

PRESERVICE TEACHERS' BELIEFS AND EXPERIENCES IN LEARNING HOW  
TO TEACH MATHEMATICS FOR SOCIAL JUSTICE

by

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## DEDICATION

I would like dedicate this work to Ksenija, my co-adventurer through life.

*"The minute I heard my first love story I started  
looking for you, not knowing how blind that was. Lovers  
don't finally meet somewhere. They're in each other all  
along."*

*- Jalal ad-Din Rumi*

And I would also like to dedicate this work to Joseph, who has joined Ksenija and me along the way.

"There are no seven wonders of the world in the eyes of a child.  
There are seven million."

-Walt Streightiff

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## ABSTRACT

The purpose of this study was to examine preservice teachers' beliefs and experiences in learning about teaching mathematics for social justice during a one-semester mathematics methods course at a large university in the Southwest. The study examined their beliefs on three levels: a) their beliefs about issues of equity, diversity, and social justice in general; b) their beliefs about how issues of equity, diversity, and social justice relate to teaching (i.e., if and how the preservice teachers perceive themselves as critical educators); and c) their beliefs about teaching mathematics for social justice. This study also analyzed the preservice teachers' experiences as they learned about and then discussed lessons and projects that could be used for teaching mathematics for social justice. The purpose of analyzing their experiences was to document what the pre-service teachers identified as positive and negative influences on their learning to teach mathematics for social justice.

## CHAPTER ONE: INTRODUCTION

### Introduction

In this chapter I first give a statement about the problem that I am researching. I discuss how teaching mathematics for social justice supports two Principles of the National Council of Teachers of Mathematics (NCTM). Then I describe how it can help foster educational reform as advocated by critical theorists, such as Peter McLaren and Michael Apple. From the reform ideas of critical agency, I next describe how preservice teachers can be taught to be critical agents in their teacher education programs. Then I discuss the purpose of my study and my research questions. Afterwards I give definitions for the terms equity, diversity, and social justice, then describe the theoretical tools I used in my study: a) critical theory, b) critical race theory, c) critical pedagogy, and d) culturally relevant pedagogy. Then I give a brief overview of my study and then of its limitations. Lastly, I provide an outline of my dissertation.

### Statement of the Problem

Teaching mathematics for social justice incorporates both social justice and mathematics pedagogical goals so that students can be “prepared through their mathematics education to investigate and critique injustice, and to challenge, in words and actions, oppressive structures and acts” (Gutstein, 2006, p. 4). There are two fundamental principles behind teaching mathematics for social justice: a) that one can use mathematics to teach and learn about the issues of equity, diversity, and social justice, and b) that one can learn mathematics through the study of social justice issues (Osler, 2007). While the literature

presents various definitions of teaching mathematics for social justice, in this study I use the term to refer to teaching and learning environments where:

1. Students are introduced to various issues of equity, diversity, and social justice;
2. Students learn to use mathematics to identify and examine social issues; and
3. Students' mathematical knowledge is increased and strengthened.

It is important, however, to clarify that many researchers perceive teaching mathematics for social justice as not merely the practice of students engaging in social justice activities in the mathematics classroom (Gutstein, 2003, 2006, 2007; Frankenstein, 1990, 1995; Tate, 1995). For them, a component of teaching mathematics for social justice is students learning how to take action outside the classroom against social injustices. Gutstein (2006) refers to this as “developing a sense of agency” (p. 27) and gives an example from Tate (1995) where students presented to their local city council mathematical data about the disproportionate number of liquor stores in their school's neighborhood.

*Teaching Mathematics for Social Justice Meets Two Principles of the National Council of Teachers of Mathematics*

Teaching mathematics for social justice also has the potential to address important goals outlined by the National Council of Teachers of Mathematics (NCTM)-led mathematics education reform movement. First, the National Council of Teachers of Mathematics is concerned about making mathematics education more equitable. Its Equity

Principle, one of six overarching principles fundamental to a high-quality mathematics education, states that:

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. (NCTM, 2000, p. 11)

Teaching mathematics for social justice helps promote equity because it seeks to expose unfair power relations, whether on a global, national, state, city, community, or classroom level. Teaching mathematics for social justice does this by using social issues as a basis for mathematical explorations. For example, Turner and Strawhun (2005) reported on students using mathematics to investigate issues of overcrowding at a middle school in a predominantly working class, minority neighborhood. Their work addressed issues of equity because the students were concerned that their school facilities were allowed to be inadequate because mostly minority students attended it. In another example, Gutstein (2005) had middle school students use mathematics to analyze mortgage data from a local newspaper to determine if they thought racism was a factor in accounting for the differences in the rates of home loan approval among Whites, Blacks, and Latinos/Latinas in a large Midwestern city.

A second reason why teaching mathematics for social justice has a place in mathematics education reform is that it can help make mathematics important to students. NCTM's (2000) Curriculum Principle states:

School mathematics curricula should focus on mathematics content and processes that are worth the time and attention of students. Mathematics topics

can be considered important for different reasons, such as their utility in developing other mathematical ideas, in linking different areas of mathematics, or in deepening students' appreciation of mathematics as a discipline and as a human creation. (p. 14)

Mathematics can be worth the time and attention of students if it is relevant to the students' lives. Many mathematics education researchers have stressed this point by arguing that teaching mathematics for social justice can bring real life applications of mathematics to students (Aguirre, 2007; Frankenstein, 1995; Gutstein, 1995; Gutstein, Lipman, Hernandez, & de los Reyes, 1997; Ladson-Billings, 1995). In one case, as mentioned earlier, students who were concerned about the large number of liquor stores near their school used mathematics in a study that they presented to their local government officials, which led to the closing of liquor stores within 1000 feet of the school (Tate, 1995).

*Teaching Mathematics for Social Justice Fosters Critical Theory Reform*

Besides fostering mathematics education reform, teaching mathematics for social justice also can reform schools on a broader level, as argued by critical theorists such as McLaren (2003), Giroux (1988), and Apple (1992). McLaren (2003) believes that schools are failing to meet the needs of students to become critical thinkers. For instance, he writes that, "School knowledge should have a more emancipatory goal than churning out workers (human capital) and helping schools become the citadel of corporate ideology" (p. 86).

McLaren and other critical theorists believe that schools ought to be teaching students how to examine and analyze social injustices rather than sustaining the status quo. To counter the status-quo-keeping component of schooling, teachers need to become critical educators.

A critical educator is, as defined by McLaren (2003), an educator interested in helping students understand how “social relationships are distorted and manipulated by relations of power and privilege” (p. 73). Critical educators believe that they have a role in improving students’ lives by raising their awareness and sense of empowerment in addressing issues that concern them. Building on McLaren’s idea, a critical mathematics educator would be one who teaches students to use mathematics as an analytical tool to examine social inequities. An advantage of a critical mathematics would be students seeing the relevance of mathematics for making social changes.

#### *Learning Critical Agency in Teacher Education Programs*

One opportunity for teachers to learn about being critical educators would be in their teacher education programs. However, some critical educators and theorists argue that this opportunity is often not provided for preservice teachers (Giroux & McLaren 1986; Cochran-Smith, 2004). For example, Cochran-Smith (2004) writes, “In most of their preservice programs, the role of the teacher as an agent for change is not emphasized, and students are deliberately socialized into assuming responsibility for school reform and renewal” (p. 29). Providing opportunities in teacher education programs for preservice teachers to learn critical pedagogy is important because it can help them address concerns about diversity, equity, and multiculturalism in their future classes (Aguirre, 2007; Lynn & Smith-Maddox, 2007; Ladson-Billings, 1992; Cruz-Jansen, 2000). For example, Aguirre (2007) reports that in her efforts to promote teaching mathematics for social justice, she meets teachers who express interest in it but feel that they have little or no experience in how it can be done (p 9).

Introducing preservice teachers to teaching mathematics for social justice can provide them opportunities to explore ideas about teaching for social justice and critical pedagogy and to think about what these ideas might mean in terms of teaching mathematics.

Some teacher education programs have attempted to address critical pedagogy in their programs with varying levels of success. Cochran-Smith (1991), in teaching preservice teachers “to teach against the grain,” found success in her program when the preservice teachers worked with experienced teachers in learning about teaching for social justice. Lynn and Smith-Maddox (2007) found the teacher education program of their study to be successful in theory but not in practice. Even though the preservice teachers were given many opportunities to discuss social justice and teaching for social justice, Lynn and Smith-Maddox found it to be unsatisfactory in practice because the preservice teachers were not adequately prepared to actually teach for social justice in the classroom. The researchers comment that though the conversations were useful, the preservice teachers needed better pedagogical content knowledge to help guide them in developing “the necessary dispositions and skills for operationalizing these [social justice] ideas in the classroom” (p. 104). Specific to mathematics, Aguirre (2007) found that preservice teachers were resistant to the idea of teaching mathematics for social justice if they did not comprehend how it could actually lead to the teaching of mathematics that would be required of them as future teachers.

Aguirre’s (2007) finding leads to the bigger issue that a large influence on preservice teachers’ future teaching are the beliefs that they bring with them into the teacher education program (Garmon 2005; Pajares 1992; Pohan, 1996). For example, Pajares (1992) in his

review of literature on preservice teachers' beliefs found that "Beliefs are formed early and tend to self-perpetuate, preserving even against contradictions caused by reason, time, schooling, or experience" (p. 324). Therefore, as Aguirre (2007) found, preservice teachers who are learning about teaching mathematics for social justice can be resistant to any novel ideas because of their preexisting beliefs about the teaching of mathematics. The idea of preservice teachers' beliefs being robust and resistant to change was an important idea to consider in the analysis of my data.

This study has the potential to contribute to the very limited research on preservice teachers' beliefs and experiences in learning about teaching mathematics for social justice.

Cochran-Smith (2004) writes:

Teacher education for social justice needs to develop much further as an area of scholarly inquiry. We need more studies linking theory and practice. Particularly, we need to know what is happening to notions of . . . diversity, equity, and social justice in the face of intense emphasis on standards, high-stakes testing, and narrow views of what counts as research. (pp. 162-163)

Gutstein (2006) writes that there are not enough studies on how teacher educators might help preservice teachers practice critical pedagogy. He argues that there has been a lot of theoretical writings on the topic, but not much on the practicality. In addition, Aguirre (2007) writes that most of the existing work on teaching mathematics for social justice focuses on upper elementary and middle school students. She states that there is a lack of research and/or literature on teaching mathematics for social justice aimed at first and second graders. She thinks this is so because people question whether children so young are ready and able to engage in critical thinking about social inequities.

### Purpose of the Study

The purpose of this study is to examine preservice teachers' beliefs and experiences related to the teaching of mathematics for social justice as they progressed through a one-semester mathematics methods course. Preservice teachers can be defined as those students enrolled in a teacher education program who are taking classes leading to certification and licensure as teaching professionals. Beliefs are "representations of the information a person has about an object, person, group of people, and so forth" (Pohan, 1996, p. 62). The term experiences refers to the interactions that preservice teachers have with learning materials, the activities, the ideas, and the people that they encounter during the mathematics methods course. In addition to studying preservice teachers' experiences, I also examined their reflections on those experiences.

### Research Questions

My research questions are: As preservice teachers progress through their mathematics methods course...

1. What are their beliefs about equity, diversity and social justice and how do these issues relate a) to their work as teachers and b) to teaching mathematics?
2. What do they identify as the difficulties and/or challenges in learning about teaching mathematics for social justice?
3. What do they identify as aiding their learning about teaching mathematics for social justice?

This study investigated preservice teachers' beliefs because, as research has shown, they strongly influence their future teaching (Garmon 2005; Pajares 1992; Pohan, 1996). This

study examined their beliefs via a survey instrument and individual interviews at both the beginning and end of the mathematics methods course to reveal any differences. This study also examined what preservice teachers perceive as helpful and challenging in their learning to teach mathematics for social justice.

### Definitions

For the purpose of clarifying what I mean by the terms of equity, diversity, and social justice in my dissertation, I provide the following definitions:

Equity: “Equity deals with the socioeconomic and political disparities in the larger social order” (Brown, 2004, p. 334),

Diversity: “Refers to the variety among people that exists in ... society” (Arends, 2007, p. G-4), and

Social justice: “[Sharing] power, knowledge, and resources equitably” (Bogotch, 2000, p. 2).

Equity and social justice basically deal with the idea of fairness in society, such as fairness in education, housing, and health care. Fairness means that regardless of one’s demographics, one has the same opportunities and access as anyone else. Diversity refers to the differences in people, and not just in race and/or ethnicity but also in gender, sexual orientation, socio-economic status, (etc.)

### Theoretical Tools

I examined issues brought forth by the study using the following theoretical tools: a) critical theory, b) critical race theory, c) critical pedagogy, and d) culturally relevant pedagogy.

### *Critical Theory*

Critical theory has intellectual roots in Marxism and 19<sup>th</sup> century German philosophical and social thought of Kant, Hegel, and Weber (Gibson, 1986). Since then, many types of critical theories have developed; however, in general, they all seek to make changes in society so that it is more just and free. Critical theorists in education, such as Giroux (1988), McLaren (2003), and Apple (1992), are concerned with the injustices and inequalities and how they are perpetuated, or reproduced, by educational systems. Giroux (1988) writes:

Critical educational theory sets itself the task of uncovering how domination and oppression are produced within the various mechanisms of schooling. Its major ideological and political task is to unravel how schools reproduce the logic of capital through the ideological and material forms of privilege and domination that structure the lives of students from various class, gender, and ethnic groupings. (p. xxix)

To counter the reproductive system of oppression and inequalities of schooling, many critical theorists offer forms of resistance, from suggesting means for teachers and students to become active social agents for change to transforming the educational system itself.

### *Critical Race Theory*

Critical race theory originated in the 1970s over concern for the slow pace of racial reform in the United States. Critical race theory espouses that any program of emancipation has to be built around the question of race because “race is always already present in every social configuring” (Ladson-Billings, 1998, p. 10). Critical race theory wishes to deconstruct oppressive structures and construct equitable and socially just relations of power (Ladson-

Billings, 1998) and can be applied to education in two ways. First, it perceives school curriculum as “a culturally specific artifact designed to maintain a White supremacist master script” (Ladson-Billings, 1998, p. 18) by muting or erasing the cultural and historical stories of minorities. For example, history textbooks represent Rosa Parks as an older African-American woman who was too tired to give up her bus seat to white person rather than as a long-time participant in the civil rights movement. Second, critical race theory suggests that some educational instructional practices presume that non-white students are “deficient”; when teaching strategies or skills fail to achieve desired results, the students, not the techniques, are labeled as failing (Ladson-Billings, 1998). Because some of the participants in my study raised issues of racism, I applied critical race theory in my interpretation of such collected data.

### *Critical Pedagogy*

One critical theorist in the field of education, a position often referred to as critical pedagogue, is Freire. Critical pedagogues, in general, show how critical theory can be applied to the goals and purposes of schooling. In *Pedagogy of the Oppressed* (1970/1993), Freire discusses how educational systems typically follow a “banking model” because teachers, presumed holders of knowledge, deposit knowledge into the minds of their students. This system of education fails to meet the needs of the students to become engaged and to develop intellectual skills fully. As a consequence, the banking model of education ends up serving the interests of the oppressors, those who wish to hold power and wealth at the expense of the welfare of others. Instead, Freire proposed that education help develop the

“critical consciousness” of the students, based on a model of inquiry, dialogue, and problem-posing. Problem-posing, as opposed to rote memorization, helps students develop skills to perceive critically the world in which they exist. The teacher and students examine these problems together, so no one person is the authority on the subject.

Much like Freire, McLaren (2003) argues that education should play an emancipatory role for students and society. McLaren believes that the ultimate class of power and privilege exercises power over subordinate classes through hegemony—the maintenance of domination through consensual social practices, social forms, and social structures. In order to fight this hegemonic control and power, McLaren states that the challenging role for teachers is to reveal and try to change the continual practice of hegemony through the teaching of emancipatory knowledge. As McLaren (2003) writes, “[Emancipatory knowledge] helps the students better understand how social relationships are distorted and manipulated by relations of power and privilege” (p. 73) and reveals the underlying political, social, and economic foundations of a society that do not get addressed in traditional schooling. The teaching of this type of knowledge has the potential to help the subordinate classes free themselves from oppression because it prevents the educational systems from serving corporate ideology by producing students to be merely workers.

Also addressing the concept of hegemony, Apple (2003) writes, “[The concept of hegemony] has opened up an entire terrain of questions concerning the ways in which the struggles over social meanings are connected to the structures of inequality in society” (p. 6). He then proceeds to argue that there is a politics of knowledge—that only some types of

knowledge become legitimate and therefore are taught in school. Other types of knowledge, mostly of disenfranchised populations, are not legitimized and are not taught in schools. Teaching mathematics for social justice might be a way to make some types of knowledge legitimate by addressing issues that students may have to deal with in their lives but are not typically addressed in a standardized mathematics curriculum.

Echoing the sentiments of McLaren and Apple, Giroux (2007) writes:

Critical pedagogy is not simply concerned with offering students new ways to think critically and act with authority as agents in the classroom; it is also concerned with providing students with the skills and knowledge necessary for them to expand their capacities both to question deep-seated assumptions and myths that legitimate the most archaic and disempowering social practices that structure every aspect of society and to take responsibility for intervening in the world they inhabit. (p. 2)

Thus, Giroux sees critical pedagogy as more than just a way to critique societal practices; it is also a way to make schooling an empowering institution for students who can make change in the world. This is one of the fundamental ideas of teaching mathematics for social justice—empowering students to make change in the world.

#### *Culturally Relevant Pedagogy*

Culturally relevant pedagogy, like critical pedagogy, is another way that critical theory can be applied to education, for it seeks to challenge dominant ideologies and to address the needs of marginalized students. According to Ladson-Billings (1995) culturally relevant teaching must meet three criteria: a) an ability to develop students academically, b) a willingness to nurture and support cultural competence,

and c) the development of a sociopolitical or critical consciousness. Ladson-Billings argues that raising critical consciousness through culturally relevant pedagogy will help minority students who may otherwise fail in the educational system. She also argues that teacher education programs need to expose their students to culturally relevant pedagogy.

I still believe researchers are obligated to re-educate the candidates we currently attract toward a more expansive view of pedagogy... This can be accomplished partly by helping prospective teachers understand culture (their own and others') and the ways it functions in education. (Ladson-Billings, 1995, p. 483)

I apply the ideas of culturally relevant pedagogy to the analysis of my data because some of the participants raise issues of culture and relevancy of curriculum to students' lives.

#### Prior Research Related to Preservice Teachers and Teaching for Equity and Justice

Hollins and Guzman (2005) conducted a review of current research on teacher education programs in preparing teachers for working with diverse populations. Their work is important to this study because it addresses preservice teachers' beliefs and what kinds of experiences preservice teachers need to help them develop less deficit oriented and more productive beliefs about teaching. Hollins and Guzman found that since the majority of teacher candidates are white, female, middle class, and from suburbs or small towns, many of preservice teachers' beliefs are negative towards people who are different from themselves. This is important to consider in the study because some of the participants may have felt unprepared to teach social justice issues because social justice issues, such as racism and poverty, had not really impacted them themselves. In order to help preservice teachers feel more prepared, Hollins and Guzman found that community-based field experiences

positively impacted preservice teachers with regards to working with diverse populations. They also found that preservice teachers preexisting beliefs were rigid enough to create barriers in implementing equity pedagogy -- the employment of methods and materials that support academic achievement of diverse students.

Cochran-Smith (2004), who is interested in preparing preservice teachers to teach for social change, found that in most teacher education programs, “the role of the teacher as an agent for change is not emphasized” (p. 29) in favor of covering the technical aspects of teaching. So, among her six principles of teaching for social justice, she advocates that: a) preservice teachers work collaboratively with university mentors and in-service teachers who are also interested in teaching for social justice and can support the teacher candidates; and b) issues of inequity, power, and social activism be made explicit parts of the teacher education curriculum. Cochran-Smith argues that teacher education programs should address preservice teachers’ struggles in thinking about and understanding social justice pedagogy. This point of Cochran-Smith’s was addressed by my second research question because it sought to answer what preservice teachers identify as the difficulties and challenges in learning about teaching mathematics for social justice.

Zeichner (1993) wrote about making teacher development genuine for its students. In his analysis of teacher education programs, he was concerned about “when teacher development and teacher empowerment become ends in themselves unconnected to any broader purposes and to questions of equity and social justice” (p. 3). What he was saying is that teacher education programs become so concerned about the roles

and responsibilities of teaching, that they lose touch with what teachers are actually telling their students. For example, when a teacher becomes so concerned with teaching to the standards, he or she may not feel that there is enough time to try to connect the curriculum to real life issues, especially ones pertaining to social justice. One of the ways that Zeichner suggests to help teacher education programs maintain genuine teacher development is by emphasizing more on the effective practices “embedded in their own and other teachers’ practices” (p. 10) and less on those as suggested by research and policy makers.

#### Brief Overview of the Present Study

In this study, I used naturalistic inquiry methodology, blended with aspects of case study methodology, to study preservice teachers’ beliefs and experiences in learning about teaching mathematics for social justice. I conducted a “presurvey” with twenty-four preservice teachers enrolled in an elementary mathematics methods course, at the beginning of the Fall 2007 semester to examine their beliefs regarding equity, diversity, social justice, teaching for social justice, and teaching mathematics for social justice. I also held two individual interviews (one towards the beginning and one towards the end of the course) and one focus group interview (about midway through the course) with five selected “case study” students. At the end of the course, I conducted another survey (the “post-survey”) to reexamine the twenty-four preservice teachers’ beliefs regarding equity, diversity, social justice, teaching for social justice, and teaching mathematics for social justice. The post-survey also asked about their perceptions concerning the aids and challenges in learning

about teaching mathematics for social justice. I also I made observations of the weekly mathematics methods classes. With regards to my methods of data analysis, I used grounded theory. I coded my data, looked for emerging themes, and then produced a coherent and grounded description of the preservice teachers' beliefs and experiences in learning to teach mathematics for social justice.

### Limitations

There were some limitations to my study that need to be clarified. First, the study would have been stronger if it had followed the preservice teachers into their student teaching. This would have allowed the researcher the opportunity of examining how the beliefs that preservice teachers held or developed in the teacher education program were actually applied to their teaching. Second, because the purpose of this study was to convey to the reader a sense of the experiences of preservice teachers in learning how to teach mathematics for social justice, it would have been better to have studied more than one mathematics methods course. The findings of my study would probably have had greater strength if I had studied a variety of courses oriented to instructing preservice teachers in teaching mathematics for social justice instead of just one. Third, the discussion of such issues as racism, discrimination, and social inequities could have been potentially heated, emotional, and/or difficult for the participants. Being a white male researcher in a class of mostly women, some of whom are non-white, may have made it more difficult for me to gain enough trust of the participants for them to fully open to me in their individual interviews, class discussions, and surveys. In addition, my being white in a white-privileged society may

have biased my perceptions of the world enough to make me incapable of fully relating to and understanding the experiences and feelings of those who feel oppressed in this society.

### Outline of the Dissertation

This dissertation is organized in five chapters, with references and appendices. In Chapter Two I review literature under the following four major themes: critical mathematics, preservice teachers' beliefs about diversity and equity, preservice teachers' ideas about teaching social justice, and preservice teachers' ideas about teaching social justice through mathematics. I first develop the idea of what critical mathematics is and how it applies to teaching mathematics for social justice. Then I examine preservice teachers' beliefs at three different levels to ascertain how their previous beliefs might influence their ideas about teaching mathematics for social justice.

In Chapter Three I describe the methodologies of my study—primarily naturalistic inquiry mixed with elements from case study. I begin with explaining why the methodologies I have chosen are valid for the nature of my study. Then I review the general design features of my study, providing descriptions of participants and setting and as well as giving accounts of my data sources and collection methods. Lastly, I describe the various ways that I analyzed my data, and how I established trustworthiness, all based on the principles of naturalistic inquiry and grounded theory.

In Chapter Four I describe my findings. I first provide the cross-cutting themes in relation to my research questions: a) themes on beliefs about equity and social justice and how they relate to teaching, b) beliefs about diversity and how they relate to teaching, c)

beliefs about teaching mathematics for social justice, and d) beliefs about the aids as well as challenges in the course about learning teaching mathematics for social justice. Then I discuss the results of my quantitative analysis of the pre and post surveys.

And in Chapter Five I first summarize the findings in answer to my research questions. Then, I review the important ideas from my findings, connecting them to what is already known in the literature. I discuss how my findings connect to the research literature: how they confirm previous findings, challenge previous findings, and inform previous findings. Then I discuss the implications and limitations of my research. I finish by making recommendations for further research.

## CHAPTER TWO: LITERATURE REVIEW

### Introduction

My dissertation examined the beliefs and experiences of preservice teachers learning about teaching mathematics for social justice in a mathematics methods course. There is little existing research regarding teaching preservice teachers to teach mathematics for social justice. For example, there is research on social justice and mathematics (Frankenstein, 1990, 1995; Gutstein, 2003; Skovsmose, 1994, Tate, 1995); on teacher education and preservice teachers (Cochran-Smith, 1991; Hollins & Guzman, 2005; Lynn & Maddox 2007; Price & Ball, 1998; Zeichner, 1993) and on preservice teachers and their beliefs about equity and diversity (Brown, 2004; Cruz-Jansen, 2000; Garmon, 2005; Green & Weaver, 1992; Hadaway & Florex, 1987-1988; Pohan, 1996); but there are only a few studies on preservice teachers learning about teaching mathematics for social justice (Aguirre, 2007; Rodriguez, 2005). The literature selected for review was based on one or more of the following criteria: relevance to the general topics of teaching for social justice; teaching mathematics for social justice; preservice teachers' beliefs about equity, diversity, and social justice; and teaching preservice teachers to teach for social justice. The resulting selected research has been divided into four thematic groups: a) critical mathematics education; b) teaching mathematics for social justice; c) preservice teachers' beliefs about equity, diversity, and social justice (what shapes them and how they impact teaching); and d) the preparation of teachers to teach for social justice (what kinds of experiences are important and what are the possible challenges).

### Critical Mathematics Education

The term critical mathematics is attributed to the works of Frankenstein (1983, 1990, 1995), which in turn were based on Freire's (1970) notion of critical pedagogy. Frankenstein believed that the teaching of mathematics need not remain neutral nor disconnected from social issues, but could be used to help raise students' critical awareness. As Frankenstein (1983) writes:

Freire's theory compels mathematics teachers to probe the nonpositivist meaning of mathematical knowledge, the importance of quantitative reasoning in the development of critical consciousness, the ways that mathematics anxiety helps sustain hegemonic ideologies, and the connections between our specific curriculum and the development of critical consciousness. (p. 189)

Using Freire's theories and ideas, Frankenstein (1990) developed the concept of critical mathematics literacy, which involves "the ability to ask basic statistical questions in order to deepen one's appreciation of particular issues...[and] the ability to present data to change people's perceptions of those issues" (p. 336). Frankenstein accomplishes these two goals by having her students analyze statistics regarding social issues, keep a mathematics journal, and solve mathematics problems together in groups. Having students critically analyze statistical data is particularly important to Frankenstein (1990) because it allows for the opportunity "to reveal and explode all the....myths that are slipped into our lives" (p. 336). For example, Frankenstein has an exercise where students examine a statistical graph concerning numbers of nuclear weapons in the world in order for them not only to be aware of the staggeringly

large stocks of these weapons, but also to raise the questions of why such weapons exist in the first place.

Frankenstein (1990) conducted a study on critical mathematics using classes she taught at a community college for adult, working class students. The purpose of the study was to see how her students would react to “confronting various race and gender issues while simultaneously learning basic mathematics” (p. 338). Frankenstein used data from real-life for her mathematics problems and employed open-ended problems as her main mode of instruction. She felt that even though her adult students were aware of race and gender discrimination, they perceived “[the] injustices as personal problems” (p. 343). She wanted to make her students aware that race and gender inequalities were actually “due to the failure of our society” (p. 343). Interestingly, Frankenstein found many of her working-class students to be resistant to her social justice curriculum. Frankenstein gave two reasons for this: a) her students were resistant to her curriculum because of their preconceptions of what mathematics instruction looks like (e.g., learning from textbooks, lectures, and worksheets); and b) they were resistant because they had internalized the dominant culture’s view of what mathematical thinking is (e.g., solving abstract problems that are not related to real life). Thus, Frankenstein realized that providing self-confidence and motivation was important in helping her students learn about critical mathematics. I kept this point in mind in my study because resistance to social justice pedagogy seemed a possibility for the preservice teachers. They too might have held traditional beliefs about mathematics and mathematical pedagogy and, therefore, resisted any new or “revolutionary” conceptions of these. A possible

limitation with Frankenstein's critical mathematics is her strong emphasis on numbers, statistics, and data in her curriculum for adults. Regular K-8 teachers do not have this "luxury" for they need to cover a diverse range of topics in mathematics, including geometry, logic, and algebra.

