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Equity Pedagogy in the Secondary Mathematics Classrooms of Three Preservice Teachers

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ACCEPTANCE

This dissertation, EQUITY PEDAGOGY IN THE SECONDARY MATHEMATICS CLASSROOMS OF THREE PRESERVICE TEACHERS, by PAMELA ANNETTE SEDA, was prepared under the direction of the candidate's Dissertation Advisory Committee. It is accepted by the committee members in partial fulfillment of the requirements for the degree Doctor of Philosophy in the College of Education, Georgia State University.

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ABSTRACT

EQUITY PEDAGOGY IN THE SECONDARY MATHEMATICS CLASSROOMS OF THREE PRESERVICE TEACHERS

by
Pamela Annette Seda

In the United States, diverse learners, defined by race, ethnicity, language, and socioeconomic status, do poorly in mathematics in disproportionate numbers. Research suggests that teachers who use instructional practices that build on the cultural strengths of racial and ethnic minorities can increase academic achievement for these students. Using culturally relevant pedagogy as a theoretical framework, this qualitative case study investigated the equity pedagogy of three secondary mathematics student interns in an alternative teacher preparation program during their student teaching experience. The following research questions were also investigated: What school factors do the interns perceive to influence their decisions in implementing equity pedagogy? Which aspects of the teacher education program do the interns perceive to most influence their implementation of equity pedagogy?

For the purpose of this study, equity pedagogy is defined as modifying instructional practices in order to facilitate the academic achievement of students from diverse racial, ethnic, and/or socioeconomic backgrounds by applying the components of Zeichner et al.'s (1998) curriculum and instruction principles specifically to the secondary mathematics classroom. Data collected through videotaped classroom observations, field notes, semistructured interviews, and examination of the participants' reflective journals were analyzed and categorized as follows: building on prior knowledge, high

expectations for diverse learners, knowing students well, culturally responsive pedagogical skills, critical consciousness, sharing of power, and multiple funds of knowledge.

Data analysis showed evidence of all seven aspects of equity pedagogy by one or more of the participants, although they demonstrated these practices to varying degrees. Colorblindness, lack of appropriate mentors, time constraints, the National Council of Teachers of Mathematics Standards (NCTM, 2000), and culturally responsive pedagogical skills that had been modeled in their mathematics methods courses most affected the interns' implementation of equity pedagogy. These results indicate that preservice teachers need a framework to critically reflect on issues of equity in education, time to develop equitable teaching practices, and teacher educators that go beyond didactic discussions of inequity to make explicit the equitable teaching practices they want their students to learn.

EQUITY PEDAGOGY IN THE SECONDARY MATHEMATICS CLASSROOMS OF
THREE PRESERVICE TEACHERS

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Pamela A. Seda

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in

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2007

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ABBREVIATIONS

CRT	Critical Race Theory
INTASC	Interstate New Teacher Assessment and Support Consortium
JRME	<i>Journal of Research for Mathematics Education</i>
MSIT	Middle-Secondary Education and Instructional Technology
NCTM	National Council of Teachers of Mathematics
TEEMS	Teacher Education Environments in Mathematics and Science

CHAPTER 1

INTRODUCTION

If more equitable mathematics achievement is a serious goal of educators, then mathematics instruction must begin to reflect the pedagogies that meaningfully integrate culture into the classroom. (Wagner, Roy, Ecatoiu, & Rousseau, 2000, p. 107)

Mathematics educators in the United States are confronted with the challenge of preparing all students with the mathematical and critical thinking skills that will enable them to be productive citizens in a technological society. However, in the United States, a large segment of diverse learners do poorly in mathematics in disproportionate numbers (Ikpa, 2004; Lee, 2004; Tate, 1997). By *diverse learners*, I mean students who have not been well served by the traditional educational system, such as students of color (African American, Latino, and Native American students), English language learners, and those of low socioeconomic status (Banks, 1997). Since the 1983 government report, *A Nation at Risk* (National Commission on Excellence in Education, 1983), highlighted the nation's failure to educate its minority students adequately, the government, along with members of the mathematical community have responded by expressing the need for reform in mathematics education. The National Council of Teachers of Mathematics (NCTM) has provided vision for this reform by calling for the comprehensive education of every child. "Every child" is defined as—

- students who have been denied access in any way to educational opportunities as well as those who have not
- students who are African American, Hispanic, American Indian, and other minorities as well as those who are considered to be a part of the majority;

- students who are female as well as those who are male; and
- students who have not been successful in school and in mathematics as well as those who have been successful (NCTM, 1991, p. 4).

The Problem

According to the *Principles and Standards for School Mathematics* (NCTM, 2000), mathematics educators must pursue equity in the mathematics classroom by challenging the pervasive notion that only some students are capable of learning mathematics at a high level. The NCTM equity principle encourages teachers to have high expectations and offer worthwhile opportunities for all students, while accommodating student differences and providing strong support for all students. However, the document does not provide specifics for the types of accommodations necessary to support diverse learners, nor does it provide instruction for how to turn inequitable mathematics classrooms into more equitable ones (Matthews, 2003). Because of this silence, educators are left to interpret what accommodations are necessary to meet the needs of diverse students effectively. Because the Standards have not provided these types of specifics, mathematics educators have had to turn to other fields, such as multicultural education, to find answers. *Multicultural education* is a reform movement designed to change educational environments so that students from diverse groups in U.S. society will experience equal educational opportunities in schools, colleges, and universities. It is built on the premise that some students are victims of discrimination in educational settings because of their unique cultural characteristics, such as ethnicity, race, language, and gender (J. A. Banks, 1997).

The problem lies in that while the multicultural education literature addresses the education of students of color in general and provides many examples in the areas of

language arts and social studies, the literature provides virtually no new knowledge on the teaching of mathematics, especially at the secondary level. Therefore, teachers desiring to create more equitable mathematics classrooms for students of color have had to turn to areas outside of mathematics education for direction. This silence is especially problematic for colleges of education that have been given the task of preparing preservice teachers to educate all students, including students of color. (I use the terms preservice teachers, prospective teachers, student teachers, student interns, and teacher candidates interchangeably to describe students enrolled in teacher education courses as preparation for teaching in K-12 schools.) Colleges of education have been given the task of preparing prospective teachers to teach mathematics effectively in increasingly diverse classrooms. However, most preservice teachers do not feel adequately prepared to teach students from diverse backgrounds (Barry & Lechner, 1995; Cho & DeCastro-Ambrosetti, 2005). There has been little evidence to support the effectiveness of most teacher education programs to prepare teachers to teach diverse populations, especially in the field of mathematics.

Because so very little research exists on the impact of “diversity training” in teacher education programs on actual classroom practice, teacher educators are confined to a hit-or-miss approach to educating the nation’s future teaching workforce. What do equitable mathematics classrooms look like at the secondary level? This question is one that prospective teachers have been left to figure out for themselves. Given the inexperience that most preservice teachers have dealing with students of color and teaching them mathematics, it is very unlikely they will be able to effectively navigate

the broadly different fields of mathematics education and multicultural education without additional support.

Description of the Study

The purpose of this study was to investigate the equitable teaching practices of three mathematics education interns during the student teaching phase of an alternative teacher preparation program. The goal of the Teacher Education Environments in Mathematics and Science (TEEMS) Program, an alternative teacher preparation program at a large urban university in the southeastern United States, is to provide a teaching certificate within a Master's-degree program to students who have already earned a non-education undergraduate degree in a mathematics related area, such as engineering, computer science, or pure mathematics. The program consists of four semesters of education and methods courses and two semesters of practicum experience, one at a middle school and the other at a high school. The TEEMS students are introduced to issues of diversity during their first 2 semesters of coursework in their methods courses. During their third semester, they complete their student teaching at a high school. I conducted my study with three TEEMS students who had all been placed in the same metropolitan area school for their student teaching. I describe the TEEMS program in further detail in context of the study section of Chapter 3.

For the purpose of this study, equity pedagogy is defined as modifying instructional practices in order to facilitate the academic achievement of students from diverse racial, ethnic, and socioeconomic backgrounds by applying the components of Zeichner et al.'s (1998) curriculum and instruction principles specifically to the secondary mathematics classroom. My adaptation of these principles are (a) building on prior

knowledge, (b) high expectations for diverse learners, (c) knowing students well, (d) culturally responsive pedagogical skills, (e) critical consciousness, (f) sharing of power, and (g) multiple funds of knowledge. I describe these principles in greater depth in the data analysis section of Chapter 3.

The three questions guiding this research study are presented below.

1. What aspects of equity pedagogy do secondary mathematics student interns practice in their classrooms?
2. What are the obstacles and/or challenges interns face in implementing equity pedagogy?
3. Which aspects of the teacher education program do the interns perceive to most influence their implementation of equity pedagogy?

Rationale of the Study

If mathematics educators are really serious about equity in mathematics classrooms, students from all cultures need to have the opportunity to succeed in mathematics, not just those who come from the dominant, middle-class, White culture. Failing to prepare preservice teachers adequately to educate students from diverse ethnic backgrounds is a luxury that U.S. schools can no longer afford. Research based upon prospective teachers' implementation of equity pedagogy is essential for helping them develop, amend, and modify their instructional practices to help members of cultural minorities achieve mathematics success.

In the January 2005 issue of the *Journal of Research for Mathematics Education* (JRME), Gutstein et al. (2005) suggested that issues of equity become a major focus of research. In particular, research that is linked to practice making equity a specific focus

of investigation can contribute significantly in both theoretical understanding of equity issues as well as provide practical suggestions for reducing existing disparities in mathematical achievement. Researchers can examine what equitable mathematics education practices look like in varied contexts, and how they align with the Standards. As a result of her 2-year study with mathematics teachers who participated in a multicultural staff development program, Christine Sleeter (1997) recommended naturalistic research of preservice teachers as they proceed through their teacher education programs into student teaching. She suggested researchers examine questions regarding the types of multicultural concepts and strategies that preservice teachers use, the strategies they have the most difficulty using, and the kinds of support during student teaching that help them develop their multicultural mathematics teaching skills.

Previous studies (Frykholm, 1997; Gutstein & Lipman, 1997; Lubienski, 2002; Matthews, 2003) have examined elementary or middle grades mathematics teachers or secondary teachers in other subjects; however, few studies have focused specifically on preservice secondary mathematics teachers. By investigating the aspects of equity pedagogy that preservice secondary mathematics teachers practice in their classrooms, in this study I attempted to fill the need to examine the influence that teacher education programs have on student teachers' ability to support the mathematical achievement of all students. It is my intention for this study to assist mathematics educators to develop an understanding of what equity pedagogy means in the practical context of a secondary mathematics classroom by providing a model and/or framework from which others can learn to help all students be truly successful in mathematics.

Theoretical Framework

For mathematics education research to contribute more fully to equity, it can no longer be bound within the traditional disciplines of mathematics and psychology but must build on the developments of anthropology and other fields that have been traditionally the domain of the social sciences, such as critical theory, critical race theory, and multicultural education (Gutstein et al., 2005). Because of multicultural education's emphasis on social justice, I have chosen to look within this field and use culturally relevant pedagogy as the theoretical framework for my study. However, in an attempt to provide a context for understanding this theoretical framework, I first discuss the historical origins and contributing theories to culturally relevant pedagogy. I place this theoretical framework in historical context by discussing social Darwinism, ethnicity theory, and the cultural deprivation paradigm. I then discuss how critical theory and critical race theory have contributed to culturally relevant pedagogy.

Social Darwinism

At the beginning of the nineteenth century, when the United States began experiencing a population explosion of immigrants, ethnic diversity was not embraced as enriching to U.S. culture, but rather as a problem that needed to be fixed (Pool & Page, 1995). To assist with their "diversity problem," educators turned to the application of theories of Charles Darwin to society. Social Darwinism provided a "scientific" basis for seeing some groups of people as being of lesser social and moral development than others. The survival of the fittest ideology justified the notion of superiority of Anglo-Saxons over other ethnic groups and cultures (Hofstadter, 1959). The public schools responded to this theory with mental measurements (IQ testing) and tracking or ability-

grouping. The seemingly objective IQ tests justified the differential treatment of students from diverse backgrounds. Although Social Darwinism and biological determinism are no longer considered credible philosophies by most educators today, the by-products of these philosophies (IQ tests and tracking) are still very much a part of our present day educational system (Herrnstein & Murray, 1994; Oakes, 1985).

