom. Upon being asked about the structure of her mathematics lessons and her understanding of the CCSS, Adriana shared, "I like common core because of how it uses different methodologies, different approaches to learning one concept" (Interview Two, March 2019). However, Adriana also attended to disparities between the CCSS's difference approaches to learning and the organization of her district's textbook. Adriana noted:

What I don't like about it is the way that the book is set up. It's like the I do, you do, we do or I do, we do, you do, you know...I do think that especially in elementary a lot of teachers feel more comfortable having that guided or you know more structured type of lesson like how the textbook uses it...It's just that it's so much in so little time that I think we're doing a disservice to the kids because then it feels like okay we spent two weeks on dividing but do they really learn those eight strategies? Or is it better to do maybe two or three strategies that they actually understand (Interview Two, March 2019)?

Although Adriana expressed appreciation for the variety of strategies in the CCSS, she also shared how the textbook setup, which covered a vast amount of information in a short period of time, was a disservice to students' learning. Similarly, Adriana posed questions about students' learning to rethink teaching practices in her classroom. Though Adriana never explicitly talked about reform-oriented mathematics, she described teaching practices that engaged students in collaborative learning, which involved hand-on projects, discussions, ownership of strategies, and long-term learning (these will be discussed later). Such practices were essential to Adriana's equitable teaching practices

and were part of Adriana's knowledge of "viewing education in a different light", which she shared emerged from her doctoral work.

Adriana's Understanding of Equity

Adriana's understanding of equity emerged from her awareness of gender differences. When asked to define equity, Adriana shared:

At first, I was thinking of equity of girls and boys because that was a big thing when I was going to school and I remember the emphasis on how you had to find a system where you call the girls as much as you call the boys, especially in math, but then I kept on thinking, equity of opportunities too...because sometimes it's not necessarily a girl, boy thing that you have to look out for and I have to make sure that I have activities that are challenging enough for all students so they have the same opportunities, you know?. In my classroom, I have extremes in learning styles because some of the gifted students are very umm talkative and they like to work, you know in groups and move around and then you have some of the SPED students that are the same. So then, they need to be moving around and you have to have a lot of manipulatives and things to manipulate. That's the equity that I'm thinking of now that students have the same opportunities to use the manipulatives in the morning with my you know gifted class and then with my regular students and my SPED students (Interview One, January 2019).

Unlike the other four participants, Adriana's understanding of equity stemmed from her earlier experiences in school, where conversations of educational equity were grounded in gender disparities in the field of mathematics. As evidenced by this quote, Adriana referred to gender disparities to acknowledge students' opportunities in the classroom and rethink her understanding of equity. Further when reconsidering her understanding of equity, Adriana attended to her classroom context and described equity as providing students with the same opportunities and access to resources as part of their mathematical learning.

While sharing the importance of equitable teaching in the mathematics classroom,

Adriana stated:

I want to see all the kids grow and learn, you know and have long-term learning. That's my main thing when I teach something in January, you know, I want them to still remember it in, you know in April. Not they just learn it for the test or something. So when you provide those different, you know methodologies or strategies or you know DI (differentiated instruction) for the high, the low and the medium, you know walking around and helping all of them or providing different manipulates or virtual manipulatives. But practicing equitable teaching translates to me to those opportunities, I think you have more of that long-term learning (Interview One, January 2019).

Here, Adriana associated equity with long-term learning for her students. Further, when describing students' opportunities for long-term learning, she identified differentiated instruction, multiple methodologies and strategies, and the use of different manipulatives. Thus, it seems that her understanding of equity was related to ideas of sameness, where she provided all students with equal access to resources to support their learning. However, when described her teaching practices, Adriana also highlighted notions of fairness when describing the need to attend to students' individual needs as part of ensuring their long-term learning of mathematics.

Adriana's Teaching Practices and the Four Dimensions of Equity

Throughout data collection, Adriana described teaching practices that were representative of both dominant and critical mathematics and associated her teaching practices to students' long-term learning. Adriana described practices that followed a lecturing approach as part of providing students with access to information, which was related to the pressure of testing and students' performance on the test. Adriana also attended to identity and power by describing practices that encouraged students to create knowledge and engage in collaborative learning as part of their long-term learning.

Dominant mathematics (access and achievement). Although Adriana described practices that were aligned to problem-based learning, she also recognized the importance of doing homework and test reviews as part of students' access to mathematical information and their achievement on tests. The day of the first interview, Adriana described her lesson as a test review, she shared:

Well today was mostly like a test review, basically reviewing for the test that is tomorrow, chapter 8. What I do is I break them up into groups and then we rotate. One group comes with me and then, you know every 15 to 20 minutes we rotate. Today I met with four groups because we had like an hour and a half. So they had different activities. Some were working with me with changing mixed numbers to fractions and fractions to mixed numbers, another group was working on the review from the book, and another group was working on gizmos (Interview One, January 2019).

In this quote, Adriana connected the test review set up with the upcoming test. She then described the use of rotations and small groups to provide students with differentiated instruction as part of their access to the material that was going to be covered on the district assessments. Adriana elaborated on test reviews in the second interview when asked how her teaching would change if testing disappeared. In her response, Adriana noted, "I think that more meaningful teaching can happen. We spent so much time getting the kids ready for the test, and while you don't teach to the test, you have to do a lot of reviews to get them to the test" (Interview Two, March 2019). Adriana, in other words, understood the necessity of doing test reviews as part of preparing students for the test, and at the same time made a distinction between meaningful teaching and test reviews. Although such teaching practices may not be supportive of Adriana's teaching style, she recognized the need to partake in test reviews as part of providing students with the same opportunities to receive access to information.

Similarly, Adriana expressed her obligation to lecture and teach students strategies as part of their achievement on tests. Although Adriana often emphasized her role as a facilitator (which will be discussed later) she also noted the need to, “teach the concepts that they’ll [students] see because unfortunately they are seen through that lens because next year if you got this score instead of this one you’re placed in tutoring, you know or I don’t know until the teacher knows you and sees well, maybe they had a bad day, but unfortunately scores do count” (Interview One, January 2019). Such a quote is reflective of Adriana’s vision of providing students with equal opportunities to receive information, which in turn affects their achievement. However, Adriana’s justification for engaging in such practices becomes less about opportunities and more about the ramifications students can face when they are seen through the lens of testing performance.

Critical mathematics (identity and power). As previously discussed, Adriana often took an approach to teaching mathematics that was grounded in hands-on learning, mathematical discussions, and students’ ownership of strategies. Though Adriana described an obligation to lecture and do homework and test reviews, she also described lessons where she positioned students as active participants in their learning. In the second interview, Adriana shared a short snippet of her lesson as:

Today we did conversions and measurement with the metric system. So we started by discussing what the metric system is and they told me, you know, some of them who travel, oh you know in Colombia we use kilometers and then somebody went to Canada and they were saying oh, you know, we were traveling and we were trying to see how many miles, but it didn’t say miles Dr. Adriana! It said how many kilometers and I had no idea where we’re going....So then I introduced it and I said how in the United States we mostly use the U.S. customary system compared to other countries in the world, they use the metric system. That’s how we started and then we did units of length with the metric

system, kilometers, meters, and centimeters.... Using metric rulers and then the meter stick, they were going around and measuring things in centimeters and then in meters. So I told them remember the whole meter stick is 1 so then they went around, they observed that the door is about one meter, my pencil is about, you know, seven centimeters or you know tens centimeters...So then I taught them, you know how to convert. We used to Promethean board and went over examples. For example, 2 meters how many centimeters will that be? And then they figured, oh so I can multiply! So it came out, you know from them instead of me telling them, okay, so you multiply (Interview Two, March 2019).

In this lesson, Adriana started by having students express their understanding of the metric system. This opening created an opportunity for students to share their observations of the metric system in other countries and ultimately created a space where students questioned the relationship between the metric system and the U.S customary system. Although Adriana followed up with words of “I introduced” and “I taught”, the overall lesson was centered student’s experiences with hands-on learning to establish connections between measurements and begin thinking about conversions. This was lesson was similar to her lesson the day of interview three, Adriana shared:

This morning we went and we measured our playground so they have a new playground and we are talking about areas. We started by solving a problem where they were painting a wall, but they were not going to paint where the window was. So the problem asked how much is the area of the wall you had to paint? They were having a hard time because they only looked at the problem and they just read it, they just wanted to add everything, you know they weren’t analyzing. So I asked them, what is it that you want to? You want to paint the wall? Are you going to add the window to it? And then how are you going to find the area of the wall and the window? We talked through the problem and then we went outside and we measured the playground and then they had to use inches, feet, and yards. So then even that was, you know, like bringing it to real life...so they can see, you know a way and then everyone was doing it, you know even my ESL students were engaged” (Interview One, January 2019).

In this lesson, Adriana started by giving students a problem to solve, which turned into questioning and a discussion about what the problem was asking. Adriana did not share if the second part of the lesson was planned, however, she followed students’ confusion

with an outdoor activity to have students experience a real-life example of finding the area of an object. Then, after students measured the playground with measuring tapes and measuring wheels, they realized they had different answers for the area. Adriana shared how this led to another discussion, she noted:

So then you know, we talked about because some of them were measuring and they would move it [the tape or wheel] or then they saw a bee and they took out the finger so then their measurements were a little bit off and you know, nobody got the exact so we talked about it, that was a great teaching moment (Interview Three, April 2019).

Again, Adriana demonstrated practices that valued students' hands-on learning as well as their questioning and discussions. In essence, Adriana's teaching practices are part of building students' identity as she described positioning students as active participants in their learning of mathematics.

Similar to Sarah, Adriana consistently communicated the importance of being a guide in the classroom. Although she described moments where she had to take on a lecturing teaching style, she described her role mostly as, "I like for them to work out the problems, you know, go through the trouble of making mistakes and all of that because once they tell me what they're doing, then I can kind of guide them or I see the misconceptions" (Interview Two, March 2019). In this quote, Adriana shared the importance of student agency in the learning process and her ability to guide them once they have expressed their understanding of the content. Later, when asked how her role was related to equity, Adriana shared:

Well, I think once they have a chance of telling, you know, either me or when they work in small groups, each other, they feel more comfortable. They feel more heard or they don't feel like oh my God, she's the authority, I am here to just listen. So I think they feel not only equality between them because you know, just because you get math maybe a little bit easier when we do number sense it doesn't

mean that you are going to be the head of the group or you're going to be the only one talking, everyone has to you know, come in and explain or figure out something...So it's equality that way and then also with the teachers that they feel that we're part of the learning that's happening and she's not the only one that knows it all. I always tell them bring in your experiences and when you do your homework if somebody explains something new or a strategy, bring it in and share it because I might not know it. So that also creates that atmosphere of being comfortable but also feeling that the teacher is not the authority. I don't like to be the one that they look up and say, oh she knows it all. And then at the beginning of the year they asked, why are you a doctor? And I had to explain to them, but a lot of kids get like intimidating because they think whoa, she knows a lot, I don't know much. So that's what I do to help with that (Interview Two, March 2019).

Is it important to note Adriana's use of the word equality when describing classroom participation among students and between the teacher and students. This quote is related to Adriana's understanding of equity as providing students with equal opportunities, while also expressing ideas of fairness by supporting all students regardless of educational backgrounds to engage in classroom discussions. At the same time, Adriana acknowledged the intimidation students felt after learning about her doctoral degree and expressed her role as a facilitator as a way of distributing power and creating a classroom environment where everyone is positioned to create and develop mathematical knowledge.