Very similar to Frankenstein's notion of critical mathematics literacy, Skovsmose (1994), another researcher/teacher in the field of critical mathematics education, has developed the concept of "mathemacy." Skovsmose (1994) writes:

Mathemacy can be used for the purpose of empowerment, because it can be a means to organize and reorganize interpretations of social institution, traditions, and proposals for political reform. (pp. 38-39)

Skovsmose believes that students need to develop critical understandings through the use of mathematics because mathematics is such an important part of the fast-advancing technological world. For example, systems of tax collection, weaponry and defense, and communications all could not work at their current state of sophistication without the help of mathematics. What Skovsmose argues for is that, given the pervasiveness of mathematics in our technology-based society, we need to teach students to become critical thinkers in their studies of mathematics. When students are trained to think critically in mathematics, then mathematics can become a tool for democracy, as well as technological advancements.

To test out his notion of mathemacy, Skovsmose (1994) conducted a critical mathematics study with a group of 14-15 year old students in which his purpose was to examine how "mathematics education [could be] part of a democratic endeavor in a highly technological society" (p. 39). Skovsmose explicitly stated that he was not trying to prove

the efficacy of critical mathematics but merely how it might be implemented. One example of a mathemacy lesson Skovsmose used was having students first examine Denmark's (Skovsmose and the students' homeland) social system of child benefits, discussing the criteria by which government monies were dispersed. Then students were divided into groups, each group creating a few imaginary families and specific information about each, such as number and ages of children, parent's or parents' occupation(s) and income(s). Then, all the imaginary families were considered to make up an imaginary micro-society, which had a fixed amount of money (240,000 Dkr or about US \$80,000) that had to be divided up among the families based on need. The students had to make up guidelines for the distribution of monies, and then "specify what data they needed in order to complete the necessary calculation based on their guidelines" (p. 42). One of his main conclusions was that critical mathematics learning afforded students the opportunity to practice "reflective knowing", which is an understanding about mathematics at a metacognitive level. In this example, students became aware of how they thought about using mathematics to dole out government child benefits in their imaginary society. Reflective knowing was an important process in teaching democratic values to the students in a technologically developing society. Students needed to be aware of how they could use their intellectual skills to promote democratic values, such as equality and justice, in the world.

What the studies about critical mathematics demonstrate is that teaching mathematics need not remain value-neutral or disconnected to social issues, but can be used to help raise students' critical awareness. This was an important point in developing my study because it

meant that students could successfully study mathematics while at the same time learning about social justice.

### Teaching Mathematics for Social Justice

Gutstein (2006) lists six goals of teaching of mathematics for social justice:

1. reading the world with mathematics—understanding the sociopolitical, cultural-historical conditions of one’s life, community, society, and world (p. 24)
2. writing the world with mathematics—using mathematics to change the world (p. 26)
3. developing positive cultural and social identities—strongly rooted in one’s home languages, cultures, and communities while appropriating necessary aspects of dominant culture to exist (p. 28)
4. reading the mathematical world—developing mathematical understanding and power (p. 29)
5. succeeding academically in the traditional sense—students passing standardized tests, graduating from high school, succeeding in college, enrolling in advanced mathematics courses, and pursuing mathematically related careers (p. 30)
6. changing one’s orientation to mathematics—students redeveloping their perspectives of mathematics from using a series of disconnected, rote rules to gaining a powerful and relevant tool for understanding the world. (p. 30)

His goals are important because they show that teaching mathematics for social justice is not merely the practice of students engaging in some “social justice” activities in the

mathematics classroom. Instead, teaching mathematics for social justice means students are engaged in real-life applications of mathematics to make changes in their lives. Gutstein (2003) writes, “An important principle of social justice pedagogy is that students themselves are ultimately part of the solution to injustice, both as youth and as they grow into adulthood” (p. 39). For example, in his study of an urban, Latino/a middle school mathematics classroom, Gutstein (2003) created 17 mathematics projects that were connected to the students’ lives. In one project, students analyzed SAT and ACT examination scores by race, class, and gender. In another study Gutstein’s (2007) students used mathematics to examine the impact of a developer’s proposal to convert a local neighborhood park into secured parking for condominiums. Students computed commuting times to downtown from their neighborhood, found them to be short, and then realized why gentrification would be such a threat to up-to-then undesirable inner-city districts. They also looked into the real costs of what developers called affordable housing in their planned housing projects. For example, they calculated the costs of purchasing a low-end unit, advertised for around \$125,000 by the developer, and discovered that \$289,000 would be much more realistic.

Gutstein (2003) reported positive results from his efforts to incorporate social justice into mathematics instruction. For example, students “work productively and reflectively...communicate their ideas and results effectively...[and] value math and engage actively in learning it” (p. 46). In his concluding remarks for his 2007 study, Gutstein writes, “Teaching mathematics for social justice in urban, public schools—in which developing

agency is a central part—can make a difference in students’ lives beyond the classroom” (p. 444). In both studies, Gutstein had his students engaged in real-life applications of mathematics to examine social issues and/or make changes in their immediate lives.

Another researcher in teaching mathematics for social justice is Tate (1995). He studied a teacher, Ms. Mason, who incorporated social justice into her mathematics teaching. For example, Ms. Mason learned that her students were very concerned about the number of liquor stores in their community because of the problems of drunks, prostitutes, and drug users (all of who tended to hang around the liquor stores) hassling community members. Ms. Mason had her students conduct a 2-year project, using mathematics to do such things as compare the number of liquor stores around their school compared to other schools. The mathematical findings of their project were presented to the local city council, which decided to close and/or relocate 13 liquor stores within 1000 feet of the students’ school.

Gutstein’s and Tate’s studies are important to my study because they show that teaching mathematics for social justice can mean more than just having students complete social justice exercises in the classroom. Teaching mathematics for social justice can also mean engaging students to take action against issues that directly impact their lives, while learning mathematics.

#### Preservice Teachers’ Beliefs

As stated in Chapter One, beliefs can be defined as “representations of the information a person has about an object, person, group of people, and so forth” (Pohan,

1996, p. 62). Another definition is that a belief “is any simple proposition, conscious or unconscious, inferred from what a person says or does, capable of being preceded by the phrase, ‘I believe that...’” (Rokeach, 1968, p. 113). This latter definition will be used throughout my study. Beliefs are important to my study for two main reasons: first, research shows that beliefs about teaching heavily influence both in-service and preservice teachers’ practices and behaviors (Hollingsworth, 1989; Pajares, 1992; Pohan, 1996); and second, preservice teachers’ beliefs are robust and resistant to change (Brown, 2004; Pajares, 1992; Rokeach, 1968). In this section I first describe how beliefs influence teachers’ practices and behaviors. Then I discuss research that has shown that preservice teachers’ beliefs are robust and resistant to change. Lastly I review literature about specific preservice teachers’ beliefs: a) beliefs about diversity and equity, b) beliefs about teaching for social justice, and c) beliefs about teaching mathematics for social justice.

### *Beliefs Influence Teachers’ Practices and Behaviors*

Researchers have found that teachers’ (both inservice and preservice) beliefs about teaching strongly influence their teaching practices and behaviors (Garmon, 2004; Hollingsworth, 1989; Pajares, 1992; Pohan, 1996; Richardson, 1996). For example, Pajares, in reviewing various research studies on teachers’ beliefs, concluded that, “Beliefs play a critical role in defining behavior and organizing knowledge and information” (p. 325).

Hollingsworth, 1989 (as cited by Pohan, pp 62-63) writes:

Preservice teachers’ previously held beliefs about teaching and learning often serve as a filter through which all that is encountered in their education courses, program, and field experiences is interpreted.

The beliefs that preservice teachers either bring with them or develop in their mathematics methods courses were important to consider when examining their reactions to learning about teaching mathematics for social justice. For example, some preservice teachers may not want to incorporate social justice into their mathematics instruction merely because they believe mathematics teachers should not address such topics in the classroom.

*Preservice Teachers' Beliefs Are Robust and Resistant to Change*

Research has found teachers' beliefs to be robust and resistant to change (Brown, 2004; Pajares, 1992; Rokeach, 1968). Preservice teachers enter teacher education programs with beliefs already developed about teaching and learning from their experiences as students. Pajares (1992) refers to preservice teachers as "insiders" (p. 323) because, for example, unlike typical medical students, they are already familiar with the profession and its practices. They already know how to behave as a teacher and what is expected of them; and, therefore, their beliefs about the practice of teaching are more set. Pajares (1992) writes:

For insiders, changing conceptions is taxing and potentially threatening. These students have commitments to prior beliefs, and efforts to accommodate new information and adjust existing beliefs can be nearly impossible. (p. 323)

In other words, pre-service teachers' "resistance" towards teaching mathematics for social justice may reflect the fact that they are being confronted with something new. Their preexisting and firmly held ideas about what teaching/learning mathematics should look like make it hard for them to change those ideas. Next, I discuss research about particular kinds of

beliefs that are relevant to my study.

*Preservice Teachers' Beliefs about Diversity and Equity*

Beliefs about diversity and equity are important to my study because these issues are likely to arise when preservice teachers discuss social justice, teaching for social justice, and teaching mathematics for social justice. Diversity can be defined as the human attributes that make people individually unique, including race, ethnicity, gender, age, language, and socioeconomic status (Dermen-Sparks & Phillips, 1997, as cited by Cruz-Jansen, 2000). Equity can be defined as the state of socioeconomic, political, and educational parities (Brown, 2004). Diversity and equity are important in teaching mathematics for social justice because, as Gutstein (2006) argues, there are such pervasive discrepancies between the mathematics achievement between white and non-white students and between low-income and high-income students. Data from the National Assessment of Educational Progress (2004) shows that on every major assessment (such as the ACT, the SAT, or state standardized tests for fourth and eighth graders), Latinos and African Americans score well below whites in mathematics (p. 11). Gutstein (2006) writes, “The travesty of unequal experiences, opportunities, and outcomes between rich and poor and between whites and student of color is unarguable—equity is not here” (pp. 11-12).

Research concerning preservice teachers' beliefs about equity and diversity can be found in the work of Hollins and Guzman (2005), who reviewed research on preparing preservice teachers to work with diverse student populations. Some of the studies reviewed reported that the majority of teacher candidates are white, female, middle class, from suburbs

or small towns, and have limited experience with cultures different from their own (Green & Weaver, 1992; Hadaway & Florex, 1987,1988). Other studies indicated that the majority of preservice teachers have neither personal nor teaching experiences with diverse student populations and, as a consequence, hold negative attitudes and beliefs about those different from themselves (Richman, Bovelsky, Kroovand, Vacca, & West, 1997; Smith, Moallem, & Sherrill, 1997). For example, Smith et al. (1997) found in their study of predominantly white preservice teachers that 56% reported holding racially discriminatory beliefs due to their socialization. Richman et al (1997) reported that in their study, when preservice teachers (from a predominantly white university) were shown photographs of four African-American children and of four similarly dressed European-American children, the preservice teachers rated the African-American children as inferior on GPA and IQ scores, as well as being less ambitious, less self-confident, and less self-initiating.

Collectively, these studies suggest that white preservice teachers may have less than open-minded beliefs and attitudes on issues of diversity and the teaching of diverse students due to their socialization and lack of experiences with diverse populations. In turn, these negative beliefs may make it more difficult for preservice teachers to learn about teaching mathematics for social justice, because they are not as open to new ideas. Thus, any analysis of preservice teachers' receptivity towards teaching for social justice should consider factors outside the classroom that may influence their beliefs and experiences.

*Preservice Teachers' Beliefs about Teaching for Social Justice*

Preservice teachers' beliefs about teaching for social justice were important to my study because this was a topic addressed by the mathematics methods course for preserviceteachers that I studied. In one previous study Price and Ball (1998) examined a teacher education program that promoted teaching for social justice and found that prospective teachers struggled with the ideas of teaching for social justice due to their preexisting beliefs about teaching and schooling. "The prospective teachers' interpretations were intimately tied to their understandings of themselves, one another, ...and mathematics as a field of inquiry" (Price & Ball, p. 262). For example, some of the preservice teachers believed that schooling was about fostering individualism, and thus the teaching of social justice was not that important. However, for other preservice teachers, schooling was about access and opportunity, and thus the idea of teaching for social justice was consistent with their own beliefs.

Lynn and Maddox (2007) studied preservice teachers enrolled in a program that utilized dialogical processes—opportunities to talk, either internally through journaling or externally through group discussions—to help them learn to incorporate a social justice perspective into their teaching. Such issues as tracking, forging relationships with the school community, and dealing with inequities in urban classrooms were discussed. These researchers found that the process of inquiry allowed preservice teachers to begin "the process of thinking critically about how one, in fact, implements a social justice agenda in the context of an urban classroom" (p. 101). However, the researchers were unsure about

how long the preservice teachers would continue thinking about teaching for social justice in their classrooms once they left the program. Without the program to help the preservice teachers examine and questions their beliefs about social justice with others, the researchers felt that the preservice teachers were likely to fall back on implementing their old beliefs in the classroom. Though Lynn and Maddox were uncertain about whether the preservice teachers would actually end up teaching for social justice as regular teachers, they did believe that the preservice teachers would reflect more on their pedagogical practices.

Cochran-Smith (1991) also studied how preservice teachers could be better prepared to teach social justice in their classrooms, and, in a follow-up article (Cochran-Smith, 2001) warned that in an era of teachers having to worry about standardization and accountability, the struggle to prepare teacher candidates to teach for social justice was going to be harder.

We are chillingly close in some states to ‘learning to teach by numbers’ at a time when more than ever we need teachers able and willing to teach against the (new) grain of standardized practices that treat teachers as interchangeable parts and—worse—reinscribe societal inequities. (p. 4)

Cochran-Smith’s warning is important because preservice teachers may have worries about sufficiently meeting state standards in their teaching. Therefore, they might demonstrate resistance to learning social justice pedagogy out of fear that they would not be able adequately to prepare their students for standardized tests.

In summary, research on preservice teachers’ beliefs about teaching for social justice indicates that preservice teachers may be quite hesitant to learn about teaching mathematics for social justice due to myriad beliefs about standardization, the nature of schooling, and/or

about their role as teachers. In addition, even if preservice teachers develop positive attitudes toward teaching for social justice in their teacher education programs, they may not have enough support to continue practicing their beliefs as regular classroom teachers. Next, I discuss preservice teachers' beliefs about teaching mathematics for social justice.

*Preservice Teachers' Beliefs about Teaching Mathematics for Social Justice*

There are very few studies concerning preservice teachers' or practicing teachers' beliefs about teaching mathematics for social justice (Aguirre, 2007; Bartell, 2006; Rodriguez, 2005). In one study, Aguirre (2007) examined preservice teachers' experiences as they learned about teaching mathematics for social justice in their elementary mathematics methods course. She found that some preservice teachers were resistant to the idea due to four kinds of beliefs. First, some teacher education students held a cultural deficit view of Latino children and their parents. They inaccurately believed that a student's inability to articulate thoughts in the mathematics classroom meant that they were not good at mathematics. Or they inaccurately believed that parents of Latino children did not value mathematics education as highly as parents of white children merely out of a cultural stereotype. Second, a few students were concerned that teaching mathematics for social justice would have no place in classrooms because they believed accountability policies required highly skills-based curriculum and test preparation. Third, some preservice teachers believed it would be impossible for students fully to learn the mathematics curriculum while examining issues of equity at the same time. And fourth, students questioned whether

teaching mathematics for social justice was doable or even appropriate for lower elementary students, such as first and second graders.

In reaction to the students' resistance, Aguirre formulated her own counter-resistant strategies. For example, to challenge their disbeliefs about teaching mathematics for social justice to young children, Aguirre engaged them in creating such lessons and found that many good ideas were generated. For example, one group began with an existing lesson on making bar graphs (called "Me Pockets") where elementary students shared and recorded items that were important to their lives. To make this already existing mathematics lesson into one that addressed equity, diversity, and social justice, the group added a post-activity discussion where elementary students would be asked to talk about the similarities and differences of children in the classroom based on the shared items. Though Aguirre provided no examples of the types of questions that her preservice teachers formulated, they might have included questions such as, "Do all children own and love pets, or only children of one particular skin color?" Getting her preservice teachers to begin thinking about teaching mathematics for social justice with young children was a big step. It was encouraging to see that Aguirre developed strategies to overcome the preservice teachers' initial resistance.

Rodriguez's (2005) research also examined preservice teachers' resistance to learning teaching mathematics for social justice. Rodriguez identified two types of opposition: resistance to ideological change (RIC) and resistance to pedagogical change (RPC). RIC refers to one's resistance to changing one's beliefs and value system when learning something new.

Thus, preservice teachers may be resistant to learning about teaching mathematics for social justice merely because it is new to them. RPC refers to the resistance due to avoiding, refusing, or feeling unable to change one's perceptions of what constitutes being an effective teacher. Preservice teachers may be resistant to some or all the ideas of teaching for social justice because they do not fit in with what they already believe about teaching, mathematics, and/or the teaching of mathematics. Helping students feel more comfortable about learning new teaching ideas and practices and impacting preservice teachers' beliefs will be discussed in a later section.

Bartell (2006) studied eight secondary mathematics teachers as they worked together designing, implementing, and revising mathematics lessons for social justice. She found that the teachers' conversations about teaching mathematics for social justice evolved during the 15 weeks of the graduate course. At first, conversations demonstrated narrow conceptions about these topics. For example, one group of teachers believed that teaching mathematics for social justice "was about relating mathematics to all cultures or relating math to society, with no explicit mention of students looking critically at...societal issues" (p. 776). Though by the end of the course, the teachers understood that teaching mathematics for social justice concerned students looking critically at social issues, they still conceived of it as an add-on activity instead of an integral part of the curriculum. That is, they believed that students

should learn the mathematics first, and then apply it to analyzing social issues, rather than learning the mathematics as they analyze social issues.

In summary, studies concerning preservice teachers' beliefs about teaching mathematics for social indicate that preservice teachers are likely to demonstrate resistance to and/or narrow conceptions of teaching mathematics for social justice. They may be resistant due to their beliefs about what mathematics and the teaching of mathematics is, or they may be resistant because the idea of teaching mathematics for social justice was novel for them. They may also express over-simplified or incorrect beliefs about what teaching mathematics for social justice is, but these ideas may be expanded and/or clarified by the end of the mathematics course.

#### *Impacting Preservice Teachers' Beliefs about Equity, Diversity, and Social Justice*

In order to foster preservice teachers' interest in addressing social justice issues in their classrooms, research shows that there has to be one or more positive influences on their beliefs about diversity and equity in their teacher education programs (Pohan, 1996; Garmon, 2005). A positive influence is a general term for any activity or event that helps a preservice teacher feel more interested or confident about teaching for social justice in his or her classroom. From the literature, positive influences can be grouped into four main categories: a) developing a learning community, b) examining and talking about one's beliefs about equity, diversity, and social justice, c) working with experienced teachers in teaching for social justice, and d) working with diverse populations at a higher-education level.

#### *Developing a Learning Community*

Kelly (2002) studied how to promote best practices for developing democratic social values in the classroom with a group of 48 elementary preservice teachers. She found the following five methods and strategies to have the most impact on preservice teachers' beliefs and attitudes:

1. heightening awareness of existing gender separations within classroom settings
2. promoting more in-depth thinking about specific lesson materials and the attributes of those materials that would either positively or negatively impact equity and learning
3. assigning professional readings about equity and equity issues
4. having preservice teachers pre-think the lesson plan to adapt as needed to democratic social values [and]
5. having preservice teachers work in real classrooms with real students and focusing directly on equity/inequity issues. (p. 49)

Kelly rationalized that these five strategies were effective in impacting preservice teachers because the teachers were more able to understand issues of equity when directly related to their lives.

Like Kelly, Frankenstein (1995) offers the following suggestions for impacting preservice teachers' beliefs and attitudes.:

1. let students work in groups
2. let students explore feelings and learning processes through journal writing

3. let students evaluate their own learning (p. 185).

Frankenstein was interested in creating a social justice learning community where people felt comfortable exploring the ideas and processes of teaching mathematics for social justice.

What Kelly's and Frankenstein's approaches have in common is that they both emphasize letting students reflect upon their beliefs. In order to have any impact on people's beliefs, one needs to provide them many opportunities to examine and discuss them. I kept Kelly's and Frankenstein's suggestions in mind when examining and discussing what helped the preservice teachers in my study.

*Examining and Talking about One's Beliefs about Equity, Diversity, and Social Justice*

Garmon (2005), in conducting extensive interviews with one 22-year-old white female teacher candidate, found six factors that played a critical role in her positive multicultural development:

1. openness to diversity—before students will accept new information, they must be open to receiving it (pp. 276-277)
2. self-awareness—being aware of one's own beliefs (pp. 277-278)
3. commitment to social justice—a deep concern for achieving equity and equality for all people (pp. 278-279)
4. intercultural experiences—opportunities for direct interaction with one or more individuals from a cultural group different than one's own (pp. 279-280)
5. support group experiences—a group of individuals who encourage a person's

growth (p. 282)

6. multicultural educational experiences—class and class-related multicultural experiences during teacher training (pp. 280-281).

Though Garmon's study had only one participant, her six factors were important in developing my survey and interview questions. For example, in considering Garmon's third factor on commitment, I wanted to ascertain through the presurvey and initial interview a participant's level of openness to the idea of teaching mathematics for social justice. I wanted to see how open a participant was at the beginning of the mathematics methods course to better predict his or her degree of resistance to the learning of it during the course.

Lynn and Smith (2007) found that they could break down preservice teachers' negative beliefs about teaching for social justice by dialogical processes. Dialogical processes are opportunities to talk, either internally through journaling or externally through group settings. Lynn and Smith found a teacher education program that uses dialogical processes helped the preservice teachers examine their preexisting beliefs and make changes to them so that they would become more open to social justice perspectives.

We are hopeful that novice teachers' participation in continuous dialogue about social justice issues may have helped them overcome certain barriers that ultimately prevent teachers from learning to incorporate a social justice perspective in their teaching. (Lynn & Smith, p. 103)

Opportunities to talk about one's ideas and feelings about social justice with other preservice teachers seem to foster positive beliefs towards teaching for social justice.

*Working with Experienced Teachers in Teaching for Social Justice*

Cochran-Smith (1991) recommended that preservice teachers work with experienced teachers in their training to teach for social justice:

The only way for beginners to learn to be both educators and activists is to struggle over time in the company of experienced teachers who are themselves committed to collaboration and reform in their own classrooms, schools, and communities. (p. 307)

By building a community of reform minded teachers and preservice teachers, Cochran-Smith believes that teacher education programs have a better opportunity to impact preservice teachers' beliefs.

*Working with Diverse Populations at a Higher-Education Level*

Melnick and Zeichner (1998) recommended that, on an institutional level, white preservice teachers work with non-white faculty or students in order to better understand those who are different from them. They argue that higher education institutions do little to make white preservice teachers' educational experiences less white-oriented. Thus, they had two recommendations to help remedy this. First, they suggest that teacher education programs actively recruit "faculty of color through the establishment of institutional policies and programs" (p. 90). As an example, they cite the Madison Plan at the University of Wisconsin-Madison, which provides incentives to departments to hire qualified faculty of color. Second, they suggest that "partnership agreements" (p. 90) be forged between predominantly white teacher education institutions and other higher education institutions with significant numbers of non-white faculty and students. These partnerships would allow

students and institutions to share resources and ideas with each other. Building on the ideas of Melnick and Zeichner, teacher education courses might purposefully structure opportunities for white and non-white preservice teachers to interact with one another rather than segmenting the two groups, as often happens via specialized programs (i.e., Bilingual education cohorts that result in a clustering of Latino/a teacher candidates).

Impacting preservice teachers' beliefs in a positive fashion was a goal for the mathematics methods course I studied because it wanted to promote teaching for social justice. In considering what previous researchers have found to be helpful, it was important to examine the following issues in this study: one, preservice teachers' feelings of either isolation or support; two, preservice teachers' opportunities to examine their beliefs about equity, diversity, and social justice, either through journal writing or discussion groups; and, three, preservice teachers' experiences in creating mathematics curricula that address social justice.

### Conclusion

In this chapter I reviewed pertinent literature concerning critical mathematics, preservice teachers' beliefs, and impacting preservice teachers' beliefs. Throughout the chapter, I argued that the teaching of mathematics for social justice is quite novel to preservice teachers, resulting in possible resistance to any of its ideas and/or concepts. As a consequence, preservice teachers need supportive experiences in their learning, including self-reflection and discussion. Though there is much research on preservice teachers and their beliefs and experiences related to mathematics, there is very little research on preservice

teachers' beliefs and experiences in learning about teaching mathematics for social justice. This study helps fill this gap in the literature.

## CHAPTER THREE: METHODS

### Overview

This study examined preservice teachers learning to teach mathematics for social justice in a mathematics methods course. I studied their beliefs about issues of equity, diversity and social justice, and then reported how these beliefs connected with their perspectives about teaching and teaching mathematics. This study also examined the helpful, as well as challenging, experiences for the preservice teachers in learning to teach mathematics for social justice. This methods chapter begins with an overview of my two research methodologies: naturalistic inquiry and case study. Next, I list my research questions. Then, I describe my research design, starting with the context and participants and proceeding with methods—based in grounded theory—for collecting and analyzing the data. The chapter concludes with how trustworthiness was maintained in accordance with the principles of naturalistic inquiry methodology.

### Research Paradigm

Research grounded in the interpretive paradigm rejects the cause-and-effect perspective and adopts a more socio-cultural constructivist viewpoint, in which teaching and learning are considered dynamic and continuous. That is, interpretive researchers are interested in examining how individuals construct their realities in trying to understand the world and their experiences in it. As Shulman (1986) states, “To understand why individuals behave as they do, one must understand both the grounds on which they render their simplifications or constructions, and the particular constructions they create” (p. 17).

The interpretive paradigm assumes that learning and teaching are complex because teachers and students construct their own meanings of what is happening in the classroom, and those meanings may not necessarily look the same because they are context bound. In my research I examined the different perceptions and interpretations that the participants made of their experiences in learning about teaching mathematics for social justice.

According to the interpretive paradigm, the goals of research are to identify: a) the specific structures of occurrences; and b) the meaning-perspectives of the particular actors in the particular events (Erickson, 1986, p. 124). The first goal involves finding answers to questions about what is happening in a particular place at a particular time. The second goal of interpretive research involves examining the particular points of views of the participants during the event. In my study I sought to better understand the preservice teachers' beliefs and perceptions about equity, diversity, and social justice and how those beliefs and perceptions related to their perspectives on teaching and teaching mathematics. The preservice teachers were taking a mathematics methods course that specifically addressed teaching mathematics for social justice, and I was interested in studying this event.

One assumption of interpretive research is that the world is not composed of cause and effect relationships; rather, individuals "create meaningful interpretations of the physical and behavioral objects that surround them in the environment" (Erickson, 1986, p.126). Thus, instead of humans acting in accordance with Newtonian-like mechanical laws that explain actions as a result of specific causes, humans continuously act in unpredictable ways. Actions can be explained as resulting from the actor's interpretations of the world. Thus, in

my study, I reported on the participants' own perceptions and interpretations, rather than expressing my own views. Another assumption of interpretive research is that "microcultures will differ from one classroom to the next, no matter what degree of similarity in general demographics" (Erickson, 1986, p. 128). Thus, it is important to realize the findings of my study are not generalizable; they pertain to only the mathematics methods class that I studied. However, I hope that the reader may be able to apply the resulting new knowledge from my study to future situations that are similar in context, such as a mathematics methods course at another university that addresses teaching mathematics for social justice.

### Research Methodologies

My study was guided by the principles of both naturalistic inquiry and case study methodologies. However, naturalistic inquiry was my primary methodology. It more strongly addresses the issue of examining the differing perceptions and interpretations of individuals, which was the aim of my study.

#### *Naturalistic Inquiry*

The essence of naturalistic inquiry is to get inside the social context of the phenomenon being studied to understand the constructions of the individual participants and build a common understanding. This was the goal in my study; I wanted to report on participants' perceptions and interpretations to better understand the phenomenon of preservice teachers learning to teach mathematics for social justice. Thus, in my study, I

needed to make sure that I captured the views of the participants, and not merely offered my own views as theirs.