Ethnicity Theory

Over time, Social Darwinism later gave way to ethnicity theory (Steinberg, 1981). Ideas of biological and racial superiority were later replaced with ideas of cultural superiority. Supporters of ethnicity theory tell different variations of the story of the ethnic group that comes to the United States facing poverty, prejudice, and very difficult hardships only to overcome them by hard work, perseverance, and determination. They were successful because their cultural values were more akin to U.S. middle-class values. The insinuation is that if the Jews, Japanese, Chinese, West Indians, and other groups that have made it up the economic ladder can do it, then something is culturally wrong with the Blacks, Hispanics, and other groups that remain at the bottom.

This view supports the idea that the United States is an open society, where birth, family, and class do not significantly restrict individual possibilities if values like industry, frugality, and prudence are embraced. By placing cultural blame on groups at the bottom of the social and economic ladder, the nation's egalitarian ideals are reconciled with patently undemocratic divisions and inequities. By setting up Asians, Jews, and West Indians up as "model minorities," proponents of ethnicity theory affirm their assumption that "success" is attainable to everyone.

However, this view becomes problematic when the history of persistent exclusion and racism in the United States is taken into account. Ethnicity theory wholly ignores the exclusion of southern Blacks and Hispanics from jobs that were liberally offered to immigrants that arrived with occupational experiences and skills that gave them a head-start relative to other ethnic groups. It also ignores the discriminatory barriers that spanned several generations erected to exclude Blacks, in particular, from the most desirable jobs. Its treatment of ethnic culture as a static entity not influenced by the societal structures covertly legitimizes existing racial inequalities because of an unwillingness to face the harsh reality that the success of European and other immigrant groups was at the expense of Blacks, Hispanics, and Native Americans. Ethnicity theory “has an implicit morale: ‘we’ are not responsible, morally or politically, for ‘their’ misfortune” (Steinberg, 1981, p. 267).

Cultural Deprivation Paradigm

Ethnicity theory applied to education has resulted in the cultural, socioeconomic, and environmental factors of students from diverse backgrounds as explanations for school failure. The cultural deprivation paradigm assumes that Black, Hispanic, and poor children, "because of cultural, biological, environmental, and social differences, lack the adaptations and knowledge necessary for school achievement" (Irvine, 1990). Because school success is manifested in good grades, students who fail must be "disadvantaged," "culturally deprived," or "at-risk."

While the cultural deprivation paradigm still has its adherents, many scholars have begun to challenge strongly the assumptions of this view. These critics have constructed a different explanation for the school failure of low-income and minority

students. They contend that these students are not having success because they experience serious cultural conflicts in school, also known as cultural incongruity or lack of cultural synchronization.

Critical Theory

Critical theory is based on the idea that political and economic power are unequally and unjustly distributed in society (Stanic, 1991). The original members of this school of thought (commonly referred to as the Frankfurt School) were interested in the idea of a more just society where all people had equal access to the good things of life and of people being in cultural, economic, and political control of their lives. They argued that these goals could only be achieved through emancipation, a process by which oppressed and exploited people became sufficiently empowered to transform their circumstances for themselves. It is called "critical theory" because they saw the route to emancipation as being a kind of self-conscious critique of all social relations.

Critical theorists such as Peter McLaren (1998), Paulo Freire (2000), Henry Giroux (2001), and Michael Apple (1996) suggest that the poor educational performance of most students from diverse backgrounds comes from the existing curriculum and pedagogical practices that do not meet the needs of all students. They assert that the school system is but one of several institutions that serve to structure privilege. The dominant school culture generally represents and legitimizes the privileged voices of the white middle class and upper classes. Giroux and McLaren (1989) describe U.S. schooling as a highly oppressive system offering little for those who are not rich, White, male, native speakers of English, and "normal." They argue that schools should

be characterized by a pedagogy that empowers all students intellectually, socially, emotionally, and politically.

Critical Race Theory

Critical race theory is closely related to critical theory. Advocates of critical race theory suggest that analyses based on theories of gender and/or class are insufficient in their discussions of social and school inequities. Writers such as Derrick Bell and Gloria Ladson-Billings suggest that racial inequality is persistent and pervasive despite the legal gains promoted by liberalism. Ladson-Billings (1998) argues that race has become even more salient in this postmodern world because it is more embedded and hidden. Given this foundation, critical race theory (CRT) has evolved around a number of general themes:

1. Racism is a normal daily fact of life in U.S. society and ingrained in the political and legal landscape as to be almost unrecognizable. Racial designations have complex, historical, and socially constructed meanings that perpetuate the political inferiority of racially marginalized groups.
2. In an effort to disrupt hegemonic practices, CRT challenges the experience of White European Americans as the normative standard. Rather, CRT grounds its conceptual framework in the distinctive contextual experiences of people of color (African American people, Native American people, Hispanic people, and/or Asian American people) and racial oppression through the use of literary narrative knowledge and story-telling to challenge the existing social construction of race.

3. CRT attacks liberalism and the inherent belief in the law to create an equitable and just society. CRT advocates have pointed to the frustrating legal pace of meaningful reform that has eliminated blatant hateful expressions of racism but has kept intact exclusionary relations of power as exemplified by the legal conservative backlash of the courts, legislative bodies, voters, etc., against "special rights for racially marginalized groups."
4. Related to the liberal perspective, CRT proponents argue that because White women have been the major recipients of affirmative action hiring policies, civil rights legislation has benefited White people more than it has people of color.

Critical race theory in education provides a lens for identifying educational research and policies that subscribe to the paradigm of inferiority for racial minorities, offers a view that affirms the cultural identity of racial minorities, and exposes structural inequities that schools (and other institutions) perpetuate. CRT exposes the official school curriculum as a carefully scripted means to maintain White supremacy primarily by legitimizing the perspectives of White, middle-class men, while simultaneously omitting or distorting the perspectives of people of color (Ladson-Billings, 1998). Instruction is seen only in individual terms masking deficient views of students of color. This race-neutral perspective inevitably provides for more stereotypical characterizations. Categories like "school achievement," "middle-class," "maleness," "beauty," "intelligence," and "science" are normal for whiteness, while categories such as "gangs," "welfare recipients," "basketball players," and the "underclass" become categories that

marginalize Blacks and represent blackness. This colorblind approach places a taboo on racial categorizations, code words such as at-risk, underprivileged, underclass, urban, and inner-city render present-day racism invisible and offers legitimacy to a system that continues to entrench inequity for racial minorities. While developing a program that addresses Black student failure is too risky and too uncomfortable for many school systems, programs aimed at increasing student achievement for urban youth are more socially palatable because they keep racist school structures intact while giving lip service to social change.

While some educators have pointed to the cultural, socioeconomic, and environmental factors of low-income and minority students as explanations for the lack of mathematical achievement of certain racial and ethnic groups (Wilson, 1998), Carter Woodson (1930/1990) argued over 60 years ago that the problem in mathematics achievement for people of color was the result of a “foreign” pedagogy rather than a deficient student. Research suggests that teachers who use instructional practices that build on the cultural strengths of racial and ethnic minorities can increase academic achievement for these students (C. A. M. Banks & Banks, 1995; T. J. Brown, 1986; Gay, 2000; Hale-Benson, 1982; Irvine, 1990; Ladson-Billings, 1994; Willis, 1992).

Culturally Relevant Pedagogy

Culturally relevant pedagogy, developed as a grounded theory by Ladson-Billings, has its roots in critical theory and multiculturalism. As a result of the Civil Rights Movement, the failure of the nation’s educational system to prepare adequately people of color and low-income students to participate equally in society began to receive much attention. In her landmark study, Ladson-Billings (1994) studied

the practices of eight exemplary teachers of African American students. They were identified as successful by both parents and administrators. In this study, she described the characteristics of culturally relevant pedagogy as those that increased academic achievement, maintained cultural competence, and instilled critical consciousness. Culturally relevant pedagogy challenges the notion that ethnic and socioeconomic minorities must put aside their own cultural values and embrace middle-class Anglo values to succeed in school (also known as assimilation).

According to Ladson-Billings, culturally relevant teachers' views of themselves, their students, and learning differ from those of assimilationist teachers (see Table 1). Assimilationist teachers ascribe to a banking paradigm of education. They often embrace a savior mentality, hoping to save their students from themselves, their families, and from their ignorance by putting in the right kind of knowledge in their students' heads. Culturally relevant teachers, however, value the knowledge that students bring with them to the classroom. They seek to build on their students' prior knowledge by viewing teaching as pulling knowledge out like mining, not putting it in like banking. Clinging to a deficit view of diverse students' culture, assimilationist teachers pressure diverse students to conform to the dominant culture. In contrast, culturally relevant teachers encourage cultural integrity by using culture as a vehicle for learning as well as for affirmation and celebration. In essence, culturally relevant teachers are involved in helping students to accept and affirm their cultural identities while developing critical perspectives that challenge inequities that schools (and other institutions) perpetuate.

Because Ladson- Billings' (1994) research with successful teachers of African American children, her grounded theory has been widely accepted in the field of

Table 1

Attributes of the Culturally Relevant and Assimilationist Teacher (Ladson-Billings, 1994)

Culturally relevant teacher	Assimilationist teacher
Views teaching as “pulling knowledge out” like mining	Views teaching as “putting in” the right kind of knowledge like banking
Views herself as an artist	Views herself as a technician
Believes all students can succeed	Believes failure is inevitable for some
Encourages cultural integrity by using culture as a vehicle for learning, as well as for affirmation and celebration	Pressure diverse learners to conform to dominant culture
Helps students make connections to their personal lives, families and communities.	Views students only in terms of individual characteristics; views achievement as a means to escape community
Teacher-student relationships are fluid, humanely equitable with interactions extending beyond the classroom	Teacher-student relationships are hierarchical, authoritarian, and limited to classroom interactions
Encourages a “community of learners”	Encourages individual competition and learning in isolation
Knowledge is viewed critically and shared by both teachers and students	Knowledge is infallible and static
Values the knowledge students bring to the learning environment	Only values the knowledge that is passed in one direction, from teacher to student
Facilitator of knowledge	Transmitter of knowledge

multicultural education, having developed into a theory in its own right. Because the characteristics of culturally relevant pedagogy are in keeping with the goals of multicultural education to provide equitable learning environments for diverse learners, I use the following terms interchangeably: multicultural, culturally relevant, culturally responsive, culturally appropriate, culturally sensitive, and culturally inclusive.

Summary

To create more equitable classrooms, mathematics educators are charged with synthesizing the content in the NCTM Standards with that of the multicultural education literature by making mathematics culturally relevant and accessible to all students. It is the job of teacher educators to help preservice teachers blend these two seemingly different bodies of information into teaching practices that are real and sustainable. The dismal mathematical performances of racial and ethnic minorities in the United States have required that issues of equity be addressed in teacher education programs. No longer can the mathematics education community simply espouse an “education for all” philosophy without coming to terms with the social and cultural aspects of mathematics education. Teaching institutions have the critical task of equipping teachers with equity pedagogy that will facilitate the academic achievement of students from diverse racial, cultural, gender, and social class groups. “An Investigation of Equity Pedagogy in the Secondary Mathematics Classrooms of Three Preservice Teachers” is an important study because of its potential to contribute to the knowledge base about creating more equitable classrooms.

CHAPTER 2

REVIEW OF THE LITERATURE

In this chapter, I provide an overview of the multicultural teacher education literature with regard to preparing prospective mathematics teachers to teach diverse learners effectively. There is a paucity of research in multicultural education beyond the elementary level. With the exception of social studies, there are very few studies on multicultural education and subject-specific content, especially mathematics. While conducting an ERIC search using the descriptors “multicultural,” “mathematics,” and “teacher education,” I discovered 87 entries. However, only 5 of these entries involved studies that connected issues of diversity with mathematics teacher education (Lewis, Collins, & Pitts, 2000; Moore, 1996; Ruggles, Taylor, & Buck, 1999; Sawyer, 2000; Tharp & Lovell, 1995). I begin this review by describing these five studies. I then attempt to fill in the remaining gaps with literature from the general multicultural teacher education literature. Finally, I conclude this literature review with my conceptual framework.