Adriana's role as a facilitator in the mathematics classroom created a collaborative space for learning. When further elaborating on her role and students' role in the classroom, Adriana shared students' use of strategies that they learned at home from their immediate family or friends. Like Natalie, Sarah, and Jessica, Adriana embraced those strategies in the classroom as part of learning from each other and valuing students' cultural and ethnic identity. When asked how this related to equity, Adriana shared:

Well, I think that just any strategy not only coming from something that you learn from another friend in class, but coming up with things or being able to share things that you learn at home makes them feel like okay, my knowledge or the knowledge that I learned from my aunt or my mom it's important as well. I think it also transcends to their idea of school and linking it to outside of school because sometimes if you say no that's not how we do it, let's do it this way, then they get home and maybe a parent can't help them with the homework and they'll say no mom, you know it's not like that. So then that creates other problems I think that would separate them or make them unequal. But I think it creates this balance between outside and inside and they feel comfortable sharing other things where they see math outside the class (Interview Two, March 2019).

Here, Adriana attended to identity and issues of power. First, Adriana described the importance of valuing students' and families' knowledge by allowing students to use and teach their own strategies. Then, Adriana related this practice to relationships outside of the classroom; she shared how devaluing that knowledge may lead students to neglect outside help and establish disparities between what is being valued in the classroom and the knowledge parents bring from other countries or from their own schooling.

Challenges Presented by the Culture of Testing for Adriana

Much like the other four participants, Adriana faced several challenges with the culture of testing. When asked about the accommodations that she made in her classes, Adriana elaborated on assignment modifications and extended time for her SPED students. Adriana shared, "if they need extended time for their tests, they can have it. I try not to go from one day to another but sometimes they do need it, especially the SPED students" (Interview Two, March 2019). However, in the same interview, Adriana expressed how challenging it was to make accommodations with the amount of time she had, she noted:

The amount of time is a challenge especially because math is like a building block. I always tell them math is like a building you need a good foundation. You have to make sure your first floor is solid, your second floor is solid you cannot,

you know build your second floor without a wall because your building is not going to make a very high you know, it's going to fall. So it's time because sometimes I think the curriculum pacing guides goes very fast and the kids don't all learn at that pace...I know it's a guide but then, once we have testing we have...for example in fourth grade, we cover 13 chapters by May so it's a lot (Interview Two, March 2019).

Adriana's comment regarding mathematics being a "building block" was reflected in her teaching practices mentioned earlier; she encouraged students to engage in hands-on learning, collaboration, and connection making as part of their long-term learning in mathematics. Similarly, Adriana's awareness of students' learning need and the tension she described to support all students, related back to her understanding of equity, where she wanted to provide students with equal opportunities to have a "good foundation".

Despite her understanding, Adriana described the challenge of not having enough time to support all students. Throughout data collection, Adriana attended to this challenge when sharing her teaching practices. On multiple occasions, Adriana shared how the pressure of covering a vast amount of information for the test resulted in her cutting mathematics lessons short. For example, when sharing how her teaching would change if testing disappeared, Adriana used phrases such as, "you can go more in depth because you're not so pressured with time", "you can do more activities in which you just give them one scenario and in that scenario they can do adding, subtracting, area, and perimeter", and "rather than I want to know that you know five strategies to do this, it could be I want to know that you can figure it out using one or two strategies and you can own it" (Interview Two, March 2019). Although Adriana's teaching practices did represent dimensions of identity and power, the phrases above demonstrate her inability to fully enact those practices given the challenges and pressures presented with the

culture of testing. Adriana also expressed feeling obliged to follow teaching practices that diverged from her own understanding of teaching and learning mathematics. These feelings were shared as part of access and achievement when Adriana used the words, “have to” to justify lecturing in her classroom and the need to teach strategies that students would see on the test. Thus, for Adriana, there existed tension between her own understanding of equity and the pressure that was placed on her as a teacher to cover all the information that was part of the test.

CHAPTER FIVE

CROSS-CASE ANALYSIS AND FINDINGS

Introduction

The purpose of this chapter is to synthesize the individual reports of the five participants through a cross-case analysis. The aim for this research study was to explore participants' understanding of equity and their use of equitable teaching practices in the classroom that represent dimensions of access, achievement, identity, and power. As presented in chapter one, the research questions guiding this study were as follows:

- 1) How do mathematics teachers describe their understanding of equity?
- 2) How do mathematics teachers describe their use of equitable teaching practices in the classroom?
- 3) How are dimensions of access, achievement, identity, and power represented in mathematics teachers' description of equitable teaching practices?
- 4) How is state mandated testing related to mathematics teachers' descriptions of equitable teaching practices?

As mentioned in chapter three, participants were aware of my study's focus on equity and my interest in learning about their own understanding of equity and their teaching practices in the mathematics classroom. In the first interview, participants were asked to define equity and share their understanding of the relationship between equity and mathematics (See Appendix A for interview protocols). Through this interview, participants expressed relationships between equitable teaching practices and their current classrooms. The second interview focused on scenarios relating to participants' description of equitable teaching practices in the classroom and the four dimensions of

equity. In the last interview, participants were asked to read, “Framing Equity: Helping Students ‘Play the Game’ and ‘Change the Game’” by Gutiérrez (2009) and share how they understood and attended to the four dimensions of equity in their classroom. For this chapter, participants’ responses from all three interviews were dissected to search for themes that traversed across cases or in other words, “strings the cases together” (Stake, 2006, p. 39).

Finding One: Two Notions of Equity – Fairness and Sameness

Throughout data collection, I continued to explore how participants understood equity (a primary research question for this study). When examining participants’ individual case reports, patterns emerged regarding similarities and differences in their definitions of and overall understanding of equity. Natalie, Maria, and Sarah, all attended to notions of fairness when describing their understanding of equity, while Jessica and Adriana shared notions of equality, or “sameness” (Gutiérrez, 2002) in their understanding of equity. When considering the marginalization of students in the field of mathematics due to their identities (e.g., race, ethnicity, gender, socio-economic status, learning disability), notions of fairness are grounded in understanding, acknowledging, and attending to inequities and injustices that affect students’ learning experiences in mathematics. On the other hand, notions of sameness are grounding in ideas of equality, where all students are seen as starting at the same place without acknowledging how students have been marginalized in the field and the need to attend to students’ individual needs. Table 2 provides a summary of participants’ understanding.

Table 2
Participants' Understanding of Equity

| Participants | Understanding of Equity |
|--|---|
| Notions of Fairness | |
| Natalie | Providing access to information at the levels that each person needs to ensure student participation and achievement. |
| Maria | Being fair and attending to what students need to get them all to the "equal mark." |
| Sarah | Treating everyone fairly and meeting individual needs to ensure student participation and comprehension. |
| Notions of Equality or "Sameness" | |
| Jessica | All students have the right to the same education regardless of the levels where they are at. |
| Adriana | Students have the same opportunities to resources and support as part of their long-term learning. |

Notions of Fairness

Throughout the study, notions of fairness emerged when participants were asked about their understanding of equity and its relationship to mathematics. For example, when asked to define equity in the first interview, Natalie shared her responsibility to provide students with "access to information or to whatever it is that you're speaking about at the levels that each person needs it" (Interview One, January 2019). Though Natalie did not explicitly state fairness in her definition, she did demonstrate an understanding of this idea when she identified the need to provide students with different levels of support. Later in the interview, Natalie argued for the need to attend to context when providing equitable support for students. This argument was addressed when Natalie shared differences in her students' background experiences and the need to look at each student individually to address equity. Natalie understood that some of her students had little to no support at home because their parents did not speak English, did not understand the curriculum, or worked multiple jobs to support the family. For those

reasons, Natalie set time aside prior to school to support those students individually using technology and one-on-one sessions.

After reading, “Framing Equity: Helping Students ‘Play the Game’ and ‘Change the Game’” by Gutiérrez (2009), Natalie expanded on her understanding of equity by highlighting the word “opportunities.” Natalie connected privilege, access to information, and opportunities when she stated, “now, especially through like learning and working with students that are not as like privileged, I realized that those students need more access to information. They need more challenging work...it’s like giving them those opportunities” (Interview Three, April 2019). In other words, Natalie understood equity as a relationship between students’ background experiences and their opportunities and access to information and recognized the need to provide her students with “more.” Though Natalie’s notion of being fair was primarily centered on dominant mathematics, specifically access, she was conscious of how students’ background experiences could lead to marginalization in the field and used this awareness to practice equitable teaching by providing students with individual support inside the classroom.

Maria’s understanding of equity also presented ideas of fairness. In her definition, Maria attended to her responsibility of “being fair” and attending to students’ needs to help them be successful and develop positive relationships with mathematics. At one point, Maria elaborated on her understanding of being fair and providing equitable support as part of “closing the gap.” Maria was one of two teachers (the other participant was Jessica) who brought up the gap throughout data collection. However, when asked to define the gap in the second interview, Maria described it as the individual gap students have when they are unable to do fifth grade mathematics because, “maybe, you

know, it wasn't given or maybe it's just they needed a little extra help or they were absent or for any given reason and they're sitting in my classroom and they don't have it" (Interview Two, March 2019). Though Maria's descriptions of equitable teaching practices were heavily focused on students' testing performance, in interview two she described "the gap" as that of the individual student. Whether Maria assessed those individual gaps using students' test scores is not known, however, Maria's understanding of "the gap" added an extra component to the findings. Maria's understanding asked the question of how participants were assessing gaps in student's knowledge and whether they were assessing students' knowledge as individuals or in comparison to the performance of other students. Thus, when considering Maria's definition of equity, her understanding of the gap was integral to her responsibility of being fair and attending to students' individual needs as part of students' success.

Like Maria, Sarah also expressed a similar understanding of equity as treating everyone fairly and giving students what they need. In her definition, Sarah elaborated on her justification of fairness by stating, "If you're treating everyone fairly, you're giving everyone what they need. What one student needs is not what another student needs" (Interview One, February 2019). Sarah's understanding of equity as providing students with fair opportunities to increase their engagement with mathematics was reflective in her teaching practices. Sarah shared her openness to explore and learn new strategies when she described examples of students bringing in their own ways to solve mathematics problems; she understood the importance of allowing students to express who they were through their strategies and using those strategies as learning resources for the whole classroom. Further, when elaborating on the use of resources and support in

the classroom, Sarah stated, “they [students] can get up and use the boards if they need to use the boards. I have this more with my inclusion class, they’ll just say can we have a small group and I let them do that. I let them work with a friend” (Interview One, February 2019). Such practices mirror NCTM’s (2000) equity principle, which proposed that teachers incorporate practices that respect and emphasize students’ differentiated processes to ensure their engagement with mathematics.

Notions of Sameness

Upon reading and analyzing Maria’s and Adriana’s case reports, it was evident that they described and understood equity through notions of equality, which Gutiérrez (2002) aligned to notions of “sameness.” From the beginning, Jessica shared her definition of equity by emphasizing words that reflected equality, such as, “they [students] all have the right to the same education” (Interview One, February 2019). Further, Jessica related her understanding of providing all students with the same education to her current experiences of working with students who were relocating to the United States. Jessica elaborated on her definition by highlighting the importance of helping students build to get to that “same” education. Jessica’s emphasis on building was mirrored in her teaching practices; it was important for her to provide students and their families with equal access to resources as part of their participation in the classroom and on mandated testing. Similarly, when describing her lesson structure, Jessica shared her lesson organization as starting with whole-class instruction followed by independent work. During independent work, Jessica created a space in the classroom for students to receive help (with an open-door policy) as part of their mathematical comprehension, which tied back to her understanding of building. Although an open-door policy to

receive help is inviting for students, the overall message is about providing equal support without necessarily acknowledging the type of support that attends to students' individual needs. Jessica shared how this space allowed her to translate information for her ESL students as part of their engagement with mathematics, which she later associated with testing. When considering equity through notions of fairness as described in chapter two, Jessica's teaching practice did not consider how students' cultural and ethnic identities could be embraced as resources for teaching and learning mathematics. Rather, Jessica's teaching practices emphasized the need to provide all students with the same education, which she associated to grade-level content and information covered on mandated testing.