In naturalistic inquiry, the researcher develops and verifies “shared constructions” (Erlandson, Harris et al., 1993). That is, the naturalistic inquiry researcher must reconstruct the words and behaviors of the participants, and then have the participants verify them (see section on member checking for more details). One goal of naturalistic inquiry is to not separate the researcher from the human interaction in the study, as some of the more formal research methodologies require (Erlandson, Harris et al., 1993). It is recommended that the researcher be involved in the activity, even at the risk of imposing bias on the findings. However, I have limited researcher bias by using grounded theory in my analysis (see section on grounded theory for more details).

Naturalistic inquiry assumes that results from a study employing its methodology are not generalizable, at least not in the traditional sense. “No two social settings are sufficiently similar to allow simplistic, sweeping generalizations from one to another” (Erlandson, Harris et al., 1993). My goal was to provide findings that could offer insights that readers might apply to their own settings (Erlandson, Harris et al., 1993). Naturalistic inquiry also assumes that “there is not a single objective reality but multiple realities of which the researcher must be aware” (Erlandson, Harris et al., 1993, pp. 11-12). I take this assumption into account into my study by allowing for the reality of the individual participant to come forth, rather than my own interpretations of what I think his or her reality is. For example, when taking notes in my field observations, I tried to my utmost to write down verbatim the ideas and opinions

of the participants as they spoke in class. I also audio taped many of the class discussions and kept track of the exact time in the recording when someone said something that I felt was very important but unable to write down completely by hand. Later in the day, when reviewing my field notes, I could replay the key sections of my recordings to make sure what I had written down in my field notes accurately captured what participants had said.

### *Case Study*

According to Merriam (1998), case study research is characterized by being particularistic, descriptive, and heuristic. Particularistic means that that the research focuses on a particular situation, event, phenomenon, or individual. Creswell (2003) writes that in case study research, the researcher explores in depth one or more individuals bounded by time and activity. Because I focused on the experiences and beliefs of five individual participants in a mathematics methods course, I also drew upon case study methodology to guide my research design. Descriptive means that the researcher constructs “thick descriptions” using numerous sources of data (Merriam, 1988, pp. 29-30). My study included data from a variety of sources, including journals, observations, and interviews. In addition, the variety of data sources was helpful in identifying themes and categories, which were important for the use of grounded theory in my analysis. Lastly, heuristic means that “case studies illuminate the reader’s understanding of the phenomenon under study” (Merriam, p. 30). This was the goal of my research—to help the reader understand the beliefs and

experiences of preservice teachers learning about teaching mathematics for social justice. I did this by frequently describing the “hows” and “whys” of events during the course.

### *The Integration of Methodologies*

I used case study methodology to support my main methodology of naturalistic inquiry. Like naturalistic inquiry, case study uses thick descriptive datasets in order to help the reader better understand the phenomenon or event being studied. In addition, case study methodology requires triangulation of multiple sources of data (to be discussed later in the Trustworthiness section of this chapter), just like with naturalistic inquiry.

### Research Questions

The following research questions guided my study:

As preservice teachers progress through their mathematics methods course...

1. What are their beliefs about equity, diversity, and social justice and how these issues relate 1) to their work as teachers and 2) to teaching mathematics?
2. What do they identify as the difficulties and/or challenges in learning about teaching mathematics for social justice?
3. What do they identify as being helpful or beneficial in learning about teaching mathematics for social justice?

These questions are important because this study aims to better understand the experiences and beliefs of preservice teachers as they learn about teaching mathematics for social justice.

## Research Setting

The mathematics methods course was held in an elementary school in the same city as the university. The goal of this course was to teach prospective elementary school teachers about methods to teach mathematics in K-8 classrooms, with an emphasis on culturally and linguistically diverse students. The course was also designed to provide prospective teachers with an opportunity to reflect on their beliefs about teaching, learning, and their expectations for students. Another feature of this course was to teach the preservice teachers about teaching mathematics for social justice through lectures, projects, journals, group activities, and discussions. For example, the preservice teachers created in small groups mathematics lessons that drew upon relevant contexts in the school and local community and incorporated equity issue(s).

The course was taught by a faculty member and a graduate student, both of whom had had previous experience teaching the course. The course met once a week for 2 hours and 45 minutes and required an additional 10 hours per week on the part of the students to observe elementary classrooms at a variety of schools.

## Participants

The participants were undergraduates studying to be elementary school teachers. More specifically, these undergraduates were enrolled in a mathematics methods course, which was a required course for their teaching degree/certificate from the university. In general, these students were female, in the senior year of university level coursework, and predominantly of European-American or Hispanic descent. While most participants were

native English speakers, some participants were bilingual (Spanish/English) or native speakers of Spanish.

There were two levels of participation in this study. On the first level, I invited all students in the mathematics methods course to participate in both a pre-survey and post-survey of questions about their beliefs about equity, diversity, social justice, teaching for social justice, and teaching mathematics for social justice. Out of a total of 30 students enrolled in the course I was studying, I had 24 respondents ( $n=24$ ) on the pre-survey and 30 respondents ( $n=30$ ) for the post-survey. In addition, level one participants were observed, audiotaped, and/or videotaped during selected activities in the mathematics methods course.

On the second level, I asked the students in the mathematics methods course to indicate on the study's informed consent form whether or not they would be willing to act as a case study participant. I explained to the class that case study participation involved two individual interviews and one focus group interview (all interviews being conducted outside of the regular class time). Of the nine potential participants who volunteered for the second level of consent, I selected six to serve as case study participants. The selection of these six case study participants was based on their replies to the pre-survey given at the beginning of the course. I tried to select to the greatest degree possible (given I had a total of nine potential volunteers) a variety of participants, based on interest in teaching mathematics for social justice and demographics (i.e. gender, ethnicity, and languages spoken – see Table 1.) Though I originally selected six case study participants, I ended up with five by the end of the study, which could be considered a rather small sample size for the quantitative analysis.

I had to drop the sixth case study participant because she missed both the focus group and final interviews. As a result, I felt that her interview data was inadequate in comparison to the remaining five case study participants.

I sought a demographic balance in my participants, which I was able to achieve with regards to ethnicity and language background. However, with regards to gender, I had only one male volunteer to be a case study participant, so I was not able to achieve a balance of male and female participants.

Table 1

<i>Demographics and Initial Attitude of Participants</i>				
Participant	Gender	Ethnicity	Language background	Initial Attitude towards Teaching Mathematics for Social Justice* (4=Very favorable)
Elena	Female	Caucasian	English	3
Javier	Male	Hispanic	Spanish	3.25
Juliana	Female	Chicana	Spanish	4
Linda	Female	Caucasian	English	4
Nataly	Female	Puerto Rican	English	3.75

\*This value, which ranges from 1 to 4 (1= very opposed, 2= opposed, 3= favorable, 4= very favorable) was computed by averaging the participants' answers to the following four questions from the presurvey:

Question #2: Teaching about issues of equity, diversity, and social justice is an appropriate practice for a teacher of mathematics.

Question #5: Mathematics can help students learn about social justice issues.

Question #6: Exploring social issues can help students learn and understand mathematics.

Question #10: I am interested in learning about how to teach mathematics lessons that incorporate social justice issues

Participants' answers to each of these individual four questions ranged from 1 to 4 (1=strongly disagree, 2= disagree, 3= agree, 4= strongly agree))

With regards to achieving balance on participants' initial attitudes towards teaching mathematics for social justice, I was unsuccessful because all my participants were either favorable or very favorable.

It is important to note the distinctness of the sample of case study participants for my study. As mentioned in Chapter Two, typical studies on preservice teachers' beliefs involve predominantly white females with little experiences with diverse populations (Hollins & Guzman, 2005; Green & Weaver, 1992; Hadaway & Florex, 1987, 1988). In comparison, the sample of preservice teachers who acted as case study participants in my study was quite unique. The majority of case study participants, though female, was non-white and had much knowledge of and/or experiences with diverse populations. As a consequence, this situation provided unique insights into what non-white preservice teachers believe about issues of equity, diversity, social justice, teaching for social justice, and teaching mathematics for social justice.

#### Methods of Data Collection

I used a variety of data sources in my research: a) surveys that included both Likert scale and open-ended items, b) individual and focus group interviews, c) field notes on classroom observations, and d) student work samples. All of these data sources are generally used in naturalistic research (Erlandson, Harris et al., 1993).

#### *Surveys*

Pre and post surveys were given to both the case study and non-case study participants. Questions for the pre-survey were designed to elicit preservice teachers' beliefs

about equity, diversity, social justice, teaching for social justice, and teaching mathematics for social justice. I gave pre and post surveys so that I could report both qualitatively and quantitatively any change in the preservice teachers' beliefs over the course of the class.

The pre-survey was comprised of three parts (see Appendix A for the complete pre-survey); the first part had five open-ended questions, allowing the participants to more fully express their opinions about the aforementioned topics. For instance, one open-ended question stated, "Please explain what the phrase 'teaching mathematics for social justice' means to you." The second part had twenty Likert scale questions, with the four answer choices of "Strongly agree", "Agree", "Disagree", and "Strongly disagree". A sample Likert scale item read, "Teaching about issues of equity, diversity, and social justice is an appropriate practice for a teacher." The third part, which was strictly optional, asked for participants' demographic information concerning ethnicity, gender, and primary language(s) spoken. The post-survey had just two parts, leaving out the repetitive section on demographics (see Appendix B for the complete post-survey). The open-ended question part had four of the same questions asked in the presurvey, plus two additional questions designed to elicit responses about the nature of preservice teachers' experiences in the mathematics methods course. For example, one of the new open-ended questions stated, "What was particularly helpful in your learning about teaching mathematics for social justice in this class?" For the second part of the post-survey, the Likert scale questions, fourteen of the original fifteen questions from the presurvey were kept, and another six questions were

added, to make a total of twenty Likert scale questions. For example, one of the new Likert scale questions read, “Seeing/experiencing the social justice teaching models was helpful for me in learning about teaching mathematics for social justice.” The six new Likert scale questions, like the two new open-ended questions, were designed to elicit responses about the nature of preservice teachers’ experiences in the math methods course to help me answer my second and third research questions. Almost all of the presurvey and post survey questions were created by me with the help of my advisor, but a few were either taken or adapted from other researchers’ survey questions (Clark, 2005; Mussington, 1996).

In order to be able to compare the results between the presurvey and post survey for the same participants, I followed two different procedures. First, I assigned each person who took the presurvey an anonymous number. Only I was aware of which presurvey participant was assigned to which number; the instructor of the course was not aware of this information. Then, when I handed out the post surveys, I made sure that each participant was given a copy with his or her anonymous presurvey number written at the top. For the new and additional post survey participants, of whom there were six, I assigned new anonymous numbers. So, when it came to the time to compare results between the presurvey and the post survey, I was able to match up the presurvey and the post survey for each participant through the assigned anonymous number. Because I had no presurveys to match with the six “new” participants’ presurveys, I ended up discarding their post surveys. This permitted in my quantitative analysis the ability to compare results between pre and post surveys for all my participants in the study.

*Individual Interviews with Case Study Participants*

The six preservice teachers selected as case study participants were to take part in three different interviews (described in further detail in the next paragraph). The questions for all interviews were semi-structured, meaning that they were guided by a set of questions, but neither the exact wording nor the order of questions was predetermined. The advantage of a semi-structured interview is it allows the researcher to find out things that he or she cannot directly observe, such as feelings, thoughts, and intentions (Merriam, 1988). Also semi-structured interviews are conducive to naturalistic inquiry methodology, because the interviews take more of a form of a dialogue or interaction. This better allows the naturalistic-inquiry-researcher to understand the data collected from the interviews in the larger context of interpersonal, social, and cultural aspects (Erlandson, Harris et al., 1993).

The three different participant interviews conducted were: 1) an initial individual interview towards the beginning of the mathematics methods course, 2) a focus group interview which occurred about midway through the semester, and 3) a final individual interview at the end of the course. Because one of the six selected case study participants missed both the focus group as well as her final interviews, I ended up dropping her as a case study participant, leaving me with five total. The remaining five case study participants all partook in the three interviews, save for Elena who missed only the final interview. Almost all of the pre and post interview questions were created by me with the help of my advisor and a colleague, but a few were either taken or adapted from other researchers' survey questions (Aguirre, 2007; Bartell, 2006).

For the individual interviews, the questions focused on elucidating further the answers that the case study participants gave in the presurvey. For example, two questions from the initial interview were: 1) “What do you think teaching for social justice means?” and 2) “What grade level(s) do you think are appropriate for students to learn about social justice in the classrooms?” (see Appendix C for the complete initial interview questions). The final interview (see Appendix D for the complete final interview questions) included some additional new questions about the perceived impact of the mathematics methods course. For example, the question “How did this course affect the way that you will teach mathematics?” was asked in the final interview.

A focus group interview was included in this study because it allows the case study participants to interact with each other as they talk about their beliefs and experiences. Like those for the individual interviews, the questions for the focus group were designed to be semi-structured. This allowed the moderator to act as a facilitator, rather than director, of the discussion so that the participants had more opportunity to talk to each other. Some of the focus group interview questions were based upon assignments that the preservice teachers did for the mathematics methods course. For example, one assignment required the preservice teachers to identify and investigate school and local community contexts that could form a basis for mathematics lessons and activities. Thus, I asked the focus group, “For your assignment, were you interested in finding a context that relates to social justice? And, if so, what was it?”

The university's Institutional Review Board (IRB) approved all interview protocols. Both the initial and final interviews were conducted at a public location that was convenient for the participants, including an outdoor terrace at the Student Union and a local coffee house. Individual interviews lasted from 45 to 60 minutes, totaling about nine hours of individual participant interview data. To help guarantee the integrity of collected data from the interviews, I used the naturalistic inquiry technique of member-checking. As Erlandson, Harris, et al. (1993) write:

Member checking may be conducted by furnishing copies of various parts of the inquiry report to various stakeholding groups and asking for a written or oral commentary on the contents. (p. 142)

So, after each interview, I transcribed the interview, reread it for any uncertain or unclear sections, and then either by email or by phone asked the participants to clarify the parts I was unsure that I had transcribed correctly in order to guarantee accuracy.

The focus group interview was held in the same classroom at the elementary school where the mathematics methods course was conducted. The focus group met fifteen minutes after the regular course ended, and it lasted a little over an hour. Unfortunately, only four of the six case study participants were able to attend; the other two were absent for personal reasons. The focus group interview was both audio and video recorded, to help with the authenticity of the transcription. Member-checking was also completed employing the same method used for the interviews as described in the preceding paragraph.

*Classroom Observations*

In naturalistic inquiry the roles of the researcher can extend to a wide range: on one extreme he or she can play the role of complete participant, who participates like any other member of the group, and on the other extreme he or she can play the role of complete observer, who covertly observes the group from afar (Erlandson, Harris et al., 1993). For my observations of the mathematics methods course, I acted more in the role of complete observer, though at times I participated in the course when required, such as giving explanations about taking the surveys or clarifying the rules for one of the model lessons exemplified in the course. In accordance with the principles of naturalistic inquiry, I did not employ any pre-created taxonomy or checklist in my observations (Lincoln & Guba, 1985). Instead, I recorded data in my field notes, which built on the topics, themes, and categories emerging from the research. (See Appendix E for a sample of a field note entry). I relied on my field notes for my observations; I audiotaped and videotaped only selected sessions of the mathematics methods class. Sessions were selected by their anticipated high worth to my study. For example, I chose to both audiotape and videotape the class held on October 1, 2007 because the students discussed assigned articles about teaching mathematics for social justice. As a recommended strategy for field note taking, I jotted down a few notes during the event and then wrote full descriptions from memory after the event (Merriam, 1988). Also as recommended, my post-event note writing took about as much time as observing the event (Merriam, 1988). The content of the field notes included: a) verbal descriptions of the setting, the people, and the activities; b) direct quotations of what people said; and c)

observer's comments (Merriam, 1998). One of the main purposes of conducting classroom observations was to contextualize the data. I wanted to make sure that the ideas and beliefs that I was gathering from the interviews and the surveys were connected to actual events and tones of the mathematics methods classroom. I wanted to better understand the beliefs and experiences of the participants by better knowing the environment in which they formed.

### *Reflexive Journal*

The reflexive journal supports the trustworthiness of the study (Lincoln & Guba, 1985). A reflexive journal consists of three separate parts: 1) the daily schedule and logistics of the study, 2) a personal diary of insights and speculations, and 3) a methodological log in which "methodological decisions and accompanying rationales are recorded" (Lincoln & Guba, 1985). I reflected in my research journal upon logistics, insights, and decisions made during the study. I also used the journal to reflect upon the interviews, using answers from the initial interviews to help guide my questions for the focus group and final interviews (see Appendix F for a sample journal entry).

### *Participants' Written Work*

In my study I analyzed some of the participants' written work because it helped "ground [the] investigation in the context of the problem being investigated" (Merriam, 1988, p. 109). Permission to examine written work was given when students agreed to participate in the study. Written work examined included: a) math autobiographies, b) on-line journal entries, and c) lesson plans created as an assignment for the course. The math

autobiographies were short papers reflecting on the participant's own experiences with mathematics as a student, and in life, and how those experiences impacted his or her attitude towards, as well as understanding of, mathematics. For the on-line journal entries, participants were asked once a week to respond to questions designed to prompt thoughtful reflection about that week's readings, and how ideas in those readings related to the participants' classroom-based experiences. I chose to include in my document sources the journal entry for October 1, 2007 because the participants reflected on assigned readings about K-12 students using mathematics to investigate equity issues in their school or local community. I chose to include in my document sources lesson plans that were given to the participants as one of the graded assignments for the course. These lesson plans were taught by the participants in actual classrooms. Then, after having taught their lessons, participants wrote an analysis of their teaching with regards to an issue concerning equity, such as calling on one type of student more often than another.

Any written work produced by the participants that was not accessible to me in a Word document form was photocopied and then transcribed.

#### Methods of Analyzing Data

For data analysis I used the grounded theory approach (Glaser & Strauss, 1967; Strauss & Corbin, 1998; Dey, 1999). Based on the early work of Glaser & Strauss (1967), grounded theory offers a qualitative research method to analyze data in a systematic, yet flexible way. Using grounded theory in this study also allowed me to analyze the complex environment of preservice teachers learning about teaching mathematics for social justice in

a mathematics methods classroom. I studied my data and then sorted and synthesized it through qualitative coding. I built “levels of abstraction” (Charmaz, 2006) directly from the data, checking and refining them, until a “grounded theory” was created. By grounded theory I mean that I am trying to reveal the participants’ own perspectives and beliefs by grounding my findings exclusively on: a) what they wrote in their surveys, journals, and lesson plans; and b) what they said during the interviews and class discussions. Grounded theory uses a iterative process of three basic steps: 1) describing, 2) conceptual ordering, and 3) theorizing (Strauss & Corbin, 1998).

### *Describing*

Describing is the process of depicting or telling a story in detail without giving interpretations of the events. I am telling a “story” about preservice teachers learning about teaching mathematics for social justice based on field notes, student work, survey results, and interviews. My research wove the experiences and beliefs of all five of my case study participants together in order to create one story, rather than five different ones. According to Strauss and Corbin (1998), in describing it is important not “to interpret events or explain why certain events occurred and not others” (p. 25). To fulfill this, I wrote in rich detail about the people, settings, events, actions, conversations of the mathematics methods course, but not my own interpretations of such.

### *Conceptual Ordering*

Conceptual ordering is “classifying events and objects along various explicitly stated dimensions ... to form an overarching explanatory scheme” (Strauss & Corbin, 1998, p. 25).

I made sense of my data by organizing them into discrete codes and categories. Codes are specific markers that I used in my analysis program to label and identify phrases and sentences in my data that might have been relevant to answering my research questions. Some examples of codes and their definitions that I used are provided in Table 2 (see Appendix G for a complete list of the common codes and their definitions).

Then I grouped common codes into categories, which had more general themes relevant to my research questions. For example, I grouped all my codes concerning beliefs about equity and teaching into the category “beliefs\_teaching\_equity”.

Table 2

<i>Code Samples and Their Definitions</i>	
Code	Definition
beliefs>diversity>ethnicity_cultural	beliefs about diversity that deal with ethnic and/or cultural differences
beliefs>teaching>equity>resources	beliefs about equity that get incorporated into teaching to show that anyone can be successful if they work hard in school
beliefs>teachmath>sj>change	believing that teaching math can be a means to bringing about social change
beliefs>tmsj>equal_math_learning	believing that teaching mathematics for social justice is about teaching/learning equally for all students (same opportunities to learn)
tmsj>aid>article	In learning about teaching mathematics for social justice, an aid was an article assigned as reading for the class

See Table 3 for some examples of categories and their respective codes.

Table 3

*Samples of Coding Categories*

	Category 1: beliefs_teaching_equity	Category 2: beliefs_teaching mathematics for social justice (tmsj)
Codes Included in Category	beliefs>teaching>equity beliefs>teaching>equity>resources	beliefs>tmsj>add_on_activity beliefs>tmsj>administration beliefs>tmsj>change beliefs>tmsj>eqdivsj_issues beliefs>tmsj>equal_math_learning beliefs>tmsj>fear_of_offending beliefs>tmsj>no_firm_def beliefs>tmsj>substantiation

I grouped codes into categories to help me synthesize my final findings into manageable themes.

*Theorizing*

Theorizing is the act of constructing from the data a logical, systematic, and explanatory scheme. An explanatory scheme is the part of the theory creating process that tries to explain what happened in the studied phenomenon. A scheme is what I sought because the results of my study are not a predictive explanation of preservice teachers' experiences in learning about teaching mathematics for social justice. Rather, I have sought with my study to enhance understanding about preservice teachers' beliefs and experiences.

*Coding*

Coding is a systematic process of analyzing data in grounded theory, and I used the software program Text Analysis Mark-up System (TAMS) to help me. My coding resembled

the open coding, however I did start with a small set of pre-established codes, such as “beliefs about equity concerning fairness” and “beliefs about social justice and teaching.” Then I began to refine these pre-established codes by rewording, combining, or adding. For example, I expanded the code “beliefs about equity concerning fairness” to “beliefs about equity that relate to equal opportunities”, “beliefs about equity that relate to respect”, and “beliefs about equity that relate to equal resources.” Another example of “refining” my codes was combining the code “beliefs about social justice related to no oppression of minorities” with the code “beliefs about social justice related to equality” to become the new code “beliefs about social justice related to fairness”

I also added new codes as I progressed further with coding. For example, I added the new code “beliefs about teaching mathematics for social justice related a fear of offending someone is expressed” because my case study participants expressed this idea on several occasions. As I progressed with coding, I also weeded out the codes that I realized would not be beneficial in helping me answer the research questions. For example, I had some codes about participants’ beliefs on how to teach mathematics that I realized were not actually related to my research questions. I had originally created the code “beliefs about teaching mathematics using manipulatives” to mark participants’ responses to the presurvey question about what their future goals as a mathematics teacher were. At the time I created the presurvey I did not realize how nonpertinent this question was to my research questions, but once I sufficiently got into the coding I did realize my mistake. Thus, I dropped this specific code.

I knew to stop coding when I reached a point of saturation, meaning that no new categories revealed themselves as I reviewed my data. This occurred approximately after three months.

### Analysis

In all, I had a total number of 47 data sources to code. (See Table 4 below).

Table 4

<i>Data Sources</i>	
Data Source	Number
Presurvey	5
Initial Interview	5
Focus Group Interview	1
Final Interview	5
Post survey	5
Math Biography	5
Journal Entry Assignment	5
Lesson Plan Assignment	5
Fieldnotes	11

After completing my coding, I ran a “code count” on my entire set of codes to see how often each code was used. Any code that was used twice or less, I combined with another or just deleted it, justifying that it was not important enough. Through this process I reduced my initial set of sixty codes to about forty. Then, I proceeded onto checking the reliability of my coding, which is discussed in the later section on trustworthiness and dependability.

To analyze my pre and post surveys, I utilized the Statistical Package for the Social Sciences (SPSS) data analysis computer program. I first wanted to check how well my survey items measured preservice teachers’ beliefs about equity, diversity, and social justice and how they related to teaching and teaching math. I did this with a reliability analysis test.

The reliability analysis test computed Coefficient Alpha values (also known as Cronbach's Alpha values) for all items on both pre and post surveys. The Coefficient Alpha values indicate the reliability of the survey by computing the degree to which items on the same test measure the same thing. Good surveys have items with Coefficient Alpha values equal to or larger than 0.80. Starting with the presurvey, I ran the reliability analysis test on the items and ended up with a Coefficient Alpha of 0.780, which was good but needed improvement.

In order to ascertain ways to improve the Coefficient Alpha value, one needs to look at the values in both the "Corrected Item-Total Correlation" column and in the "Coefficient Alpha if Item Deleted" column in the Item-Total Statistics table that the reliability analysis test created (see Appendix H). I started first by looking at values in the "Corrected Item-Total Correlation" column to see which items might be reversed in order to increase the Coefficient Alpha value. When one reverses an item for a reliability analysis test, one interchanges the values of the responses from the participants. For example, if a participant marked "Strongly Agree" on an item, that response received a value of 4, and if a participant marked "Strongly Disagree" on an item, that response received a value of 1. However, when one reverses an item, any response marked "Strongly Agree" now receives a value of 1, and the response "Strongly Disagree" receives the value of 4. (See table 5 below).

Table 5

*Value of Marked Responses Before and After Reversal in A Reliability Analysis Test*

Marked response to an item	Marked response value before reversal	Marked response value after reversal
Strongly agree	4	1
Agree	3	2
Disagree	2	3
Strongly disagree	1	4

Though reversing an item might seem to misrepresent a participant's true response, the reversal actually brings the item in better correlation with the composite score of the whole survey.

The "Corrected Item-Total Correlation" column indicated that items #7 and #11 from the presurvey should be reversed because they had negative values. If reversed, they might better fit the rest of the items in measuring beliefs. After reversing items 7 and 11 on the presurvey and rerunning the reliability analysis test, I received a new Coefficient Alpha value of 0.842, which was an improvement.

Next, I wanted to figure ways to improve the Coefficient Alpha value by deleting items. First, I looked at values in the "Coefficient Alpha if Item Deleted" column of the Item-Total Statistics table (see Appendix I). This column gave a new Coefficient Alpha value for the whole presurvey if the particular item in question were deleted because items not related to the rest increase the Coefficient Alpha when deleted. Thus, any "New Coefficient Alpha" value in this column that was greater than the original value of .780 indicated that the item should be deleted. The Item-Total Statistics table indicated that the reversed items of #7 and #11 and the regular items of #12, #14, and #15 should be deleted. I

dropped one item at a time to see how the Coefficient Alpha increased. I started with deleting item #11, and received a new Coefficient Alpha of 0.852, which was an improvement. When items #12, #14, and #15 were individually dropped, the resulting Coefficient Alpha value consequently increased. Finally, I examined the new Coefficient Alpha value when I dropped the reversed item #7; and, though it did increase, I decided nevertheless to keep this item because the change was so small (from .896 to .898).

Then I repeated the same processes for items on the post survey. Values in the “Corrected Item-Total Correlation” column indicated that items #7 and #11 would better fit the measure of the post survey if they were reversed (just like on the presurvey). Then values in the “Coefficient Alpha if Item Deleted” column indicated that reversed items of #7 and #11 and the regular items of #12, #14, #18, and #20 should be deleted. After individually dropping these items and checking the new Coefficient Alpha value for significant increases, I ended up deleting all these items save for #7. To summarize my results from the Reliability Analysis test, I ended up dropping items #11, #12, #14, and #15 and reversing item #7 on the presurvey and dropping items #11, #12, #14, #18, and #20 and reversing item #7 on the post survey.

Next, I performed paired t-tests (or dependent means t-tests) to see if the difference in means on comparable items on both surveys were significant. The results of these paired t-tests are discussed in the next chapter on Findings. Then, I performed another set of paired t-tests on comparable items, but this time I distinguished and compared the results between the

case study participants and the non-case study participants. These results are also discussed in the next chapter.

Any reported changes in beliefs from the surveys were supported by parallel shifts in beliefs from other data sources. That is methodologically when I found a shift in beliefs on the survey, I also looked to other data sources to confirm or not confirm that shift.

### Trustworthiness

Establishing trustworthiness is important in grounded theory because it gives worth to the findings of one's study (Lincoln & Guba, 1985). Naturalistic inquiry affords trustworthiness through the following three structures: 1) credibility (truth value), 2) transferability (applicability), and 3) dependability (consistency).