Diversity and Mathematics Teacher Education Literature

Mathematics Teacher Education Programs

The first study (Ruggles et al., 1999) described the reform efforts of a mathematics teacher education program at Colorado State University that supported mathematics teacher candidates in their development and implementation of multicultural

mathematics lessons and equitable teaching practices. Most of the changes that occurred were structural, such as the collaboration between mathematics methods and education methods faculty, the development of a mathematics cohort that shared the same university supervisor during student teaching, and the collaboration of the university supervisor with both the mathematics methods and education methods faculty during the student internship. Curriculum changes included requiring teacher candidates, before their field placements, to design multicultural mathematics lessons that addressed mathematics standards using a variety of lesson designs. The next semester, student teachers were placed in an urban setting for their internships, thereby increasing the likelihood that they would be working with ethnically and racially diverse students.

Through surveys, interviews, and observations of multicultural lessons, the researchers of this qualitative case study concluded that although the vast majority of the participants had an increased desire to know more about multicultural mathematics, their limited opportunities to see multicultural mathematics content implemented during student teaching made it very difficult for them to implement multicultural mathematics lessons. A year later, some of the participants shared that they were so busy trying to “survive” their first year of teaching that they rarely found the time to incorporate their multicultural lesson plans into their classroom repertoire.

Because they wanted to learn more about multicultural mathematics, a voluntary sample from the previous study were chosen to participate in the Equity Leadership Study Group, a group at the same university that was created to prepare teachers for leadership roles in educational equity (Hartley, Cruz-Janzen, Oltjenbruns, & Farmer, 1999). The participants attended five 3-hour sessions focused on issues of educational

equity. Researchers examined the personal and professional growth of the participants throughout the sessions. They concluded that while the program had successfully increased awareness of the effects of racism in the classroom, the preservice teachers thought about equitable practices in abstract terms. They did not know how to act on their newly found awareness in meaningful ways in the mathematics classroom. Besides talking and listening to each other, the study group offered very few concrete strategies.

The following quotations illustrate this point.

I've noticed that equitable treatment for all groups of student is easier said than done. Of course, in my teaching I have deliberately avoided the overt behavior of ridiculing any student and I enforce a "no put downs" policy to create a safe environment. Questions are: What other things could I do to create a more cohesive group of learners? How can I identify students feeling marginalized?

... This really hit me hard. I can talk about different ways to deal with diverse students until I am blue in the face, but until I am actually forced to react to a real-life situation, it is a speculation. I want to go to different schools and see how the teachers there deal with everyday problems.
(p. 84)

There are plenty of studies within the multicultural teacher education literature that confirm the difficulties preservice teachers have with transforming the theories of multicultural education in practice, especially in content areas such as mathematics and science (Hsiung, Arvold, Johnson, & Wojtowicz, 2003; LeCompte & McCray, 2002; McDonald, 2005; Milner, 2005; Mujawamariya & Mahrouse, 2004; Taylor & Sobel, 2001). Programs that increased awareness did not necessarily improve student teachers' capacity to use such awareness in practice. While some of the prospective teachers recognized the intersection(s) between diversity and academic subject matter, the vast majority did not. Diversity was spoken of as a social phenomenon rather than a matter connected to academics. Most often, prospective teachers were left to figure out the

“how” of multicultural education on their own and were not given enough practical information to teach diverse learners effectively. They wanted guidance in the form of more concrete strategies, especially in the area of assessment, and how to integrate culturally relevant pedagogy with their subject matter.

A second study of a mathematics teacher education program described the experiences of four middle school preservice teachers' experiences with multicultural education during their approximately 16-week student teaching practicum in the southeastern United States (Moore, 1996). Using interviews, classroom observations, fieldnotes, student teacher' journals, and the written evaluations from the mentor teacher and university supervisor as data sources, Moore concluded that student teachers of mathematics and science see very limited opportunities to apply multicultural practices and that there needs to be more of a direct connection between subject-specific content (like mathematics) and components of diversity, rather than just dealing with broad principles of diversity. His findings also indicated that teacher preparation before the student teaching semester was extremely fragmented and that the lack of guidance and support from mentor teachers and university supervisors significantly impeded the practice of culturally diverse teaching.

Preservice Mathematics Teachers' Beliefs

In contrast to the previous studies that examined mathematics teacher education programs as objects of study, the following studies examined the views, attitudes, perceptions and beliefs of preservice mathematics teachers themselves. The ideas explored in these studies range from preservice teachers' levels of reasoning about equity to adapting curriculum to perceptions of diverse learners.

Cognitive equity. In this first study, Tharp and Lovell (1995) examined the reasoning of 23 preservice mathematics teachers in response to a “dilemma of equity in practice.” The “dilemma” is as follows:

The following is a description of a challenge encountered in the life of a teacher. Please take time to give your reasoning on this incident.

A white female elementary school teacher in the United States posed a math problem to her class one day. “Suppose there are four blackbirds sitting in a tree. You take a sling shot and shoot one of them. How many are left?” A white student answered quickly, “That’s easy. One subtracted from four is three.” An African immigrant youth then answered with equal confidence, “Zero.” The teacher chuckled at the latter response and stated that the first student was right and that, perhaps, the second student should study more math. From that day forth, the African student seemed to withdraw from class activities and seldom spoke to other students or the teacher.

What are your thoughts on this matter (p. 4)?

The preservice teachers’ responses were categorized in stages from lowest to highest as (a) a hypothesized level of silent knowing, (b) authority centered/self-protective, (c) mutualism, (d) autonomy/proceduralism, and (e) contextual relativism/constructivism. The implication is that preservice teachers operating at higher stages of reasoning will be more likely to attend to the differences in children by honoring each child’s reasoning process through careful probing and non-negative critical questions. Only 9% of the respondents showed evidence of stage 5 thinking; the co-construction of knowledge and non-judgmental comparison of reasoning. The remaining 91% were categorized in lower stages of reasoning. These results indicate that the majority of mathematics preservice teachers may not be ready to provide mathematics instruction that fully honors the backgrounds of diverse learners, where individual reasoning is sought out to magnify the growth in understanding of the entire class. Although the

researchers suggest that teachers will need assistance in moving to a stage of reasoning about equity that allows them to recognize the value of fully honoring diverse perspectives in the classroom, they provide no indication of how to accomplish this task.

Also missing from this discussion is how operating within stage 5 of non-judgment comparison of reasoning can actually contribute to the reproduction of inequity, if issues of power and privilege are not openly discussed (Delpit, 1995). In spite of the teacher's unwillingness to pass judgment on differing student reasoning, students still come to know that certain types of mathematical reasoning are more valued in the culture of schooling. High-stakes tests are more likely to contain problems that require reasoning similar to the White student's who quickly answered with an answer of "three." Therefore, students who are able to demonstrate proficiency in this type of reasoning are privileged in school settings over those who are not able to demonstrate it. Moreover, outside of school, including in the workplace, answers based upon real-world experiences are more likely to be valued. Thus, those whose reasoning and real-world experiences more closely match those of the dominant culture will be privileged when it comes to employment opportunities. However, if these differences are not explicitly discussed and explored, patterns of inequity will continue to exist for students who are not aware of the types of reasoning that are more valued on standardized tests or for those that do not understand that employers greatly desire creative people who are able to "think outside the box" and reason within real-world contexts. Students from marginalized groups will be the least likely to have access to this type of information. Therefore, it is important that mathematics teachers give all students access to the "culture of power" (Delpit) by making these understandings explicit in the mathematics classroom.

Adapting curriculum. In another study involving preservice teachers, Sawyer (2000) examined the perceptions of alternate-route and college-prepared teachers about adapting mathematics and writing curriculum to student diversity. The study included all the secondary English and secondary mathematics individuals completing college based teacher preparation programs as well as a 40% sample of individuals completing elementary programs in New Jersey. It also included all the individuals in the alternate route program. Surveys and interviews given in the years 1987, 1988, 1989, and 1993 indicated that while most teachers favored curriculum adaptation in general, commitment to these beliefs was inconsistent. Although many teachers in their survey responses agreed rhetorically with the concept of adapting curriculum to students' cultural values, they were quick to deflect responsibility for doing so to other content areas. Teachers in both groups showed a relative lack of consistent support over the course of the study for meaningful adaptation of either their writing or mathematics curricula. However, there was much less interest in adapting the mathematics curriculum than with the English curriculum.

As seen in the findings of the previous studies (Hartley, Cruz-Janzen, Oltjenbruns, & Farmer, 1999; Moore, 1996; Ruggles, Taylor, & Buck, 1999), neither alternate route nor college prepared teachers appeared to have pedagogically meaningful perspectives on the education of diverse student populations. Both cohort groups were asked the question, "When you think about the ways that your students are different from one another, what kinds of differences come to mind? Focus especially on those that you think are critical for teachers to consider." The lack of recognition of culture—race, ethnicity, or socioeconomic status—as making a difference to their teaching was

consistent across both groups. The student differences the teachers were more willing to consider in their teaching were individual characteristics such as student intelligence, and student learning styles. For example, the following college prepared mathematics teacher prided herself on her colorblind stance by writing the following:

The only thing that I see in students is their difference in ability. People asked me how many Blacks do you have, because _____ is basically a Black area, and I don't even know. I think that's great on my part. I liked that about myself. (p. 357)

This teacher's colorblind ideology is ingrained in a belief system called "naïve egalitarianism" based on the assumption that all people are created equally and experience the world equitably (Causey, Thomas, & J. Armento, 2000). Finney and Orr (1995) noted that after a multicultural education course, preservice teachers exchanged their prejudices for a "colorblindness" consistent with their ideology of individualism and meritocracy. Colorblindness was now considered by many a new and positive achievement because they had moved away from their prejudices. Many teachers believe that they are helping their students by ignoring skin color and by treating all students the same. Many teachers have assumed with the best of intentions that colorblindness in a multiracial classroom will result in equity. However, when prospective teachers fail to take students' race or culture into consideration when making pedagogical decisions, the dominant culture of the teacher becomes the only culture valued or "seen" in the classroom, to the detriment of those who are not members of that cultural group (Presmeg 1998).

Numerous studies cite how common colorblindness is among preservice teachers (Barry & Lechner, 1995; Cho & DeCastro-Ambrosetti, 2005; Finney & Orr, 1995; Milner, 2005; Olmedo, 1997; Santoro & Allard, 2005). The researchers in these studies

conclude that prospective teachers should recognize and acknowledge students' race. Not seeing or recognizing color (and the historical concerns surrounding it) prevents preservice teachers from seeing some of the systemic events that have become regular occurrences in schools. When teachers do not consider the significance of race or culture, these systemic problems continue to be perpetuated in the form of disproportionate numbers of students of color in special and gifted education, and high numbers of African American students, particularly males, being suspended and expelled (Milner, 2005).

Sawyer concluded his study of adapting mathematics and writing curriculum for diverse learners by stating that the nature of curriculum adaptation for diversity will need to be further clarified if it is to be incorporated in meaningful ways into the beliefs and practices of teachers, regardless of preparation route. He also indicated that a greater commitment to the education of diverse student populations is imperative as the United States becomes more diverse.

Before I continue with my discussion, I would first like to elaborate on the term "colorblindness." While its use had been well established within the literature, I wish to illuminate an inherent problem with the term. When I use the term "colorblindness" in an educational context, I mean the lack of recognition of culture—race, ethnicity, gender, or socioeconomic status—as making a difference in the mathematics teaching process. The emphasis is on the culture that students bring with them into the classroom from their homes and communities. However, the term "colorblindness" simply reduces these differences to a skin color, a physical trait that may or may not have any cultural significance. I propose that the term "culture-blindness" would probably be more

accurate in these contexts. However, for the sake of convention, I will use “colorblindness” throughout the rest of this study when I actually mean culture-blindness.