Like Jessica, Adriana shared a similar understanding of equity. When asked to define equity in the first interview, Adriana reflected on how her understanding developed overtime. At the beginning of her career, Adriana's understanding of equity was informed by gender difference in the field, it was about finding, "a system where you call the girls as much as you call the boys, especially in math" (Interview One, January 2019). This understanding, which mirrors notions of equality, informed her current understanding of equity as, "students having the same opportunities" (Interview One, January 2019). Adriana elaborated on this idea by highlighting her responsibility to provide all students with access to the same resources as part of supporting their mathematical learning. For Adriana, equity was informed by ideas of equality, where all students are given the same support to be able to participate and develop long-term learning. However, something that stood out from Adriana's case was how her teaching practices differed from her conceptual understanding of equity. Although her conceptual understanding of equity was centered on notions of sameness, her teaching practices

attended to notions of fairness. This difference was highlighted in Adriana's case in chapter four when sharing how she provided different methodological approaches, taught and allowed students to use different strategies, and practiced differentiated instruction to attend to disparities between students and will be highlighted in the last finding of this chapter.

As seen in chapter two, conceptualizations of equity in the mathematics education literature have changed throughout the years in response to multiple events (e.g. low-test scores, underrepresentation of students of color in STEM, inequitable access to resources). Although participants in this study did not directly identify sources or events that contributed to their understanding of equity, their shared notions of equity aligned with how equity has been described and attended to in the literature. For instance, Jessica's and Adriana's understanding reflected views of equity as equality, which emerged following *A Nation at Risk* (NCEE; 1983) and NCTM (1989). Such understandings reflect an image where all students are seen as having a universal experience in mathematics and are provided with equal access to resources to support that experience. On the other hand, notions of fairness shared by Natalie, Sarah, and Maria mirrored more recent literature arguing that equity be understood through notions of justice and fairness to differentiate it from equality, which represents ideas of sameness (Gutiérrez, 2002; Secada, 1989). It should be noted that although participants shared similar understandings of equity, there were difference in how they described their justification for equitable teaching in the field of mathematics. This will be discussed in the next section.

Finding Two: Justification for Equitable Teaching Varied

Aside from participants sharing notions of fairness and sameness in their understanding of equity, their justification for equitable teaching in the mathematics classroom differed by participant (See Table 2). When looking closer at Natalie's and Sarah's understanding of equity, there exists a pattern of attending to equity as part of ensuring students' participation and achievement in mathematics. For instance, when asked about the importance of equitable teaching in the mathematics classroom, Natalie shared:

I think it's really important and I speak because of my students and I know with the diverse group of cultures that I have in my room, a lot of students have a different understanding of math and then maybe their homes or their cultures teach it differently. So I think that it's important for me to not value one student's form of doing something just because it was from a different perspective (Interview One, January 2019).

Natalie related equity and mathematics by sharing her awareness of differences in students' understanding of mathematics, which stemmed from cultural differences. Further, Natalie shared examples where she allowed students to use strategies from different countries and when asked how that practice related to equity, she stated,

Because you're valuing what they bring, and I think that's important because if you just shut them down on things that they know make sense and are actually mathematically sound then you're not giving them the power to use what they know" (Interview Two, March 2019).

When considering students' participation and achievement in mathematics, Natalie recognized the importance of attending to students' individual needs, which in this case was centered on students' cultural background. Natalie also tied her teaching practice to student empowerment, as she expressed students' ability to engage in the classroom and feel valued by using knowledge that they knew and made sense to them.

Likewise, Sarah shared her value for students, especially special education students, using their own strategies in the classroom. Sarah was aware that students needed to use strategies that embodied their special learning needs to be able to participate in the classroom and engage with mathematics. Sarah related this teaching practice to her expectations; though she understood students move at different paces and have different understandings of mathematics, she wanted to provide them with the resources and support necessary to help every student move forward. Sarah associated her ideas of helping students move with “making gains” (Interview One, February 2019), which is aligned to students’ comprehension of mathematics.

Natalie’s and Sarah’s justification for equitable teaching in the mathematics classroom mirrored parts of NCTM’s (2000, 2014) position on equity, where individualized support is necessary for students to attain mathematics proficiency. Further, for students to attain mathematics proficiency, teachers must acknowledge and be responsive to students’ backgrounds to provide them with resources that support their participation in the classroom. At the same time, their justifications for equitable teaching are reflective of students’ identity, a dimension of equity focused on creating opportunities for students to use their culture and language as a resource for learning and teaching mathematics (Delpit, 1995, 1998; Gutiérrez, 2009). Further, when considering notions of fairness in their understanding of equity, identity plays a large role in how students were supported to use their culture and experiences as learning tools for mathematics.

Maria and Jessica related their justification of equitable teaching in the mathematics classroom to students’ testing performance. Such justifications mirrored

conceptualizations of equity as equality that emerged following the enactment of NCLB (2001) and the pressure to close achievement gaps. Maria, on multiple occasions justified her use of equitable teaching practices in the classroom by highlighting the importance of students performing equally on the test. For example, in the first interview, Maria emphasized notions of fairness to get students to the “equal mark”, which she characterized as fifth-grade content. Maria shared her current experiences with ESL students, and the need to help them “build” as most of them entered her class one or two levels behind grade level. When sharing teaching practices that were attentive to students’ individual needs, Maria referred to the space between students’ current knowledge and fifth-grade content as “the gap.” Although Maria described the gap in reference to each student, she later related equity and the gap by stating the need to help students. For example, when describing two students – one who was performing on grade level and another performing below grade level, Maria shared the need to help the latter student “catch up” so both students, when looking at the same test can answer appropriately” (Interview Two, March 2019).

Although Jessica’s definition of equity was different from Maria’s, as Jessica described notions of equality from the beginning, she justified her teaching practices by expressing her responsibility to provide all students with the “same education.” Further, when justifying the need to provide her students with access to and support for grade-level content, Jessica related it to the content that would be covered in mandated testing and students’ performance on the test. For instance, when sharing her students’ use of strategies from different countries, Jessica emphasized the need for students to learn the method taught in the United States because that was part of their achievement on the test.

Similarly, when sharing her support for ESL students, Maria highlighted the importance of translating the test for them as part of students' achievement. Although Maria and Jessica did describe practices that reflected students' individual needs, they tied their justification for equitable teaching to testing outcomes. Thus, their justifications are representative of theoretical framings of equity that prevailed in the early 2000s, where educators emphasized and shared the responsibility to help close achievement gaps (Gutiérrez & Ezekiel Dixon-Román, 2011).

Like Jessica, Adriana also presented ideas of equality when describing her understanding of equity and her teaching practices. Though notions of sameness were evident in Adriana's understanding of equity, her justification for equitable teaching differed from other participants. When describing her teaching practices, Adriana attended to students' individual needs and described her responsibility of providing students with individualized support to ensure their long-term learning of mathematics. From the beginning, Adriana associated equity and long-term learning when she stated:

So when you provide those different, you know methodologies or strategies or you know DI (differentiated instruction) for the high, the low and the medium, you know walking around and helping all of them or providing different manipulates or virtual manipulatives. But practicing equitable teaching translates to me to those opportunities, I think you have more of that long-term learning (Interview One, January 2019).

For Adriana, opportunities were understood as students' access to use resources that supported their differentiated processes of learning mathematics. Adriana also elaborated on the relationship between equity and long-term learning when she shared practices that were representative of reform-oriented mathematics. Adriana justified providing students with equal opportunities by highlighting the importance of student engagement in

collaborative environments, which involved students' creation and development of mathematical knowledge. As such, Adriana's justification for equitable teaching in the mathematics classroom was tied to students' long-term learning and is reflective of the literature discussed in chapter two, where equity is justified by providing students with access to reform-oriented mathematics (Boaler, 1997a, 1997b).

Participants' justifications for equitable teaching in mathematics were reflective of mathematics education literature focused on equity. Natalie and Sarah highlighted justifications for equity that were pertinent to NCTM's (2000, 2014) position on equity, where students are provided individualized support to ensure their participation and proficiency in mathematics. Maria and Jessica's justifications were related to goals of closing achievement gaps, which emerged following the enactment of NCLB (2001) and the pressure that was placed on teachers through accountability measures. Sarah's justification for equitable teaching in mathematics mirrored ideas presented in debates of traditional versus reform-oriented mathematics and the need for students to experience meaningful mathematics characterized by problem solving, connection making, data analysis, communication, and reasoning. The differences in participants' justification for equitable teaching in the field of mathematics are reported to provide a reflection of how mathematics teachers construct their own understandings and visions of equity in the classroom.

Finding Three: Prevalence of Dominant Mathematics in the Classroom

When examining participants' teaching practices through the lens of dominant and critical mathematics, practices that attended to the dominant dimensions of access and achievement were prevalent across all participants. The access dimension was

characterized by participants as providing students with individualized support (e.g., differentiated instruction, reinforcing instruction to meet the needs of ESL students, use of manipulatives and different resources) in the mathematics classroom. The achievement dimension was described in relation to students' performance, which was centered primarily on their testing performance. Further, when describing their teaching practices, participants often associated access and achievement by highlighting the need to be conscious of the access they provided for students to engage with mathematics because it was related to their achievement. This, the participants seemed to say, was part of their responsibility to ensure students' success within the culture of testing. Similarly, participants described their use of such practices by sharing their understanding of the consequences that students could face if not exposed to such information and opportunities.

Natalie, for instance, focused largely on students' access to information and their participation in the classroom. This was evident in the beginning of data collection when she used the words access and information to define equity. Natalie's understanding was parallel to her described teaching practices of providing students with:

- Instruction that reinforces English for students who do not have English-speaking parents
- Extra resources if students are not getting them at home
- Opportunities to engage in word problems to build their problem-solving skills, with a large focus on critical thinking skills
- Individualized support and feedback to ensure participation

Though Natalie did not explicitly connect her teaching practices to testing, the practices above are reflective of dominant mathematics as the instruction is centered on information that is covered through mathematics standards and is ultimately part of mandated testing. Similarly, when elaborating on the need to provide students with more instruction that emphasized English, Natalie shared her push for ESL students to use English only in the classroom. Natalie stated,

If I don't push them to that then they're just going to be scared. And they have to learn English eventually like, you know, we have to learn English if we don't, if they don't learn English, then they're going to be stuck” (Interview One, January 2019).

Natalie’s focus on student exposure to the English language was part of students receiving access, which was also related to students’ achievement as she expressed concern about students getting “stuck.”