### *Credibility*

Because naturalistic inquiry does not assume a single objective reality, the researcher must try to make sure that the constructed realities of the individual participants are compatible with the ones that the researcher attributes to them in the study (Erlandson, Harris et al., 1993). This is called credibility, and it can be established in naturalistic inquiry research through the following strategies: a) prolonged engagement, b) triangulation, and c) member checks.

### *Prolonged engagement*

The researcher must spend enough time in the context being studied to overcome distortions due to the researcher's presence, his or her biases, and the effects of unusual events. I studied the preservice teachers for the entire length of their mathematics methods

course—14 weeks. Ideally, I would have spent a greater length of time studying the preservice teachers, such as following them into their student teaching, but, as noted in Chapter One, this was a limitation for my study.

### *Triangulation*

In order to help guarantee the trustworthiness and usefulness of the research findings, this study used triangulation of data sources. Triangulation is the use of multiple investigators, multiple sources of data, or multiple methods to confirm the emerging findings (Merriam, 1988). Triangulation is important because it helps establish validity for one's study. I achieved triangulation by using multiple sources of data to confirm emerging findings. For example, as suggested by Yin (2003), in my coding, if a category that emerged from one source of data was not confirmed by two other sources, then this category was not considered valid. For example, as mentioned earlier, I deleted some codes because they were used only once and did not appear in multiple sources.

### *Transferability*

Transferability refers to the extent to which a study's findings can be applied in other contexts or with other respondents (Erlandson, Harris et al., 1993). In contrast to the notion of generalizability, with transferability the reader, not the researcher, decides whether or not the findings can be applied outside the immediate study. The reader does this by recognizing shared characteristics from the original context of the researcher's study that can be transferred to other situations. The reader is able to recognize the shared characteristics through the researcher's use of thick descriptions (Erlandson, Harris et al., 1993). As a

researcher, I reported my data with sufficiently detailed descriptions to “bring the reader vicariously into the context being described” (Erlandson, Harris et al., 1993) and to allow the reader to make adequate judgments about transferability. For example, I provided descriptions of the participants in Chapter Four so that readers may decide if they share similar characteristics to the persons in their own contexts.

### *Dependability*

Lincoln and Guba (1985) define dependability as a process in which the researcher attempts to “determine whether the findings of an inquiry would be repeated if the inquiry were replicated with the same (or similar) subjects (respondents) in the same (or similar) context” (p. 290). However, because the naturalistic researcher assumes that there are multiple constructed realities, he or she is concerned with having trackable variance, not strict invariance, in replication. Trackable variance is “variability that can be ascribed to particular sources (error, reality shifts, better insights, etc.)” (Erlandson, Harris et al., 1993, p. 34). Thus, in naturalistic inquiry, it is important to provide a check for dependability, referred to as a dependability audit. Erlandson, Harris, et al. (1993) write, “The researcher must make it possible for an external check to be conducted on the processes by which the study was conducted” (p. 34). This can be done by providing documentation and a running account of the inquiry process during the study. I did this by two means: a) keeping a reflexive journal during the study detailing decisions and data gathering procedures; and b) keeping copious field notes on the processes of interviewing and observing.

Also as a way to establish dependability, I checked the reliability of my coding.

This reliability coding process began with the training of a colleague in the coding processes for my research. We first reviewed the categories that I had selected for my coding to give her a general sense of what I was looking for in my research. Then we reviewed definitions for individual codes for confusions on the part of my colleague. Once my colleague had received sufficient training, I selected a random sample of 20% of the data sources for her to code and then check against my own work. Out of the total number 130 different instances of coding that we had both used, we had agreement on only 63 instances, which was approximately a 48% coding reliability rate. This was not good enough. So, I reviewed the 130 different instances of coding to see how I could improve the percentage rate of coding reliability. I had three basic strategies: a) condensing codes, b) correcting codes, and c) applying new codes.

I condensed by combining codes that, though worded differently, in reexamination referred to the same notion. For example, I took the code “beliefs about teaching mathematics for social justice related to issues of equity and social justice” and renamed it with the already existing code “beliefs about teaching math and social justice”. I realized that the two codes were almost identical, and therefore it was redundant to have the two similar codes.

The second strategy I employed when my colleague and I disagreed on codes in the code reliability testing process was correcting. If I felt that one person had been more correct

in their selection of code than the other, then I changed the latter's code to the former's. For example, for the lines spoken by Juliana:

Whether it's catching yourself and not only always calling on the children that you know, because it is always the same little eight that raise up their hand, and as an educator you see the ones who are melting away, 'Please, please, don't call me' and then a lot of educators use popsicle sticks for fairly calling on students. (Final interview)

I had coded them "beliefs about teaching mathematics for social justice related to the idea of equal math learning", and my colleague had coded them "beliefs about teaching and equity". In reexamining these lines, I could see that they had nothing to do with teaching mathematics for social justice, so I switched my code for these lines to the one my colleague had used.

My third strategy was applying new codes. When in reexamining lines that we had coded differently and realizing that we were both right, I just added each other's code to each other's lines. Now, a line that originally had only one code now had two correct codes. For example, for the lines:

I do not believe this country's politicians in any way, shape, or form appreciate children with diverse cultural backgrounds. As a result, a great deal of legislation makes academic and scholastic demands of ELL students an uphill journey. (Presurvey, Linda)

I had coded them "beliefs about teaching and diversity" and my colleague had coded them "beliefs about teaching and equity". Since I felt that quote was both about diversity and equity in teaching and that we had both been correct, I gave these lines both codes.

After recoding using the aforementioned strategies, my colleague and I then disagreed on only 17 out of 124 differently coded parts. Thus, interrater reliability was 86%, which meant I had successfully met the required minimum of 80% of coding reliability for the dependability part of trustworthiness in research (see Appendix J).

### Conclusion

In this chapter I presented how I used the methodologies of naturalistic inquiry and case study in my research. I reviewed how each methodology contributed to the framework of my study in its unique way. Then, I presented general methodological information about my study, covering the facts that my participants were undergraduates, of various ages, enrolled in a mathematics methods class that emphasized teaching mathematics for social justice. Lastly, I described the various ways that I generated and analyzed my data, as well as preserved trustworthiness.

## CHAPTER FOUR: FINDINGS

### Purpose

The primary purpose of this study was to examine preservice teachers' beliefs and experiences in learning about teaching mathematics for social justice. The study focused on three levels of beliefs: a) beliefs about issues of equity, diversity, and social justice in general; b) beliefs about how issues of equity, diversity, and social justice relate to teaching (i.e., if and how the preservice teachers perceive themselves as critical educators); and c) beliefs about teaching mathematics for social justice. This study also analyzed the preservice teachers' experiences as they learned about, and then tried to develop for themselves lessons and projects that could be used for teaching mathematics for social justice. The purpose of analyzing their experiences was to document both the positive and negative events of and/or influences on preservice teachers learning to teach mathematics for social justice.

### Introduction

In this chapter, I present the findings of my research. I begin with descriptions of each of the individual case study participants. I include their basic demographics as well as their general dispositions towards teaching and teaching mathematics for social justice. Then I present the overarching themes that emerged from my analysis. I begin with case study participants' beliefs about equity and social justice, and then how they relate these beliefs to teaching. Next, I report on their beliefs about diversity and how these beliefs relate to teaching. Then I discuss findings on their beliefs about teaching mathematics for social justice

and how they evolved during the course. Following that I discuss their perceptions about what was helpful in their learning about teaching mathematics for social justice during the course and what was challenging. Lastly I present a quantitative analysis of the pre and post surveys. I compare and examine the means, standard deviations, levels of significance, and effect sizes (when applicable) between pre and post surveys for all the participants, and then between case study and non case study participants. I then explain how items that showed statistically significant change reflect changes in case study participants' beliefs about the relationship between social justice issues and the teaching and learning of mathematics. These shifts in their beliefs from the surveys were also evident in other data sources.

### The Case Study Participants

The sample of case study participants in my study was quite distinct. In comparison to the traditional samples of white females in research on preservice teachers' beliefs, my sample was a majority of Hispanic participants (Hollins and Guzman, 2005; Green & Weaver, 1992; Hadaway & Florex, 1987,1988; Richman, Bovelsky, Kroovand, Vacca, & West, 1997; Smith, Moallem, & Sherrill, 1997). My participants have had a lot of experiences with diverse populations. This is noteworthy because most other studies on preservice teachers' beliefs are about preservice teachers who do not have these experiences; and thus these other studies provide views and conceptions of a very limited sample. More

specific details about each of the case study participants are provided in the following descriptive vignettes.

*Juliana*

Juliana is a forty-ish, big-hearted woman who passionately identified herself as Chicana on the first day I met her during the presurvey. She is very generous, explaining when I visited her house for the initial interview that the absence of furniture in her living room was a result of her having given it all to a recently divorced friend who had moved into a new apartment. She has wanted to be a teacher all her life, but “life got in the way” (Initial interview, September 10, 2007). She married at the age of twenty, had a child, and waited until her son was in college before going to the university herself to earn a teaching certificate. She loves teaching, and spoke passionately about a time in grade school when a teacher took her and her classmates to the university and in the main plaza explained to them that that they could all go someday if they really wanted.

She recognizes that a role she plays when teaching is confidence builder, believing this arises naturally from the “mother” in her. When she circulates throughout the classroom she tells me that she likes to say something constructive to each student, such as “You have such neat handwriting” or “That’s a wonderful, different way of working out that problem.” She finds the labeling of schools by the state’s education department a horrendous practice because of the potential effects on the morale of the parents and the children.

She is very interested in promoting knowledge of Chicano culture, and she is very big on promoting community as a cultural value. For example, as a mathematics teacher one of her goals is to create community math trails to liberate her mathematics students from the confines of the classroom and reconnect them to their community. “This is important to me to show the students that math is real, math is everywhere, and math is in their daily lives and in their community as well not only in their classroom” (Mathematics biography, August 29, 2007). She is interested in pursuing teaching mathematics for social justice when she becomes a regular teacher because she believes it will help make students more socially aware and “[possibly they will] participate in change for the better as they get older.” (Final Interview, December 10, 2007).

*Javier*

Javier is a young, Hispanic man, who seems concerned about having an orderly and just society as evidenced by his numerous statements about the importance of establishing good and just laws and having people follow them. He also strongly believes in the importance of adolescents staying in school so that they can have “opportunities” in life. His Dad explained to him in high school that either he needed to find a job, or study hard so he could stay in school and have opportunities. With his Dad’s encouragement, Javier stayed in school, studied hard, and succeeded going to college (whereas many of his cousins got into trouble early and/or dropped out of school). As a teacher Javier wants to work at an elementary with a large Hispanic population so he can act as a role model for these students.

He wants to show that a Hispanic person, despite economic hardships, can succeed in school and go to college. Javier wants to inspire his students so that they believe they can do whatever they want to do in life:

[Students] can do almost anything they want as long as they have that inspiration and I have always wanted to provide that inspiration. Make them feel like that they are capable of anything as long as you know, as long as they do their work. (Initial Interview, September 18, 2007)

Javier expressed keen interest in learning about teaching mathematics for social justice. He is very interested in mathematics, claiming to see mathematics frequently in his day-to-day routines, such as the number and/or shapes of objects on buildings as he walks around campus. Whereas his education in mathematics has been very traditional and “cold” (Initial interview) he wants to teach mathematics in both a relevant and exciting way to his students. He believes that culturally Hispanics are not as interested in mathematics as in other academic skills, such as reading and writing. He would like to help change this so his students may one day become scientists, mathematicians, and other technical professionals.

#### *Linda*

Linda is a young (early twenties), white female who eagerly waits to start her first year of teaching in a school with a diverse student population. She explained that her interest in social justice started as a child when her parents frequently discussed social justice issues at the dinner table. She had contemplated earning a college degree to become a civil rights lawyer, but she chose instead to become a teacher. She rationalized this decision by realizing that there are already enough very educated, socially conscious, and well-paid lawyers

whereas the education field doesn't attract nearly as many people who regard issues of social justice with high importance.

Her goal as a future educator is "to work with the students in our society who I think are all too often overlooked, undervalued, and underestimated." (Initial Interview, September 21, 2007). As a teacher she wants to present new material so that it connects to the students prior knowledge and experiences, believing that this helps students tremendously. Also as a teacher, she believes that it is very important to know her students well. She wants to know what they are passionate about so she can use their interests in motivating them to learn. She is also very interested in promoting civic responsibility in her students. Linda told me, "It becomes the role of an educator to help people realize that we all have a place in society" (Initial Interview). Thus, she was very open to the idea of discussing social justice and democratic issues in the classroom.

As a mathematics teacher she wants to move away from direct instruction as much as possible and "[allow] for construction of knowledge to happen within a community of learners." (Focus Group Interview, October 17, 2007). She wants to provide her students opportunities in mathematics to solve problems actively on their own, rather than passively watching the teacher solve them in front of the class. Her rationale for this is that she believes a major problem with mathematics pedagogy today is that "We teach math as a disjoint bag of tricks...to be memorized and applied in certain situations. People never really

come to appreciate or understand the true concept of what math is.” She believes that less emphasis on directing instruction will be beneficial to all students, especially her English Language Learners, because they will be able to utilize more of their own prior knowledge and experiences in the learning of mathematics.

*Elena*

Elena, like Linda, is a young (early twenties), white female. Also, like Linda, she feels an affinity to work with students from less wealthy areas of the city, explaining that her interest arises from having grown up and attended schools in a low socio-economic status area of the city. She feels that schools often do not have children’s best interests in mind, not intentionally, but because “things need to be thought out better” (Initial Interview, September 17, 2007). When asked to clarify what she meant by this, she responded that as a teacher, she wants to emphasize critical thinking and problem solving in her classes, which she feels are not stressed enough in today’s schools just because they do not fit into the curriculum. She is also skeptical about teachers being asked to use scripted lessons, especially after having to go through a teacher education program. However, she does feel that accountability in education is important so that, “Teachers [can] be great and, like all the students, should meet all the standards” (Initial Interview). She is against scripted lessons because she believes that there are ways for a teacher to teach to the standards and meet the goals set by the State Department of Education without having to ignore the individual teacher’s creativity, training, and personal experiences. For her mathematics teaching, she

wants to explain the “whys” behind calculations and formulas because she found these helpful when she was learning mathematics as a student. However, she also realizes that, “the whys that makes sense to me might not work for everybody else” (Initial Interview). As a consequence, she thinks she will use many different approaches and explain things in different ways to reach as many different students as possible in her future teaching. To this end, she wants to incorporate lots of hands-on activities in mathematics. She was very interested in learning about teaching mathematics for social justice as yet another way to connect mathematics to her students. Also, she thought that teaching mathematics for social justice would be a great way to help her students to “be more aware of more people and more peoples’ situations” (Initial Interview). Though at the beginning of the course she was very confused about exactly how a teacher would do this, by the end she felt much more comfortable. She realized through assigned readings and course projects how teaching mathematics for social justice could be hands-on for her students and an approach that helps teach the whys of mathematics.

### *Nataly*

Nataly is a young Puerto Rican woman who is interested in teaching early elementary. She is a very pleasant, friendly person--the type who could easily strike up a conversation with a stranger while waiting in line at a grocery store. Nataly was raised by two Dads, which may make her more sensitive to issues about homosexuality and traditional

marriage. She is reticent about telling her students about her upbringing by two Dads, but feels that it would be good for them to hear about.

She believes that effective mathematics teachers are those who generally take interest in and provide many different learning opportunities to their students. For example, she believes in the value of allowing her mathematics students to use manipulatives in her class because “[manipulatives] make the math ideas more accessible for everyone to understand...[The students] are using a different sense, like feel, they are looking and feeling” (Initial Interview, September 18, 2007). She does not believe that it is fair to rely exclusively on timed tests or math drill sheets to assess her students because “that is taking away the whole concept of math because...you want them to understand what really  $9 \times 5$  means and not just that  $9 \times 5$  is 45” (Initial Interview).

Nataly is interested in the idea of teaching mathematics for social justice, but had a hard time at the beginning of the study conceiving what it could be and how she would actually go about implementing it in her classroom. She is interested in pursuing teaching mathematics for social justice when she becomes a teacher, believing it is a good way for her students to “better [see] math as not just a set of numbers but like a tool to see the world...to do things and fight for causes that they believe in, just as social rights that they have” (Final Interview, December 4, 2007).

### Cross-Cutting Themes

To begin, I present cross-cutting themes related to participants' beliefs about equity and social justice. Though I had set out to report separately on the case study participants' beliefs on equity and social justice, I decided to discuss them together because the case study participants frequently used the two terms to refer to the same idea. For example, in the presurvey, Linda defined equity as, "Everyone gets what he/she deserves" and social justice as, "Members of a society... have the same entitlements." For Linda both equity and social justice refer to the idea of people getting what they need and/or deserve. As another example, Javier in the post survey defined equity as, "Making sure that everything is distributed fairly" and social justice as, "Deals with fairness in society." Though his definition of equity is limited to the act of distribution, both terms refer to the same idea, the notion of fairness in society. Therefore, instead of discussing separately themes about preservice teachers' beliefs on equity and social justice, they are discussed together.

#### *Beliefs about Equity and Social Justice*

##### *Equity and Social Justice as Equal Opportunities*

The case study participants thought that equity and social justice were about people having opportunities and access to resources to succeed in society. For example, the belief that all people should have access to resources was reflected in the participants' answers to the item on the presurvey that stated, "All members of a democratic society are entitled to an equal share of society's resources." All five case study participants marked "Strongly

agree”. Representative of their belief that equity is about opportunities for all, Linda defined equity on the presurvey as, “Everyone gets what he/she deserves or needs to achieve success.” Though all participants in general believed that equity and social justice were about having opportunities and access to resources to succeed, there were subtle variations in their perceptions.

For example, in the presurvey Juliana wrote, “[Equity is] equality for all, equal conditions and opportunities.” When I asked her to explain her definition more during the initial interview, she recounted the following story:

I went with my husband to the brand new elementary, Villa D’Oro Vista [in a wealthier part of the city], and it was more like a junior college. I mean the classrooms were in different pods and they had these wonderful windows and it was just unbelievable the resources that they had...I was just in awe. Of course, their taxes are higher and they just had everything. And I go to Lincoln School [in the poorer Southside] and I see teachers begging for a box of Graham crackers,...for Kleenex, and for reams of paper. These people don’t have money as it is; they are low income. ... That’s my version of the haves and the have-nots.” (Initial interview)

Juliana perceives the inequity in educational opportunities in the city; those students and teachers in the richer areas go to schools with more and better provisions while students and teachers in the poorer areas have to get by on what little they have. Javier expressed a similar opinion to Juliana’s. Though he successfully graduated from high school, Javier did not feel that he had the same extra-curricular opportunities, such as playing in the school band, as those students who came from wealthier families. “[As a child] I understood that we did not have as much money as other families did or that I couldn’t do the same things

because I did not have the same opportunities that other kids my age had” (Initial Interview). Later in the same interview, he told me that he hoped that by having the opportunity to attend college, he would be able to provide more opportunities for his children than he had experienced as a child. Thus, Javier too could see the inequities in education that some students encounter, an understanding that was informed by personal experience. This was also true for Juliana. She remembered as a ninth grader “playing softball as a pitcher and going to other schools and you would look at them and you would say, ‘Wow, I want to go to this [school]; I don’t want go to [my school].’ Even the display cases were like, ‘Wow!’ I was in awe and impressed” (Initial interview). Like Javier, her understanding of the inequities in schooling was informed by personal experience.

The other three participants also expressed views that equity and social justice are about having equal opportunities to succeed. They also gave examples concerning schooling; they felt that schools in this state were inequitable because they were not providing opportunities for all students to succeed. Some schools were not perceived to have sufficient resources (Nataly), some schools to have higher percentages of bad teachers (Elena), and some not to meet adequately the needs of special populations of students, such as English Language Learners (Linda). All participants framed their examples of equity and social justice in society around schooling. Linda specifically linked inequities in schooling to language, while the rest linked them to social class or economic status. Whether they saw inequities

concerning school facilities, supplies, and/or extra-curricular activities, participants perceived these various inequities as connected to the students' opportunities to successfully get a high quality education.

*Beliefs about Equity and Social Justice as They Pertain to Teaching*

Next I discuss participants' beliefs about equity and social justice as they relate to teaching. These types of beliefs fall into two categories: a) teachers have a responsibility to provide opportunities for all students to succeed in their classrooms, and b) teachers need to act as critical agents for the students.

*Teachers Have A Responsibility to Provide Opportunities for All Students to Succeed*

The participants' perspectives about teaching reflected their beliefs about equity and social justice; they felt that in their teaching they should provide opportunities for all students to succeed. For example, on the post survey Linda defined equity in teaching as the condition where, "everyone gets what he/she deserves or needs to achieve academic successes."

Further elaborating her beliefs about equity and social justice in teaching, Linda said in the final interview,

In education, social justice means that the classroom setting is set up so that every student is presented and provided with an opportunity to learn. And it's not necessarily... that every student gets the same thing; it's that every student gets what he or she needs to make learning possible.

Linda clearly expressed that it is the teacher's responsibility to make sure that all students are provided with opportunities to help guarantee their individual success in learning. And she

made it very clear that this does not mean treating all the students the same, but meeting their individual needs.

However, what does it entail to meet the individual needs of a diverse group of students? Nataly expressed this concern when she said during an interview, “I’m definitely concerned about like giving all my students what they need to kind of succeed in whatever that they are learning in that moment but it’s so difficult because each student needs something different” (Final Interview). Though Nataly was concerned about being equitable in her teaching and providing all students opportunities to succeed, she realized that it would be difficult. One way she thought she could do this was by making more provisions for those who are behind so that they may catch up with others. Nataly wrote in her post survey, “By equitable I mean ...that some students need extra resources to succeed in the lessons or meet state requirements.”

The other case study participants also felt helping students to succeed in school was important. Interestingly, Juliana and Javier expressed particular interest in helping Hispanic students, while Elena just spoke in general terms about helping all her students. This difference probably reflects Juliana’s and Javier’s explicit desire to be role models for Hispanic students, an idea that will be further discussed in the section about beliefs about diversity in relation to teaching.

*Teachers Need to Act as Critical Agents*

The case study participants also felt that it was important for a teacher to make students aware of issues of equity and social justice in the classroom in order to help make the students more aware about their world. Linda said during a discussion in the mathematics methods course, “In my personal opinion, we should be trying as teachers to raise social awareness” (Fieldnotes, October 3, 2007). Linda felt it was very important as a teacher to act as a social agent and raise students’ understandings of social inequities and injustices so they could feel empowered. According to Linda, by being more aware of what is happening around them, students are more likely to speak out against what they feel is wrong. Like Linda, Nataly said:

I think topics about social justice are really hard to talk about, but when students... are in school the most amount of their time as children, that’s when they learn the most about the world and how we govern it and how we treat people and how life is lived.” (Initial interview)

She too felt that it was important for students’ social awareness to be raised so that they could better understand the world that they live in.

The other three case study participants also expressed interest in discussing equity and social justice issues in their classrooms. They too thought the students would benefit from knowing these issues so that they could speak or act out against them. Javier even thought that every person is accountable for the ways things are in society; and, therefore, people need to strive to make improvements. He stated,

The world is the way that it is because we made it that way. It didn't just happen. It's this way because someone didn't do something. So, the only way to change it is if you take it into your own hands and you do something about it. (Focus group interview)

This is an interesting point of view because it is so easy to blame someone else for one's misfortunes, rather than looking at how one creates them oneself.

The participant's strong interest in discussing equity and social justice issues in their classrooms is supported by their answers to two items from the surveys: item #1 which stated, "Teaching about issues of equity, diversity, and social justice is an appropriate practice for a teacher", and item #3 which stated "I feel comfortable with the notion of discussing issues of equity, diversity, and social justice with my future students. The participants all marked "Strongly agree" to these items, save for Elena who marked "Agree". Both their answers to items #1 and #3 on the surveys, and their answers and comments in the interviews and class discussions, reflected participants' beliefs that teachers should act as critical agents and address issues of equity and social justice in the classroom.

In summary the case study participants thought that equity and social justice were about people having opportunities and access to resources to succeed in society, regardless of one's race, gender, economic status, (etc.) They believed that barriers to these opportunities and resources were based on class and language differences. These barriers resulted in inequitable schooling situations, where white, rich students tend to go to schools with better facilities, teachers, and resources. To counter these inequitable and/or unjust trends in

schooling, the case study participants believed it was the responsibility of the teacher to provide opportunities for all students to succeed. This does not mean to them treating all the students the same, but striving to meet their individual needs through extra resources, extra help, (etc.) They also believed that teachers need to act as critical agents by making students aware of issues of equity and social justice in the school, the community, and the world. They felt that this would help the students become more socially aware and perhaps more willing to speak up and/or act out against inequities and injustices they perceive in the world. The case study participants did not all feel exactly the same on issues of equity and social justice; however, the generalizations in this summary capture the essence of their beliefs.

#### *Beliefs about Diversity*

Beliefs about diversity followed two different themes: (a) diversity is more than just differences in race and/or ethnicity, and (b) ethnic and/or cultural representations of minorities in popular culture are sometimes malevolent. I discuss beliefs about diversity as a separate category from equity and social justice because the case study participants perceived of it in this fashion. Their views on diversity were quite distinct from those on equity and social justice.

#### *Diversity is More Than Just differences in Race and/or Ethnicity*

The case study participants perceived diversity in a complex fashion. Rather than diversity being about differences in only race and/or culture, to the case study participants diversity also included the differences in social economic status, sexual orientation, academic

abilities, (etc.) For example, Elena said when defining diversity, “It’s not just ‘Oh, there are different races and that’s diversity’. There’s diversity in how people think and how they act and the backgrounds they come from and the things that they do in day to day life” (Initial interview). Like Elena, Nataly expressed a more in depth view about diversity.

Talking about the school where she was student teaching, she said:

Because if you really do have a diverse class, like not diverse as in Che Guevara Elementary where like 90% of the students are Hispanic. That’s not diverse. Diverse is where you really have different ethnicities, different levels, people from different social economic classes. (Initial interview)

Linda thought that diversity enriches American culture because it brings different languages, customs, foods, (etc.) to our society, while Javier and Juliana expressed beliefs about diversity similar to Elena’s and Nataly’s. However, Juliana voiced concern that the term race, often used when discussing diversity, is nebulous. She said,

How would you define race? It’s gets really funky. You can’t say we are this or that. I can’t really define it. It’s a box that you have to fill in. For example, the word ‘Hispanic’, the government created it. But, people are touchy about being labeled. People usually define race by skin color, but we can’t really do that. We are different than that; we are more than our skin color. In my own family, we could be labeled ‘Hispanic’ or ‘Chicano’, you can also find French blood in us as well as indigenous. (Initial interview)

The case study participants had rich perspectives on diversity possibly because they had previous experiences (especially for the non-white participants) in dealing with diverse populations. Or possibly they felt inclined to give more rigorous definitions and answers because they were participating in a study. For whatever reason(s), the case study participants showed more complex perspectives than might be expected from a group of

preservice teachers. As reported in Chapter Two, Hollins and Guzman (2005) found that the majority of teacher candidates, who were white, middle-class, and suburban or rural females, have limited experiences with and views on diversity. The group of case study participants in my study did not match Hollins and Guzman's findings most likely because of the location of their university. Hollins and Guzman reviewed studies that took place at universities and colleges primarily in the Midwest, while my participants were from a large city in the southwest, an area of the country that has a more diverse population. Thus, my sample of preservice teachers was quite distinct; most research in the field of teacher education has focused on white, suburban females. The participants in my study were a more diverse and, therefore, unique representation. Three identified themselves as Hispanic, two were bilingual teacher candidates, and one had same sex partners as parents. Thus, the opinions and beliefs expressed by my sample of preservice teachers were quite distinct in a field of study that seems to primarily focus on white, suburban females.