Perceptions of diverse learners. Lewis, Collins, and Pitts (2000) also conducted a study of preservice teachers’ perceptions by presenting a predominantly White group of 30 preservice mathematics and science teachers with the following statement:

There have been a number of reports in recent years which describe the science and math achievement of African American students. In general, these reports show that when compared to national averages, African American students have lower science and math achievement than their peers. This lower achievement is characterized by taking fewer science and math courses, performing more poorly on standardized exams, and pursuing science-related careers in lower numbers. (p. 9)

Participants were asked to indicate whether or not these reports reflected their experiences as a mathematics or science teachers, to give reasons for the lower achievement, and to name changes or interventions that would address the lower achievement of African American students in mathematics and science. Responses to the first question were coded as aware or unaware. Responses to the second and third questions were coded according to emerging categories.

About one-third of the responses to the first question were coded as unaware. The researchers attributed these responses to King’s (1991) notion of dysconscious racism, an uncritical habit of mind that justifies inequity and exploitation by accepting the existing order of things as given. However, because of how he worded the question, it is not clear whether the preservice teachers in this study were truly unaware or if their personal experiences did not support the reports. A person can be aware that the achievement gap exists without personal experiences either verifying or nullifying its validity.

Another explanation for the “not aware” responses is what Zeichner and Tabachnick (1981) describe as “impression management”—the need to respond based on their perceptions of what they think the instructor/researcher wants to see or hear. They maintain that students refrain from revealing their true attitudes and perceptions in class in order to insulate themselves from the highly charged nature of discussions dealing with race, class, and gender. In their study on the distancing strategies White preservice teachers use when approaching issues of race, Case and Hemmings (2005) noted that the real opinions of White students surfaced only when everyone in the class was White. When the class was racially mixed, White students worried about offending the Black students and, therefore, become overly cautious in what they said—if they said anything at all. In the case of prospective mathematics and science teachers’ responses that were coded as unaware, they simply may have been afraid to acknowledge the lack of achievement of African Americans for fear of being labeled a racist. Preservice teachers ascribing to colorblind ideologies would be probably less likely to admit an awareness of the achievement gap.

In responding to the second question in the Lewis, Collins, and Pitts study, the majority of the respondents ascribed the differential achievement between Black and White students in mathematics and science to factors within the students’ cultures and families, or within the students themselves. Although, only one-third of the responses to the second question blamed aspects of the teaching and learning process itself, the vast majority of the prospective math and science teachers responded to that question by citing changes in teaching and learning processes as a means to improve math and science achievement for African Americans. These results seemed to be contradictory.

If prospective teachers tend to blame students for their own lack of success, then why do most of them suggest changes in the teaching and learning process as a means for increasing achievement? These contradictory results would seem to indicate that the respondents may have simply expressed opinions that they thought the researchers wanted to hear, rather than betray their true beliefs. The presence of an African American male researcher might have caused some of the respondents to hide their true feelings.

The results of the previous study are similar to the findings of a study in Canada where Avery and Walker (1993) conducted a survey of preservice teachers regarding their perceptions of gender and ethnic disparity in academic achievement. Survey results indicated that the preservice teachers were most likely to attribute gender differences in academic achievement to systemic issues of society and attributed ethnic differences in achievement to ethnic culture. Likewise, the preservice teachers in a study conducted by Artiles and McClafferty (1998) cited the home or culture of diverse learners as the primary explanation for academic failure.

The fact that all of these teachers tended to place culpability for lack of achievement for cultural and racial minorities within students' culture and community indicates that preservice teachers tend to hold deficit views of diverse learners. Milner (2005) explained that prospective teachers rely on stereotypes they have learned and internalized from the media or their families. These stereotypical images then translate into deficit thinking and beliefs about diverse learners. Mathematics teachers may lower their expectations and “water down” the curriculum because they believe that a certain group of students cannot handle the rigor of higher level mathematics. Therefore, deficit

thinking occurs when teachers focus on what students do not know, rather than what they do know. Cook-Sather and Reisinger (2001) suggest in their study that when student teachers have inaccurate or inflexible perceptions of their students because of stereotypes, they can make poor pedagogical choices which can hinder student achievement and lead to self-fulfilling prophecies. Although preservice teachers do typically stereotype their students, this study does positively note that these stereotypes can be overcome through personal experience, and critical reflection.

Olmedo (1997) also discovered that stereotypes can be overcome in her study where preservice teachers' assumptions about children of color in inner-city schools were challenged. Assumptions of the preservice teachers before their field service in an inner-city elementary school were: (a) inner-city children are unmotivated; (b) inner-city children have so many home problems that they cannot learn; and (c) inner-city schools are doomed to fail because of limited resources, large class sizes, standardized tests, and inadequate facilities. Content analysis of preservice teachers' journals after fieldwork in an inner-city school, coupled with opportunities for critical reflection, revealed more positive views about teaching in an inner-city school. Likewise in another study (Aaronsohn, Carter, & Howell, 1995), preservice teachers negatively perceived that inner-city children would be "out of control," would not want to learn, and would have negative attitudes toward school. They believed that teachers would have a hard time teaching because they would have to spend their time being baby sitters or police officers, they would have no control, and they would be frustrated and burnt out.

Ukpokodu's (2004) study illustrates how the effects of deficit thinking with regard to children of color can cause serious cultural clashes in the classroom. She

recounts how several interns had been placed in an inner-city school with mostly children of color for their student internship. Apparently, on the first day of class, the students were so excited to see their new “White” teachers that they sought physical closeness by excitedly rushing to surround them. Alarmed by the supposed invasion of their space, the interns screamed at the students and removed themselves from them. The interns, perceiving the actions of the students through stereotypical lenses, “felt threatened by the unruly, and wild students and feared for their lives” (p. 21).

These five studies demonstrate that preservice mathematics teachers have difficulty implementing multicultural math lessons and transforming theory to practice (Ruggles et al., 1999; Hartley, Cruz-Janzen, Oltjenbruns, & Farmer, 1999); need more direct connections made between mathematics and components of diversity (Moore, 1996); have views about equity in mathematics classrooms that are lacking (Tharp & Lovell, 1995); hold to colorblind ideologies that may be detrimental to students that do not share the same cultural group as the teacher (Sawyer, 2000); and have deficit views of diverse learners (Lewis, Collins, & Pitts, 2000). While the information that can be gleaned from these five studies spans a broad range of diversity issues, they are still woefully inadequate for providing a knowledge base for the critical task of teacher educators to equip prospective mathematics teachers with the knowledge, skills, beliefs, attitudes, and practices to teach all students effectively, including diverse learners. The fact that a search of the ERIC database only produced two studies of mathematics teacher education programs preparing prospective teachers for diversity, clearly demonstrates the need for more research in this area. Because the multicultural mathematics teacher

education literature is so sparse, I turn to the general multicultural teacher education literature to help fill in some of the gaps.

Multicultural Teacher Education Literature

Connecting Theory to Practice

In the previously mentioned literature, preservice teachers expressed the need for teacher educators to be more direct in assisting them to develop culturally relevant pedagogical skills. Sleeter (1997) indicates that most teachers will not make the connections between multicultural education and mathematics by figuring it out on their own or by attending staff development programs in multicultural education. However, she does contend that a multicultural education course can be the beginning of the process of understanding how students' linguistic, ethnic, racial, gender, and socio-economic backgrounds influence the learning environment. In addition to a multicultural education course, specific connections between mathematics content and components of diversity must be made. Ethnomathematics is one approach that mathematics teacher educators can use to prepare mathematics teachers to handle the challenge of cultural diversity in their classrooms (Presmeg, 1998).

Ethnomathematics. Proponents of ethnomathematics maintain that genius is universal and that the origin of deficit thinking is ignorance (A. G. Hilliard, personal communication, May 2006). Therefore, it is dangerous to characterize mathematical developments solely in terms of European developments. In his book, *The Crest of the Peacock*, George G. Joseph (2000) details the importance of understanding the global nature of mathematical pursuits. He cites ancient Egypt and Mesopotamia, Greece, the Hellenistic world, India, China, the Arab world and Europe as all making major

contributions to the historical development of mathematics. In addition, he discusses the possibility of independent mathematical development within cultures, and identifies the transmission of mathematics across cultures, that culminated into the unified discipline of modern mathematics.

Norma Presmeg (1998) defines ethnomathematics as the mathematics of cultural practices. She also challenges the ethnocentric assumption that mathematics is largely a product of the intellectual work of men of European descent by asserting that people all over the world are involved in mathematical activities. Ethnomathematics values the contributions of non-European peoples as equally important. They count items, measure quantities, design buildings, create works of art, locate places in space and time, and play games that use mathematical concepts. Out of necessity, they develop ways of communicating with others about these practices. These activities differ from one society to another (Zaslavsky, 1998).

Because of the view that mathematics, more than any other subject, was value and culture free, many mathematics educators did not feel the need to take the growing diversity of student populations into account. Presmeg (1998) asserts that when teachers take the position that everyone, including the teacher, has ethnicity, the way is open to view ethnicity as a resource and an asset rather than a liability in a mathematics classroom. In her graduate ethnomathematics course for prospective and practicing teachers, Presmeg stresses the student's ownership of their individual and personally meaningful cultural mathematics projects as a key element. The principles guiding the development of the projects were (a) each student has ethnicity; (b) this ethnicity is a mathematical resource; (c) students can use their ethnicity in developing mathematical

activities for sharing with peers; and (d) those who belong to a culture should be involved in making decisions about who should share the mathematics of its practices, and which practices should be shared. The construction of these individual projects enabled her students to bridge the gap between multicultural theory and classroom practice.

Modeling multicultural practices. Teacher educators often do not practice what they preach. To reduce the gap between theory and practice, it has been recommended that teacher educators model the multicultural competencies they want to develop in their student teachers (Cooney & Akintunde, 1999; Kaste, 2004; Moore, 1996; Mujawamariya & Mahrouse, 2004). In deciding how to be effective role models of multicultural education, teacher educators need to ask themselves the following questions (Sleeter, 1997): As it is difficult to learn about addressing issues of diversity in an environment with very little diversity, does the faculty of teacher candidates reflect the diversity of the university? As multicultural education is an orientation that requires building dialogue and learning how to share decision-making power with marginalized communities, have university professors shared their power and decision-making processes with their prospective teachers? If the teacher candidates are sharing their ideas about what they need to teach effectively, how much are the university professors listening? Are university professors modeling the behavior they expect from their teacher candidates? Are teacher educators who treat all of their students as if they know nothing about teaching diverse learners guilty of the same deficit thinking that they are trying to change in their students? How can teacher educators expect their students to construct knowledge about multicultural mathematics education when they have not experienced this perspective or know what it can look like? Teacher educators who are determined to help

their prospective teachers become practitioners of multicultural education will ask themselves these questions, and many more like them.

One teacher educator took a particularly creative approach to modeling multicultural practices for her students. Kaste (2004) simultaneously taught university methods courses while assisting a first grade class with reading. She audiotaped her reading sessions with diverse learners and brought them back to her methods class for discussion. This strategy enabled her to model for her students effective strategies and allowed her preservice teachers to participate actively in creating effective teaching strategies for diverse learners. Although their actual classroom practices were not studied, results of the study indicated that preservice teachers were able to articulate a culturally responsive orientation toward teaching literacy.

Cross-cultural experiences. Providing cross-cultural experiences is a common theme in multicultural teacher education literature (Aaronsohn, Carter, & Howell, 1995; Boyle-Baise, 2005; E. L. Brown, 2005; Causey, Thomas, & J. Armento, 2000; Deering & Stanutz, 1995; Finney & Orr, 1995; Olmedo, 1997; Ukpokodu, 2004). Sleeter (1997) contends that preservice teachers should spend time in community contexts that are different from their own and that, in the context of the teacher education program, they should be given the conceptual frameworks to derive pedagogical insights from these experiences. In their study of preservice teachers' cultural sensitivity before and after a field experience in a multicultural setting, Deering and Stanutz (1995) concluded that one field experience, if not combined with the critical reflective tools of a multicultural education course, will not significantly change the attitudes of preservice teachers.