Like Natalie, Maria also expressed awareness for the consequence students could face if not provided with equitable access. From the beginning, Maria stated her responsibility to attend to students’ individual needs and related her responsibility to students’ testing performance. Maria’s understanding and awareness was echoed in her teaching practices. She largely focused on providing students with:

- Enrichment if needed
- Extra support, or in her words “more depth” to help students catch up to grade-level content
- Traditional instruction that exposed students to mathematical information
- Differentiated instruction to ensure individualized feedback and support as part of “building”

Though Maria's practices may be related to students' success, they were bounded by a system of accountability associated with testing and provide a narrow view of mathematics achievement. This is not to say Maria intentionally focused on dominant mathematics over critical mathematics, as she expressed serious frustration toward testing. During the last interview, which took place during science testing and right before mathematics testing, Maria shared her understanding of the achievement dimension after reading the article as:

Okay, it mentioned a lot of things that are considered achievement and unfortunately, the only one that matters here is standard testing...it's the truth. I can give any of these kids like an A or a B, they can earn it, but then on the day of the test they come in they have a headache they get a one or two next year and they have intervention (Interview Three, May 2019).

After proctoring a long exam, Maria described herself as feeling drained and "uncreative" after observing students in testing mode. This comment attended to the responsibility Maria felt to attend to practices that were centered on testing and the prevalence of dominant mathematics in her classroom. After that comment, I asked Maria, "So you're saying like what happens in the classroom sometimes doesn't relate [small pause]?" Before I finished the question, Maria answered, "it doesn't at all" (Interview Three, May 2019). This understanding is something to consider when examining Maria's teaching practices and her ability to engage in critical mathematics, as she described disparities between the teaching that happens in the classroom and testing.

Sarah described teaching practices that emphasized the relationship between access, participation, and mathematics comprehension. Sarah's teaching practices included providing students with:

- Resources to support their individual needs and ensure their participation

- Lessons that simplified confusing mathematical language
- Expectations that were attentive to students' needs and related to their comprehension or "movement" in mathematics

Although the first practice did relate to students' identity, as Sarah shared students' use of strategies that embraced their special learning needs and prior experiences, Sarah later expressed the need to teach specific strategies because "they're going to be tested on it" (Interview Two, March 2019). Such practices, which are often taught through traditional lecture approaches, are part of dominant mathematics. Further, Sarah understood the relationship between access and achievement when she added, "even if I disagree with that, I have to teach it to them" (Interview Two, March 2019).

Jessica was also conscious of how students could be affected if she did not attend to dominant mathematics. Jessica's teaching practices reflected a goal of providing all students with the same education by engaging in the following teaching practices:

- Following a lesson structure with whole level instruction at the beginning and independent work at the end
- Setting time aside during every lesson to provide students with individualized support (with an open-door policy)
- Translating mathematics information to students' home language to ensure participation and achievement in the classroom and on testing
- Using technology to support students' learning inside and outside of the classroom

Jessica's teaching practices throughout data collection were solely focused on dominant mathematics. Although she hinted at teaching practices that were part of embracing

students' ethnic identities, each practice was associated with the set-up of testing because she understood the importance of providing students with access to information that would be covered on the test. This understanding was highlighted in interview two when Jessica shared how she allowed students to use their own strategies (whether invented or from different countries), but she also told students that they needed “to learn how to do it this way because when you get your test, your state test, they don't know you, you know, so you have to show them I know how to divide. I know how to get the answer the American way” (Interview Two, March 2019).

Adriana also described her responsibility of engaging in teaching practices that addressed students' access and achievement. These practices engaged students in:

- Homework reviews at the beginning of class
- Lecture-based lessons as part of test reviews
- Small group work to provide differentiated instruction
- Use of resources to support their individual needs

There were many instances when Adriana shared the necessity to attend to the practices above. When asked how her teaching would change if testing was removed, Adriana disassociated meaningful teaching from testing preparation when she said, “I think that more meaningful teaching can happen. We spent so much time getting the kids ready for the test, and while you don't teach to the test, you have to do a lot of reviews to get them to the test” (Interview Two, March 2019).

When looking at the individual report of each participant in chapter four, access and achievement stand out in their described teaching practices. The purpose of this

finding is to show the prevalence of dominant mathematics and teachers' reasoning for attending to such practices. Further, when considering participants' definitions of and their overall understanding of equity, it is important to consider the restrictions they face when they feel responsible to attend to the culture of testing as part of helping students achieve on mandated testing. This responsibility stems from participants' awareness of the ramifications (e.g. being held back, being stuck, getting placed in intervention) students can face if not given fair, or to some, "equal" access to mathematical information covered on the test.

Finding Four: Scratching the Surface of Critical Mathematics

When examining participants' teaching practices through the axis of critical mathematics, three of the five participants provided solid examples that mirrored components of identity and power. However, when looking closer at their teaching practices, it became clear that they did not attend to the criticality described by Gutiérrez (2000, 2002, 2009). For the most part, participants described and associated their teaching practices with identity formation in the classroom. As discussed in chapter two, such visions of identity are centered on students' relationship with mathematics and how they understand their assigned position in the field (Holland, Lachicotte, Skinner, & Cain, 1998; Horn, 2008). Participants in this study also described teaching practices that reflected parts of Gutiérrez's (2009) conceptualization of equity through the dimension of power.

Although a vital component of identity is centered on understanding how students have been marginalized in the field of mathematics and enacting teaching practices that attend to students' identities, such as race, ethnicity, gender, and class (Delpit 1988,

1995; Gutiérrez, 2009), participants in this study rarely established a connection between students' identities and their teaching practices in the classroom. Further, when examining participants' teaching practices through the dimension of power, most participants did not consider ideas of using mathematics as a tool to question society and create change in the world (Gutiérrez, 2009; Gutstein, 2006). Even when presented with the article in interview three, most participants expressed moments of learning and reflection, yet they were unable to provide examples from their teaching practices that differed from those shared in earlier interviews.

For example, in the first two interviews, Natalie described teaching practices that were responsive to students' needs and mirrored components of identity and power; her teaching practices included:

- Providing students with individualized feedback and support to encourage their participation in class
- Allowing students to use strategies from different countries to ensure participation and achievement

When describing the practices above, Natalie shared her students' prior experiences with mathematics. Natalie understood that most of her students did not identify with the mathematics due to their struggle with the subject. Therefore, Natalie saw it necessary to create a classroom environment that provided students with individualized support to help them develop positive relationships with mathematics. When asked about her feedback to guide students' learning, Natalie shared,

It's more open-ended questions or I'll tell them like well does it make sense? Why does it make sense? It's more of that kind of stuff as opposed to, you added wrong exactly there, I don't do that. I don't really point it out. I just try and get them to

go back and understand where they went wrong on their own. So that's kind of the feedback I go through (Interview One, January 2019).

When considering identity formation, Natalie created a classroom environment that positioned students to focus on their individual processes as part of their success and advancement. In interview three, Natalie related this practice to critical mathematics when asked how she understood and addressed power in her classroom. Natalie stated,

Giving them the power to just be able to express themselves and to try and own their work and own their individual process...And I think that like the power is that they have the power to make change and showing them that they have power to make those changes within themselves. Not in comparison to or not out in the world to go and say I have power because I learned this. No, like I have the power to make things better, I have power to learn (Interview Three, April 2019).

The theme of owning your own process stands out from Natalie's teaching practices and is essential to her understanding of equity through notions of fairness. Natalie related her teaching practice of providing students with individualized feedback to students gaining power to make changes within themselves, which was described as shifting students' identification with not knowing mathematics in chapter four. Although Natalie's teaching practice encompassed the power students develop as individuals, it diverged from an essential part of the power dimension, where students are engaged in critical thinking and social issues by using their knowledge of mathematics (Gutiérrez, 2009; Gutstein, 2006). This difference was highlighted in Natalie's comment of power being unassociated to making changes, "out in the world."

Similarly, when describing her understanding of identity, Natalie did not address the identities listed in the article, and instead focused on students' identifying with failure due to their previous experiences and her responsibility to provide them with opportunities to be successful in mathematics. Furthermore, Natalie showed that she

attended to students' identities by allowing them to use strategies from different countries, which shows value in students' cultural knowledge. However, Natalie fell short of acknowledging how this teaching practices is connected to the marginalization of students based on their ethnicity or nationality in the field of mathematics. Further, Natalie chose to have an English-only policy in her classroom. Thus, while Natalie showed a few ways in which she attended to identity in the classroom, her classroom policies on the whole lacked the criticality described by Gutiérrez (2000, 2002, 2009).

For Sarah, critical mathematics were represented through the following teaching practices:

- Allowing students to use strategies that fit their individual needs to ensure participation and comprehension
- Playing the role of a facilitator in the classroom to encourage students to take leadership in the classroom

Because of Sarah's extensive work as a special education teacher, she understood students' need to use strategies that embraced their individual needs. This was expressed in the first interview when Sarah shared a recent experience of a student who expressed resistance in using the traditional division algorithm and instead used partial products to be able to participate and understand the content. When examining Sarah's teaching practice through critical mathematics, it seemed she associated students' status as special education students as part of their identity. For Sarah, it was important to create a learning environment where students could use their own strategies as she understood it was unfair to force students to use strategies that did not embrace their individual needs and not doing so would diminish their participation in class.

Although Sarah attended to identity in her teaching practice above, she even realized this fell short of the critical mathematics discussed in the article. After reading the article, Sarah reflected on her understanding of equity. She stated,

When we're talking about equity this just goes way beyond the scope of what I was even homing in on. So I'm realizing by reading this, that I'm just looking at what's going on in my little classroom, in my little community right here when there's so many things that she's pointing out that make me know that I have to re-examine this whole concept of equity (Interview Three, April 2019).

Sarah was the only participant who acknowledged the narrowness of her understanding. In addition, when asked how she understood identity, Sarah continued to highlight parts of the reading that made her reexamine her teaching practices. Sarah posed the following questions,

How will it [attending to students' past including the contributions of their ancestors] enhance their esteem? Am I thinking about that? Am I doing that? We have Hispanic heritage week and we have Black history month and we have women's history month, but am I doing enough for the children individually or making them connect to it and not just saying this is a project go do this (Interview Three, April 2019)?

Sarah's comments in this interview attended to her neglect of students' racial, ethnic, class, and gender identities. Further, when asked how she attended to identity in her classroom, Sarah said "a lot of times when I focus on their identities, I can't really say that it's so much math related" (Interview Three, April 2019). Sarah's comment provides some evidence to support how her teaching practices did not attend to the marginalization of students based on identities mentioned above.

Sarah's role as a facilitator also represented dimensions of identity and power. For Sarah, this practice was about creating a space for students to develop and create mathematical knowledge. Sarah wanted students to see themselves as both learners and

teachers in the classroom and was interested in students collaborating, “thinking on their own”, “challenging them”, and “seeing where they go with it”, which are all part of student agency (Bandura, 2005) and identity formation (Holland, Lachicotte, Skinner, & Cain, 1998; Horn, 2008). After reading about the power dimension, Sarah highlighted her role as a facilitator and stated, “I like to hear where they go with it and then also by facilitating and letting them take off with it, sometimes it turns into a spontaneous lesson” (Interview Two, March 2019). Though this practice certainly attends to power as it accounts for voice in the classroom and decisions about curriculum (Gutiérrez, 2009), Sarah also recognized that more work could be done in this area. When asked about making curriculum decisions, Sarah stated “to a certain extent we [teachers] don’t have that power” (Interview Three, April 2019). As such, Sarah was connecting her teaching practices to students’ voice in the classroom and their ability to take lessons in different directions, however, she did not consider how this teaching practice could also encompass one of the most important traits of power, which is students’ ability to use mathematics as analytical tool to create change in the world (Delpit, 1988, 2006; Gutiérrez, 2009; Gutstein, 2006).