#### *Malevolent Ethnic and/or Cultural Representations of Minorities in Popular Culture*

The second theme in beliefs about diversity was that ethnic and/or cultural representations of minorities in popular culture are sometimes malevolent. Three of the five case study participants (all three of whom demographically identified themselves as non-white) expressed indignation about cultural and sexual stereotypes of minorities. They didn't like how people like them were portrayed based on other people's biases, prejudices, and/or misconceptions. For example, Juliana recounted an incident with a family member concerning what it meant to be Mexican-American:

I remember my father-in-law saying ‘Nobody even speaks English like Mexicans anymore.’ And I said what does that mean. And he said ‘No one has accents.’ And I said, ‘Doo you whaant us to staart tawking like dis, mahn?’ He had upset me. (Initial interview)

Juliana was offended that another person, even another Mexican-American, could hold such a closed-minded view about her ethnicity. Javier too expressed concern about how minorities were represented, but his example was about the American movie industry:

That reminds me of a documentary that I saw about Disney movies and how in the movies there are subliminal or sometimes even blatant stereotypes about minorities.... If you look at those movies, they give out all these messages and the kids might not realize that they are taking them in and go home tell everyone, ‘Oh, I think this about minorities now.’ It slowly seeps into their minds and it just develops, develops, and develops until they subconsciously believe it. You know, just how all the villains are made to be ethnic groups and the princesses are always blonde, perfect figures, and stuff like that.” (Final interview, December 4, 2007)

Javier expressed concern that representations of whites and non-whites in popular culture were subtly influencing children to have misconceptions and distortions about the physical appearances and characteristics of different ethnicities. He was afraid children would unquestionably accept that what Disney portrayed as socially desirable in one’s appearance. Lastly, Nataly expressed a concern about another minority issue—homosexuality. As mentioned earlier, Nataly was raised by two gay men, which apparently has made her more sensitive to issues about homosexuality and traditional marriage. For example, in discussing issues she was concerned about, she said:

A big issue is ...[do] gay parents ...raise gay children? ... [Do] straight parents raise straight children? They obviously don’t. But, so that’s like one of the biggest issues regarding same sex adoptions ...I was raised by two gay

guys. And, so when I hear stuff being talked about, like homosexuality or how it's bad or even in the classroom, it can be uncomfortable if people say all the time, "Oh, you're gay." (Initial interview)

Nataly was upset that people naturally assumed that she was gay just because she had gay parents. It's interesting that the case study participants who were non-white expressed concerns about how minorities were stereotypically represented and/or perceived. It is possible that they are much more sensitive to these issues as a result of their personally being affected by it in their everyday experiences. In contrast, Elena said that though she experiences slights or indignities during her everyday life, she ignores them, rationalizing that it is "just how life is" (Initial interview) and tries not to let them get her angry or indignant. The view that the non-whites experience the effects of stereotyping and/or prejudice more in their everyday life is supported by the results of the survey item that asked participants to respond to the statement, "I have personally experienced inequities and/or injustices based on my ethnicity, cultural heritage, linguistic background, race, class, sexual orientation, and/or gender." The two white participants marked "Strongly disagree" and "Disagree", while two of the non-white participants marked "Strongly Agree" and "Agree" and the other marked "Disagree". The results from this survey item seem to indicate that the non-white participants agreed to a stronger degree to the statement about personally feeling inequities and injustices in their lives than the white participants. It may be that the more a case study participant personally felt inequities and injustices, the more likely he or she was to perceive negative representations of themselves in society.

*Beliefs about Diversity as They Pertain to Teaching*

Participants beliefs about diversity as they pertain to teaching emerged in two cross-cutting themes: a) teachers, especially whites, need to remain open-minded to students who are “different” (racially, economically, religiously, etc.) from them, and b) minority teachers need to act as role models in getting minority students to succeed in their K-12 schooling and go to college.

*Being Open-Minded as a Teacher*

In order to be an effective educator in an increasingly more diverse United States, the case study participants expressed the opinion that a teacher needs to be open minded to students and accepting of their differences. Otherwise the teacher can dangerously fall into stereotyping students, not understanding them as individuals, and ultimately hampering their educations. For example, Juliana, in giving advice about teaching minority students, said, “Don’t stay closed-minded...Just go in there and understand that all these kids come from varied backgrounds” (Final interview, December 10, 2007). Linda stated a similar belief about diversity and teaching when she said, “Be one who accepts that your students come with a diverse and a beautiful bouquet of experiences which you can build on and help them to come to greater understanding in all curriculum areas” (Initial interview). Linda and Juliana both advise that a teacher needs to be open-minded towards his or her students.

Two case study participants who were minorities expressed concerns that some white teachers, because of their upbringing, might be close-minded about students who are different from them. Juliana expressed her concern towards the beginning of the course.

Maybe it's my prejudice but a lot of [white females in this course] are sorority girls and they have their views. They come from [wealthy parts of the state] with their affluent families and I can understand why they see the Southside as a scary, intimidating, frightening, unsafe place. But, instead of learning from it, they are actually falling into name-calling, making stereotypes. (Initial interview)

Juliana did not base her judgment merely on these young women's economic status. She recited examples of conversations she overheard; she was astounded and saddened by how prejudiced some of her white classmates seemed to be. Juliana quoted one student she overheard, "I don't even know how to get [to the school where I am placed]. I can't even believe that they placed me here and I hear a lot of bad things....My friends said you will hear shots while you are working there" (Initial interview). Juliana then commented on this:

I don't know if they thought there would be drug deals going on in the hallways of the elementary school or if they were going to encounter gangsters at every corner... Hearing their comments, it makes me wonder what type of educators they are going to be. (Initial interview)

Javier, who had also expressed concern about stereotypes, held a similar belief to Juliana's regarding teaching and diversity:

Growing up in [poverty], it kind of opens minds. It let me see that there is a lot of good to be done. Maybe, and I'm not trying to belittle other people, but I just think that some of the other girls in [this] class don't understand that or maybe a lot of the people here don't understand what that is like. They don't

see that everyone starts off the same and that the opportunities that we are given is what shapes us into who we are now.” (Initial interview)

Javier was concerned that because some of the young white preservice teachers in the course did not have first-hand experiences with living in poverty, they may not be able to relate to their students who do. Like Juliana, Javier feared that they might hold stereotypes that would interfere with the effectiveness of their teaching of the minority students. Also like Juliana, Javier was concerned that some of the young white preservice teachers do not have life experiences that would open their minds to the living situations of their students. It is interesting that the case study participants who expressed concern over the stereotyping of minorities held stereotypes themselves of affluent white females.

The white female participants did not express stereotypes of white preservice teachers nor of the non-white preservice teachers. However, Linda felt some types of teachers were not very willing to work with diverse populations. However, instead of phrasing it in terms referring to rich, white sorority women, Linda stated her belief in terms of ignorance:

I think ignorance is sometimes bliss. And if we choose to think that things are going well, we then don't start looking at things for what they actually are. And, in doing so, we kind of cripple... ourselves in terms of a very human level of connecting to the people that we are around in a day to day basis.

Linda, like Juliana, believes that some preservice teachers do not know how to connect to all their students because they are not willing to see them for who they really are. However, instead of putting it in terms of economic status or skin color, Linda phrases it in terms of a

human fault, ignorance, that all people are susceptible to, not just rich sorority women. The other white case study participant, Elena, made no specific stereotypes about any of the preservice teachers when teaching students who are different from them. However, at one point in the study she hinted that she was uncertain if she would be able to handle teaching. She said:

I think there's problems in all schools ... and it becomes a lot about politics but, my concern is I'm becoming a teacher because I want to teach kids and there's a lot of stuff that I will have to deal with and it's very easy for me to be optimistic now, as opposed to this time next year when I'm actually in a classroom with students. (Initial Interview)

She did not make clear what her actual concern about teaching was; she just said that she was scared. She may have felt unprepared to deal with all the different types of students she would have as a regular classroom teacher.

#### *Minority Teachers as Role Models for Minority Students*

The minority case study participants also felt that they wanted to be role models for students who were of the same minority. They expressed a desire to show their students that they could succeed in school and go to college. They probably felt that they wanted to fight the stereotype that minorities can't do as well as whites in school by showing that they could. For example, Juliana told me the story about one of her elementary teachers taking a group of students, including Juliana, to the university and telling them they could all go there if they really wanted to. Juliana, who had been strongly influenced by this event, said:

And I want to show them that they can do it. They can do it too. If I could do it at my age [early forties] and to see a Mexican American say, “My teacher went to this school and became a teacher. I can do it also.” (Initial interview)

In the final interview Juliana reiterated this idea; “I want them in a major university. I want them to see what it is like. And, I want to tell them while we’re standing there ‘You, all of you, can come here if you want to. You can make it here’” (Final interview). Javier, like Juliana, wanted to be a role model for Hispanic students, but in terms of getting them interested in mathematics. He said:

I just never have felt that math is an important thing in [Hispanic] culture, and maybe that kind of inspires me to make it an important thing in our culture. Finding a way to connect it to my own culture and then using that to help kids in school, like at Che Guevera Elementary, where the Hispanic population is over 90% and just kind of changing things around for them. Helping them find meaning. Showing them that [mathematics] can be part of our culture.” (Initial interview)

Javier was interested in fostering Hispanic students’ interest in mathematics, a gap that he thought was culturally based. He explained to me that in Hispanic culture mathematics “wasn’t a big thing” (Initial interview), but to himself mathematics was very important. Thus, he wants to show his students how important mathematics is in their lives, even though he feels that it is not emphasized in Hispanic culture.

Though Nataly, also a minority participant, did not talk explicitly about being a role model like Juliana and Javier did, she wanted to discuss the issue of same-sex marriages and partnerships in her classroom. However, she felt it might be inappropriate.

I have to teach a social studies lesson next week on families and like how different families are. And you go, there's this line...do you say something that people see as inappropriate to talk about, like having two Dads, or two Moms. (Initial Interview)

Nataly seemed interested in being a “role model” in progressive thought towards same sex marriages and partnerships, for she herself was raised by same-sex parents. However, she was more hesitant about being a role-model than either Juliana or Javier. In fact, neither of the white participants talked explicitly about being role models as teachers. For example, on both the surveys, in response to the open-ended question, “How would you define your role as teacher”, Elena and Linda discussed being a facilitator to the students’ learning, where students are allowed to explore ideas and concepts rather than merely being told about them. Being a facilitator is much different than being a role model because a role model makes him or herself an example for others. A facilitator merely helps others to be themselves without necessarily trying to pass on one’s own beliefs or behaviors. Elena and Linda probably held these teachers-as-facilitators beliefs because they both expressed in their presurveys that they were interested in letting students explore mathematics.

In summary, beliefs about diversity followed two different themes: a) diversity is more than just differences in race and/or ethnicity, and b) ethnic and/or cultural representations of minorities in popular culture are sometimes malevolent.

The case study participants showed complex perspectives; and, the non-white participants felt more personally connected to issues of diversity than the white participants. Participants

beliefs about diversity as they pertain to teaching emerged in two cross-cutting themes: a) teachers, especially whites, need to remain open-minded to students who are “different” (racially, economically, religiously, etc.) from them, and b) minority teachers need to act as a role model in getting minority students to succeed in their K-12 schooling and go to college. Two case study participants who were minorities expressed concerns that some white teachers, because of their upbringing, might be close-minded about students who are different from them. Linda voiced a similar concern, but in terms of ignorance and not skin color or economic status. Lastly, the minority case study participants felt that they wanted to be a role model for students who were of the same background.

#### *Beliefs about Teaching Mathematics for Social Justice*

In this section I discuss the participants’ beliefs about teaching mathematics for social justice and compare and contrast them at the beginning of the course to those held at the end. I also weave into this section discussions of their beliefs about equity, diversity, and social justice and how they relate to teaching mathematics.

#### *Beliefs about Teaching Mathematics for Social Justice at Beginning of Course*

At the beginning of the course, the case study participants’ perspective of teaching mathematics for social justice fell into either of two general categories: either the participants a) had no real conception of what teaching mathematics for social justice was, or b) thought that teaching mathematics for social justice meant just treating all your students equally in the mathematics classroom.

*No conception of teaching mathematics for social justice.* In the initial interview when asked to define teaching mathematics for social justice, Juliana said, “First of all, it’s interesting...just say the word math and how many people just cringe, let alone throwing in additionally the words social justice...what does that mean?” (Initial interview). Juliana’s comment reflects the uncertainty that the case study participants had in even trying to define the term for themselves. Nataly expressed similar sentiments to Juliana’s about not comprehending what teaching mathematics for social justice was. “To hear about social justice being even related to math, I’m just like “What?” (Nataly, initial interview). Javier expressed the same puzzlement when asked to explain his definition for teaching mathematics for social justice:

That definitely made me think...how do you [teach mathematics for social justice]? How do you incorporate that into a math lesson? I can see incorporating other things into a math lesson, but social justice, diversity, equality? (Initial interview)

These case study participants were confused at the beginning just because they had never heard or thought before of connecting mathematics to social justice. It was new to them. The initial conceptions of teaching mathematics for social justice of the other two case study participants are discussed in the next section.

*Teaching mathematics for social justice as equal mathematics instruction.* The other perception at the beginning of the course was that teaching mathematics for social justice means that teachers treat all their students equally. For example, in defining teaching

mathematics for social justice on the presurvey Elena wrote, “students all have an equal and fair opportunity to learn and be taught mathematics” (Presurvey). Similarly, in the presurvey Linda defined teaching mathematics for social justice as, “allow[ing] all students fair opportunities to acquire and learn the curriculum.” This may arise out of their perception that social justice is about equal treatment, so when given the term “teaching mathematics for social justice” they connected the act of teaching mathematics to the notion of equal treatment.

*Beliefs about Equity and Social Justice and How They Relate to Teaching Mathematics.*

Case study participants’ expressed beliefs about how teaching mathematics through social justice gives students opportunities to succeed in fighting against injustices and inequities. They believed that mathematics creates the numerical data that support and give credence to one’s arguments against injustices and inequities. For example, in a journal assignment Javier reflected, “I think that by presenting children with examples of how some individuals use math for their own personal gain, we can also show them how to use math to fight back in a just way” (Journal assignment, October 1, 2007). Nataly expressed this same thought; “[The students] see that math can be used to support a social justice issue right at hand” (Journal assignment, October 1, 2007). Like Javier and Nataly, Linda also believes that mathematics can be used in the struggle for social justice:

Math [is] a great “substantiator”. That is it’s not just a bunch of number crunching; it is this problem solving base that if we think that things are not

fair, and we think that inequities are occurring...math is what takes [an argument] to the next level and makes it legitimate. (Final interview, November 30, 2007)

The case study participants' perspective that mathematics can be used to support social justice was also reflected in their responses to one of the Likert scale items on the presurvey. Item number five read: "Mathematics can help students learn about social justice issues." Three of the case study participants marked "Strongly Agree" and two marked "Agree" to this statement. Their responses reflected the belief that mathematics is a tool that can support students' understanding of social justice issues.

#### *Beliefs about Teaching Mathematics for Social Justice at End of Course*

By the end of the course the case study participants' views about teaching mathematics for social justice had evolved and grown more complex. Instead of having no meaning or just meaning equitable treatment in mathematics classroom, teaching mathematics for social justice now had expanded to mean the following: a) incorporating equity, diversity, and social justice issues into the mathematics curriculum to raise social awareness, b) making the mathematics curriculum relevant to the students' lives, and c) increasing students' knowledge of mathematics.

*Incorporating equity, diversity, and social justice issues into the mathematics curriculum to raise social awareness.* Having no real ideas at the beginning of the course of what teaching mathematics for social justice was, by the end of the course Juliana believed that it was about making students more socially aware. Juliana had previously limited her

conception of teaching mathematics for social justice to calling on boys and girls in the class equitably. She said, “This class has taught me a lot...because, in a sense I was aware of [teaching mathematics for social justice] only with gender. This [now] means...helping the students to become socially aware of real world situations and how [those situations] apply to them” (Juliana, Final interview). Similar to Juliana, Javier said:

Teaching math for social justice means using real life examples that are meaningful to students in a way that it gets them to understand things that they may not realize about our society that are unjust. Using things that hit closer to their home, things that they would understand. (Final interview)

Javier further explained that he thought one approach to letting students explore social issues using mathematics would be to create projects so that students would have either several class periods or several weeks to study one issue. Like Juliana, Javier believed that teaching mathematics for social justice could be used to help students better understand injustices in their world. He also expressed the idea that teaching mathematics for social justice was about using real life examples to make the mathematics curriculum more relevant to the students.

*Making the mathematics curriculum relevant to the students' lives.* The notion that Javier expressed above was also expressed by Linda and Nataly. These three case study participants believed in the importance of making the mathematics curriculum relevant to the lives of the students. This relates to their beliefs about diversity as respecting the differences

of students. For example, Linda believed that it is a problem that “universal” mathematics problems in traditional textbooks do not necessarily connect to all students. She stated:

I think another way of doing this is, in the context of word problems, making sure that you choose word problems that actually reflect the knowledge your class has...For example, if you start talking about snow days, and you have a bunch of students who have no idea what a snow day actually is, for them to do the math might not be so universal. You might have to take the time to actually construct word problems that associate to your students’ lives. (Final interview)

Linda acknowledges in her quote that the teacher will most likely have to create his or her own mathematics problems. So, matching the mathematics curriculum to the lives of diverse students would likely take extra work on the part of the teacher. Nataly said the following about making the mathematics curriculum relevant to her students’ lives:

If you decide that... you teach better from relating the material to the students and not relying on the textbooks and handouts, then by doing that you are already in kind of like the arena of where you are teaching kids for social justice. (Final interview)

This comment by Nataly is interesting because it suggests her belief that teaching mathematics for social justice is about making the mathematics curriculum relevant to the students’ lives. This links back to the claim in Chapter One that teaching mathematics for social justice supports NCTM’s (2000) Curriculum Principle, which states, “School mathematics curricula should focus on mathematics content and processes that are worth the time and attention of students” (p. 14). Nataly thinks by making the material more relevant

to students' lives, one is teaching mathematics for social justice. This probably means that Nataly believes that making mathematics more relevant to the students is a necessary reform, and she sees that this is possible through teaching mathematics for social justice.

*Increasing students' knowledge of mathematics.* Crucial to the concept of teaching mathematics for social justice is the notion that not only would students' social awareness increase but also their mathematical understanding. As Linda stated:

I will absolutely incorporate issues of social justice and/or community issues into my mathematical lessons. Students will benefit from exploring important worldly issues while building and developing mathematical concepts. (Final interview)

Her answer demonstrated her belief that the practice of teaching mathematics for social justice will not only increase students' knowledge of social justice issues, but it will also strengthen students' understandings of mathematics. This feeling was expressed by all the other case study participants in the post survey in responding to item #6: "Exploring social issues can help students learn and understand mathematics." Four of the five marked "Strongly agree" and one marked "Agree". The idea of increasing mathematical understanding is a key component of teaching mathematics for social justice, as outlined in Chapter One.

In summary the case study participants' understandings of teaching mathematics for social justice evolved over the semester long course. At the beginning they either had no conception of what it was, or a very limited one where it was equated with treating all

students equitably in the mathematics classroom. However, by the end of the course participants understood teaching mathematics for social justice to be about incorporating equity, diversity, and social justice issues into the mathematics curriculum to raise social awareness. They also understood it to be about making the mathematics curriculum relevant to the students' lives. The evolution of the participants' perceptions was also found in Bartell's (2006) study on in-service teachers learning about teaching mathematics for social justice. Though not all participants in my study agreed about how and to what degree social justice issues should be incorporated into mathematics, they did agree that mathematics helps create the numerical data that supports and gives credence to one's arguments against injustices and inequities.

#### What Do the Case Study Participants Identify as Aiding their Learning about Teaching Mathematics for Social Justice?

Participants identified three aspects of the methods course as aiding their understanding of teaching and learning mathematics for social justice: a) access to concrete, classroom-based examples of a teaching mathematics for social justice lesson, b) experiences that required them to think about connecting mathematics with the school and/or community, and c) a classroom environment that supported them in forming their own opinions.

##### *Access to a Concrete, Classroom-Based Example*

One of the assigned readings for the course was *With math it's like you have more defense* (Turner & Strawhun, 2005). The article, which arose from a research study, was about how a mathematics class had engaged in a teaching mathematics for social justice

project in order to study and present findings to the local school board about overcrowding problems at a middle school in a poor, working class neighborhood in New York City. The article was particularly helpful to the case study participants because it better clarified what teaching mathematics for social justice was and how it could be used in the classroom. For example, Nataly said, “The article that we read about the school in New York, you know with the class size and the whole school size and enrollment, that really kind of gave me a concrete example of how to use math to promote social justice” (Focus group interview). She went on to explain that it was fruitful for her to read about how the students measured the hallways and classrooms, and then calculated ratios of students per square foot. “They used these measurements to present a speech to the school board. How much more meaningful and relevant does that make it for students.” (Focus group interview). As mentioned in the section on beliefs about diversity and the teaching of mathematics, Nataly was very interested in making the mathematics curriculum relatable and relevant to her students’ lives. The article gave her a good example of how this could be done.

Elena also talked about how the article by Turner and Strawhun was helpful in expanding her knowledge about teaching mathematics for social justice and how it could be used in the classroom. She said, “[The article about] the one school in New York... it was eye opening. I learned that [teaching mathematics for social justice] is not this big production. It’s there; we just have to know how to look for it” (Focus group interview).

Elena, who at the beginning of the course had been confused about how to enact teaching mathematics for social justice in the classroom, now felt more knowledgeable after having read this particular article. She seemed to be saying what was helpful was realizing that teaching mathematics for social justice could be done in the school setting.

*Experiences that Required Preservice Teachers to Think about Connecting Mathematics with the School and/or Community*

The case study participants particularly found helpful a community problem posing project that was assigned in the course because it showed them how they could release mathematics learning from the exclusive domain of the classroom and out into the local school and/or community. For the project preservice teachers were asked to identify and investigate school and local community contexts that could form the basis of powerful mathematics lessons and activities. The instructor felt that this assignment was important because it helped students recognize how mathematics plays an important role in their daily lives, and in the lives of people in their school and neighborhood community. Moreover, using school and local community contexts helps develop “a sense of agency” (Gutstein, 2006, p. 27), which is important to the practice of teaching mathematics for social justice as discussed in Chapter One. By the nature of the case study participants’ responses, the instructor was right. Juliana said, “[In] this class, I think the best thing was to send us out of our confinement, which was our classroom, send us out into the local community... because community, no matter where you live, it’s very important” (Final interview). Juliana found the project helpful because it showed her a way to be able to connect her students to the local

community. Echoing Juliana's sentiments, Nataly said in discussing the school and community project, "I really liked that one because it showed you how you can use the community to see math and see these issues and examine 'Is this fair?' (Final interview). Javier, who also found the school and community project extremely helpful in learning about teaching mathematics for social justice, did so for a slightly different reason:

The activity of the Community Investigation, where we got to go around and investigate our own kind of things...I think that activity was really helpful; it just made me realize, 'Wow, there are...issues that I don't even know about. And, how can I expect kids to know about these things?' So, maybe introducing them through math is a good idea. (Final interview)

In his case, Javier and his group had studied the mathematics involved in running a school library. Javier felt that library issues were connected to social justice because he was surprised to find a big percentage of the library budget was to pay for books that had been lost or stolen. He felt that the students might respect public property more if they were aware of how much the replacement costs were. Javier felt that the project had helped him learn that there were social justice issues right at school that connected mathematics to real life for the students.

*A Classroom Environment that Supported Them in Forming Their Own Opinions*

The classroom environment was very beneficial in helping the preservice teachers to learn about teaching mathematics for social justice. The case study participants felt that they were not being told what to think about teaching mathematics for social justice but were

permitted to develop their own opinions about it. For example, Elena stated, “I have never felt that this is a professor who is telling us how to think. She presented ideas, and she allowed us the opportunity to think about them as we chose to think about them” (Focus group interview). Adding on to Elena’s opinion, Linda said:

I think that [the professor] in particular does a fantastic job of not necessarily telling...she doesn’t tell you how to think, but she presents opportunities for us to explore mathematics in a way by which we challenge ourselves to see what a decent approach to teaching [teaching mathematics for social justice] would be. (Focus group interview)

The case study participants really appreciated being able to form their own opinions about teaching mathematics for social justice, rather than being told what to think about it. The instructor had made the classroom environment safe enough where the participants were permitted time and opportunities to think about ideas on their own and then share them with their classmates. For example, when holding whole class discussions, the instructor always gave the students time to talk first in small groups about questions that she would post on the overhead. This allowed for more students to share their ideas with each other. The instructor also encouraged the preservice teachers to think critically as mathematics teachers. For example, she encouraged them to be “critical consumers” (Fieldnotes, September 6, 2007) of textbooks; they could add to or delete problems as they saw fit.

The case study participants found it helpful to have examples about and experiences with the concept of teaching mathematics for social justice. They also found it helpful to be

in a class that supported their discussions of the topic, while they struggled to figure out better for themselves what it meant. Now, the discussion turns to the challenges that the case study participants experienced.

#### What Do They Identify as the Difficulties and/or Challenges in Learning about Teaching Mathematics for Social Justice?

Participants' ideas about the challenges in learning about teaching mathematics for social justice during the course fell into two categories: a) there is a lack of resources for teaching mathematics for social justice for first and second graders, b) a lack of other courses in the teacher education program that addressed teaching for social justice, and c) having the fear of not being supported by administrators and/or parents when enacting teaching mathematics for social justice as regular teachers.

##### *Lack of Resources for Early Grade Levels*

A big challenge for the case study participants was the doubt that there were sufficient resources to support their work in teaching mathematics for social justice. For example, Javier expressed doubts about resources to support his use of teaching mathematics for social justice in early elementary education:

They showed us ways to teach math for social justice in the classroom, but I always felt that the examples that they gave us were more for the later elementary years or perhaps even middle school. Like now that I think about it, I would have no idea how to bring it up to kindergarten or first grade students. Second grade, maybe, depending on the class. But, the younger grades, I still feel unprepared for something like that. (Final interview)

Javier added to his concern about materials for early elementary, “Maybe it’s not meant to be yet; I don’t know. But, that’s one thing I wish that we would have been able to cover” (Final interview). As another example, working in her small group to plan what the group could do for the School and Community project, Elena asked the instructor about the available curriculum materials on water use. The instructor replied that she knew of available materials, but starting at the third and fourth grade levels (Fieldnotes, October 3, 2007).

Other case study participants expressed concern about resources for early elementary, but they thought they could make up for the lack of materials by adapting the presently available materials to younger children. For example, in discussing using teaching mathematics for social justice with very young children, Linda said:

You have to be able to adapt, like with the cookie example... of showing little kids that, “Heh, that’s not fair. How come there are ten kids here with thirty cookies and there are fifteen of us over here and we have just one to share amongst fifteen?” So, I think kids get the idea of one person having more than another at a very young age. Kids want things to be fair and I think you can do that at any age. It’s just how you introduce it. (Final interview)

As another example, when asked how teachers would incorporate teaching mathematics for social justice for kindergarteners, Nataly responded:

Teachers just have to adapt the way they teach and the content that they are teaching, but I think you can teach it [teaching math for social justice] at any level and I think it’s best to start at younger age because kids aren’t becoming narrow-minded yet, and they are more open at kindergarten. (Final Interview)

So, the preservice teachers felt like they could teach mathematics for social justice with early elementary students by adapting materials, but they would like to see more materials specifically oriented for these specific grade levels.

The belief in the lack of available resources is also reflected in the participants' answers to item #16 on the post survey, which read, "I feel that I have a good understanding of available resources to support my teaching mathematics for social justice should I decide to do so." Only one participant marked "Strongly agree", and the others marked "Agree". When one looks at the answers this item alone, it appears that the participants believe that there are available resources. However, when one compares these answers to the ones for item, #15, one can see the lower level of certainty the participants hold about resources. Item #15 read, "I feel that I have a good understanding of teaching mathematics for social justice form taking this class.", to which four of the the participants marked "Strongly agree" and one marked "Agree". In comparing the answers for item #16 versus those for item #15, one can see the lower level of certainty. This may reflect participants' concern over available materials for the early grade levels.

#### *More Teaching-for-Social-Justice Oriented Classes*

The case study participants found it challenging that there were no other courses in their teacher education program that explicitly addressed teaching for social justice. The case study participants expressed a desire to have more college courses about teaching for social

justice to support their learning. For example, Javier expressed regrets about not discussing equity, diversity, and social justice issues in his mathematics content for elementary teachers courses:

I think that it would have been great if we had had a class prior to this that focused just on that, and not just like Math 302A & B, where it's just like math terms and stuff like that, but where they actually talk about these issues with us beforehand. (Focus group interview)

Nataly also expressed concern about the lack of social justice oriented classes in her teacher education program. However, she did not limit her desire to just the mathematics classes; she wanted to see social justice addressed in all her teacher preparation courses. "It's not even just about teaching it [social justice] through math, but there should be like a class for preparing teachers [to teach social justice] across the board" (Focus group interview). Lastly, Linda expressed the desire for her teacher education courses to teach explicitly how to be an activist for social change:

Teach us preservice teachers how to ask for change in the system. Have them tell us, "Okay, I know you guys don't think this is right. This is who you write to address this area." Or, "This is who is who you could send a letter to say, 'Look, this needs to be changed.'" Or provide opportunities to tell us who we turn to if we don't think it is the way that it should be. (Focus group interview)

Linda, along with the other case study participants, felt a strong desire to learn about teaching for social justice. For example, on the post survey for item number ten that stated, "I am interested in learning about how to teach mathematics lessons that incorporate social justice

issues”, all five case study participants marked “Strongly Agree”. Because they were more interested in learning about teaching mathematics for social justice than many of their peers, their desire for more social justice courses may not reflect the feelings of preservice teachers in general.