The results of cross-cultural experiences are mixed. Some studies (Aaronsohn, Carter, & Howell, 1995; Boyle-Baise, 2005; Ukpokodu, 2004) indicated significant changes in attitudes, perceptions, and beliefs about diverse learners, while others report only modest changes, or no changes at all (Causey, Thomas, & J. Armento, 2000; Finney & Orr, 1995; Olmedo, 1997). In general, several recommendations were given for making cross-cultural experiences positive ones for all parties involved. Finney and Orr allowed persons of color to speak for themselves. These types of cross-cultural experiences helped preservice teachers overcome stereotypical attitudes. They recommended that successful cross-cultural experiences provide preservice teachers with opportunities to develop positive aspects of previously stereotyped persons and cultures. When preservice teachers have opportunities to interact with so called “others” as equals, it minimizes the possibility for students to patronize or objectify students of diverse backgrounds. They also recommend that initial cross-cultural experiences occur in a semester free of teaching responsibilities so that preservice teachers may freely focus on personal relationship building, critical reflection, and in-depth study. In general, cross-cultural experiences should not take place in the sheltered world of classrooms and laboratories, but should be moved out into real world contexts.

Service-learning in multicultural settings has more recently become an increasingly popular method of providing contexts for developing cross-cultural understandings (Boyle-Baise, 2005; E. L. Brown, 2005). Boyle-Baise’s (2005) service-learning project at a community center helped African American preservice teachers overcome deficit views of diverse learners by allowing them to perceive urban communities as funds of knowledge. Too often service-learning participants treat people

of color or those living in poverty as clients, not as sources of wisdom. Because two preservice teachers had previously described culturally responsive teaching as something often discussed but very seldom practiced in their teacher education program, this project helped them practically demonstrate culturally responsive teaching.

Likewise, in a 10-week school-based study, Brown (2005) investigated the influence of service-learning on the multicultural perceptions, cross-cultural communication skills, and social justice awareness of prospective teachers. The study participants were 73 secondary preservice teacher candidates. Data sources included participant reflective journals, debriefings and final reports, letters from and discussions with host school service recipients, and investigator interviews and field notes. Study results indicate that service-learning within the time constraints of a 1-year alternative route to teacher certification can provide future teachers with insight into the politics of education, increase their interactive proficiency with culturally diverse students, teachers and administrators, raise their level of multicultural consciousness, and augment their educational foundations and content knowledge while connecting theory to classroom practice. While this service-learning study did have many positives, several participants noted that building community by getting to know students, their families, and their neighbors was just too time consuming and perceived as secondary to teaching content. The research here indicates that cross-cultural experiences can help students overcome their fears because of negative portrayals of people of color in the media and move beyond the clichés and stereotypes presented by the media. However, more than one cross-cultural experience is necessary to help preservice teachers with limited cross-

cultural experiences to acquire the knowledge and skills necessary to teach in multicultural settings.

Identifying cultural identities and White privilege. It is also important to help prospective teachers explore their own cultural identities and White privilege in nonthreatening ways. In their study with White teacher education candidates, LeCompte and McCrays (2002) explored the ways they embraced aspects of racial identity as a cultural component of their teacher preparation. These White preservice teachers found it very difficult to identify themselves as part of a racial or ethnic group. They could only think of themselves in terms of their individual identities. In a similar study conducted in Australia by Santoro and Allard (2005), the participants initially viewed their ethnicity as unimportant or non-existent. Being Australian was understood to be White and Anglo-Australian. Non-Anglo backgrounds were specified as "other." Being asked to reflect on their own identities was a powerful act and important starting point for helping student teachers see "difference" as a source for learning, not as a "problem" to be solved.

Many multicultural educators (Bullock & Freedman, 2006; Case & Hemmings, 2005; Gay & Kirkland, 2003; Mujawamariya & Mahrouse, 2004; Ukpokodu, 2002) agree that because of the emotionally charged nature of issues of race and White privilege, it is important to open student beliefs to critique and lead preservice teachers in conversations about equity and social justice in nonthreatening ways. Case and Hemmings (2005) emphasize the importance of communicating in ways that enable preservice teachers to grapple with issues of racism without fear of social disapproval, reprisal, and/or confrontations.

Gay and Kirkland (2003) set the stage for their courses right at the beginning of the semester by informing their students that they will be expected to think deeply and analytically and to check themselves about the topics they will be studying; to examine carefully their feelings about what they experience; and to work diligently at translating the knowledge they are learning into instructional possibilities for use with the students they will teach. Ukpokodu (2002) has a similar strategy of breaking down students' resistances. She works extra hard to create a learning environment of mutual respect. She does this by explaining to her students at the beginning of the semester that some of the issues discussed in the course will be "touchy," "too close to home," and will challenge their ideas and beliefs and perhaps even create disequilibrium. She tells that her intent is not to scapegoat or provoke anyone's guilt; rather, it is to identify and reconcile contradictions between democratic ideology and social reality. She indicates that only ideas and not the personhood of the individual can be challenged. She then begins by engaging students in activities that work to disarm them, captivate their interests and get them hooked. Using these methods, Ukpokodu has been able to guide her preservice teachers in empowering and nonthreatening ways and to help them to become not only aware of the reality of privilege but to advocate on behalf of those who are not privileged.

Because conversations about race and White privilege can cause defensiveness and anger, the use of metaphors can also help prospective teachers deal with these issues in nonthreatening ways. In her book, *"Why are the Black Kids Sitting Together in the Cafeteria?" and other Conversations about Race*, Tatum (1997) asserts that everyone has prejudices because everyone is continually exposed to misinformation about others

through stereotypes, omissions, and distortions. Therefore, she likens prejudice to smog, an inescapable consequence of living in a racist society. While sometimes it is so thick it can be seen and other times it is invisible, nevertheless, people breathe it in and out everyday, not because they want to but because it is the only air available.

Tatum (1997) extends the smog metaphor by explaining that people do not introduce themselves as “smog-breathers” in the same way that they do not want to be identified as prejudiced. Still, if a person lives in a smoggy place, constantly bombarded by stereotypes and misinformation, he or she cannot avoid breathing the air. No one is completely free of prejudices. Even people of color, because they breathe the same polluted air, often internalize these stereotypical images to some degree. Tatum continues that because prejudice is part of a person’s socialization, it is not his or her fault. Although he or she may not have polluted the air, because everyone experiences the negative consequences of air pollution, each person needs to take responsibility for cleaning it up. Each person must examine his or her own behavior. Unless people commit to examine actively and to challenge their own prejudices, they will be guilty of perpetuating and reinforcing the negative messages so pervasive in society.

By using this metaphor, Tatum has successfully engaged her students in conversations about racism in nonthreatening ways. As a result, these conversations have affected educators who have now chosen to become change agents while transforming their curricula and interacting with students of color in ways that facilitate rather than hinder their academic success. Her example can serve as a model for teacher educators desiring to bring about similar changes in their students.

Time for development. Teachers need time to conceptualize and negotiate culturally responsive teaching. Ukpokodu (2002) encourages teacher educators to be patient with preservice teachers and work with them on a continuum of multicultural education, and not to expect that all teachers will be able to get to the same place at the same time. She stresses that because multicultural competencies do take time to develop. She explains that it is important to encourage teachers in their development wherever they happen to be in the process of becoming promoters of equity and advocates for diverse learners.

Many educators believe that having a single course that addresses multicultural issues does not allow sufficient time for multicultural awareness, knowledge, and skills to be developed in prospective teachers (Artiles & McClafferty, 1998; Causey, Thomas, & J. Armento, 2000; Gay & Kirkland, 2003; Mujawamariya & Mahrouse, 2004; Sleeter, 1997; Zeichner et al., 1998). Simply adding a multicultural course to a curriculum that remains “untouched” in every other aspect is often ineffective because it further marginalizes issues of equity. Milner (2005) suggests that an “infusion” approach to multicultural education, where issues of diversity are infused throughout the teacher education curriculum, will be more likely to give prospective teachers the time they need to develop multicultural competencies than the “additive” approach of a single multicultural education course. He asserts that more time needs to be spent in methods courses making connections and pointing out alternative curriculums and possible pedagogical approaches that bridge subject matter learning with that of diversity. Thus, in order to help prospective teachers visualize the “big picture” of diversity as well to be able to think about issues of diversity as they think about, develop, and implement

content, he suggests that more structured subject matter courses be designed that will establish opportunities for students to bridge their understanding of diversity with that of learning strategies and assessments of content.

According to Taylor and Sobel (2001), both the “additive” and “infusion” approaches have their problems. Neither a specialized course nor the integration of diversity across the curriculum has been confirmed to have a lasting impact on the beliefs or practices of preservice teachers. Programs that use the “infusion” approach by integrating diversity issues across the curriculum tend to present multicultural topics in an incoherent, fragmented, and inconsistent manner. In her comparative study of two elementary education teacher programs, McDonald (2005) presents a faculty member’s claim that without the focus of a multicultural education course, issues of diversity can tend to become invisible or disappear because they become a part of the subconscious of everyone in the department. Students had a difficult time recalling exactly when their viewpoints changed. This suggests that a general multicultural education course can be the spark that is needed to help prospective teachers develop a conceptual framework with which to organize and synthesize diversity issues that have been integrated throughout the rest of the curriculum.

These findings indicate that the process of preparing prospective teachers to work toward equity is a complex one. It begins with increasing their awareness of inequitable educational patterns and progresses to a commitment to action (thoughtful reexamination of curriculum, policies, and practice). The time that is required for teachers to progress from awareness to commitment to action varies, and still largely unknown. Further studies are needed that describe this process.

Examining Multicultural Classroom Practices

Because I examined the equitable teaching practices of three mathematics education interns during student teaching, my review of the multicultural education literature would not be complete without mentioning other studies that examine classroom practices. I present such studies in the following section.

Culturally relevant mathematics classroom practices. In their case study in a multicultural elementary school, Rodriguez and Sjostrom (1995) used Villegas' (2002) framework for assessing the cultural competence of six teachers (two student teachers, two 1st-year teachers, and two experienced teachers). Using field notes from two observations, postlesson interviews, and class and instructional profile forms completed by the teachers, the researchers provided a detailed analysis on Cynthia, a 6-year veteran in a fifth grade class, and Michael, a prospective teacher completing his final student teaching experience in a second grade class. Both teachers were African American, and both had participated in the Elementary/Early Childhood Education teacher preparation program at Rowan College of New Jersey.

Cynthia was observed teaching a math and a science lesson, while Michael was observed teaching two science lessons. The researchers reported that, for both teachers, there was extensive evidence of the infusion of diversity across the three competency areas: (a) attitude and respect for cultural differences, knowledge of students' cultural resources and skills in building cultural bridges between home and school; (b) belief that all students are capable of learning with an enriched curriculum implemented for all; and (c) having a sense of professional efficacy. Because of the potential to shed light on the

study I conducted with secondary mathematics teachers, I describe Cynthia's culturally relevant approach to teaching fractions in greater detail.

Cynthia provided evidence for the first competency area in several ways. She respected cultural differences by allowing for differing perspectives of success in her explicit statement of the learning goals for the class. She mentioned that the learning goals for that lesson were to learn to subtract fractions with different denominators (traditional academic achievement), to apply this knowledge to their own lives (personal development), and to learn how to work cooperatively in teams (social development). She also showed respect for cultural differences by giving her students active roles in deciding the amount of time necessary to complete other tasks. As a resident of the district in which she taught, she knew her students well, and she was in frequent communication with the parents of her students. She used this knowledge of the community to relate the importance of the lesson to students' lives. She encouraged her students to respect each other, to listen to each other's questions and comments, and to use classmates as a resource for understanding concepts and completing projects.

Cynthia also provided plenty of evidence of the second competency area by verbalizing and demonstrating her belief that all students can learn. She mainly accomplished this by asking higher order questions and encouraging all students to think for themselves. Rather than simply accepting an answer from a student, Cynthia would reply with questions and/or comments like the following:

Why were your teams successful? Why do you think they were successful? It is important to get the right answer but it is also important to know why and how you got that answer. You're right, the answer is three, but how did you get to it? What procedure did you have to use? A lot of answers are being shouted out. If you continue this, people won't be able to think for themselves because the answers are being given. (p. 306)

Thirdly, Cynthia clearly had a sense of professional efficacy in reaching her students. She thoroughly knew her subject matter, including the structure of mathematics, and she was able to use this knowledge to build on students' past learning to pave the way for future learning. Because Cynthia felt responsible for all of her students' learning, she continually sought ways of making content comprehensible to those who struggled academically. Her subject matter knowledge and pedagogical expertise allowed Cynthia to adapt instructional content in creative ways that best fit the needs of her students.