Adriana also described teaching practices that mirrored critical mathematics.

Adriana’s teaching practices included:

- positioning students as active participants of their learning
- expressing her role as a facilitator in the classroom
- encouraging and respecting students’ individual learning processes
- allowing students to use strategies from different countries to encourage student and parent participation in the field of mathematics

Adriana's teaching practices were grounded in hands-on learning, mathematical discussions, and students' ownerships of knowledge. Further, Adriana shared the importance of providing students with opportunities to use resources, engage in discussions, question material, and develop and create mathematical knowledge in the classroom. Though Adriana's teaching practices are related to identity formation as she positioned students to develop critical and analytical thinking skills, which are necessary for the development of student agency (Bandura, 2005), she also related this practice to power. Adriana shared how the skills students gained through her teaching practices related to students developing a voice,

Because if they have that background in mathematics, like I said, it gives you that reasoning, you know of things and not only math but also in life. I think you can transfer your problem-solving skills that you learn in math class to solve all the problems in life. So I think that gives them a voice later on and then gives them some power, you know (Interview Three, April 2019).

Adriana was the only participant who established a connection between her teaching practices and students' experiences outside of the classroom. When asked to elaborate on her understanding of students using their skills to solve problems in life, Adriana described students' ability to use mathematics to solve problems related to their career interests (e.g., artists decorating spaces, engineers designing buildings). Similar to Natalie and Sarah, Adriana's teaching practice fell short of the essence of power, where mathematics is used as a tool to understand inequities in society and make changes in the world (Gutiérrez, 2009; Gutstein, 2006).

Further, when asked how she attended to the dimension of identity in the classroom, Adriana described how her role as a facilitator created a collaborative space for learning. For Adriana, it was important that students felt valued in the classroom.

Adriana allowed students to use and share mathematics strategies that they learned at home or from other countries as part of their engagement in a learning community.

Adriana tied this teaching practice to equity by stating:

I think it also transcends to their idea of school and linking it to outside of school because sometimes if you say no that's not how we do it, let's do it this way, then they get home and maybe a parent can't help them with the homework and they'll say no mom, you know it's not like that. So then that creates other problems I think that would separate them or make them unequal. But I think it creates this balance between outside and inside and they feel comfortable sharing other things where they see math outside the class (Interview Two, March 2019).

Then, when discussing identity in the last interview, Adriana attended to this teaching practice as she questioned the universality of mathematics, she stated:

I always think that people have the mentality that math is universal. Yes, it is because we can understand it right? Like in all countries...that's what I say, but you do have different ways to do it in different countries. For example, you have different ways to add and different ways to subtract (Interview Three, April 2019).

Adriana was the only participant who questioned the universality of mathematics by acknowledging and attending to how mathematics is done in different countries. Further, when examining both comments above, Adriana established a connection between students' identity, in this case students' ethnicity and nationality, and her teaching practices. By allowing students to highlight their knowledge in the classroom and add to the field of mathematics, Adriana was attending to the identity dimension. In other words, through this teaching practice, Adriana was shifting the idea of what is considered mathematics by drawing on students' identities as resources for teaching and learning (Gutiérrez, 2009). At the same time, Adriana's teaching practices were connected to her awareness of how students and families have been marginalized in the field of mathematics when she acknowledged the tension students build within families when

students' knowledge is not valued in the classroom. When considering the dimension of identity, Adriana's teaching practices highlighted some awareness of how students have been marginalized in the field of mathematics (e.g., creating positive relationships between students and their parents by allowing students to use strategies from different countries). However, Adriana did not consider how this message, of "mathematics being universal" has contributed to narrow visions of teaching and learning mathematics informed by Euro-centric frameworks that do not take into account the learning needs of multi-lingual and multi-cultural students and further marginalize their participation in the field.

In this study, critical mathematics were defined by dimensions of identity and power. After examining participants' teaching practices through critical mathematics, it was clear that participants' teaching practices did represent some ideas of identity and power. However, the instances of critical mathematics described rarely referred to the marginalization of students in the field based on different identities (e.g., race, gender, class, ethnicity). Similarly, it was rare to learn about teaching practices that attended to the power dimension of using mathematics as an analytical tool to critique society and develop critical citizen. When considering identity and power, Gutiérrez (2002, 2009) shared the importance of rethinking what is considered mathematics and how mathematics is used (e.g., What type of problems are students solving? What history of mathematics is being presented? How does mathematics relate to students' identities?). However, the teaching practices that were described in this study overwhelmingly represented mathematics as a subject comprised entirely of material covered in standardized testing.

CHAPTER SIX

CONCLUSIONS, IMPLICATIONS, AND LIMITATIONS

The present study set out to examine how mathematics teachers described their understanding of equity and use of equitable teaching practices in the classroom, and the associations to the culture of testing. To do this, Gutiérrez's (2002, 2007, 2009) conceptual framework of equity was used to examine how the teaching practices of five elementary mathematics teachers represented both dominant mathematics (access and achievement) and critical mathematics (identity and power). The findings led this research to discover concerns within participants' understanding of equity and generate more questions that are pertinent to mathematics education and teacher education.

When conducting the cross-case analysis, there were four themes that connected all cases. First, the results showed that participants shared notions of fairness and sameness when describing their understanding of equity. Notions of fairness were characterized by understanding, acknowledging, and attending to inequities that affected students' mathematical learning experiences, whereas notions of sameness were characterized by language that mirrored equality. That is, an understanding that all students can receive the same resources and support without considering how students have been marginalized in the field of mathematics and the need to attend to students' individual needs. The second theme that connected all cases was differences in how participants described their justification for equitable teaching in mathematics, which reflected past and present literature. Natalie and Sarah's justifications aligned with NCTM's (2000, 2014) position on equity, which is focused on attending to students' individual processes to ensure their participation and proficiency in mathematics. Maria

and Jessica's justifications reflected literature that emerged following the enactment of NCLB (2001), which placed pressure on educators to close achievement gaps. Sarah's justification for equitable teaching in mathematics mirrored recent debates of traditional versus reform-oriented mathematics and the need to provide students with a meaningful learning experience informed by problem solving, collaboration, and hands-on learning in mathematics.

Another theme that connected all cases was their prevalence of teaching practices that reflected the dominant dimensions of access and achievement. Although participants did describe some teaching practices that attended to critical dimensions of identity and power in the mathematics classroom, they did not encompass the criticality described by Gutiérrez (2002, 2007, 2009), which is the last theme that connected all case and is described in chapter five. This chapter builds on these findings by discussing two implications that resulted from this study, reexamining equity through research with mathematics teachers and reexamining dominant and critical mathematics in teacher education.

Reexamining Equity through Research with Mathematics Teachers

When considering why dominant and critical mathematics are essential to addressing equity in mathematics education, Gutiérrez (2007) presented a compelling argument to challenge the existing belief that there is a one-way relationship with mathematics. That is, a relationship where mathematics serves as key in the success of people and not the other way around, where people's contributions, especially marginalized people, are pivotal to the field of mathematics (Gutiérrez, 2007). A similar

challenge was posed by Martin (2003) when he argued for the need to extend equity discussions and equity-driven efforts,

beyond a myopic focus on modifying curricula, classroom environments, and school cultures absent any consideration of the social and structural realities faced by marginalized students outside of school and the ways that mathematical opportunities are situated in those larger realities (p. 7).

Though the challenges presented by Gutiérrez (2007) and Martin (2003) are critical to understanding and enacting practices that encompass both dominant and critical mathematics, participants in this study rarely discussed equity from these viewpoints.

One question that I found myself asking after analyzing participants' understanding of equity was, what resources do mathematics teachers have available to learn about equity and to help them reexamine their understanding of equity to consider issues of identity and power? Almost two decades ago, NCTM (2000), the largest mathematics education organization in the United States, revised and released their position on equity focusing on reasonable accommodations and strong support for the success of all students in the field of mathematics. Although participants in this study did not directly identify NCTM (2000) as a resource for learning about equity, they did describe teaching practices that mirrored NCTM's (2000) suggestions of individualized accommodations and support for students in the classroom. Then, when asking participants about the use of resources available and how equity was talked about within their school context, most participants attended to their schools' focus on equal opportunities and support for all students, which were also reflective of NCTM's (2000) equity principle. Adriana, for instance, shared her administration's focus on attending to students' special needs. She stated:

When we talk here at my school about equity we have a very big push to include students with disabilities. So that's something that has been growing in the last couple of years. So I think that maybe if you asked the administration or teachers since we are in that movement now to include students because we used to have the pull out program and now we have the inclusion program. So I think they probably will go that route and say that we are trying to equate education for all students regardless, you know, if they have disabilities or not (Interview Three, April 2019).

Here, Adriana seems to demonstrate what many of the participants shared as their schools' focus of attending to equity by providing support for students' individual needs. When examining the context of Adriana's comment, notions of equality stand out when she highlighted her school's focus on equating education for all students regardless of their backgrounds. Adriana's quote, in other words, reflects a teacher who is learning about equity in a context that is centered on dominant mathematics. Like other participants, there was no instance where Adriana spoke about her schools' focus on understanding why students continue to be marginalized in the field and how that relates to the need to enact teaching practices that are attentive to students' marginalized identities. Although NCTM's (2000) position on equity was reflective in participants' understanding and their schools' push for equitable teaching, the question from earlier stills stands, what resources do mathematics teachers have available to learn about equity and help them reexamine their understanding of equity to consider issues of identity and power?

Given that all participants in this study identified themselves as equitable teachers and their teaching practices rarely addressed issues of identity and power to the extent called for by Gutiérrez (2002, 2007, 2009), it is critical for mathematics education researchers to create opportunities for mathematics teachers to learn about and reflect on

critical mathematics. For instance, upon learning that the participants' understandings of equity were situated in dominant mathematics, I saw it valuable to use an article by Gutiérrez (2009) to engage participants in an experience where they were able to read, reflect, question and rethink their understanding of equity and how they attended to equity through their teaching practices. This experience was meaningful to participants as it helped them reexamine their scope of equity and consider the role that identity and power played in mathematics. For example, after reading the article, Sarah highlighted how narrow her scope of equity was and the need to reexamine her understanding. For each dimension, Sarah highlighted parts of the reading that challenged her current thinking and teaching practices. When sharing her understanding of access, Sarah shared, "after seeing this in writing, I'm thinking about that. After class hours, kids go home and I've no idea what's going on in their lives" (Interview Three, April 2019). Then, later when sharing how she attended to identity, Sarah stated, "I can't really say I put my finger on anything that I really do. And so again, I'm picking out all the things that I need to focus more on" (Interview Three, April 2019).

Conducting research in this manner could take many forms, mathematics education researchers could engage in research that uses specific techniques such as elicitation interviewing, to bring in artifacts (e.g. writings, photos, diagrams, videos, lessons) that give participants an opportunity to interact with the artifact as part of expressing their understanding of an abstract topic (Bangnoli, 2009; Douglas, Jordan, Lande, & Bumbaco, 2015; Eyerman, Hug, Mcleod, & Tauer, 2018;). Conducting research in this manner could lead to the construction of new knowledge for participants and researchers because interviews are treated as a social encounter, which is "more than

a simple information gathering operation; it's a site of, and occasion for, producing knowledge itself" (Holstein & Gubrium, 2003 p. 4).