*Fear of Not Having Support from Administrators and/or Parents*

The case study participants expressed a future fear of not having administrative and/or parental support in trying to teach mathematics for social justice as future teachers. This was the biggest issue that came up for them during the focus group interview. For about ten to fifteen minutes during the focus group interview, the case study participants discussed this topic without any intervention on my part. For example, Nataly exasperatedly asked, “How do you teach about all these different areas of social justice without making people upset or people just being appalled that you are even introducing this?” (Focus Group Interview). Javier responded that he would gradually incorporate teaching mathematics for social justice into his future teaching, and not start right away as a beginning teacher when his power was weakest:

I think initially, just because I would just be getting into the teaching profession, I think that maybe creating examples that lead towards issues in social justice, and then gradually, as I get more liberty to teach what I want maybe, I could do full-on lessons. But, I think at the beginning, it would just be through examples. (Focus group interview)

Linda's response to Nataly's question would be to make sure that she had the support of her administration before taking a job as a teacher:

I mean I think if you want to explore social justice in the classroom, you have questions ready when you go to interview to make sure that you know this administration supports a foundation for students to explore equity. And if it doesn't then that is not where I'm going to teach. (Focus group interview)

Though none of the case study participants expressed such a large fear of offending administrators and/or parents that they would not even attempt to teach mathematics for social justice in the future, they did express concern about limits to what topics they might address. For example, Nataly said, "I think that there [are]....boundaries and what you can and cannot talk about in the classroom and I guess it will be different from school to school, administration to administration" (Focus group interview). Nataly was particularly concerned about discussing same sex partnerships in the classroom, though she was strongly connected to this issue because of her experience being raised by two Dads.

Though cognizant of boundaries in the classroom, the case study participants did express a basic strategy of slowly incorporating teaching mathematics for social justice so that others could slowly become more accustomed to it. For example, Javier stated:

I think initially, just because I would just be getting into the teaching profession, I think that maybe creating examples that lead towards issues in social justice, and then gradually, as I get more liberty to teach what I want maybe, I could do full-on lessons. (Final interview)

So, the case study participants were definitely concerned about being able to teach mathematics for social justice as future teachers. This concern should probably be more fully addressed in other mathematics methods courses that want to introduce teaching mathematics for social justice.

In summary the case study participants found the lack of teaching materials for first and second graders in teaching mathematics for social justice a challenge. They felt either first and second graders were not ready yet for the critical thinking skills of teaching mathematics for social justice, or that they would have to put in the extra time to create those materials. They also found it challenging that this was their only course in teaching mathematics for social justice. They would have liked either more education courses specifically on teaching mathematics for social justice or in general on teaching for social justice. Lastly, they felt that there would be a lack of support for their teaching mathematics for social justice once they were regular teachers.

#### Findings From the Pre and Post Surveys

Pre and post surveys were given to all participants, both case study and non-case study. Questions for the surveys were designed to elicit preservice teachers' beliefs about equity, diversity, social justice, teaching for social justice, and teaching mathematics for social justice. Administering surveys both at the beginning and the end of the course facilitated the analysis of shifts in the preservice teachers' beliefs. Each survey contained four point Likert scale items: a score of four meant "Strongly agree", a score of three meant

“Agree”, a score of two meant “Disagree”, and a score of one meant “Strongly Disagree”. The quantitative analysis included two parts: a) comparing means, standard deviations, levels of significance, and effect size values for all participants, and b) comparing means, standard deviations, levels of significance, and effect size values between case study and non-case study participants.

*Comparing Means, Standard Deviations, Levels of Significance, and Effect Size values for All Participants*

Paired t tests were run on the results from the four point Likert scale items to compare mean scores for questions that were both on the presurvey and the post survey to see what possible changes or shifts might have occurred in their beliefs. In the first round of analysis, no distinction was made between the answers of case study and non-case study participants; they were considered as one collective group, with the later intention of making a distinction between the two groups in a subsequent analysis.

Table 6 shows the results from my first round of quantitative analysis. I included only questions 1 through 10 and 13 in this table because they are the only questions that were: a) both on the pre and post surveys, and b) were not dropped from either survey by the reliability analysis test described in the analysis section of Chapter 3. My interpretation of the results of this table is that the statistically significant shifts in mean scores for items #2, #5, and #6 may have been a result of the course promoting positive beliefs in the preservice teachers towards the relationship between social justice issues and the teaching and learning of mathematics. By the time they took the post survey, participants held more favorable

attitudes towards: a) the teaching of issues of equity, diversity, and social justice as a mathematics teacher (item #2), b) exploring social issues through mathematics (item #5), and c) both mathematical and social justice understandings increase as a result of teaching the two together (item #6).

Table 6

*Comparison of Mean, Standard Deviation, Level of Significance, and Effect Size values for All Participants*

Item	Mean Scores		Std. Deviation		<i>p</i> *	Effect Size
	Pre	Post	Pre	Post		
1. Teaching about issues of equity, diversity, and social justice is an appropriate practice for a teacher	3.75	3.83	.532	.381	.491	na
2. Teaching about issues of equity, diversity, and social justice is an appropriate practice for a teacher of mathematics	3.54	3.79	.509	.415	.031	.538
3. I feel comfortable with the notion of discussing issues of equity, diversity, and social justice with my future students	3.63	3.54	.495	.588	.328	na
4. Schooling should provide students with opportunities to examine and/or address social issues	3.71	3.79	.464	.415	.426	na
5. Mathematics can help students learn about social justice issues	3.21	3.83	.779	.381	.001	1.01
6. Exploring social issues can help students learn and understand mathematics	3.25	3.58	.737	.584	.017	.799
7R**. Mathematics curriculum should be based exclusively on the textbook and state standards.	3.29	3.38	.550	.647	.426	na
8. I feel comfortable developing new curriculum that is not part of the textbook.	3.13	3.22	.757	.795	.648	na
9. Mathematics curriculum should be grounded in cultural contexts relevant to students.	3.33	3.5	.637	.590	.162	na
10. I am interested in learning about how to teach mathematics lessons that incorporate social justice issues	3.63	3.79	.495	.509	.162	na
13. Minorities in the U.S. are disadvantaged because schools and other social institutions do not serve them well	3.17	3.26	.650	.752	.492	na

\* significance is established if  $p < \text{or equal to } .05$

\*\* Question 7 was reversed as a result of the Reliability Analysis. This means that the values assigned to participants original answers have been reversed; those who originally marked the answer "Strongly Disagree" and received an answer score value of 1 now, as a result of the reversal, received an answer score value of 4. So, though the new answer score values seem to indicate the opposite of what they originally marked, these new answer score values better fit the overall measure of the presurvey.

I also included values for effect size in the table. Effect size scores indicates the size of the level of significance: 0.3 is indicative of a small effect, 0.5 a medium and 0.8 a large effect size (Cohen, 1988). For the items that showed significance in the change of mean scores from the presurvey to the post, the effect size values were .538, 1.01, and .799. Since the effect sizes were from medium to high, I concluded the changes in mean scores were not small or trivial. So, I feel confident in stating that there were significant changes in the preservice teachers views on items #2, #5, and #6.

*Comparing Means, Standard Deviations, Levels of Significance, and Effect Size values Between Case Study and Non-Case Study Participants*

I was also interested in comparing mean scores between the two groups of case study and non-case study participants. (See Table 7). The results are interesting because the only changes of significance in mean scores are for the non-case study participants for items #2, #5, and #6 (.430, 1.37, and .854 respectively); there are none for the case study participants. So, it appears that changes in significance for all participants were primarily a result of shifts in beliefs by the non-case study participants. I explain this resulting from the condition that the case study participants were already highly favorable to the idea of combining mathematics instruction with social justice issues. They entered the course with these favorable opinions, were mostly likely motivated to volunteer to be case study participants as a result of these already existing highly favorable opinions, and their opinions stayed highly favorable at the end of the course.

Table 7

*Comparison of Mean, Standard deviation, Level of Significance, and Effect Size Values between Case Study and Non-Case Study Participants*

Item	Case Study Participants						Non-Case Study Participants					
	Mean Scores		Std. Deviation		<i>p</i>	Effect Size	Mean Scores		Std. Deviation		<i>p</i> *	Effect Size
	Pre	Post	Pre	Post			Pre	Post	Pre	Post		
1. Teaching about issues of equity, diversity, and social justice is an appropriate practice for a teacher	3.80	4.00	.447	.000	.374	na	3.74	3.79	.562	.419	.716	na
2. Teaching about issues of equity, diversity, and social justice is an appropriate practice for a teacher of mathematics	3.60	4.00	.548	.000	.178	na	3.53	3.74	.513	.452	.04	.430
3. I feel comfortable with the notion of discussing issues of equity, diversity, and social justice with my future students	3.80	3.80	.447	.447	na	na	3.58	3.47	.507	.612	.331	na
4. Schooling should provide students with opportunities to examine and/or address social issues	3.60	3.80	.548	.447	.374	na	3.74	3.79	.452	.419	.667	na
5. Mathematics can help students learn about social justice issues	3.60	3.80	.548	.000	.178	na	3.11	3.79	.809	.419	.002	1.37
6. Exploring social issues can help students learn and understand mathematics	3.60	3.80	.548	.447	.374	na	3.16	3.53	.765	.612	.031	.854
7R**. Mathematics curriculum should be based exclusively on the textbook and state standards.	3.60	3.60	.548	.548	na	na	3.21	3.32	.535	.671	.429	na
8. I feel comfortable developing new curriculum that is not part of the textbook.	3.00	3.40	.707	.548	.178	na	3.11	3.17	.809	.857	1.00	na
9. Mathematics curriculum should be grounded in cultural contexts relevant to students.	3.60	3.80	.548	.447	.374	na	3.26	3.42	.653	.607	.268	na
10. I am interested in learning about how to teach mathematics lessons that incorporate social justice issues	3.60	4.00	.548	.000	.178	na	3.63	3.74	.496	.562	.429	na
13. Minorities in the U.S. are disadvantaged because schools and other social institutions do not serve them well	3.50	3.75	.577	.500	.391	na	3.11	3.16	.658	.765	.716	na

\* Significance is established if  $p < \text{or equal to } .05$

\*\* Question 7 was reversed as a result of the Reliability Analysis. This means that the values assigned to participants original answers have been reversed; those who originally marked the answer “Strongly Disagree” and received an answer score value of 1 now, as a result of the reversal, received an answer score value of 4. So, though the new answer score values seem to indicate the opposite of what they originally marked, these new answer score values better fit the overall measure of the presurvey.

However, with the non-case study participants, they did not all strongly agree at the beginning of the course with the idea of combining mathematics instruction with social justice issues. Their mean scores on the presurvey to items #2, #5, and #6 were 3.53, 3.11, and 3.21 respectively. (In contrast, the mean scores for the case study participants to these items were 3.60, 3.60, and 3.60). Therefore, the non-case study participants entered the course being less agreeable to the relationship between social justice issues and the teaching and learning of mathematics; and, therefore, might have been less likely motivated to volunteer to be case study participants.

However, their collective opinions changed on average from “Agree” to “Strongly Agree” by the end of the course. The means scores for the non-case study participants on items #2, #5, and #6 raised from 3.53, 3.11, and 3.21 (respectively) to 3.74, 3.79, and 3.53 (respectively).

The effect size values ranged from medium to high, meaning that the changes in the means scores were not trivial. The effect size values for items #2, #5, and #6 were .430, 1.37, and .854 respectively. In order not to overstate the significance of the shifts in beliefs for items #2, #5, and #6, it is important to understand the difference between statistical significance and practical significance. Though statistical significance was found for shifts in

mean scores for items #2, #5, and #6 between the presurvey and post survey, one needs to keep in mind the relatively small size of my sample of preservice teachers. I had a total of 24 participants in my study, of which 5 were case study and 19 were non-case study participants. Thus, when a statistically significant shift was found in the non-case study students, one must keep in mind that practically this means only five or six non-case study participants (out of 19) changed their answers from “Agree” to “Strongly Agree” from the presurvey to the post survey. Limitations related to my sample size are further discussed in Chapter Five.

Another issue to address concerning shifts in beliefs is that these shifts in the Likert-scale section of the surveys were supported by shifts in other data sources. For example, open ended question #6 on the post survey asked, “When you are a teacher, do you think you will incorporate issues of social justice and/or community issues into your mathematics lessons? Why or why not?” Two examples of the favorable responses from the non-case study participants were “I certainly hope to. I feel it is very important to help make students aware of and sensitive to these issues” and “Yes, I will because I think it is very important for students to understand the world they live in. It will prepare them as they become adults.”

Another example of other document data supporting the reported shifts is from my fieldnotes concerning a class discussion the school and community project, which had been

assigned to the preservice teachers. The school and community project was related to teaching mathematics for social justice because it asked the preservice teachers to find a local issue (defined as occurring within a two mile radius of the Che Guevera school) that incorporated some kind of equity issue and could be examined using mathematics. One non-case study student responded favorably to this project by stating, “I thought [the project] was really fun. I really enjoyed going out and doing it. And I think it could really help kids get comfortable with using word problems and trying to find concrete solutions.” (Fieldnotes, October 17, 2007).

In summary the biggest shifts in preservice teachers’ beliefs were with the non-case study participants, whose beliefs became more agreeable towards the relationship between social justice issues and the teaching and learning of mathematics in three facets: a) the teaching of issues of equity, diversity, and social justice as mathematics teacher, b) exploring social issues through mathematics, and c) both mathematical and social justice understandings increase as a result of teaching the two together. The case study participants’ beliefs also became more agreeable towards the relationship between social justice issues and the teaching and learning of mathematics, but not statistically significant as with the non-case study participants.

### Conclusion

In this chapter I presented both qualitative findings from case studies and quantitative findings from my surveys. Overall, the participants held very favorable beliefs towards the

idea of teaching mathematics for social justice. They believed that social justice issues were important to address in school, even in the mathematics classroom. For example, they believed that teaching mathematics for social justice could be used to help students better understand injustices in their world. They also believed that teaching mathematics for social justice was about using real life examples to make the mathematics curriculum more relevant to the students. And they believed that the students' understanding of mathematics would improve as a result of this style of teaching. However they did express concerns about administrative and parental support, as well as having sufficient teaching resources for the primary grade levels. In the next chapter, I first summarize findings related to each research question. Then, I discuss several important ideas from my findings, connecting them to what is already known in the literature. I conclude by discussing the implications and limitations of my research and making recommendations for further research.

## CHAPTER FIVE: IMPLICATIONS

### Purpose

The purpose of this study was to examine preservice teachers' beliefs and experiences related to the teaching of mathematics for social justice as they progressed through a one-semester mathematics methods course. The study examined their beliefs on three levels: a) their beliefs about issues of equity, diversity, and social justice in general; b) their beliefs about how issues of equity, diversity, and social justice relate to teaching (i.e., if and how the preservice teachers perceive themselves as critical educators); and c) their beliefs about teaching mathematics for social justice. This study also analyzed the preservice teachers' experiences as they learned about, and then tried to develop for themselves lessons and projects that could be used for teaching mathematics for social justice. The purpose of analyzing their experiences was to document both the positive and negative events of and/or influences on preservice teachers learning to teach mathematics for social justice.

### Introduction

In this chapter I first synthesize my findings, drawing on both qualitative and quantitative analyses, for each research question. Next, I discuss the important key ideas from my findings in light of what is already known from the literature. The four key ideas I discuss are: a) preservice teachers of color question whether some white female teachers could effectively teach minority students, b) whether changes in preservice teachers' beliefs are sustained, c) preservice teachers need more materials and resources for teaching mathematics for social justice to primary grade students, and d) preservice teachers fear little

or no support from administrators and parents when they teach mathematics for social justice as regular teachers. My discussion of these important ideas addresses the extent to which my findings confirm, challenge, inform, and/or extend the findings of previous research. After the discussion, I address the implications of my findings for mathematics methods courses similar to the one in my study. Finally I discuss the limitations of my study, followed by recommendations for further research.

#### Summary of What Was Learned for Each Research Question

My research questions were: As preservice teachers progress through their mathematics methods course...

1. What are their beliefs about equity, diversity and social justice and how do these issues relate a) to their work as teachers and b) to teaching mathematics?
2. What do they identify as the difficulties and/or challenges in learning about teaching mathematics for social justice?
3. What do they identify as aiding their learning about teaching mathematics for social justice?

In regards to the first research question, preservice teachers' beliefs about equity and social justice often refer to the same idea that all people should have fair opportunities and access to resources. These beliefs about equity and social justice were translated into teaching as a) teachers having the responsibility to provide opportunities for all students, regardless of race, gender, economic status, (etc.), to succeed in school and find well-paying jobs and b) teachers acting as social agents by addressing issues of equity, diversity, and social justice in the classroom in hopes of eventually creating change in society. In regards to their beliefs

about diversity, the preservice teachers believe that diversity is more than differences in race or ethnicity. It also incorporates differences in values, sexual orientation, religion, (etc.) These beliefs about diversity were translated into teaching as a) teachers, especially affluent whites, need to remain open-minded to students who are “different” (racially, economically, religiously, etc.) from them, and b) minority teachers need to act as role models in getting minority students to succeed in their K-12 schooling and go to college. Participants’ beliefs about equity, diversity, and social justice were translated into the teaching of mathematics as a) making the mathematics curriculum more culturally relevant and b) incorporating equity, diversity, and social justice issues into the mathematics curriculum to raise social awareness.

In regards to the second research question about the difficulties and/or challenges, the findings suggest that preservice teachers benefit from having concrete examples of teaching mathematics for social justice. For example, the participants stated that reading articles with specific examples of teachers enacting teaching mathematics for social justice in classrooms was helpful. It also proved beneficial to the preservice teachers to have assignments that required them to think about connecting mathematics with the school and/or community. Teaching mathematics for social justice is strongly connected to local and community issues, and therefore it is helpful to think about connecting mathematics lessons to the students’ communities. Lastly, it was helpful for the preservice teachers to have a course about teaching for social justice where they were allowed opportunities to reflect and form their own opinions. They reported that it would not have been helpful for the instructor to have

just told the preservice teachers what to think about the topic of teaching mathematics for social justice.

In regards to the third research question, it was challenging for the preservice teachers not to have concrete examples of teaching mathematics for social justice curriculum that could appropriately be enacted in the first and second grades. They also felt it was challenging as future teachers for social justice to have only one course in their teacher education program that specifically addressed this topic. They would have preferred having several courses that addressed social justice so that their understanding of teaching for social justice could be more completely developed over a longer period of time. Lastly, they felt challenged by their fears of not receiving support from administrators and parents when teaching mathematics for social justice in a regular classroom. They feared that the ideas of teaching mathematics for social justice might offend or threaten administrators and/or parents too much. Having summarized the findings to my research questions, I now discuss several key ideas from my study.

### Key Ideas

The key ideas from my study were formed by synthesizing the findings from Chapter Four by common themes found woven throughout. The key ideas reflect the preservice teachers' main beliefs and experiences in their learning about teaching mathematics for social justice. The resulting four key ideas that emerged from my study are: a) preservice teachers of color argue that some white teachers hold stereotypes of minority students, and therefore they question whether those teachers can effectively teach minority students, b) preservice

teachers' beliefs can change but may need further support to put those changes in their practice, c) teaching mathematics for social justice needs be made realistic for preservice teachers through modeling of lessons and exposure to teaching resources, and d) preservice teachers have a big fear of not having support from administrators and/or parents when they enact teaching mathematics for social justice as beginning teachers.

*Preservice Teachers of Color Argue that White Teachers May Hold Stereotypes of Minority Students and Therefore Question if Those Teachers Can Effectively Teach Minority Students*

Preservice teachers of color questioned whether some white female teachers in the elementary mathematics methods course could effectively teach minority students. They argued that some white preservice teachers held stereotypes of minority students, which in turn prevented them from authentically bonding with the students. These preservice teachers felt particularly strong about the white females who came from affluent families who did the hurtful stereotyping. The minority preservice teachers said that teachers who would be effective with minority students are those who have shared experiences with them. It was not simply a matter of skin color, but required shared experiences with the students, such as upbringing in a common culture or social-economic class. In Chapter Two, a study by Hollins and Guzman (2005) was mentioned in which they found that “since the majority of teacher candidates are white, female, middle class, and from suburbs or small towns, many of preservice teachers’ beliefs are negative towards people who are different from themselves” (p. 485). Javier and Juliana felt this might apply to some of the white preservice teachers who came from much wealthier backgrounds than their mainly Hispanic students. Javier and

Juliana felt that these teachers held negative beliefs about the students at the school, including, according to Juliana, beliefs about neighborhood shootings and on-campus drug deals. Unfortunately, none of these white females that according to Juliana were stereotyping the students were case study participants, so I could not study their beliefs about minority students in depth.

Another reason the non-white preservice teachers felt that they might be able to better reach minority students better is that they believed that they would serve as good models for minority students. Javier mentioned how his upbringing in a poor Hispanic family would help him better understand the poor Hispanic students that he would someday teach. Hollins and Guzman (2005) stated a similar idea in their study. “Candidates of color were committed to incorporating aspects of their insider cultural knowledge into their teaching” (p. 504). This is very similar to what the minority preservice teachers stated in my study. For example, Javier said:

I have always wondered once I’m at the point I want to be, in a position where I can do good, where I can help these kids and they can help themselves, and I have always wondered is there something that I can tell them... Things that I have thought of maybe saying ...just talking to them about where I come from. I know that at Che Guevera a lot of the kids are in the same situation that I was in. (Initial interview)

Javier was interested in using his common knowledge with the students to help teach them.

Though the white preservice teachers in my study did not explicitly address their abilities to effectively educate minority students, they did express the opinion that they could

more effectively teach mathematics to diverse students by connecting the material to the students' lives. Swartz (2003) in a review of studies on teaching practices for white preservice teachers of non-white students found that pedagogical practices that were "culturally responsive" (p. 260) were effective. Culturally responsive curriculum means making it inclusive by being relevant to the students' lives. This was the same goal for the white case study participants in my study. Zeichner (1992), also in a review of studies, found that successful teaching for ethnic-and language minority students involves the teacher's "desire and ability...to learn about the special circumstances of their own students and their communities and the ability to take this knowledge into account in their teaching" (p. 6). This quote can apply to both non-white and white teachers just as long as they have the desire and capability to learn about the cultural backgrounds and communities of their students.

As mentioned earlier, Hollins and Guzman (2005) found in a review of studies on preservice teachers' beliefs, that the majority of white preservice teachers held negative beliefs towards non-white students. However, neither of the white case study participants in my study expressed these negative beliefs. In fact, they seemed quite open to the idea of working with diverse student populations as teachers. So, what was different about white case study participants in my study? What happened in their histories that made them more open to teaching diverse students than some of the other white preservice teachers in the course? It might have been for the reason mentioned above—that they were more interested in teaching and learning about students who came from different cultural backgrounds. Or,

perhaps having field placements in a strongly Hispanic school made the difference.

This was a finding by Hollins and Guzman (2005). They found that community-based field experiences positively impacted the preservice teachers with regards to working with diverse populations. This applied to the white case study participants in my study. At the time of their mathematics methods course, they were also placed for their fieldwork in a school with a majority Hispanic student population. These fieldwork experiences may have made them more open to the idea of teaching Hispanic children.

However, this finding of Hollins and Guzman does not account for the attitudes of some of the white preservice teachers who were not case study students. As previously discussed, Juliana gave accounts of some white preservice teachers who seemed very closed to the idea of working with Hispanic students because of fears arising from stereotyping. These affluent white preservice teachers that Juliana spoke of had similar fieldwork placements as the white case study participants, but the latter were much more open-minded. Thus, perhaps it was the upbringing of the white case study participants that made them more willing to work with diverse students. For example, Elena said she came from a similar socioeconomic upbringing as her students. She grew up in a non-wealthy white neighborhood, so she may have been better able to identify with the students at Che Guevera Elementary School than the white preservice teachers who came from more affluent communities. And, Linda's upbringing in a household where discussions of social justice issues were commonplace might help explain why she was able to feel connected to the Hispanic students at Che Guevera. She probably could better understand the issues and

challenges that underserved populations experience in this country, and therefore had an easier time connecting to minority students than the white preservice teachers who had had no previous knowledge of or experiences with minority students.

*Preservice Teachers' Beliefs Can Change*

The second main idea from my findings is that preservice teachers' beliefs can change. Both my quantitative and qualitative findings showed that some of the preservice teachers' beliefs about the relationship between teaching mathematics and addressing issues of equity, diversity, and social justice in the classroom changed. However, many other beliefs, such as beliefs about basing mathematics curricula exclusively on textbooks and state standards or beliefs about teachers needing to be open-minded, remained unchanged or the changes noted were not statistically significant. Substantial research has found that preservice teachers' beliefs are robust and resistant to change (Brown, 2004; Pajares, 1992; Rokeach, 1968). However, I found not all beliefs were resistant to change. Why was this? Why was a shift in preservice teachers' beliefs possible in my study when some of the literature suggested that it would be unlikely? I found other literature (Kelly, 2002; Lynn & Smith, 2007) that might help explain why my participants' beliefs were not as resistant as those of preservice teachers in other studies.

Other literature suggests several possible explanations for the preservice teachers' willingness to change some beliefs: a) the new beliefs about teaching mathematics for social justice were already consistent with existing beliefs about schooling, b) a learning

community was established in the classroom (Kelly, 2002), and c) the preservice teachers felt that they had opportunities to reflect on their beliefs (Lynn & Smith, 2007).

*New beliefs are consistent with old beliefs.*

Price and Ball (1998) examined a teacher education program that promoted teaching for social justice and found that prospective teachers struggled against the ideas of teaching for social justice. They found that preservice teachers' resistance to new beliefs was founded on perceptions that they already held about schooling and themselves as teachers. For example, some of the preservice teachers believed that schooling was about fostering individualism, and thus the teaching of social justice was not that important. However, for other preservice teachers, schooling was about access and opportunity, and thus the idea of teaching for social justice was consistent with their own beliefs. Therefore, the preservice teachers in my study might have been willing to change their beliefs because the basic ideas of teaching mathematics for social justice, such as exploring issues of equity, diversity, and social justice in the classroom, were already consistent with their fundamental beliefs.

*Learning community established.*

Of the five strategies that Kelly (2002) found helpful in impacting preservice teachers' beliefs and attitudes, the mathematics course that I studied met three: a) promoting more in-depth thinking about specific lesson materials and the attributes of those materials that would either positively or negatively impact equity and learning, b) assigning professional readings about equity and equity issues, and c) having preservice teachers prethink a lesson plan to adapt as needed to targeted concepts (in this case equity, diversity,

and social justice). Many in-class discussions were held in the course I studied, asking students to think deeply about lesson materials. The instructor assigned readings about equity and social justice issues; and the preservice teachers, as an assignment for the course, created a lesson plan where they had to reflect on some issue regarding equity and teaching. These assignments and readings from the mathematics methods course resembled Kelly's (2002) strategies, and they may have positively impacted preservice teachers' beliefs and attitudes.

*Opportunities to reflect on beliefs.*

Lynn and Smith (2007) found that they could break down preservice teachers' negative beliefs about teaching for social justice by dialogical processes, or opportunities to reflect on their beliefs through journaling or group discussions. Lynn and Smith found that dialogical processing helped the preservice teachers examine their preexisting beliefs and make changes to them so that they would become more open to social justice perspectives. This was the case with this mathematics methods course; preservice teachers examined their beliefs about equity, diversity, and social justice through journal assignments and either small group or whole class discussions. In addition, those who participated in my study had further opportunities to reflect on their beliefs through the surveys and the interviews that I utilized.