Even though she was an elementary school teacher, Cynthia's pedagogical style can provide insight to prospective teachers needing to know how to implement culturally relevant pedagogy in the mathematics classroom. There is a need for more studies like these, especially on the secondary level, so that prospective mathematics teachers can have an idea of what culturally relevant mathematics is supposed to look like. My study contributes this knowledge base by being one such study.

Culturally relevant language and literacy classroom practices. There are two similar studies that focus on culturally relevant classroom practices beyond the elementary school level (Kaste, 2004; McNeal, 2005). However, these studies focus on language and literacy rather than mathematics. In the first study, Kaste (2000) examined the classroom practices of four preservice teachers during their student teaching experience in three middle schools with diverse populations in the southeastern United States. Her data sources included field notes of lessons, audio taped debriefing sessions, and participants' reflection journals.

Using Au's (1998) conceptual framework for improving the school literacy learning of students of diverse backgrounds to analyze the teachers' culturally responsive teaching practices, Kaste found that individually, the four preservice teachers' implementation of Au's elements varied by type and occurrence. Collectively, (a) classroom management and interactions with students, (b) personally meaningful instruction, and (c) authentic instructional methods were the most prevalent elements of Au's framework used by the participants. They were least likely to implement the elements of (d) making connections to the community, (e) role of the home language, and (f) using multicultural materials. Factors such as the learner's own beliefs, constraints of the school context, and lack of knowledge for applying theory to practice influenced their classroom practice, while reflection during practice influenced them to attend to culturally responsive pedagogy. She concluded that providing more deliberate support for preservice teachers' practice in attending to culturally responsive literacy is of the utmost importance. The results of this study seem to indicate that when trying to implement culturally responsive pedagogy, both language arts and mathematics teachers struggle with similar factors of teachers' prior beliefs, constraints of the school context, and the difficulty connecting theory to practice.

In the second study, McNeal (2005) examined the multicultural teaching practices of two novice secondary English teachers teaching in the same school district that serves a diverse student population. Data sources included in-depth semistructured interviews, classroom observations, lesson planning material, philosophy of teaching statement, and electronic mail interviews. The researcher used principles that focused on curriculum and instruction issues for multicultural teacher education programs (Zeichner et al.,

1998). The results of the study indicated that both teachers implemented the principles of multicultural literature, active learning, real life application, student choice, individual attention and critical pedagogy. The multicultural principles that were unique to each teacher were cultural physical adaptation and cooperative grouping. The data also suggested that preservice teachers with previous cross-cultural experiences are predisposed to be more culturally sensitive and accepting of diversity. McNeal (2005) concludes that although there is convincing evidence supporting the influence of a multicultural teacher education program on teachers' multicultural practices, other variables such as schooling contexts, and individual characteristics, influence teachers' multicultural practices as well.

Conceptual Framework

Although McNeal's (2005) study focused on secondary English teachers, I have included her study in my literature review because of my interest in using the same conceptual framework in my study. Therefore, I present a brief history of the development of these principles. The process of developing a set of design principles that would represent a view of good practice multicultural preservice teacher education began when the coordinators of the Multicultural Preservice Teacher Education Project (Zeichner & Grant) gathered reviews of the literature on multicultural teacher education and evaluated them at a 2-day meeting with other multicultural scholars, including Geneva Gay, Maureen Gillette, Linda Valli, and Ana Maria Villegas. As a result of this meeting, an initial set of design principles were developed, and then revised afterwards. These design principles were presented at the 1996 annual meeting of the American Association of Colleges for Teacher Education in Chicago. Feedback from this meeting along with

consultation of additional literature resulted in 14 design principles organized into three main categories: (a) institutional and programmatic principles, (b) personnel principles, and (c) curriculum and instruction principles.

Because my focus will be on preservice teachers in secondary mathematics classrooms, only the curriculum and instruction principles will apply to my study. I have chosen to use these principles because of the credibility and expertise of the contributors, the multistep process used in their development, the broad range of feedback solicited in the project's many revisions, and the potential of the principles to provide unambiguous direction for what should be included in the curriculum and how instruction should proceed for diverse learners (McNeal 2005). Although these principles were presented in paragraph form, for the purpose of my study, I have taken these curriculum and instruction design principles and formed them into categories that that can be useful during mathematics instruction. They are (a) building on prior knowledge, (b) high expectations for diverse learners, (c) knowing students well, (d) culturally responsive pedagogical skills, (e) critical consciousness, (f) sharing of power, and (g) multiple funds of knowledge (see Table 2). I provide a more detailed description of each of these categories in the data analysis section of chapter three.

Summary

I began this literature review by presenting the research on mathematics teacher education programs and issues of diversity and equity. I then presented studies from the general multicultural teacher education literature that could help fill in the gaps resulting from the sparse research on multicultural mathematics teacher education. The last few

Table 2

Adaptation of Curriculum and Instruction Design Principles (Zeichner et al., 1998)

Principle	Description
Building on prior knowledge	Using students' prior knowledge, both personal and cultural, as critical resources for creating learning
High expectations for diverse learners	Avoiding deficit views of diverse learners
Knowing students well	Learning about students, their families and their communities for the purpose of improving instruction
Culturally responsive pedagogical skills	a) Using multicultural materials; b) using activities where students are actively engaged such as cooperative learning and inquiry-based instruction; c) using examples from students' daily lives to introduce or clarify new concepts; d) using classroom management styles that take differing interaction patterns into consideration; e) and using a variety of assessment techniques
Critical consciousness	Committing to be change agents who work to promote greater equity and social justice in schooling and society
Sharing of power	Allowing students to make choices about learning
Multiple funds of knowledge	Extending beyond the textbook and teacher as authorities to validating multiple types and sources of knowledge

studies of this review focused on multicultural classroom practices. I concluded with a discussion of my conceptual framework. The majority of the literature on preparing preservice teachers to teach diverse learners effectively focuses on preservice teachers' beliefs, attitudes, and perceptions about diversity. These studies indicate that preservice teachers come to colleges of education with limited cross-cultural experiences and often hold deficit views of diverse learners. While these studies demonstrate that the impact of teacher education programs on previously held beliefs and attitudes is limited, there is evidence that certain aspects, like providing cross-cultural experiences, critical reflection, and opportunities to participate in nonthreatening discussions on racism and White privilege, can move preservice teachers in the right direction. However, when it comes to investigating the classroom practices of preservice mathematics teachers at the secondary level, studies within the multicultural education literature are virtually nonexistent. It was my intention to expand this literature by investigating the equitable teaching practices of three preservice teachers in their secondary mathematics classrooms and the factors that influence these practices.

CHAPTER 3

METHODOLOGY

In this chapter, I describe the naturalistic methodology used to complete this study. As previously mentioned in the first chapter, the research questions guiding this study are as follows:

1. What aspects of equity pedagogy do preservice secondary mathematics teachers practice in their classrooms?
2. What are the obstacles and/or challenges interns face in implementing equity pedagogy?
3. Which aspects of the teacher education program do the interns perceive most influence their implementation of equity pedagogy?

I have included a description of the research design, context of the study, data collection techniques, data analysis, trustworthiness of the data, and a summary.

Design of the Study

I have chosen a qualitative study because “researched focused on discovery, insight, and understanding from the perspectives of those being studied offers the greatest promise of making significant contributions to the knowledge base and practice of education” (Merriam, 1998, p. 1). For outsiders to understand the impact of mathematics teacher education programs, preservice teachers need a voice. Qualitative research provides a vehicle for this kind of understanding, by giving voice to its participants. I chose a qualitative case study in an attempt to capture the complexity of learning to

teach in culturally diverse settings. The natural setting of a culturally diverse classroom is the only context that makes sense to understanding how preservice teachers synthesize the knowledge gained from their teacher education program into effective classroom practice. By being a participant observer, I was afforded the opportunity to provide contexts for these preservice teachers to reflect on their practice with regard to issues of diversity and equity in mathematics. Thus the study itself could be a vehicle for transforming the participants' teaching practices. While I would hope that the reflection that occurred as a result of their discussions with me and each other about equity pedagogy did indeed bring about changes in their thinking and ultimately their practices, their transformation was not the focus of this study. Because I had no way of knowing the impact of their participation in this study on their teaching practices, I simply described and interpreted their practices as they unfolded.

The study involved a collection of three instrumental case studies, also known as a collective case study (Creswell, 1998). Researchers use instrumental case studies to illustrate the issue or phenomenon being studied, as opposed to having an interest in the uniqueness of a specific case. Therefore, a thick description of each case (student teacher) will be for the purpose of gaining insight in the equitable teaching practices of preservice teachers. Examining similarities and differences across the cases, as with a collective case study, can strengthen the precision, validity, and stability of the findings (Merriam, 1998).

Context of the Study

The study examined the complexities of implementing equity pedagogy in the secondary mathematics classrooms of three preservice teachers during the 13-week

student teaching phase of their programs. The major purpose of this student teaching phase was to immerse preservice teachers into the professional responsibilities of teaching by providing opportunities to test, reflect, and demonstrate competence in teaching in a secondary mathematics classroom (Appendix A). During the first 3 weeks of that spring semester, the student teachers observed and assisted in their mentor teachers' classes. They gradually took over the teaching responsibilities for one to two classes over the next 2 weeks. By week 6, they had a full teaching load of five classes, which they continued until week 10. For the next 2 weeks, they were once again only responsible for teaching one to two classes. The last week was reserved for observation, reflection, and finalizing all student teaching requirements. During the semester, the student teachers were required to develop and teach a 4-week unit plan that demonstrated "competency in three or more of the following areas: technology, cooperative learning, interdisciplinary approaches, diversity, or special needs students" (see Appendix A).

Role as College Supervisor

My role as their college supervisor was to make approximately six visits to the school site for conferences or observations during the semester. During this time I was to have an initial conference with them before they began their teaching responsibilities, a final conference, and three to four classroom observations in between. Two of these observations were to include a formal evaluation of their teaching practices—a midterm and final evaluation. Because I was responsible for making sure the student teachers could teach both lower level and upper level students, I made sure that I observed classes at both levels for each student teacher. This was not difficult because each teacher only had two preps. However, I chose to make more frequent visits to their lower level classes

for the purpose of gathering data for my study. I ended up making seven to eight classrooms observations for each student teacher, rather than the required three to four.

Because I did not want their fear of getting a low grade from me to impede their willingness to experiment with instructional strategies or hamper their communication with me, I informed my student teachers that I would only be evaluating their teaching practices twice during the semester, their prescheduled midterm and final evaluations. Any other time that I visited the school site would be solely for the purpose of helping them become better teachers, not to judge them. I even explained to them that my study was simply another vehicle for them to improve as teachers and not a means to judge them. I felt that their ability to learn from me was dependent on their ability to trust me enough to expose their weaknesses, problems, and challenges to me. I did not take that trust lightly.

School Site

The student internship phase of the program took place at Crestview High School (pseudonym), an urban school just outside a large metropolitan in the southeastern United States. The school's racially and ethnically diverse population was 12% Asian/Pacific Islander, 27% African American, 18% Latino, and 43% White (National Center for Education Statistics, 2001-2002). The student body of approximately 2,400 students began school that year in a brand new two-story building. Although the building was new, the school's history dates back to 1873 (Flanigan, 1933). Crestview High School is located in rapidly growing school district with an increasingly diverse student population.

Teacher Education Environments in Mathematics and Science

In an effort to visualize and plan a new approach to teacher education, the designers of TEEMS based the program on constructivism (von Glasersfeld, 1991), which suggests that human beings construct knowledge through acting on their environment and interacting with other humans. Constructivist educators (Reid & Stone, 1991; Rogoff, 1990) suggest that how students think, understand, or negotiate meanings cannot be separated from the context, including social interactions, in which learning is facilitated. The work of Shulman (1987) on the Stanford Knowledge Growth in Teaching Project also influenced the program's design. Shulman suggests that understanding teaching and learning requires more than an investigation of general pedagogical tools, such as teachers' use of questions, teaching strategies, use of class time, and design of assignments. He asserts that in order for student learning to take place, teachers must transform the subject matter by critically reflecting and interpreting it; finding multiple ways to represent the ideas; and adapting and tailoring the material to students' abilities, gender, and prior knowledge so that students can be successful. These two perspectives provide the underlying framework for the program's integration of the following four major components: (a) knowledge of pedagogy, (b) knowledge of subject matter content, (c) knowledge of students, and (d) knowledge of environmental contexts for learning.