Future mathematics education research, for that matter, should use research designs that encourage reflection and questioning among teachers to make sense of current research. For example, take the response of Natalie who was sharing her understanding of power and took off with an idea that came to mind,

Equity has been used so loosely and in all of these worlds...I think that it's just trying to put a word to something and to, as opposed to like dealing with the real issue, which is we are not, we are not providing accessible information and resources to our students...and when you are in the field a little bit closer, those terms are just frustrating to you because you're pushed to use these terms that are meaningless in a sense. Because the things that you do are much more meaningful than say, how are you equitable? You know, like what we do in our classroom I think surpasses that word. I'm not saying let's not use the word, but I think maybe we don't need to use the term so much. Maybe we need to really focus in on like the actual act, like the action itself...Like let's talk about these steps. Let's talk about, you know, how we can provide opportunities, how we can give students access to information. It's more wordy, but like it makes more sense, especially to people who are not interacting with academia (Interview Three, April 2019).

In this quote, Natalie emphasized the abstractness of the word equity and the need to focus on discussing actions that are taking place to help teachers, including herself, learn about what they can do to provide students with opportunities and access to information. When considering the implications of mathematics education research, Natalie's response is evidence to the learning that can happen when participants interact with artifacts and share their meaning-making, and in this case their frustration with concepts that often feel "meaningless" in the classroom. Further, in light of participants' understanding of equity in this study, which was primarily aligned to dominant mathematics, and the need to help them recognize the importance of critical mathematics, mathematics education research needs to ensure that students, communities, and schools "become equal partners in

mathematics equity discussions and in formulating solutions that address not only content and curricular concerns but issues of social justice as well” (Martin 2003, p. 18). With more research designed in this manner, all those involved may develop greater understanding about how abstract concepts are understood by mathematics teachers and what they look like in the classroom.

Reexamining Dominant and Critical Mathematics in Teacher Education

When considering the pressure of testing following NCLB (2001) and how it permeated a narrow vision of achievement in schools (Guisbond & Neil, 2004; Hargrove et al., 2004; Schoen & Fusarelli, 2008), it is important to also consider how it is related to teachers’ understanding and use of equitable teaching practices in the classroom. Further, when taking into account Gutiérrez’s (2002, 2007, 2009) equity framework, another question I found myself asking is, how do we help mathematics teachers understand each axis in its entirety for them to be able to attend to all four dimensions and envision the goal of both dominant and critical mathematics working together? This question continued to come up as I analyzed participants’ use of teaching practices that attended to identity but did not reach the extent described by Gutiérrez (2009). For instance, Jessica emphasized value in students’ using strategies from other countries; however, upon being asked how that teaching practice related to equity, Jessica stated,

Well because math like I tell them math is math, it doesn't matter what language you're speaking, you know, we can all apply the knowledge that we bring from other countries or from strategies that we have...They come with doubt sometimes because they divide in a different way, you know, and then I'll show them ok this is how you do it and you're getting the right answer, wonderful. You can do it that way, but you need to learn how to do it this way because when you get your test, your state tests, they don't know you, you know, so you need to show them I know how to divide. I know how to get the answer the American

way but if you feel comfortable, go ahead and do it the way that you learned in Cuba (Interview Two, March 2019).

When examining Jessica's quote, a couple things stand out. First, Jessica is communicating to students their ability to use their knowledge to solve a problem that is part of dominant mathematics, as she related it to state testing. Second, although Jessica attended to the student's ethnic identity as she expressed the application of knowledge from a different country, she did not encourage a meaningful connection between that knowledge and the "American" way to solve division problems. Instead, the presence and pressure of testing led Jessica to place greater value on the "American" way because she was aware that students would be assessed through this lens. Although Jessica allowed students to use their knowledge in class, her teaching practice lied within dominant mathematics, as it related directly to students' access and achievement.

Sarah, Natalie, and Adriana also described value in students' using strategies that embraced their ethnic identity and special needs. Like Jessica, they also described their use of this practice by emphasizing dominant mathematics. That is, participants encouraged students to use their knowledge to solve problems that were part of the Common Core State Standards (CCSSM, 2010) and reflected in mandated testing. Consequently, there is a need to help participants think critically about how their practices mirror dominant mathematics and the urgency to understand and enact practices that build on students' identities. This cycles back to Gutiérrez's (2007) argument of using students' knowledge as contributions to the field of mathematics. Although participants in this study aligned their practices with the identity dimension, there was limited understanding as to how they could move beyond the sole application of

knowledge from different countries to consider how students' knowledge could be used to plan mathematics instruction.

I suggest that we reflect on how we can improve teacher education programs and professional development for practicing teachers to help develop understanding of equitable teaching through dominant and critical mathematics. The findings of this study can be beneficial to inform the design of courses for preservice teachers and professional development for practicing teachers by engaging them in questioning that challenges and encourages reexamination in their understanding of equity. This effort will require questions, discussions, and resources to facilitate this knowledge development. Similarly, this effort needs to highlight the importance of context when attending to dominant and critical mathematics, as we cannot cluster students' identities into one. This was evident among the participants in this study as they were sharing their understanding of equity in relation to their context and the students who they were serving (e.g. special education students, English language learners, students from diverse ethnic backgrounds). Educators can use the following questions to design courses and professional development:

- How can mathematics teachers use the knowledge that students bring into the classroom to inform lesson planning?
- What opportunities are teachers giving students to draw on their cultural and linguistic resources in the mathematics classroom (Gutiérrez, 2009)?
- How are mathematics teachers working with students to use mathematics beyond the classroom walls?

- How do we help teachers understand the messages they communicate to students when they place all their energy on mathematics that are reflective of Western culture (e.g. the “traditional” or “American” strategies that are valued in class, attending only to access and achievement)?
- How do mathematics teachers understand fairness and justice beyond enacting practices that attend to the access students receive to mathematical information and their performance on mandated testing?

This questioning can be useful to emphasize notions of justice and fairness that are attentive to students’ marginalized identities in the field of mathematics. Further, for educators who express understandings of equity through dimensions of access and achievement, this may require them to grapple with their current understanding and recognize how their teaching practices are solely attending to a goal of student participation in the economy and privileging of the status quo (Gutiérrez, 2002).

Although such realizations may be difficult to accept because testing and systems of accountability are so prevalent in our education system, they are necessary to help mathematics educators understand why marginalized students continue to feel disconnected from the field of mathematics (Lubienski & Gutiérrez, 2008) and why it is important to understand and address equity through dimensions of identity and power.

Limitations

The findings of this multi-case study must be considered in the context of potential limitations. First, while focusing on a small sample size allowed for a thorough and meaningful representation of each participant, the sample size of five participants is a limitation of this study. Therefore, the findings of this multi-case study are not intended

to form generalizations that hold across all contexts, but rather to reach Guba's (1981) threshold of transferability. Furthermore, all participants in this study identified themselves as equitable teachers, limiting the ability to generalize to other teachers who do not identify in this way. Another limitation is the reliance on self-reported interview data. This is a limitation because the participants were not observed while teaching to determine how they attended to their understanding of equity through their teaching practices. As a result, further research that observes participants in the classroom are necessary to examine the relationships between teachers' understanding of equity and the teaching practices they enact in the mathematics classroom.

Summary

Chapter six concluded the study with conclusions, implications, and limitations. The aim of this study was to explore participants' understanding of equity and use of equitable teaching practices that attended dimensions of access, achievement, identity, and power. This aim was guided by four research questions, which were: (1) How do mathematics teachers describe their understanding of equity?, (2) How do mathematics teachers describe their use of equitable teaching practices in the classroom?, (3) How are dimensions of access, achievement, identity, and power represented in mathematics teachers' descriptions of equitable teaching practices?, and (4) How is state mandated testing related to mathematics teachers' descriptions of equitable teaching practices?

This section provided implications for mathematics education research and pre-service and in-service teacher education. This study gives readers a better understanding of practicing teachers' understanding of equity and use of equitable teaching practices.

Further, it provides the reader with an understanding of how the system of accountability is related to such understandings and how teachers attend to equity in the classroom.

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APPENDIX A

ADULT CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Exploring Mathematics Teachers' Equitable Teaching Practices Through Dimensions of Access, Achievement, Identity, and Power, and the Associations to the Culture of Testing: A Multi-Case Study

Hello, you have been chosen to participate in a research study about equitable teaching practices in the math classroom. Please read this consent letter carefully and ask any question you may have prior to agreeing to be part of this study.

PURPOSE OF THE STUDY

The purpose of this study is to learn about your understanding and use of equitable teaching practices in the mathematics classroom.

NUMBER OF STUDY PARTICIPANTS

If you decide to be in this study, you will be one of ten people in this research study.

DURATION OF THE STUDY

Your participation in this study will take approximately 3 hours.

PROCEDURES

If you agree to be in the study, we will ask you to do the following things:

1. You will be asked to provide math lesson plans that align with your understanding of equity.
2. You will be asked to participate in three, one-hour, semi-structured interviews. The first interview will take place in January/February, the second interview will take place in March, and the last interview will take place in April. The first interview will include background information about yourself and your understanding of equity. The second interview will include information about your equitable teaching practices and the challenges presented with testing. The third interview will include information about your experiences with equitable teaching practices.
3. In addition, all three interviews will be audio-recorded. The interviews will be transcribed without referencing any individuals. Once the transcriptions are completed, the recordings will be deleted immediately.

RISKS AND/OR DISCOMFORTS

There are no foreseeable risks for your participation in this research study.

BENEFITS

There are no foreseeable benefits for your participation in this research study. It is expected that this study will benefit education, and society in general, by developing a greater understanding of math teachers' understanding and use of equitable teaching practices in the classroom.

ALTERNATIVES

There are no known alternatives available to you other than not taking part in this study. However, any significant new findings developed during the course of the research which may relate to your willingness to continue participation will be provided to you.

CONFIDENTIALITY

The records of this study will be kept private and will be protected to the fullest extent provided by law. In any sort of report we might publish, we will not include any information that will make it possible to identify a subject. Research records will be stored securely and only the researcher team will have access to the records. However, your records may be reviewed for audit purposes by authorized University or other agents who will be bound by the same provisions of confidentiality.

COMPENSATION & COSTS

You will not be responsible for any costs to participate in this study.

RIGHT TO DECLINE OR WITHDRAW

Your participation in this study is voluntary. You are free to participate in the study or withdraw your consent at any time during the study. Your withdrawal or lack of participation will not affect any benefits to which you are otherwise entitled. The investigator reserves the right to remove you without your consent at such time that they feel it is in the best interest.

RESEARCHER CONTACT INFORMATION

If you have any questions about the purpose, procedures, or any other issues relating to this research study you may contact Barbara King at Florida International University by email at bking@fiu.edu or by phone (305) 348-3215.

IRB CONTACT INFORMATION

If you would like to talk with someone about your rights of being a subject in this research study or about ethical issues with this research study, you may contact the FIU Office of Research Integrity by phone at 305-348-2494 or by email at ori@fiu.edu.

PARTICIPANT AGREEMENT

I have read the information in this consent form and agree to participate in this study. I have had a chance to ask any questions I have about this study, and they have been answered for me. I understand that I will be given a copy of this form for my records.

Signature of Participant

Date

Printed Name of Participant

Signature of Person Obtaining Consent

Date

APPENDIX B

Interview #1 Protocol for all Teachers

Introduction Questions: Can you please tell me about yourself in relation to your personal and professional journey?

- Can you tell me a little bit about yourself?
- Where are you from?
- How did you decide to become a teacher?
- How long have you been teaching?
- How long have you been teaching at this school?

School Background:

- Can you describe the student body in your school?
- Can you describe the student body in your classroom?