As a caveat, it should be noted from the literature (Vacc & Bright, 1999; Phillip, 2007) that changes in beliefs may not necessarily lead to change in practice. That is, though the preservice teachers in my study changed some of their beliefs about social justice and the teaching of mathematics, these changes may not be sustained into their actual teaching, either

as a student teacher or as a regular teacher. For example, Vacc and Bright (1999), studying preservice teachers learning about and enacting Cognitively Guided Instruction (CGI) in their mathematics class, found that, “preservice teachers may acknowledge the tenets of CGI and yet be unable to use them in their teaching” (p. 107). So, based on what Vacc and Bright found, perhaps the shift in beliefs for the preservice teachers in my study may not prove significant when they are actually teaching. Similar to Vacc and Bright, Phillip (2007) in reviewing studies on teacher’s beliefs and their practices found a significant inconsistency between the two. He wrote, “Because of the complexity of teachers’ beliefs systems, researchers may find that teachers hold beliefs that appear to be inconsistent with their teaching practices” (2007, p. 271). In study after study, the findings were that teachers were not practicing what they professed to believe. Phillip accounted for this phenomenon due to the result of practical issues of teaching, such as taking attendance, standardized testing, and student behavior, having a larger influence on their actual teaching practices than teachers’ beliefs.

So what more is needed in a mathematics methods course to sustain these shifts in beliefs? We know from the literature that favorable beliefs towards teaching mathematics for social justice cannot be sustained by just one course. They need more courses about teaching for social justice, in both mathematics and in other subjects. The preservice teachers in my study even stated that they would have liked more courses about teaching for social justice in their teacher education program. Another strategy to sustain the change in preservice teachers’ beliefs would be to continue supporting the preservice teachers in teaching

mathematics for social justice after they finished the mathematics methods course.

Lynn and Maddox (2007) studied preservice teachers learning about teaching for social justice and were also unsure about how long the preservice teachers would continue thinking about teaching for social justice in their classrooms once they left the program. Without some type of program to continue supporting the preservice teachers in examining and questioning their beliefs about social justice, the researchers felt that the preservice teachers were likely to fall back on implementing their old beliefs in the classroom. Phillip (2007) suggested continued support for teachers as a means to sustain their change in beliefs, but through professional development experiences. Phillip stated:

Change in teachers' beliefs may not lead to change in their practice, or vice versa, but I conjecture that the most lasting change will result from professional development experiences that provide teachers with opportunities to coordinate incremental change in beliefs with corresponding change in practice. (p. 281)

So, although the shift in beliefs on the part of the preservice teachers in my study is not common according to the literature, the literature also cautions that any changes in belief do not usually end up reflected in the teacher's practice.

*Preservice Teachers are Concerned about Teaching Mathematics for Social Justice for the Early Elementary Grade Levels Because of the Lack of Lessons and/or Resources*

A third important idea from the findings of my study is that the preservice teachers struggled to think about how to apply teaching mathematics for social justice in the first and second grade classrooms. As mentioned in the last chapter, the preservice teachers said that one of the challenges they encountered during the course was the lack of

available materials to use with early elementary students in teaching mathematics for social justice. Some of them said that they would have to spend extra time adapting existing materials for older grade levels to make them suitable for first and second graders. This problem is also reflected in the literature. Aguirre (2007), who taught an elementary methods course to preservice teachers about teaching mathematics for social justice, found that her students questioned whether it was doable with lower elementary students. During the course the students noted that “all of [the] readings and video or material lesson examples were aimed at upper elementary and middle school students” (p. 27). So, they questioned whether teaching mathematics for social justice was even possible for first and second graders. Wanting to address their concern rather than ignore it, Aguirre engaged the preservice teachers in creating mathematics lessons incorporating social justice for young children. The class took several teaching mathematics for social justice activities geared for older students and worked together in small groups to adapt them for first and second graders. As a result Aguirre found that many good ideas for teaching mathematics for social justice in the early grade levels were generated. The preservice teachers in my study, like Aguirre’s students, also suggested that to counter the issue of the lack of teaching mathematics for social justice lessons and activities for early grade levels, that those for older grade levels would have to be modified and/or adapted.

Another strategy for handling preservice teachers’ concern about teaching mathematics for social justice being “doable” would be based on one offered by Leonard and Dantley (2005). To help students develop more multicultural mathematics lessons, they

suggested that prospective teachers learn how to use storybook characters from diverse backgrounds to make mathematical concepts more culturally and socially relevant. The storybook characters would help show or explain the mathematics to the children. A similar strategy could be used with preservice teachers in creating teaching mathematics for social justice lessons. Preservice teachers could use storybooks suitable for early elementary students and find social justice themes in them that could be explored with mathematics. For example, Leonard and Dantley discussed the children's story *One Grain of Rice* (Demi, 1997) where a young Indian girl is granted one wish from the raja. Her wish is to receive a grain of rice and then that amount doubled each day for thirty days. This story exemplifies the enormity of exponential growth over a long period of time. Like with Aguirre, this might be a nice strategy to help preservice teachers better understand the potential resources for teaching mathematics for social justice to early elementary students. However, though these seem like good solutions, once the preservice teachers encounter the time demands of regular teaching (for grading, lesson planning, etc.), they may not have the extra time required to adapt lessons. The literature that argues that changes in beliefs do not necessarily translate into practice cites the time constraints of regular teaching as a hindrance (Brown, 2004).

*Preservice Teachers Fear Lack of Support from Administrators and/or Parents When Attempting To Teach Mathematics for Social Justice as Regular Teachers*

A fourth important idea from the findings of my study is that the case study participants expressed a fear of not having administrative and/or parental support in trying to teach mathematics for social justice as regular teachers. This was a big point of concern that

arose during the focus group interview. Though I could find nothing in the literature specifically about preservice teachers' concern about not having adequate support from administrators and/or parents when enacting teaching mathematics for social justice in the regular classroom, I did find in the literature preservice teachers' concerns about standards when trying to teach for social justice. For example, Cochran-Smith (2004) warned that in an era of teachers worrying about standards and accountability, the struggle to prepare teacher candidates to teach also for social justice would be harder. Aguirre (2007) found a few of her preservice teachers were concerned that teaching mathematics for social justice would have no place in classrooms because accountability policies in schooling these days require highly skills-based curriculum and test preparation. The preservice teachers in my study also expressed a concern that teaching mathematics for social justice would have no place in classrooms, but they did not express it in terms of standardized testing. Instead, they expressed it in terms of causing too much controversy or being too offensive for administrators and/or parents. For example, one non-case participant during a discussion about a potential teaching mathematics for social justice lesson on healthcare and the cost of prescriptions, said, "I can see a student going home to their parents and saying, "We talked about drugs today" (Fieldnotes, October 1, 2007). This comment raised laughter from the rest of the preservice teachers who could see this potentially volatile incident in their teaching career if they were to attempt to teach mathematics for social justice. As another example, Nataly was concerned about discussing her upbringing by two Dads because this might

offend someone. Thus, the factor that preservice teachers in my study accounted for their concerns was not about standards and accountability, but rather about the offending of either administrators and/or parents. Having reviewed the key ideas of my study, in the next section I discuss the implications.

### Implications

The complexities of preservice teachers learning about teaching for social justice are many, as the findings on their experiences and beliefs suggest. The preservice teachers encountered several challenges in learning about teaching mathematics for social justice and expressed concerns about all students succeeding in school. Given these challenges and concerns, I find myself asking the following questions: a) should more teaching mathematics for social justice materials be developed for early elementary students, b) should discussions be held for preservice teachers to address issues of racism and stereotyping between white and non-whites, and c) should more courses in teacher education programs be required to address social justice issues and the teaching of such in the classroom?

#### *Should More Teaching Mathematics for Social Justice Materials Be Developed for Early Elementary Students?*

Though some people may question whether teaching mathematics for social justice is appropriate for early elementary children, there was an expressed demand for these materials by the preservice teachers in my study. They felt that it was appropriate as long as the materials are adapted to the cognitive and emotional capabilities of seven and eight year olds. Since the preservice teachers in my study as well as those in Aguirre's (2007) study both

expressed a desire for more teaching materials, this is significant because, of the few existing studies on preservice teachers learning about teaching mathematics for social justice, in at least two this has been one of the findings. In addition Gutstein (2003, 2005, 2006, 2007), one of the foremost researchers in the field of teaching mathematics for social justice, acknowledges that there is a dearth of available resources for the early elementary grade levels. However, he suggests making adaptations of existing materials, especially those that can be found on the Rethinking Schools website. However, to save preservice teachers the burden of having to create their own materials for first and second graders, I suggest that a more concerted effort be made in the field of teaching mathematics for social justice to create them for usually busy teachers.

*Should Discussions Be Held for Preservice Teachers to Address Issues of Racism and Stereotyping?*

My findings suggest that discussions between minority preservice teachers and white preservice teachers be held about teaching minority students. In my study the non-white preservice teachers expressed concern about some white preservice teachers abilities to effectively teach non-white students. In turn, had the white preservice teachers in my study followed the national trends cited in Hollins and Guzman (2005), they would have held negative beliefs and attitudes toward minority students. To address the concerns about racism and stereotyping, I recommend that white and non-white preservice teachers have opportunities to talk and work with one other. In a similar vein, Melnick and Zeichner (1998), who were interested in finding a way to positively impact preservice teachers' beliefs

about equity, diversity, and social justice in teacher education programs, recommended that white preservice teachers work with non-white faculty or students in order to better understand those who are different from them. One way to do this is for teacher education courses to purposefully structure opportunities for white and non-white preservice teachers to interact with one another rather than segmenting the two groups, as often happens via specialized programs (i.e., bilingual education cohorts that result in a clustering of Latino/a teacher candidates). This way they have opportunities to talk with each other, and perhaps clear up some misconceptions or wrong stereotypes about each other. Therefore, for other elementary mathematics methods courses, I would recommend that the instructor allow such opportunities for discussion between white and non-white preservice teachers in order to explore and correct misconceptions and wrongful stereotypes of each other. For the sake of the exercise, the class could be divided between white and non-white preservice teachers; and with skillful guidance, the instructor could facilitate question-and-answer discussions between the two groups addressing concerns about racism, stereotyping, and teaching. Schoem and Hurtado (2003) wrote a book about designing and leading such interracial discussion exercises, which they call “Intergroup Dialogues”. This book would be very helpful to any instructor interested in pursuing my recommendation for holding such discussions in his or her teacher preparation course.

*Should More Courses in Teacher Education Programs Be Required To Address Social Justice Issues and the Teaching of Such in the Classroom?*

The case study participants in my study asked for more courses in their teacher education program that address equity, diversity, and social justice. They felt that, though this one mathematics methods course did a good job instructing them about teaching for social justice, they would have liked more classes like it. The literature has much to say about this idea. For example, Zollers (2000) wrote an article about educators addressing social justice issues in teacher education programs. In order to effectively teach about social justice issues, he wrote that:

Social justice issues [should] not be relegated to a single course in the preservice program... but rather that they be an ongoing concern of all teachers and teacher educators. Doing so would require that issues of equity and social justice be embedded within multiple experiences. (p. 2)

Zollers calls for, like the case study participants in my study, teacher education programs that have more than one course that addresses social justice issues. Teacher education programs should in fact provide their preservice teachers multiple courses on social justice.

#### Limitations

There were three limitations to my study: a) the lack of longitudinal data, b) the small number of participants included, and c) the limited nature of the survey instrument used in the study. First of all, the study would have been stronger if it had followed the preservice teachers into their student teaching. This would have allowed the researcher the opportunity to examine how the beliefs that preservice teachers held or developed in the teacher education program were actually applied to their teaching. As mentioned earlier, changes in

preservice teachers' beliefs do not necessarily get translated into practice. My study would have a greater impact if I had followed the case study participants into their student teaching to examine how well their beliefs from the study were integrated into their student teaching. For example, how well did their beliefs about diversity and teaching materialize into making their mathematics curriculum culturally relevant? As another example, how much did their fears about not receiving adequate support from administrators and parents actualize? Did they have problems trying to teach mathematics for social justice, or were they supported?

The second limitation was, because the purpose of this study was to convey to the reader a sense of the experiences of preservice teachers in learning how to teach mathematics for social justice, it would have been better to have studied more than one mathematics methods course. If this had occurred, the findings of my study would have had greater strength because my findings would have represented a larger sample of preservice teachers. As it is, I have case study results for only five preservice teachers, and quantitative results for only twenty-four. With such small sample sizes, the findings are not generalizable. However, I hope that either I or some other researcher will be able to do this in the future when the field of teaching mathematics for social justice has grown and perhaps becomes an included topic in a handbook on research. That being said, the participants in my study were more diverse (e.g., culturally, linguistically, economically) than pre-service teachers who typically participate in research on preservice teachers' beliefs. Only two of five case study participants were white, suburban females; two others were Hispanic females, and the fifth

was a Hispanic male. Thus, the findings for such a distinct group are noteworthy and may prove valuable for some readers.

The third limitation was that the use of Likert scale surveys as an instrument for measuring beliefs was very limited. Phillip (2007) in an article about mathematics teachers' beliefs and affect questioned the effectiveness of using Likert scale surveys in measuring beliefs. To support his argument against Likert scale surveys, he questioned whether respondents' different interpretations of the items might throw off the validity of the test. He also raised the point that Likert scale questions provide little or no context. The items ask participants to respond to one or two sentence items that have no explained setting. Instead, Phillip suggests that researchers use a context-based open-ended survey as an improved way to quantitatively measure teachers' beliefs. For example, as an improvement this new type of survey situates its items in contexts. This would have helped my study by clarifying better the specific situations I had in mind when writing the items. For example, for the item that stated, "Mathematics curriculum should be based exclusively on the textbook and state standards", the participants may not have interpreted in the way that I meant. I wanted to get feedback on a participant's willingness to create his or her own teaching mathematics for social justice lesson as opposed to using mandated scripted lessons. However, because this context was not conveyed in the item, the participants may have been responding to another situation that I was not considering, such as basing the mathematics curriculum on the Free School model, where students are permitted to learn at their own pace rather than one based textbooks and standards. In addition, if a survey more like the one Phillip describes had been

used in my study, then problems related to misinterpretation or multiple interpretations of an item would have been decreased. For example, for the item in my surveys that stated “Anyone (regardless of race, ethnicity, gender, etc.) can be successful in the U.S. if he/she is willing to work hard”, the word “successful” and phrase “work hard” are open to interpretation. What does “successful” exactly mean? Does it mean being employed, or working a job that is intrinsically satisfying? What does “work hard” mean? Does it mean working forty hours a week, or perhaps sixty? Because the items were so open to interpretation, though two participants may have both marked “Strongly agree”, they may have had different interpretations of the item. Therefore, the Likert scale survey that I used could have been improved. Next I provide some recommendations for further research concerning preservice teachers learning about teaching mathematics for social justice.

#### Recommendations for Further Research

I would recommend the following: a) study preservice teachers’ beliefs both during the mathematics methods course as well during their first teaching experience, b) use an improved beliefs survey, and c) create and study preservice teachers’ discussions about racism. The first recommendation arises out of concern over fully studying preservice teachers’ beliefs from teacher education programs and into real classrooms. This could be done by following preservice teachers into their student teaching, and perhaps even better yet, into their first year of regular teaching. The experiences that the preservice teachers have as regular teachers would better reveal how beliefs are enacted in practice. The second recommendation arises over my concern over the limitation of using Likert scale surveys to

study beliefs. It would be better to use an improved survey as suggested by Phillip (2007), where greater detail for each item is provided in order to give the respondent a better idea of exactly what the item is about. The “improved” survey is able to capture better, among other things, the contexts of preservice teachers’ beliefs as well as the preservice teachers’ interpretations of how items are worded. Of course, no such improved survey presently exists to measure preservice teachers’ beliefs about teaching mathematics for social justice. New items in accordance with Phillip’s suggestions would have to be developed. Lastly, I would recommend that future research in teaching mathematics for social justice address and study racism. The non-white preservice teachers in my study expressed concern over how effectively certain classes of white preservice teachers could teach minority students. The non-white preservice teachers felt that some white preservice teachers stereotype minority students, and therefore cannot be fully open to them. And though neither of the two white case study participants expressed stereotypes about minorities, one of them was concerned about ignorant beliefs that teachers may hold about their students. To help counteract ignorant beliefs or stereotypes, discussions between white and non-white preservice teachers should be held, studied, and analyzed. These discussions would probably prove productive in helping preservice teachers understand each other better, as suggested by the literature. As Cochran Smith (2004) states, “One thing we have learned well in our society is how not to talk or listen to each.” It is important to study these discussions in the field of teaching mathematics for social justice to examine what impact they may have on preservice teacher’s negative beliefs and stereotypes.

## Conclusion

The preservice teachers in my study felt that learning about teaching mathematics for social justice was a good experience in their teacher education program. Though at the beginning some were perplexed about exactly how to enact it and for what grade levels, by the end they were supportive of the idea, even though materials lacked for the early grade levels. They did express concern about administrative and parental support for this method of teaching mathematics, and I wonder how far they will go with it once they are in real classrooms. However, I hope that the positive impact of the course on the participants' beliefs about themselves as mathematics teachers will last. For example, Juliana said, "I used to have a bad attitude about math. I would say to myself, 'I hate math. What makes me think I can teach it?' But, after this semester, I feel more inspired [to teach it in a way]... that gives my students a voice and opportunities to grow" (Final interview). Juliana's change in beliefs about her mathematics teaching is encouraging, and I hope that future preservice teachers will also be positively impacted by instruction in teaching mathematics for social justice.

## APPENDIX A

## PRESURVEY

**Pre-survey: Pre-service Teachers' Beliefs about Equity, Diversity, and Social Justice****Name:** \_\_\_\_\_**Part I****Directions: Please answer the following five open-ended questions. You may use additional paper if needed.**

1. *Please describe what the following three terms mean to you: 1) equity, 2) diversity, and 3) social justice. In your opinion, how do each of these terms relate to teaching?*
  
2. *Please explain what the phrase “teaching mathematics for social justice” means to you.*
  
3. *How would you define your role as a teacher?*
  
4. *What are your goals as a future teacher of mathematics?*
  
5. *How might you explain low mathematics achievement scores of minorities in public schooling?*

**Presurvey Part II:**

**Directions: Mark the response that best represents your opinion. The response scale is:**

**Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )**

Likert scale items:

1. Teaching about issues of equity, diversity, and social justice is an appropriate practice for a teacher.  
Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )
2. Teaching about issues of equity, diversity, and social justice is an appropriate practice for a teacher of mathematics.  
Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )
3. I feel comfortable with the notion of discussing issues of equity, diversity, and social justice with my future students.  
Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )
4. Schooling should provide students with opportunities to examine and/or address social issues.  
Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )
5. Mathematics can help students learn about social justice issues.  
Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )
6. Exploring social issues can help students learn and understand mathematics.  
Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )
7. Mathematics curriculum should be based exclusively on the textbook and state standards.  
Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )
8. I feel comfortable developing new curriculum that is not part of the textbook.  
Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )
9. Mathematics curriculum should be grounded in cultural contexts relevant to students.  
Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )
10. I am interested in learning about how to teach mathematics lessons that incorporate social justice issues.  
Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )

11. My concerns about teaching to the state standards makes me hesitant about incorporating issues of equity, diversity, and social justice in my mathematics classroom.  
Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )
12. I have personally experienced inequity or injustice based on my ethnicity, cultural heritage, linguistic background, race, sexual orientation, and/or gender.  
Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )
13. Minorities in the U.S. are disadvantaged because schools and other social institutions do not serve them well.  
Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )
14. All members of a democratic society are entitled to an equal share of society's resources.  
Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )
15. Anyone (regardless of race, ethnicity, gender, etc.) can be successful in the U.S. if he/she is willing to work hard.  
Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )

**Presurvey Part III--Demographic info**

**Directions; This section is optional. Please fill in the blank with an appropriate answer.**

What is your gender? \_\_\_\_\_

What is your ethnicity? \_\_\_\_\_

Your first language(s) is/are : \_\_\_\_\_

## APPENDIX B

## POST-SURVEY

**Post-survey: Pre-service Teachers' Beliefs about Equity, Diversity, and Social Justice****Name:** \_\_\_\_\_**Part I****Directions: Please answer the following five open-ended questions. You may use additional paper if needed.**

- 1) *Please describe what the following three terms mean to you: 1) equity, 2) diversity, and 3) social justice. In your opinion, how do each of these terms relate to teaching?*
- 2) *Please explain what the phrase “teaching mathematics for social justice” means to you.*
- 3) *How would you define your role as a teacher?*
- 4) *What was particularly helpful in your learning about teaching mathematics for social justice in this class?*
- 5) *What was particularly challenging or difficult in your learning about teaching mathematics for social justice in this class?*
- 6) *When you are a teacher, do you think you will incorporate issues of social justice and/or community issues into your mathematics lessons? Why or why not?*

**Part II:**

<b>Directions: Mark the response that best represents your opinion. The response scale is:</b>			
<b>Strongly Agree ( )</b>	<b>Agree ( )</b>	<b>Disagree ( )</b>	<b>Strongly Disagree ( )</b>

Likert scale items:

- 1) Teaching about issues of equity, diversity, and social justice is an appropriate practice for a teacher.  
Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )
- 2) Teaching about issues of equity, diversity, and social justice is an appropriate practice for a teacher of mathematics.  
Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )
- 3) I feel comfortable with the notion of discussing issues of equity, diversity, and social justice with my future students.  
Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )
- 4) Schooling should provide students with opportunities to examine and/or address social issues.  
Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )
- 5) Mathematics can help students learn about social justice issues.  
Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )
- 6) Exploring social issues can help students learn and understand mathematics.  
Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )
- 7) Mathematics curriculum should be based exclusively on the textbook and state standards.  
Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )
- 8) I feel comfortable developing new curriculum that is not part of the textbook.  
Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )
- 9) Mathematics curriculum should be grounded in cultural contexts relevant to students.  
Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )
- 10) I am interested in learning about how to teach mathematics lessons that incorporate social justice issues.  
Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )
- 11) My concerns about teaching to the state standards makes me hesitant about incorporating issues of equity, diversity, and social justice in my mathematics classroom.  
Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )
- 12) I have personally experienced inequity or injustice based on my ethnicity, cultural heritage, linguistic background, race, sexual orientation, and/or gender.  
Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )
- 13) Minorities in the U.S. are disadvantaged because schools and other social institutions do not serve them well.  
Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )

14) Anyone (regardless of race, ethnicity, gender, etc.) can be successful in the U.S. if he/she is willing to work hard.

Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )

15) I feel that I have a good understanding of teaching mathematics for social justice from taking this class.

Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )

16) I feel that I have good understanding of available resources to support my teaching mathematics for social justice should I decide to do so.

Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )

17) Seeing and experiencing lessons and activities that incorporated social and community issues in teaching mathematics was helpful for me in learning how to teach mathematics for social justice.

Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )

18) I feel anxious about trying to incorporate issues of social justice into my math lessons once I start teaching

Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )

19) I felt comfortable in expressing my views about equity, diversity, and social justice and teaching mathematics for social justice in this class.

Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )

20) I feel that my efforts to incorporate social and community issues into my mathematics lessons will be supported by colleagues and administrators at my future school(s).

Strongly Agree ( )      Agree ( )      Disagree ( )      Strongly Disagree ( )

## APPENDIX C

## INITIAL INDIVIDUAL INTERVIEW QUESTIONS

Warm up questions:

1. *Did you have a good summer vacation?*
2. *How did you get into education?*
3. *What are you looking forward to as a teacher?*
4. *Have you ever participated in a study before? (Lead-in to consent form)*

Questions for initial interview:

1. *In your opinion, what are the best ways to help students learn math?<sup>1</sup>*
2. *In your opinion, what are some of the biggest reasons why students have difficulty in learning math?<sup>1</sup>*
3. *In your opinion, what does it mean to have 'social justice', in general, in society? In education?<sup>2</sup>*
4. *What does teaching for social justice mean to you?*
5. *How have you personally been impacted by the issues of equity, diversity and social justice in your own life? (Probe for specific examples*
  - a. *Follow up probe: Do you think those experiences have impacted your ideas about teaching, and education? If so, how?*
6. *What does teaching mathematics for social justice mean to you?*
  - a. *Follow up probe: What do you think is the purpose for teaching mathematics for social justice?*

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<sup>1</sup> Aguirre, J. (2007, April). Integrating equity/social justice into a university pre-service mathematics methods course: A Latina mathematics educator's perspective. Paper presented at the annual meeting of the American Education Research Association Conference, Chicago, IL.

<sup>2</sup> Taken from Bartell, G.T. (2005). Learning to teach mathematics for social justice. Unpublished doctoral dissertation, University of Wisconsin-Madison, Madison, WI.

*b. Follow up probe: What do you think can students get out of it?*

- 7. What challenges might you anticipate, either for yourself or someone else, who is interested in teaching mathematics for social justice?*
- 8. Have you had any previous experience in teaching for social justice, either as a student or an instructor?*
- 9. In what ways, if at all, do your cultural identities (race, language, class, culture, gender, etc.) inform your vision for teaching math? Please give a few examples.*
- 10. On the initial survey, you said that, “quote survey response.” Can you give me an example of what you mean by that? Or can you say more?”*

## APPENDIX D

## FINAL INDIVIDUAL INTERVIEW QUESTIONS

Warm up questions:

1. Are you looking forward to winter break? What are you doing?
2. Have you enjoyed the class?
3. Are you looking forward to student teaching next semester? Where will you be?

Questions for final interview

- 1) *Please clarify how did this course affect the way that you will teach math? (Probe for specific examples to follow up post-survey open-ended question #3)*
- 2) *What does teaching for social justice mean to you?*
- 3) *What does teaching mathematics for social justice mean to you?*
  - a. *Follow up probe: What do you think is the purpose for teaching mathematics for social justice?*
- 4) *What are some of the disadvantages, for the teacher and/or students, in teaching mathematics for social justice?*
- 5) *What are some of the advantages, for the teacher and/or students, in teaching mathematics for social justice?*
- 6) *How did this course impact your beliefs about equity, diversity, and social justice?*
- 7) *Did this course affect the way you think about teaching and/or schooling? (Probe for specific examples)*
- 8) *Are you interested in either teaching for social justice or teaching mathematics for social justice in your future classrooms? Why or why not?*
- 9) *What challenges do you anticipate, either for yourself or someone else, who is interested in teaching mathematics for social justice?*

- 10) *Do you think one can cover the necessary math topics and standards while at the same time incorporating social justice issues into the curriculum? If so, how? Probe for specific examples.*
- 11) *What experiences in this class helped you to incorporate social and community issues, and issues of social justice into making your own mathematics lesson for this class?*
- a. *Follow up probe: What did you think about the model lessons?*
  - b. *Follow up probe: Were they helpful in your learning about teaching mathematics for social justice?*
  - c. *Follow up probe: Would you use them in your own classroom; and if so, how? What would you change?*
- 12) *What grade level(s) do you think are appropriate for students to learn about social justice in the classrooms?*

## APPENDIX E

## FIELD NOTE ENTRY SAMPLE

Fieldnotes  
Oct 1, 2007

Case study participants: 5, 16, 20, and 27

Teaching and Learning Elementary Math  
PowerPoint week8 schoolcomm\_math hunt

- In-class Activity: Using mathematics to investigate real-world issues

**Readings Due:**

CN (section 5) – Peterson, *Teaching math across the curriculum*

CN (section 5) – Turner & Font Strawhun, *With math it's like you have more defense*

CN (section 5) - Gutstein, *Real-World Projects*

CN (section 5) – Richardson, *Designing a math trail for the elementary school*

Discussion of reading (assignment)

1. 2-3 key ideas from readings
2. How might incorporate into your own teaching
3. What questions/concerns do you have

Transcriptions from discussion  
File #20054

5: The themes I took from the readings is how math can be used to teach your students how they can have a voice for defending themselves, a voice for social justice, a voice for improvement. [for them to see math as] a catalyst for change. I thought that was really powerful.

A non-case study participant commented on Turner's article.

In response,

5: The students got to see the wealth was distributed in the areas where there were the fewest people, versus having an equal distribution.

20: I liked the one where the kids measured the room and the hallways of their school to see how unfair their conditions were in comparison to other schools. Their school was more dense [in student population] and less space. And then they used that, the kids

understood that math helped them prove what they were going for. Like when they went to the school board they said they couldn't have done it without the math facts. It started making sense more, this whole teaching math through social justice.

Non cs: It brought in area, percentage, problem solving, division, like everything.

5: And it made it [math learning] exciting. It wasn't like these kids... Usually math is viewed as a isolated discipline, that isn't connected to anything else that you teach. And this showed that it first doesn't have to be isolated; it can be involved in all of your curriculum areas, and secondly, it can be exciting for your kids because it can be a way for them to find their voice. If we had done things like that when I was little with math, I would have liked math. I hated math because math was so boring.

20: The special thing about this article was that they had the teacher ask them what are some issues going on in your community, your neighborhood, in your school (analysis; bring this up in focus group), and so when they thought of the issues, then that is when the teacher chose one that they could develop a unit upon. So, they [the students] had a say in what they were learning. I'm just thinking that is really hard...you have to be really...I don't know what the word is, as a teacher to let your students just chose the topic and then you take that and then develop a unit.