The TEEMS program is characterized by reflective and constructivist models of learning; a holistically organized pedagogical curriculum; and learner-centered instruction in which students engage in a series of field-based experiences (MSIT, 2005). During their methods course the first semester of the program, the TEEMS students read and discussed the National Council of Teachers of Mathematics Principles and Standards

(NCTM, 2000), which included the equity principle. According to this principle, equity in mathematics education requires high expectations and strong support for all students, including diverse learners. The equity principle does not suggest that every student receive identical instruction, but it does require accommodating differences to help all students learn. Included in this principle is the suggestion that teachers need help in understanding and confronting their own beliefs and biases in order to understand the strengths and needs of students who come from diverse linguistic and cultural backgrounds. During these discussions, the TEEMS students begin to grapple with the kinds of accommodations necessary to help diverse learners succeed in mathematics.

As part of their second semester coursework, the TEEMS students were expected to investigate and apply the Interstate New Teacher Assessment and Support Consortium (INTASC) teaching standards, including the following principles that relate to equity.

Principle #3: The teacher understands how students differ in their approaches to learning and creates instructional opportunities that are adapted to diverse learners.

Principle #4: The teacher understands and uses a variety of instructional strategies to encourage students' development of critical thinking, problem solving, and performance skills.

Principle #5: The teacher uses an understanding of individual and group motivation and behavior to create a learning environment that encourages positive social interaction, active engagement in learning, and self-motivation. (Council of Chief State School Officers, 1992, pp. 14-19)

While investigating and applying these INTASC teaching standards, preservice teachers had the opportunity to develop lesson plans, activities, and strategies for accommodating diverse learners in the mathematics classroom. During that same semester, a guest speaker specifically addressed issues of diversity in the mathematics classroom. The TEEMS students were then required to research and develop a plan for diversity for their own classrooms. These classroom experiences were intended to provide the foundation

for TEEMS students to implement equity pedagogy during the student teaching phase of their program the following semester.

Participants

I present the cases of three secondary mathematics preservice teachers in an alternative certification program at an urban university. Participating in the study were two White women and a foreign born man of Mediterranean descent. Each participant had already earned a non-education undergraduate degree in a mathematics related area, such as engineering, computer science, or pure mathematics. By the time of the study, the participants had already completed a 6-week practicum at a middle school. Upon completion of the TEEMS program, they received a teaching certificate along with a mathematics education graduate degree. I have protected the identities of the participants by using self-selected pseudonyms in the reporting of the cases. I employed a convenience sample based on the three student teachers that have all been assigned to the same high school. Three is a number that is small enough to allow for “thick description” (Geertz, 1973) but large enough to reflect an adequate range of experience. The participants chose to take part in this study because of their desire to teach all of their students equitably. They felt like this was another opportunity to hone their skills. The following is a description of their backgrounds before they entered the TEEMS program.

Patricia. Patricia was a 28-year-old, White woman who grew up in a middle-class family in a predominately White suburban neighborhood in the southeastern United States. Although she grew up in a two-parent family with two younger brothers, her parents divorced after 20 years of marriage when she was in college. Her father later remarried and had two more children. She recalled that her father had a huge influence

on her success in mathematics. She stated, “My mother was never good in mathematics, but my father was a very good student. He was valedictorian of his school and did very well, and I think that naturally from him I gained an understanding of mathematics” (PI 4-16, p. 6). Although she had very little interaction with people from diverse backgrounds, she described these experiences as positive. In her high school class, there were only four Black students, and she happened to know two of them. Of those two, one of them was only an acquaintance, while the other student shared a birthday with her. Patricia recalled that although they never socialized outside of school, she did consider her to be a friend.

In college, Patricia was disheartened that students were divided by racial, ethnic, and religious lines in the sororities and fraternities. However, she met people from many different backgrounds living in the campus dormitories. Yet her network of friends were mostly from high school and other people that were a lot like her, White, and middle-class.

After receiving a business degree from the state university in her home state, Patricia decided to become a corporate person by working in the insurance industry as a commercial property underwriter. About 6 years later, she decided she needed to make a career change. She recalled the series of events that led to her decision to teach.

I didn't feel a sense of satisfaction from the work that I was doing. I'd come in every morning, I had a lot of perks at that job. I got paid well. I took a lot of fun trips. I got to do a lot of things, but at the end of the day, I did not, I wasn't excited about coming to work the next day. I didn't enjoy what I did during the day. I was often frustrated at the way corporate America works in general, not just in my company, but just talking to other people and their companies. I knew that I couldn't stand to be doing that for, you know, another twenty or thirty years. So I really had to sit and think, “Okay what are the things that I really enjoy? What can I do that I think can give me some sort of satisfaction with the work

that I am doing?” And I originally thought about teaching when I was in high school, thinking about going to college, thinking about what I wanted to do. I knew that in order to be a teacher I had to be one-hundred percent dedicated to it and I wasn't at that point. I was too motivated by making money. And I knew that a teacher couldn't make a significant amount of money. (PI 4-16, p. 3-4)

Patricia later realized that there were things more important to her than money and that she should do what she really enjoyed doing. She understood that her drive to make money was more motivated by her desire to be independent and her competition with peers. As she matured, her love for children and mathematics provided the impetus for her to quit her job and move back in with her parents, who would support her while she pursued a second career as a high school mathematics teacher. Therefore, she enrolled in the TEEMS program in order to earn a teaching certificate and a Master's degree in mathematics education.

Katie. Katie was a 22-year-old, White woman who also grew up in a predominately White suburban neighborhood in the southeastern United States. She considered her family to be typically middle-class and average. It consisted of Katie; her brother, who was 13 years older; and her parents, who were still married after 37 years. Like Patricia, she had very limited experiences with people from different cultural backgrounds in high school. However, she did have positive experiences at work with people with different ethnic backgrounds. She also interacted with people from many different cultures while getting her undergraduate degree in mathematics at a small school in the southeastern United States. As the peer advisor for the international group at her school, Katie participated in all kinds of cultural activities. Katie remarked, “We had people from all over the world, whether it was the Caribbean, Asia , Mexican events

or European. We did a little bit of everything for everybody so the whole school could be more culturally diverse . . .” (KI 4-16, p.2).

Unlike Patricia, whose dissatisfaction with corporate America steered her into teaching, Katie always knew that she wanted to be a mathematics teacher.

I've always wanted to teach math. I don't know why. My favorite subject was always math in school and I've wanted to teach since I was two feet tall. I had the smartest baby doll on the block. I just put two and two together, because I do have a passion for math. I don't really know what really triggered it, but I was always more math-minded and it just appealed to me. I'm not really sure what got me into it that route. (KI 4-16, pp. 2-3)

Katie chose to get an undergraduate degree in pure mathematics first so that she would be sure that she had a math background strong enough for teaching upper level mathematics. She had heard about mathematics teachers with education backgrounds not having an adequate understanding of some of the mathematics necessary for teaching secondary mathematics. She also knew that she could always get a good job with a mathematics degree, if for some reason teaching did not work out.

As a woman majoring in mathematics, Katie did acknowledge that she had to overcome obstacles of prejudice. “Well, I struggled because all my professors were all men. . . . I've had to overcome difficulties with people not believing I could do it just because I'm a girl, or [because] a lot of men are in that profession” (KI 4-16, p. 4). Her personal experience with gender stereotypes made her more determined to help all of her students to succeed in mathematics.

Mike. Mike was a 27 year-old Iranian American born in Cyprus and raised in a middle-class family. His dad was a businessman from Iran, and his mother was from Azerbaijan. He admitted that although he was raised in a way where he did not

necessarily need anything, he did not grow up to be money hungry. He contrasted his upbringing with the materialism that he observed in the United States: "In America everybody's driven to get that million; like today, for example, the big lottery. 'Money, money, capitalism, yes, yeah, let's get a new car!'" (MI 4-16, p. 2) After spending some time in Vancouver, Canada, Mike moved to a metropolitan city in the southeastern United States and majored in chemical engineering at a local engineering school. After about 3 years, he began to dislike his program at Regional Tech (pseudonym).

Mike: I had to argue with my father many times, I used to yell at him and ask him, why Regional Tech? 'I hate this school! I hate it! I hate it! I hate it! It's not for me.'

Seda: Why did you hate it so much?

Mike: Because it wasn't right. I wasn't the right choice for that, chemical engineering . . . the kids who were in that program were cut and dry . . . I'm not an engineer type. I could never . . . it would be suffocating to me. I just couldn't see myself working as engineer. I could not see chemical engineers, mostly at a station, you know. I just couldn't see myself being engaged in this kind of environment. I need an environment that is more artistic, more creative, more human interaction in a way. (MI 4-16, p. 7)

While he felt compelled to stay at Regional Tech, Mike was able to change his major to International Product Marketing. He later realized that his perseverance in staying at Regional Tech was a positive influence for him.

After graduating with a Bachelor of Science, Mike went to work in Australia for a company that created packaging for the embroidery business. For a time, he enjoyed traveling with the head of marketing to different trade shows. However, like Patricia, Mike began to become disheartened with the shallowness in his life while working his way up the corporate ladder. He related, "I really think that it is more appealing to me to come to this world and to be engaged in something that you truly have passion for and

truly enjoy doing” (MI 4-16, p. 2). He affectionately described his decision to become a math teacher.

I’ve always been engaged in peer tutoring. . . . So I had a good clientele . . . I’m an extrovert and I like to be in the center. . . . I’m very dramatic . . . why wouldn’t I take advantage of it; . . . strong mathematics background, an extroverted person, put them together, boom . . . So when I realized it’s like falling in love. When your mom or dad tells you that when you fall in love, you get like goose bumps, and you get these butterflies in your stomach. God is a witness, when I made a decision of changing, to . . . education, it felt so good. (MI 4-16, p. 4)

It was at that point that he decided to pursue an educational program where he could earn his teaching certificate and a Master’s degree simultaneously.

Data Sources

The data sources for this study were participant observations, individual interviews, group interviews, and reflective journals. I observed and videotaped three class periods for each student teacher. I then conducted interviews based on these observations. Finally I made a copy of the reflective journals kept by the participants during their student teaching.

Participant Observations

During their 13-week student teaching phase, the participants were responsible for teaching a full load (all five classes) during weeks 6 through 10. I observed and videotaped three full classes for each student teacher during this time. I also took field notes during these observations.

I chose to study Patricia teaching her fourth-period Tech Math II class because of the diversity of learners in this class. This course was designed to give lower level students access to algebra concepts and skills at a slower pace. The racial/ethnic makeup

of the class was 4 African American females, 5 African American males, 2 Latina females, 1 Latino male, and 1 Asian male, for a total of 13 students.

I studied Katie's teaching her sixth-period Algebra I class because there was a greater diversity of learners in this class than in her Gifted Algebra II classes. The racial/ethnic makeup of this class was 8 White females, 5 White males, 3 African American females, 2 African American males, 3 Latina females, and 2 Asian females, for a total of 23 students.

I chose to observe Mike's teaching his fifth-period Tech Math III class because this class was more diverse than his Honors Algebra I class. Like Patricia's class, this course was also designed as a remedial class. The class demographics were as follows: 10 African American females, 2 African American males, 1 Latina female, 4 Latino males, 2 White females, and 1 White male, for a total of 20 students.

During these observations, I made note of the interactions between the preservice teachers and their students. I recorded both strengths and weaknesses of their teaching along with suggestions for improvement. I videotaped three observations for each teacher so that I could go back and analyze their classroom practices several times, making sure I did not miss pertinent information. Because I used these classroom observations to verify the number of incidences of equity pedagogy practiced by the participants, I did not feel it was necessary to transcribe each of these videos. Instead I coded each occurrence under the proper category, and made note of the videotape time on my observation log (see Appendix B).