Lead Question One: How do you define equity?

- What resources do you seek to continue learning about equity?
- How did you learn about equity in the math classroom?
- Why do you think equitable teaching practices are necessary in the math classroom?
- What drives your commitment to enact equitable teaching practices?
- How do you address equity in your classroom? More specifically, how do you address issues of equity in your math lessons?
- How do you describe the relationship between students and math in your classroom?
- What do you feel is the long-term impact of your students when you attend to issues of equity in your classroom?

Lead Question Two: What does a typical math lesson look like in your classroom? (Here, I will collect a lesson plan if it is available or go based off what a typical lesson looks like)

Lesson Structure

How do you decide which topic you will cover?

- What did you use to pace your lessons (or learning objectives)?
- What happens at the beginning of the lesson?
- What happens at the middle of the lesson?
- What happens at the end of the lesson?
- What outside resources did you use to support learning in this lesson?
- Can you describe what your expectations look like for students in your lesson?
- What learning outcomes do you hope your student will gain from this lesson?
- How do you assess learning in your lesson?
- What type of feedback do you use in your lesson?

Communication during Lesson

How do students communicate during the math lesson?

- How do you describe your role during the discussion?
- How do you guide the classroom discussion?
- How do you attend students' cultural and language differences during math discussions?

Support for Students

What type of accommodations did you make for students during this lesson?

- What accommodations do you make for students (e.g. ELLs, students with disabilities) in your lesson?
- What type of support do you offer students who may be struggling with math?
- What resources do students have available to them if they are struggling with the lesson?
- What are some challenges you face when attending to student differences?

General Questions

- You mentioned _____. Can you describe a little more about that?
- How does _____ attend to your understanding of equity?
- Can you elaborate a little more on what you mean by _____?
- You mentioned _____. Can you describe a little more about that?
- Can you elaborate a little more on what you mean by _____?

Interview #2 Protocol – Natalie Interview

Question One

In our last interview you mentioned how your commitment to equity stems from your interaction with students and understanding how so many outside variables are affecting them.

1. Can you elaborate a little more on these outside variables?
2. How do those variables affect their learning in the math classroom?
3. How does _____ attend to your understanding of equity?

Question Two

During our last interview, you mentioned how you go through lessons and see what is more valuable to go through and where you shouldn't waste your time.

1. Can you elaborate a little more on what you mean by what's more valuable?
2. How do you make this decision?

Question Three

In our last interview you mentioned how you allow students to use strategies that they have learned in their home country to solve math problems.

1. How do you relate this teaching practice to equity?
2. How do you think this teaching practice relates to this student's success in math?
3. What can this do for students and their relationship with math?
4. What message does this practice send to other students in your class?
5. Can you elaborate a little more on _____?

Scenario One

During one of your math planning meetings, your team leader (or math coach) comes up with an idea to host an event where parents can come to school to learn about how they can support their children with the new curriculum that was recently adopted.

1. How would you respond to this idea?
2. Can you elaborate a little more on _____?
3. Do you see this event being beneficial to students' success?
4. Have you done something similar to this with your students and their families?

Scenario Two

When talking about her classroom communication, Mrs. Ibarra shares that it is important for her to do most of the talking during the lesson because students look up to her as the expert and she knows more mathematics than her students.

1. What are your thoughts about Mrs. Ibarra's role in the class?
2. How do you think _____ relates to equity?
3. How is this role similar or different to your role during lessons?

4. Can you elaborate a little more on _____ ?

Scenario Three

In our last interview you mentioned that Florida is getting rid of the CCSS.

1. How do you feel about that?
2. Can you elaborate on _____ ?

Imagine the CCSS are no longer adopted by Miami-Dade Public Schools and your new standards cover about half of the material that CCSS used to cover.

1. What would you do differently in your class?
2. Can you elaborate on _____ ?
3. What do the CCSS mean to you and your instruction?

Scenario Four

Let's take it a step further. Imagine there was no more testing for your students, how would that change your teaching?

1. How would that change your lesson structure?
2. How would your use of resources, including textbooks change?
3. How would that change your students' relationship with math?
4. Can you elaborate on _____ ?

Covering Mathematics Lesson

For this part of the interview, I want to learn about your mathematics lesson today. Can you take me through what happened during your lesson?

- What happened at the beginning of the lesson?
- What happened at the middle of the lesson?
- What happened at the end of the lesson?
- What outside resources did you use to support learning in this lesson?
- Can you describe what your expectations look like for students in your lesson?
- What learning outcomes do you hope your student will gain from this lesson?
 - How did you assess learning in your lesson?
- What type of feedback did you use in your lesson?

Interview #2 Protocol – Adriana Interview

Lesson Structure

- How do you assess learning in your lesson?
- What type of feedback do you use in your lesson?

Communication during Lesson

- How do students communicate during the math lesson?
- How do you describe your role during the discussion?
- How do you guide the classroom discussion?
- How do you attend students' cultural and language differences during math discussions?

Support for Students

What type of accommodations did you make for students during this lesson?

- What accommodations do you make for students (e.g. ELLs, students with disabilities) in your lesson?
- What type of support do you offer students who may be struggling with math?
- What resources do students have available to them if they are struggling with the lesson?
- What are some challenges you face when attending to student differences?

Scenario One

The teacher next door is currently working on division. One of her students solved a division problem in the following way:

$$\begin{array}{r} 75 \overline{)4} \\ 35 \ 18 \\ \underline{3} \end{array}$$

The student says to her teacher, “my answer is 18 remainder 3.” The teacher informs the student that his way of showing his work is not correct in the U.S., even though his answer is right, and he learned it in his math class in Cuba.

1. Do you agree or disagree with the way the teacher handled this situation?
2. If you agree, why do you think the student's way of solving this problem was incorrect?
3. If you disagree, how would you approach this situation in your own classroom?
4. How do you relate this teaching practice to equity?

Scenario Two

During one of your math planning meetings, your team leader (or math coach) comes up with an idea to host an event where parents can come to school to learn about how they can support their children with the new curriculum that was recently adopted.

5. How would you respond to this idea?
6. Can you elaborate a little more on _____?

7. Do you see this event being beneficial to students' success?
8. Have you done something similar to this with your students and their families?

Scenario Three

I have been hearing from many teachers in Miami-Dade Public Schools that Florida is getting rid of the CCSS.

3. How do you feel about that?
4. Can you elaborate on _____?

Imagine the CCSS are no longer adopted by Miami-Dade Public Schools and your new standards cover about half of the material that CCSS used to cover.

4. What would you do differently in your class?
5. Can you elaborate on _____?
6. What do the CCSS mean to you and your instruction?

Scenario Four

Let's take it a step further. Imagine there was no more state testing for your students, how would that change your teaching?

5. How would that change your lesson structure?
6. How would your use of resources, including textbooks change?
7. How would that change your students' relationship with math?

Covering Mathematics Lesson

For this part of the interview, I want to learn about your mathematics lesson today. Can you take me through what happened during your lesson?

- What happened at the beginning of the lesson?
- What happened at the middle of the lesson?
- What happened at the end of the lesson?
- What outside resources did you use to support learning in this lesson?
- Can you describe what your expectations look like for students in your lesson?
- What learning outcomes do you hope your student will gain from this lesson?
 - How did you assess learning in your lesson?
- What type of feedback did you use in your lesson?

Interview #2 Protocol – Sarah Interview

Question One

In our last interview you mentioned how you hope the long-term impact of your equitable teaching helps students achieve academically as some of them already have an expectation of failure.

4. Can you elaborate a little more on how this fear is shown in your classroom?
5. What are some things you incorporate into your lessons to help alleviate that feeling of failure students express?

Question Two

During our last interview, you mentioned how you were behind in the pacing guide, but you didn't rush your students because you are learning where you can cut and where you can move them ahead.

3. Can you elaborate a little more on what you mean by where you can cut?
4. How do you know where you can cut material?
5. What is your decision based off?

Question Three

In our last interview you mentioned how you allow students to use strategies that they have learned in their home country to solve math problems.

6. How do you relate this teaching practice to equity?
7. How do you think this teaching practice relates to this student's success in math?
8. What can this do for students and their relationship with math?
9. What message does this practice send to other students in your class?

Question Four

In the first interview you mentioned how you take on the role of a facilitator during classroom discussions.

1. Why do you think this role is important in the math classroom?
2. How does this role you take on relate to equity?
3. If you are playing the role of the facilitator, what role do your students play during math discussions

Scenario One

During one of your math planning meetings, your team leader (or math coach) comes up with an idea to host an event where parents can come to school to learn about how they can support their children with the new curriculum that was recently adopted.

9. How would you respond to this idea?
10. Can you elaborate a little more on _____.
11. Do you see this event being beneficial to students' success?
12. Have you done something similar to this with your students and their families?

Scenario Two

In our last interview you mentioned that Florida is getting rid of the CCSS.

5. How do you feel about that?
6. Can you elaborate on _____?

Imagine the CCSS are no longer adopted by Miami-Dade Public Schools and your new standards cover about half of the material that CCSS used to cover.

7. What would you do differently in your class?
8. Can you elaborate on _____?
9. What do the CCSS mean to you and your instruction?

Scenario Three

Let's take it a step further. Imagine there was no more testing for your students, how would that change your teaching?

8. How would that change your lesson structure?
9. How would your use of resources, including textbooks change?
10. How would that change your students' relationship with math?

Covering Mathematics Lesson

For this part of the interview, I want to learn about your mathematics lesson today. Can you take me through what happened during your lesson?

- What happened at the beginning of the lesson?
- What happened at the middle of the lesson?
- What happened at the end of the lesson?
- What outside resources did you use to support learning in this lesson?
- Can you describe what your expectations look like for students in your lesson?
- What learning outcomes do you hope your student will gain from this lesson?
 - How did you assess learning in your lesson?
- What type of feedback did you use in your lesson?

Interview #2 Protocol – Jessica Interview

Question One

In our last interview you mention how you have a lot of students who have a fear at the beginning of math and you always tell them there's nothing to fear.

6. What are some things you incorporate into your lessons to help alleviate that fear students express?
7. How do you help students see themselves as mathematicians?

Question Two

In our last interview you mentioned how you allow students to use strategies that they have learned in their home country to solve math problems.

10. How do you relate this teaching practice to equity?
11. How do you think this teaching practice relates to this student's success in math?
12. What can this do for students and their relationship with math?
13. What message does this practice send to other students in your class?

Question Three

You mentioned the use of a bell curve to describe the type of feedback you provide to your students.

6. Can you elaborate a little bit more on what you mean by bell curve?
7. How do you use the bell curve to provide students individualized feedback?

Scenario One

During one of your math planning meetings, your team leader (or math coach) comes up with an idea to host an event where parents can come to school to learn about how they can support their children with the new curriculum that was recently adopted.

13. How would you respond to this idea?
14. Can you elaborate a little more on _____ ?
15. As a math teacher do you see this event playing a role in your students' success with mathematics? OR Do you see this event being beneficial to students' success?
16. Have you done something similar to this with your students and their families?

Scenario Two

When talking about her classroom communication, Mrs. Ibarra shares that it is important for her to do most of the talking during the lesson because students look up to her as the expert and she knows more mathematics than her students.

5. What are your thoughts about Mrs. Ibarra's role in the class?
6. How do you think _____ relates to equity?
7. How is this role similar or different to your role during lessons?

Scenario Three

In our last interview you mentioned that Florida is getting rid of the CCSS.