5: Remember, she didn't incorporate all the students topics in terms of what they wanted to investigate. They found the focus that lent itself well to math, lent itself well to social justice, and lent itself well to the kids. Because AIDS was also brought up. There were a could of other topics too that weren't necessarily dismissed but that they weren't explored.

20: I think that is a quality of a good teacher is being able to change and like as times change to be able to adapt your curriculum to that. It's like relevant.

Non cs: I thought it was interesting the stereotypes about the women (note: figure out what reading this is from the Class notes packet), looking at the put-downs. I thought that was really ...it would make them [the students] aware of their surroundings and media and how everything isn't fact. It isn't the way the world really is. I think it's interesting to make them [the students] kind of see, to make them do the cartoons and stuff. That's stuff they see everyday and they don't think about the negative things that are portrayed.

5: These articles really redefine the term mathematics, not necessarily that they are breaking ground but in terms of how they are apply it [tmsj] to the curriculum, it's really exploring math, showing how it can be interesting from different perspectives. I thought they were great articles, made me excited to teach math.

16: I thought it was interesting to integrate it [math] with other things. It makes sense when you think about it that way to integrate it and there are so many resources now, like this, that we are able to find [to tmsj]. It's not like it [tmsj] is that far fetched now; it's just not how we [traditionally] think about it. So, it's not so much effort [to do].

20: To piggyback on what you [#5] said about math not being seen as isolated focus or how math is only relevant for like mathematicians and scientists, like even with politics and stuff, numbers are being constantly thrown at us and as a society it is important to understand kind of what that [the numbers that politicians use] really means, like one of the examples was the minimum wage where people say "oh, yeah, it's increasing" but in comparison to cost of living and how all the other stuff is changing, it is actually the lowest it has ever been. (note; combining math and politics, using math to understand politics)

Non CS: They made it seem like it was a good percentage but really it was.

5: If you do hone your math skills, you can participate in society with a certain amount of knowledge rather than being easily manipulated. Statistics get misconstrued all the time, especially in political campaigns. You really have to shift through the BS to figure out what is really going on. So, it [how to think critically about stats] is really valuable tool to give your students. (note: math as civic skill)

The discussion continued—File 20055

The Rethinking article: (note: Peterson, *Teaching math across the curriculum?*)

Non cs: (cleared up how to use social justice in the math classroom)

Erin: One of the great benefits of doing this kind of work in elementary classrooms is that you do have the students all day long. So, you have the ability to integrate across content areas which doesn't always happen in higher grade levels.

Non cs: Our group liked the fact that math is was related to everyday life. Even though we all have different experiences with math, it's really cool that they give us suggestions on how to do it [tmsj] with the students in our classrooms, to show that math is everywhere. (note: this math is everywhere seems to be a common theme for these preservice teachers)

Erin: Was there a particular suggestion that seemed to make sense to you.

Non cs: we had two. Edith really liked the math trails, walking through the school and seeing patterns or counting bricks and stuff like that (note: similar to what #26 said; did he get his opinion from math trails). I really liked the essay, "the Numeric me" (find this!). The teachers assign it at the beginning of the year and the students have to write

how numbers are in their lives, so they have to write like birthdays, and telephone numbers, addresses, so I really liked that.

Comments about Voice article by Turner:

5: I thought the article did a good job of providing an easily convincing argument for having math as a catalyst for social change, which is not often the role that I would have seen math in prior to taking this course. And like other people have said before, the idea of math and social justice, I have always thought of it in terms of, “Well, make sure that you are representing people fairly” but I never really saw it in terms of, “Hey, you can use math to prove and support arguments” I really liked all four articles that we read this week.

Erin. (Helps kids see math as a tool to improve a situation in their school or in their life)

5: I thought all of these articles, unlike some of the book (what book is this) articles where I feel the need to fix them because I don't see how they would necessarily fit [with my teaching], I liked all of the suggestions in these articles this week. I really thought that they were good ideas for teachers that didn't need to be changed.

Non cs: It seems that (the authors of these articles) were trying to relate math to something that the kids were interested in, like in your article concerning the school being overcrowded. (The issues of equity and fairness were really brought up for the kids, which are things that they are interested in). (The students would be motivated [by tmsj lessons])

Erin: what are the issues that push the kids in your classes, that motivate your kids in your classes? It is different depending on the age of your students, different on where you are teaching.

Non cs: the idea of creating space for students to pose their own problems and to interject their own interests was a powerful way for supporting student activism.

Sample TMSJ activity: Nutrition lesson

Erin (how can we use math to investigate something related to kids' lives). (note: This is an example of a math lesson that does that.) This is an example of a lesson that can be done in the classroom, and not out in the community [like your project]

Non cs: (what is healthy follows more of a rule of moderation. You can drink really sugary drinks, but in moderation. When kids start drinking them non-moderately, that is when it becomes a health issue)

Non cs (This [nutrition] is an important issue because of obesity.)

Non cs: (make distinction between fructose and glucose)

Whole class discussion of patterns that students see in the table of data and the scatter plot.

27: (Can use for younger students by narrowing focus of assignment/lesson. For example, younger students could make bar graphs of just calories, instead of figuring out all the other things like number of teaspoons, cost per serving, etc.)

#### School and Community Based Project

I followed 5, 16, 20, and one non cs participant as they went through the planning stages of their project (see lecture slide show for oct 1 for details). Basically , visiting sites, collecting photos and data, and making some initial questions. For this group, school project was attendance, community project was housing development construction. O'Leary construction. Water tank-how much water it can hold. How much fuel the construction trucks used. How much earth/volume could be scooped up by 'one bucket'. One worker kept stressing how they were working in 10's (metric system). Recounted story of how new Federal courthouse was designed on 10;s (metric) but confused the construction company that was using English system.

Attendance: collected info of number of absences for the day, broken down by grades. They were surprised to find the documents listed absences also by ethnicity. Were very confused about the label 'White, non Hispanic'. They were confused about why Hispanic would be confused with Caucasian. (I think it's because Spain is considered part of Western Europe.)

Follow-up on Oct 1. I asked #20 about her hang-up on the label of White, non Hispanic'  
**Audio file 20067**

20: On the attendance I notice that it had all those ethnicities, and then it gets to white, and the sheet says, White, non-Hispanic. But, can't you be Native American and non-Hispanic. I don't understand why the only one they put non-Hispanic is for the whites?

Why would they say. It just seemed really odd to me. Because I don't understand why the only they put non-Hispanic is for the white category.

16: No, I don't think so.

20: Yah, they did

16: Are you sure?

20: They put African-American, Native-American, Asian-American, but there's White, non-Hispanic. I don't know, maybe there's some valid reason. Some politician decided that is how we are going to organize the attendance for schools [hint of racism for politicians?]. I think because they think they know the most about schools, because they went to Law school and everything, you know Harvard.

Looked at attendance sheet again (on Oct 3 after having this follow-up discussion with Nicole, and discovered that for "races" there was listed "Black, not Hispanic" as well as "White, not Hispanic". There was also "Hispanic"

APPENDIX F  
JOURNAL ENTRY SAMPLE

Reflexive Journal Entry for the Week of Sept 5 & 6

The hardest part in the research for me so far is developing a familiarity or comfortableness with the students. I usually feel awkward around people until I get to know them a bit. On Sept 6, I finally had the opportunity to meet each student (save for the absent Brad) and learn his or her first and last names. Since I don't speak Spanish, I have a fear of appearing to be the white gringo male who knows nothing about Latinos/as. I feel awkward because I can't pronounce some of the names correctly in Spanish; I have to ignorantly ask, "How do you pronounce/say your name again?" But, at this point I do know everyone's name (though with a gringo pronunciation). One student even surprised me by telling me her first name with a gringo pronunciation, though I heard the instructor later calling her name with a Hispanic pronunciation.

I am glad that I got to meet all the students on Thursday (Sept 6) because there were two students who had not marked the video/audio permission box, and a) I wasn't sure if they had intended this and b) if they did intend this, I thought about how awkward this would make the study (to have to purposefully not record them). This could be a big problem when video taping, because the camera would have to stay stationary, and if they sat in the middle in the room, my camera angles would be very limited. Because I felt that it would compromise the confidentiality of their consent forms, I couldn't discuss the marking of the audio/video box with them in the classroom (which would have been the

fastest way to take care of this), so I told them that I sent an e-mail, and that they could respond to it. The other limit would be in one of these two students are in a discussion group with one or more case study students; I won't be able to record.

I worry that my field notes so far are not adequate enough: that I'm not writing down enough information to be used as data and that that aren't thick with rich descriptions. I believe it will be helpful to record more discussions that my case study students are involved in to capture some good quotes. It's too hard to copy down quotes during discussions; I feel that I am missing stuff or not completely being accurate. I am also having the problem/concern that I'm not capturing enough of the context. So far, there hasn't been direct/concentrated talk about TMSJ; so I feel that I am dealing with a lot of 'chaff' (as opposed to 'wheat'); and I am not feeling too inspired to take field notes on what I currently feel is chaff. However, I feel when I write up my analysis, I will want more descriptions of what happened in class when, so I can recreate the learning flow of the class. I will have to talk to the instructor about this.

At this point I feel that I need to reflect upon on what kind of detail/descriptions I need to be capturing right now. Once in a while I do here something that I feel is related. However, another approach would be to write down everything now, and then sort through next semester. I probably just need to find a balance. I know that I will have good data from the interviews and the surveys, but how much should my field notes be contributing. Do I want to have them so detailed that the reader would have a complete image of case study's experience in the class? However, I think this would be impossible because I have too many case study students to follow.

At this point, I am trying to figure out whether I should invite an additional case study student just because my gut/intuition tells me that I should. This student is very articulate and outgoing; I think he/she would contribute to the focus group tremendously. Also by having an additional case study student, I would have some insurance in case someone has to drop out. I haven't heard anything from any of the recruits, so I am afraid that I won't get an additional student from that group.

Summary of questions/concerns:

What should I be capturing in my field notes? What kind of 'data' is important to be recording?

How much field note data do I want by the end of the study? More sounds better, but I want quality more, not junk more.

Should I invite an additional student based on intuition?

## APPENDIX G

## COMMON CODES AND THEIR DEFINITIONS

Code	Definition
beliefs>diversity>differences	believing that diversity means more than different ethnicities but encompasses how people think, act, dress differently. (Also includes generic answers that 'diversity is about differences')
beliefs>diversity>ethnicity_cultural	beliefs about diversity that deal with ethnic and/or cultural differences
beliefs>diversity>stereotypes	beliefs about diversity that involve stereotypes about a group of people
beliefs>equity>equal_treatment	beliefs about equity concerning all peoples being treated with the same amount of respect and understanding
beliefs>equity>resources	believing that equity is about people having equal access to resources and opportunities
beliefs>sj>fairness	believing that social justice is about fairness and/or equality for all
beliefs>sj>legal	believing that social justice is about having legal rights and enforcing them
beliefs>sj>no_oppression	believing that social justice is about society as a whole not being oppressive to other people's existence and their contributions to society
beliefs>teaching>diversity	believing that teaching is about respecting diversity as the teacher and/or teaching students to respect diversity
beliefs>teaching>equity	beliefs>teaching>equity: beliefs about equity that influence teaching
beliefs>teaching>equity>resources	beliefs about equity that get incorporated into teaching to show that anyone can be successful if they work hard in school
beliefs>teaching>sj	believing that teaching should incorporate principles of social justice in the classroom and/or examine sj issues on a community or global level
beliefs>teachmath>concern_about_standards	believing that teaching math will be hard because of standards
beliefs>teachmath>diversity>cultural	believing that teaching math is about incorporating cultural differences
beliefs>teachmath>equity>resources	believing that teaching math can incorporate equity issue of providing opportunities and access to resources
beliefs>teachmath>sj	believing that in teaching math one can incorporate social justice issues
beliefs>tmsj>administration	beliefs regarding tmsj and school administration
beliefs>tmsj>age_appropriate:	believing that in tmsj one needs to be age appropriate
beliefs>tmsj>change	holding beliefs about tmsj where it brings about changes in both society and people's worldviews
beliefs>tmsj>eqdivsj_issues	believing that tmsj is about incorporating issues of equity, diversity, and social justice into the students mathematical curriculum
beliefs>tmsj>equal_math_learning	believing that tmsj is about teaching/learning equally for all students (same opportunities to learn)
beliefs>tmsj>fear_of_offending	believing that in tmsj one might offend a parent or a student by addressing a controversial topic...or...beliefs about how to keep parents from being offended
beliefs>tmsj>fearofoffend>non_traditional:	believing that in tmsj one might offend a parent or a student because the math class is too non-traditional
beliefs>tmsj>no_firm_def	believing that one doesn't fully know what the term tmsj means and/or how to enact it
beliefs>tmsj>other	tmsj "other" category
beliefs>tmsj>substantiation	believing that tmsj is about learning how to substantiate one's arguments with facts
tmsj>aid>article	in learning about tmsj, an aid was an article(s) assigned as reading for the class
tmsj>aid>modeling:	in learning about tmsj, an aid was having a tmsj lesson modeled in class
tmsj>aid>more_sjclasses:	in learning about tmsj, an aid would be requiring students to take

tmsj>aid>new_perspectives:	more sj classes in learning about tmsj, a benefit of the class was being given new perspectives about life, the world, and/or math
tmsj>aid>professor	in learning about tmsj, an aid was the modeling by the professor
tmsj>challenges>know_what_is	in learning about tmsj, a challenge is knowing exactly what it is
tmsj>challenges>prejudices:	in learning about tmsj, a challenge is being closed to any new ideas because of one's prejudices

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## APPENDIX H

## ITEM-TOTAL STATISTICS TABLE BEFORE REVERSING ITEMS #7 AND #11

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
1pre. Teaching about issues of equity, diversity, and social justice is an appropriate practice for a teacher	45.09	21.229	.381	.871	.769
2pre. Teaching about issues of equity, diversity, and social justice is an appropriate practice for a teacher of mathematics	45.32	20.894	.474	.654	.763
3pre. I feel comfortable with the notion of discussing issues of equity, diversity, and social justice with my future students	45.18	19.584	.841	.926	.741
4pre. Schooling should provide students with opportunities to examine and/or address social issues	45.14	20.885	.544	.735	.761
5pre. Mathematics can help students learn about social justice issues	45.64	17.576	.752	.981	.729
6pre. Exploring social issues can help students learn and understand mathematics	45.64	17.576	.828	.977	.723
7pre. Mathematics curriculum should be based exclusively on the textbook and state standards.	47.18	24.823	-.315	.502	.816
8pre. I feel comfortable developing new curriculum that is not part of the textbook.	45.77	18.660	.639	.686	.743
9pre. Mathematics curriculum should be grounded in cultural contexts relevant to students.	45.45	19.403	.694	.829	.744

10pre. I am interested in learning about how to teach mathematics lessons that incorporate social justice issues	45.18	19.965	.744	.884	.747
11pre. My concerns about teaching to the state standards makes me hesitant about incorporating issues of equity, diversity, and social justice in my mathematics classroom	46.09	24.087	-.175	.340	.819
12pre. I have personally experienced inequities and/or injustices based on my ethnicity, cultural heritage, linguistic background, race, class, sexual orientation, and/or gender	46.00	22.000	.085	.355	.800
13pre. Minorities in the U.S. are disadvantaged because schools and other social institutions do not serve them well	45.68	19.942	.502	.770	.758
14pre. All members of a democratic society are entitled to an equal share of society's resources	45.27	21.732	.233	.507	.780
15pre. Anyone (regardless of race, ethnicity, gender, etc.) can be successful in the U.S. if he/she is willing to work hard	45.45	21.688	.140	.514	.793

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## APPENDIX I

## ITEM-TOTAL STATISTICS TABLE AFTER REVERSING ITEMS #7 AND #11

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
1pre. Teaching about issues of equity, diversity, and social justice is an appropriate practice for a teacher	46.18	27.203	.396	.871	.837
2pre. Teaching about issues of equity, diversity, and social justice is an appropriate practice for a teacher of mathematics	46.41	27.301	.395	.654	.837
3pre. I feel comfortable with the notion of discussing issues of equity, diversity, and social justice with my future students	46.27	25.351	.851	.926	.817
4pre. Schooling should provide students with opportunities to examine and/or address social issues	46.23	26.374	.658	.735	.826
5pre. Mathematics can help students learn about social justice issues	46.73	23.065	.761	.981	.812
6pre. Exploring social issues can help students learn and understand mathematics	46.73	23.255	.806	.977	.809
7preR. Mathematics curriculum should be based exclusively on the textbook and state standards.	46.64	27.481	.313	.502	.841
8pre. I feel comfortable developing new curriculum that is not part of the textbook.	46.86	24.028	.690	.686	.818
9pre. Mathematics curriculum should be grounded in cultural contexts relevant to students.	46.55	25.307	.675	.829	.822

10pre. I am interested in learning about how to teach mathematics lessons that incorporate social justice issues	46.27	25.922	.724	.884	.823
11preR. My concerns about teaching to the state standards makes me hesitant about incorporating issues of equity, diversity, and social justice in my mathematics classroom	47.73	27.732	.173	.340	.852
12pre. I have personally experienced inequities and/or injustices based on my ethnicity, cultural heritage, linguistic background, race, class, sexual orientation, and/or gender	47.09	27.420	.178	.355	.855
13pre. Minorities in the U.S. are disadvantaged because schools and other social institutions do not serve them well	46.77	26.279	.432	.770	.835
14pre. All members of a democratic society are entitled to an equal share of society's resources	46.36	27.100	.361	.507	.839
15pre. Anyone (regardless of race, ethnicity, gender, etc.) can be successful in the U.S. if he/she is willing to work hard	46.55	28.165	.102	.514	.859

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APPENDIX J  
RELIABILITY CODING

Data Source	Line #	Both coded same text?	Both used same code?	My code	My colleague's code
Final Interview with Juliana	9	y	n	beliefs>tmsj>equal_math_learning	tmsj>aid>new_perspectives
	26	y	n	beliefs>tmsj>eqdivsj_issues	tmsj>aid>new_perspectives
	30	y	n	beliefs>tmsj>age_appropriate	beliefs>tmsj>change
	39	y	y	tmsj>aid>article	tmsj>aid>professor, tmsj>aid>article
	45	y	y	tmsj>aid>modeling	tmsj>aid>modeling
	63	y	y	beliefs>tmsj>age_appropriate, beliefs>teachmath>sj	beliefs>tmsj>age_appropriate, beliefs>teachmath>sj
	71	y	y	beliefs>teaching>sj	beliefs>teaching>sj
	80	y	y	tmsj>aid>modeling	tmsj>aid>modeling
	84	y	y	beliefs>teaching>equity	beliefs>teaching>equity
	111	y	n	beliefs>teaching>equity	beliefs>teaching>sj
	121	y	y	beliefs>diversity>stereotypes	beliefs>diversity>stereotypes
	131	y	n	tmsj>challenges>prejudices	beliefs>teaching>status_quo
	153	y	n	beliefs>teaching>sj	no code
	164	y	y	beliefs>diversity>stereotypes	beliefs>diversity>stereotypes
	182	y	n	tmsj>challenges>prejudices	beliefs>diversity>stereotypes
	190	y	y	beliefs>teaching>equity	beliefs>teaching>equity
	203	y	y	beliefs>teaching>diversity	beliefs>teaching>diversity
	222	y	n	tmsj>challenges>prejudices	beliefs>diversity>stereotypes
	225	y	n	beliefs>teaching>equity	beliefs>teaching>sj tmsj>aid>new_perspectives,
	242	y	y	beliefs>teachmath>sj	beliefs>teaching>sj
260	y	y	beliefs>teachmath>equity>choice	beliefs>teachmath>equity>choice	
Open-ended presurvey-Linda	7	y	y	beliefs>equity>equality	beliefs>equity>equality
	8	y	y	beliefs>equity>resources	beliefs>equity>resources
	11	y	y	beliefs>diversity>differences	beliefs>diversity>differences
	14	y	y	beliefs>sj>fairness, beliefs>teaching>sj	beliefs>sj>fairness
	21	y	y	beliefs>tmsj>equal_math_learning	beliefs>tmsj>equal_math_learning
	30	y	y	beliefs>teaching>sj	beliefs>teaching>sj
	48	y	y	beliefs>teaching>equity	beliefs>teaching>equity
Lesson Plan-Javier	89	y	y	beliefs>teaching>equity	beliefs>teaching>equity

	111	y	y	beliefs>teaching>equity	beliefs>teaching>equity
	124	y	y	beliefs>teaching>equity	beliefs>teaching>equity
Focus Group Interview	46	y	y	tmsj>aid>new_perspectives	tmsj>aid>new_perspectives
	56	y	y	tmsj>aid>more_sjclasses	tmsj>aid>more_sjclasses
	69	y	y	tmsj>aid>more_sjclasses	tmsj>aid>more_sjclasses
	75	y	y	tmsj>aid>more_sjclasses	tmsj>aid>more_sjclasses
	92	y	y	tmsj>aid>new_perspectives	tmsj>aid>new_perspectives
	99	y	y	tmsj>aid>modeling	tmsj>aid>modeling
	112	y	y	tmsj>aid>professor	tmsj>aid>professor
	121	y	y	tmsj>aid>article	tmsj>aid>article
	126	y	y	beliefs>tmsj>change beliefs>tmsj>substantiation	beliefs>tmsj>change
	137	y	y	beliefs>tmsj>change	beliefs>tmsj>change
	187	y	y	tmsj>aid>new_perspectives	tmsj>aid>new_perspectives
	225	y	n	tmsj>aid>modeling	tmsj>aid>new_perspectives
	233	y	y	tmsj>aid>modeling	tmsj>aid>modeling
	237	y	y	tmsj>aid>modeling	tmsj>aid>modeling
	239	y	y	beliefs>teaching>sj	beliefs>teaching>sj
	240	y	y	tmsj>aid>modeling	tmsj>aid>modeling
	254	y	y	tmsj>aid>modeling	tmsj>aid>modeling
	283	y	y	tmsj>aid>modeling	tmsj>aid>modeling
	295	y	n	beliefs>teachmath>equity>choice	beliefs>teachmath>sj
	316	y	y	beliefs>tmsj>fear_of_offending	beliefs>tmsj>fear_of_offending
	345	y	y	beliefs>tmsj>fear_of_offending	beliefs>tmsj>fear_of_offending
	338	y	y	beliefs>tmsj>substantiation	beliefs>tmsj>substantiation
	354	y	n	beliefs>tmsj>administration	No code
	350	y	y	beliefs>tmsj>fear_of_offending	beliefs>tmsj>fear_of_offending
	377	y	y	beliefs>tmsj>fear_of_offending	beliefs>tmsj>fear_of_offending
	385	y	y	beliefs>sj>fairness	beliefs>sj>fairness
	388	y	y	beliefs>tmsj>administration	beliefs>tmsj>administration
	396	y	y	beliefs>tmsj>administration	beliefs>tmsj>administration
	418	y	y	beliefs>teaching>sj	beliefs>teaching>sj
	471	y	y	beliefs>tmsj>administration	beliefs>tmsj>administration
	482	y	y	beliefs>tmsj>fear_of_offending	beliefs>tmsj>fear_of_offending
	498	y	y	beliefs>tmsj>age_appropriate	beliefs>tmsj>age_appropriate
	504	y	y	beliefs>tmsj>fear_of_offending	beliefs>tmsj>fear_of_offending
	520	y	y	beliefs>tmsj>administration	beliefs>tmsj>administration
	537	y	y	beliefs>tmsj>administration	beliefs>tmsj>administration
	553	y	y	beliefs>tmsj>fear_of_offending	beliefs>tmsj>fear_of_offending
	558	y	y	beliefs>tmsj>fear_of_offending	beliefs>tmsj>fear_of_offending
	580	y	y	tmsj>challenges>ulterior_agenda	tmsj>challenges>ulterior_agenda
	613	y	y	beliefs>teaching>equity	beliefs>teaching>equity

	640	y	y	beliefs>teaching>sj	beliefs>teaching>sj
	714	y	n	beliefs>sj>legal	beliefs>teaching>sj
	728	y	y	beliefs>teaching>sj	beliefs>teaching>sj
	742	y	y	beliefs>teaching>sj	beliefs>teaching>sj
	752	y	n	beliefs>teaching>diversity	beliefs>teaching>sj
	781	y	n	beliefs>teaching>sj	beliefs>teaching>status_quo
	808	y	y	beliefs>tmsj>administration	beliefs>tmsj>administration
	760	n		no code	beliefs>teaching>status_quo
	881	y	y	beliefs>teachmath>sj	beliefs>teachmath>sj
	896	y	y	beliefs>teaching>status_quo	beliefs>teaching>status_quo
Journal Oct 1	5	y	y	tmsj>aid>article	tmsj>aid>article
	21	y	n	beliefs>teachmath>sj	beliefs>tmsj>change
	29	y	y	beliefs>teachmath>sj	beliefs>teachmath>sj
Presurvey Q#3: non- case participants	14	y	y	beliefs>teaching>sj	beliefs>teaching>sj
	23	y	y	beliefs>teaching>sj	beliefs>teaching>sj
	49	y	y	beliefs>tmsj>substantiation	beliefs>tmsj>substantiation
Postsurvey Q#2: non- case participants	4	y	y	beliefs>tmsj>eqdivsj_issues	beliefs>tmsj>eqdivsj_issues
	11	y	y	beliefs>tmsj>eqdivsj_issues	beliefs>tmsj>eqdivsj_issues
	13	y	y	beliefs>tmsj>change	beliefs>tmsj>change
	17	y	y	beliefs>tmsj>equal_math_learning	beliefs>tmsj>equal_math_learning
	21	y	y	beliefs>tmsj>eqdivsj_issues	beliefs>tmsj>eqdivsj_issues
	24	y	y	beliefs>tmsj>eqdivsj_issues	beliefs>tmsj>eqdivsj_issues
	28	y	y	beliefs>tmsj>eqdivsj_issues	beliefs>tmsj>eqdivsj_issues
	36	y	n	beliefs>tmsj>eqdivsj_issues	beliefs>tmsj>change
	45	y	y	beliefs>tmsj>eqdivsj_issues	beliefs>tmsj>eqdivsj_issues
	49	y	y	beliefs>tmsj>change	beliefs>tmsj>change
	50	y	y	beliefs>tmsj>change	beliefs>tmsj>change
	53	y	y	beliefs>tmsj>substantiation	beliefs>tmsj>substantiation
	60	y	y	beliefs>tmsj>equal_math_learning	beliefs>tmsj>equal_math_learning

APPENDIX K  
HUMAN SUBJECTS APPROVAL

THE UNIVERSITY OF  
ARIZONA  
TUCSON ARIZONA

Human Subjects Protection Program  
P.O. Box 245137  
Tucson, AZ 85724-5137  
(520) 626-6721

August 24, 2007

David Muller  
College of Education  
TTE Department  
P.O. Box 210069  
BSC: B07.304 PRESERVICE TEACHERS' BELIEFS AND EXPERIENCES IN TEACHING MATHEMATICS  
FOR SOCIAL JUSTICE

Dear David Muller:

We received your research proposal as cited above. The procedures to be followed in this study pose no more than minimal risk to participating subjects and have been reviewed by the Institutional Review Board (IRB) through an Expedited Review procedure as cited in the regulations issued by the U.S. Department of Health and Human Services [45 CFR Part 46.110(b)(1)] based on their inclusion under **research categories 6 & 7**. As this is not a treatment intervention study, the IRB has waived the statement of Alternative Treatments in the consent form as allowed by 45 CFR 46.116(d)(2). Although full Committee review is not required, the committee will be informed of the approval of this project. This project is approved with an expiration date of 24 August 2008. Please make copies of the attached IRB stamped consent documents to consent your subjects.

The Institutional Review Board (IRB) of the University of Arizona has a current **Federalwide Assurance** of compliance, **FWA00004218**, which is on file with the Department of Health and Human Services and covers this activity.

Approval is granted with the understanding that no further changes or additions will be made to the procedures followed without the knowledge and approval of the Human Subjects Committee (IRB) and your College or Departmental Review Committee. Any research related physical or psychological harm to any subject must also be reported to each committee.

A university policy requires that all signed subject consent forms be kept in a permanent file in an area designated for that purpose by the Department Head or comparable authority. This will assure their accessibility in the event that university officials require the information and the principal investigator is unavailable for some reason.

Sincerely yours,

Elaine G. Jones, PhD, RN, FNAP  
Chair, Social and Behavioral Sciences Human Subjects Committee

EGJ/rkd  
Cc: Departmental/College Review Committee

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