7. How do you feel about that?
8. Can you elaborate on _____?

Imagine the CCSS are no longer adopted by Miami-Dade Public Schools and your new standards cover about half of the material that CCSS used to cover.

10. What would you do differently in your class?
11. Can you elaborate on _____?
12. What do the CCSS mean to you and your instruction?

Scenario Four

Let's take it a step further. Imagine there was no more testing for your students, how would that change your teaching?

11. How would that change your lesson structure?
12. How would your use of resources, including textbooks change?
13. How would that change your students' relationship with math?

Covering Mathematics Lesson

For this part of the interview, I want to learn about your mathematics lesson today. Can you take me through what happened during your lesson?

- What happened at the beginning of the lesson?
- What happened at the middle of the lesson?
- What happened at the end of the lesson?
- What outside resources did you use to support learning in this lesson?
- Can you describe what your expectations look like for students in your lesson?
- What learning outcomes do you hope your student will gain from this lesson?
 - How did you assess learning in your lesson?
- What type of feedback did you use in your lesson?

Interview #2 Protocol – Maria Interview

Question One

In our last interview you mention how you want to help build some confidence in students so they can see themselves as math students and how this attends to your job of closing the gap the best that you can.

8. Can you elaborate more on what you mean by the gap?
9. How do you think the gap relates to equitable teaching?

Question Two

In the first interview you mentioned how you take on the role of a someone who guides during classroom discussion, in other words the less you talk the better.

4. Why do you think this role is important in the math classroom?
5. How does this role you take on relate to equity?
6. If you are playing the role of the facilitator, what role do your students play during math discussions?

Scenario One

The teacher next door is currently working on division. One of her students solved a division problem in the following way:

$$\begin{array}{r} 75 \overline{)4} \\ 35 \ 18 \\ \underline{3} \\ 3 \end{array}$$

The student says to her teacher, “my answer is 18 remainder 3.” The teacher informs the student that his way of showing his work is not correct in the U.S., even though his answer is right, and he learned it in his math class in Cuba.

5. Do you agree or disagree with the way the teacher handled this situation?
6. If you agree, why do you think the student’s way of solving this problem was incorrect?
7. If you disagree, how would you approach this situation in your own classroom?
8. How do you relate this teaching practice to equity?

Scenario Two

During one of your math planning meetings, your team leader (or math coach) comes up with an idea to host an event where parents can come to school to learn about how they can support their children with the new curriculum that was recently adopted.

17. How would you respond to this idea?
18. Can you elaborate a little more on _____?
19. Do you see this event being beneficial to students’ success?
20. Have you done something similar to this with your students and their families?

Scenario Three

I have been hearing from many teachers in Miami-Dade Public Schools that Florida is getting rid of the CCSS.

9. How do you feel about that?
10. Can you elaborate on _____?

Imagine the CCSS are no longer adopted by Miami-Dade Public Schools and your new standards cover about half of the material that CCSS used to cover.

13. What would you do differently in your class?
14. Can you elaborate on _____?
15. What do the CCSS mean to you and your instruction?

Scenario Four

Let's take it a step further. Imagine there was no more state testing for your students, how would that change your teaching?

14. How would that change your lesson structure?
15. How would your use of resources, including textbooks change?
16. How would that change your students' relationship with math?

Covering Mathematics Lesson

For this part of the interview, I want to learn about your mathematics lesson today. Can you take me through what happened during your lesson?

- What happened at the beginning of the lesson?
- What happened at the middle of the lesson?
- What happened at the end of the lesson?
- What outside resources did you use to support learning in this lesson?
- Can you describe what your expectations look like for students in your lesson?
- What learning outcomes do you hope your student will gain from this lesson?
 - How did you assess learning in your lesson?
- What type of feedback did you use in your lesson?

Interview #3 Protocol for all Teachers

Part One

For this part of the study, I brought a short article on equity. This article is by Rochelle Gutiérrez (2009) and is titled, “Framing Equity: Helping Students ‘Play the Game’ and ‘Change the Game’”. If it is okay with you, I was thinking we can both read the article, you can share your thoughts on it, and then I can ask you some questions about it. Is this okay with you?

Framing Equity – Four Dimensions of Equity

Access

1. How do you understand the dimension of access?
2. How do you attend to access in your mathematics class?

Achievement

3. How do you understand the dimension of achievement?
4. How do you attend to achievement in your mathematics class?

Identity

5. How do you understand the dimension of identity?
6. How do you attend to identity in your mathematics class?

Power

7. How do you understand the dimension of power?
8. How do you attend to power in your mathematics class?

General Questions

- You mentioned _____. Can you describe a little more about that?
- How does _____ attend to your understanding of equity?
- Can you elaborate a little more on what you mean by _____?
- You mentioned _____. Can you describe a little more about that?
- Can you elaborate a little more on what you mean by _____?

Covering Mathematics Lesson

For this part of the interview, I want to learn about your mathematics lesson today. Can you take me through what happened during your lesson?

- What happened at the beginning of the lesson?
- What happened at the middle of the lesson?
- What happened at the end of the lesson?
- What outside resources did you use to support learning in this lesson?
- Can you describe what your expectations look like for students in your lesson?
- What learning outcomes do you hope your student will gain from this lesson?
 - How did you assess learning in your lesson?
- What type of feedback did you use in your lesson?

APPENDIX C

Contact Summary Form Miles and Huberman (1994)

Contact Type: Initial Interview with Natalie (Fourth Grade Teacher)

Contact Date: January 18, 2019

Today's Date: January 18, 2019

1. What were the main issues or themes that struck you in this contact?
 - Natalie made statements to describe her understanding of equity as different from equality.
 - The word “value” was used many times when Natalie was describing her understanding of equity.
 - When talking about her high expectations for all of her students, she mentioned the use of English only in her classroom.
 - Natalie describes a strong sense of communication with her students and their families, especially students who are ESLs and or students with disabilities in the class.
 - Natalie is part of a committee that goes through all the standards at the fourth-grade level and creates the end of the chapter assessments for the district.
 - When going over the structure of her lesson, Natalie brought the five main resources she used to put her lessons together.
 - Natalie just recently started teaching at the same school where she attended as a child. Natalie pointed out how the demographics of the school have changed so much from when she attended. She used to be one of the few students of color and now the school is almost “50-60% are minority” and the rest are predominately white or Jewish demographic.
 - Natalie is teaching two blocks, “I have to two blocks one is the like relatively lower from the grade levels, but then the other one is the lowest with the ESC students and ESL students in one group. So it’s kind of like an inclusion classroom” (p. 2).
2. Summarize the information you got (or failed to get) on each of the target questions you had for this contact.

Understanding of equity

Providing access to information at the levels that each person needs them

Giving them the size that they need (relating to image of students looking over fence)

Equitable teaching practices

Attending to the different understandings of math that students have.

Valuing the work of students in different ways

Use of strategies from different countries to solve problems in class.

3. Anything else that struck you as salient, interesting, illuminating or important in this contact?
- The connections that Natalie made between her experience as a student of color and the experiences of her students to describe her understanding of equity. She mentioned how much she values students' knowledge that they bring from home and also reflects on factors that may be affecting their learning.
 - Natalie's role in the committee of standards provides her with a holistic view of the standards and how she can use multiple resources to attend to each standard. This also allows her to make decisions about what should be covered and what can wait all while keeping her students' needs in mind.
4. What new (or remaining) target questions do you have in considering the next contact with this teacher?
- Natalie mentioned outside factors affecting her students' learning.
Question:
What are some outside variables that she sees affecting her students?
How does she see this related to the math classroom?
How do such factors relate to her understanding of equity?
 - English-Only in class—
Question:
What does she relate this "being stuck" thing to?
How does this tie back to her expectations?
How does she understand the consequences students could face if they do not learn English?

APPENDIX D

Codes and Categories Developed from Interviews

Access (Category)

| | |
|-------|---|
| BDL= | Breaking down language |
| DI= | Differentiated Instruction |
| GLM= | Grade level material |
| IF= | Individualized feedback |
| MAN= | Manipulatives |
| PAI= | Parent access to info |
| TECH= | Technology |
| HTR= | Homework and test-review lesson structure |

Achievement (Category)

| | |
|-------|------------------------------------|
| AOBS= | Assessed through observation |
| DIA= | DI as part of achievement |
| FSAN= | FSA Nights |
| STPA= | Students participation in class |
| MIS= | Learning assessed through mistakes |
| RAM= | Ramification students face |

School and Classroom Demographics (Category)

| | |
|--------|------------------------------------|
| MIPW= | "Minority" and predominantly White |
| ESL= | Primarily ESL students |
| GIFT= | Gifted students |
| SPED= | Special Education students |
| TIT= | Title one school |
| DCOUN= | Students from different countries |

Reasoning for Equitable Teaching in Math (Category)

| | |
|--------|--------------------------------------|
| EPA= | Ensure participation and achievement |
| POSR= | Positive relationships with math |
| CAP= | Closing achievement gaps |
| LONGT= | Long-term learning for all students |
| VALUE= | Value of different perspectives |

Identity (Category)

| | |
|--------|-----------------------------------|
| LANDI= | Attending to language differences |
| BMI= | Building a math identity |
| DIUN= | Different understandings of math |
| STRAT= | Strategies from other countries |

Power (Category)

| | |
|-------|------------------|
| FACR= | Facilitator role |
| PEER= | Peer learning |

IDEPOW= Valuing identity leads to power
REEX= Reexamination of Equity
SCOP= Creating a bigger scope

Changing Students' Relationships with Math (Category)

FAIL= Expectation of failure
MIH= Math is hard
NEGPOS= Negative to positive changes

Understanding of Equity (Category)

ACCIN= Access to information at different levels
FAIR= Being Fair
SAME= Equality/Sameness
IEXPE= Influenced by Experiences
LTL= Long-term Learning
NEEDS= Meeting needs of the student

VITA

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PUBLICATIONS AND PRESENTATIONS

Zamudio, L., & Gil, I. (*currently revising for resubmission in The Qualitative Report*).
The negative experiences of six Latinx preservice teachers and their perceptions on
learning and teaching mathematics.

Gil, I., Zamudio, L., & King, B. (*pending decision from The Journal of Mathematics
Education at Teachers College*). After presenting multiple strategies, what's next?

Gil, I., Zamudio, L., & King, B. (2018, February) After presenting multiple strategies,
what's next? Paper presented at the annual meeting for the Eastern Educational Research
Association, Clearwater, FL.

Zamudio, L., & Gil, I. (2018, January) The negative experiences of six Latina preservice
teachers and their perceptions on learning and teaching mathematics. Paper presented at
the annual meeting for The Qualitative Report, Fort Lauderdale, FL.

Lovett, M., Gil, I., Zamudio, L., Gil, B., Sanchez, G., & Austin, C. (2017, October).
Resistance in the classroom: Examples from students, researchers, and educators. Panel
discussion at the annual meeting for the Sources of Urban Educational Excellence,
Atlanta, GA.

Zamudio, L., & Gil, I. (2016, October). Social justice through mathematics: The algebra project. Paper presented at the annual meeting for the Diversity Challenge Conference: Educating Our Youths Developing Whole People, Not Widgets, Boston, MA.

Zamudio, L. (2015, April). Multiplying and dividing fractions in a meaningful way. Paper presented at the annual meeting for the National Conference on Undergraduate Research (NCUR), Cheney, WA.

Zamudio, L. (2015, February). Multiplying and dividing fractions in a meaningful way. Poster presented at the annual meeting for the NAAAS & Affiliates National Conference, Baton Rouge, LA.