Individual Interviews

Individual interviews helped further my understanding about their classroom experiences (Seidman, 1998). I conducted a total of three individual interviews, one interview with each student teacher. The interview lengths ranged from 45 minutes to over an hour. I interviewed Patricia, Mike, and Katie consecutively all on the same day. The interviews served the dual purpose of providing data for my study as well as being their final conference with me as their college supervisor.

Prior to each interview, I asked the student teachers to view the three videotapes of their classroom observations. From these tapes, they were to select a 20-minute video clip that they believed to demonstrate equity pedagogy. I asked them to bring these video clips with them to view with me during the interview. I asked them to do this exercise because it forced them to thinking critically about their own teaching practices and to give specific attention to equity pedagogy. While equity issues were a constant focus for me, I am not sure that was always the case with my student teachers. I think that they viewed teaching equitably as a nice thing for them to know but often took a back seat to the cognitive aspects of teaching. I knew that the task of choosing a video clip of themselves practicing equity pedagogy would place equity front and center in their minds.

The interviews were semistructured with questions about their personal and cultural identities, and how decisions regarding curriculum, teacher-student interactions, and classroom management all play a role in equity pedagogy. In addition, I asked them to describe their experiences as they tried to implement equity pedagogy as well as the obstacles or challenges that they faced during their student teaching. They also had the

opportunity to describe to me their reasons for selecting the particular 20-minute video clip. Even though I came into each interview with the list of predetermined questions detailed in Appendix C, each interview was open-ended enough for me to ask clarifying questions and pursue related topics not specifically mentioned in my individual interview guide. Because these interviews took place at the end of the student teaching semester, I also saw this as an opportunity for my students to reflect critically on their entire teacher educator preparation programs. I videotaped and transcribed each of these individual interviews.

Group Interviews

The purpose of the group interview was to give the student teachers the chance to reflect on their classroom practices as fellow practitioners of equity pedagogy. Each student teacher had the opportunity to listen to the opinions of others while forming new ones. This technique was chosen to yield richer data than just the individual interviews alone (Vaughn, Schumm, & Sinagub, 1996). Although I had initially planned to have a single group interview with all three participants after concluding the individual interviews, Katie was not at the school site on the day that I conducted my initial group interview. Therefore, I scheduled a second group interview when all three participants could be present. I used data from both group interviews in my study. The group interview guide that I used during these semistructured interviews can be found in Appendix D.

During the first group interview, I read Mike's paraphrase of equity pedagogy from his individual interview. After playing his video clip, I asked Patricia to decide if equity pedagogy was demonstrated in that clip. Likewise, after viewing Patricia's video

clip, I asked Mike to comment on the equity pedagogy demonstrated in her video clip. During the second group interview that took place a week later, both Mike and Patricia commented on Katie's video clip. Unfortunately, because of time constraints, Katie was not able to comment on anyone else's video clip during the group interview. I videotaped each of these group interviews and recorded the instances of equity pedagogy in the same manner as the classroom observations (see Appendix B).

Documents

During the 10-week student teaching experience, each participant was required to keep a record of their student teaching experience in a reflective journal. The following instructions were given.

In the journal discuss your feeling about your experiences, but concentrate on a critique of your actual teaching. Reflect upon what worked well, what did not and what you will do to improve the lesson. The journal must include an entry for each day that you teach and at least three entries per week during the period that you are not teaching. (Appendix A)

At the end of the semester I made copies of their handwritten reflective journals, transcribed them, and used them in my study.

Role as Researcher

The positivist paradigm suggests that reality can be only be determined by an objective observer. However, in the qualitative paradigm humans can be never be completely objective. The "blindness" of objectivity simply prevent us from seeing the impact of our subjectivities on our research. Blindness are defined as something that serves to obscure clear perception and discernment (Editors of The American Heritage Dictionaries, 2004). As I was the primary instrument of data collection, it is important that my vision not be obscured by my own notions of objectivity. I believe that removing

the “blindness” means to state my beliefs and biases upfront and explore the ways they could possibly affect the study. The following section is my attempt to do just that.

I am an African American woman who is passionate about changing the negative mathematical experiences of students who have not previously experienced mathematical success. “Success” to me is not just simply passing a class, but rather being able to use mathematics as a tool to reason, analyze, communicate, and open doors of opportunity. Too often mathematics has been taught in a manner where students cease to think on their own but rather memorize meaningless routines and procedures simply to pass a class. Rather than opening doors of opportunity, mathematical failure often leads to lack of self-esteem, frustration, heartache, and shattered dreams of furthering their education. For me, the mathematics classroom was a place where I took great delight in making connections, reasoning, and analyzing mathematical ideas in an environment where I was valued, esteemed, and confident. In other words, I not only felt “smart” in class, I was constantly told that by my teachers, classmates, and friends. However, it did not take me very long to realize that many people did not share that same experience. For many, mathematics class meant confusion, failure, heartache, lack of confidence, and feeling like a “dummy.” I became a teacher because I wanted my students to experience mathematics the way that I did—as something positive and empowering. I have become a researcher because I want more teachers to have positive and empowering mathematics classrooms for their diverse learners.

In the process of conducting this study, it would have been very easy for to me to observe and critique everything around me and not leave myself open for critique. However, it is the lack of self-critique that continues to perpetuate the status quo of

inequity. Everyone knows that inequity exists, but playing the blame game is safer than becoming self-reflective about the roles we play in reproducing inequity in society. I am no exception. Therefore, I reflect on my own inadequacies on approaching this problem of preparing preservice teachers to effectively teach diverse learners in secondary mathematics classrooms. I initially wanted only to focus the lens of observation on those that I observed—Patricia, Katie, Mike, their students, their mentor teachers, their school, and their teacher education program. However, that would be hypocritical of me. I would venture to say that colorblindness, which is really “culture-blindness,” has resulted from the lack of self-reflection about one’s own cultural identity, resulting in an “othering” of any culture that is not his own. White middle-class as the normative culture renders it invisible to those who possess it, while those who are not White and middle-class are perceived as the ones with culture. It is the lack of critical reflection that contributes to inequity. If my study is to illuminate and remove the “blindness” that prevent us from seeing factors that contribute to inequity, I must be willing to be part of the same process.

Data Analysis

To analyze the individual and group interviews, participant observations, reflective journals, and diversity statements, I used my adaptation of Zeichner et al.'s (1998) curriculum and instruction principles as a conceptual framework for categorizing classroom practices (see Table 2). Because the reflective journals were handwritten by the participants, I transcribed their journals using the codes that the participants provided in their journals for each entry. I also personally transcribed each of the individual interviews. To answer the research question, *What aspects of equity pedagogy do*

preservice secondary mathematics teachers practice in their classrooms?, I established tables with the seven categories that I extrapolated from Zeichner et al.'s (1998) curriculum and instruction principles as headings. As I read through the transcripts, I highlighted the contexts that related to the appropriate categories using a seven color coding scheme. I also used these tables to record the incidences of each category as I reviewed the videotapes and field notes of classroom observations. Although, the data often supported more than one category, for the sake of clarity, I placed each incident in only one category. I continually revisited the categorical descriptions to determine the best alignment for the data. I used the following categorical descriptions during analysis.

Building on prior knowledge is based on the assumption that all students bring knowledge, skills, and experiences, both personal and cultural that should be used as resources in teaching and learning (Zeichner et al., 1998). For this category, I looked for instances where the teacher sought to find out what students already knew about a concept or used familiar referents to teach new concepts.

High expectations for learning should be held for all students. However, traditionally structured schools privilege the experiences of dominant groups and tend to view ways of learning that differ from the norm as deficient. Unfortunately, teachers who hold deficit views of certain students cannot accurately assess their strengths because they tend to emphasize what they cannot do rather than what they are capable of doing well (Hilliard, 1992). While analyzing my data, I looked for examples of teachers providing positive feedback, maintaining high standards and rigorous work, and avoiding negative stereotypes of diverse learners.

Closely related to building on prior knowledge is knowing students well. Because any given individual may be very much like most of the members of his or her historical groups of reference or may operate in ways that are quite outside the norms of that group, simply teaching prospective teachers about the cultural norms of different cultural groups is insufficient (Hilliard, 1992). In addition to learning about the cultural norms of diverse learners, prospective teachers must be taught various procedures for acquainting themselves with the specific students in their classes, such as making home visits, talking with parents, consulting with other teachers, conferring with community members, and observing children in and out of school (Zeichner et al., 1998). Therefore, I looked for examples where the teachers sought to learn about the lives of their students' both inside and outside of the classroom.

Culturally responsive pedagogical skills are instructional practices that take advantage of the sociocultural dynamics of diverse classrooms and the personal and cultural resources students bring to school. Zeichner et al. (1998) describe them as (a) using multicultural materials; (b) using activities where students are actively engaged such as cooperative learning and inquiry-based instruction; (c) using examples from students' daily lives to introduce or clarify new concepts; (d) using classroom management styles that take differing interaction patterns into consideration; and (e) using a variety of assessment techniques. Teachers who strictly adhere to one type of strategy will invariably disadvantage some students, so I looked for evidence that a variety of these strategies were being used by the participants.

Critically conscious teachers are those that have developed "the commitment to be change agents who work to promote greater equity in and social justice in schooling

and society” (Zeichner et al., 1998) by affecting relationships of power and privilege through curriculum, pedagogy, and individual and collective action in schools, districts, and communities. I looked for examples that indicated the participants were advocates for culturally diverse students both personally and collectively. I looked for instances where the participants took personal responsibility for the achievement of his or her students as well as instances where they promoted collective action for social change.

Connected to critical consciousness is the sharing of power. The best way to redistribute power and privilege in a culturally diverse classroom is to model that behavior as a teacher. One simple way to share that power is to allow students choice in the typical operation of the classroom. Therefore, I looked for examples where the preservice teachers allowed students to exercise choices in such things as methods of instruction, types of assignments, and seating arrangements.

The last category that I used was using multiple funds of knowledge. As Ladson-Billings (1994) noted, the culturally relevant teacher does not view knowledge as static but as continuously recreated and shared by both teacher and student. I looked for opportunities where the teacher could play the dual role of being a student as well as a co-teacher. I also looked for evidence that the teacher was more a “guide on the side” rather than a “sage on the stage.” Referring to classmates, the Internet, partners, and parents as resources for right answers were all examples teachers using multiple funds of knowledge. Although drawing upon and validating sources other than the teacher or textbook can be an act of sharing power itself, I decided to code examples as sharing of power only if it involved student choice.

These seven categories provided the framework for the analysis of my data. As I mentioned in Chapter 2, I chose this conceptual framework for the clear direction that these principles can provide for analyzing equity pedagogy. While my theoretical framework of culturally relevant pedagogy still serves as a lens for viewing equity pedagogy, these seven categories further refined the “gaze.” Rather than develop my own coding system, I chose to use predetermined categories to “seek a collection of instances from the data, hoping that issue-relevant meanings will emerge” (Creswell, 1998, p. 154). In essence, I looked for patterns and correspondences between several categories to develop generalizations that people can use to learn from the cases individually or collectively.

Trustworthiness of the Data

Within the qualitative research paradigm, there are four different criteria that have been accepted for judging the trustworthiness of a research study. They are transferability, confirmability, credibility, and dependability (Lincoln & Guba, 1985).

Credibility

Credibility is the qualitative counterpart to internal validity (Lincoln & Guba, 1985). It applies to activities that make it more likely that credible findings and interpretations will be produced from the data. Activities that establish credibility are prolonged engagement, persistent observation, member checking, and triangulation. The purpose of prolonged engagement is to keep the researcher open to the multiple influences that affect the actors in the study (Lincoln & Guba, 1985). I visited the research site on a weekly basis for an entire semester. These visits should satisfy the conditions of prolonged engagement and persistent observations. However, I only used

the three observations as part of my study. I used member checking in two ways. I allowed the participants the opportunity to respond to my notes taken during my observations after they have viewed videotape of those lessons. They then had the opportunity to confirm or adjust my interpretations based on their recollection of the events. The videotapes were used to help them recall the events described in my field notes. To demonstrate triangulation, I used multiple data sources, such as observations, individual and group interviews, and document analysis to assure that my interpretations adequately reflected the data.

Transferability

Transferability is the qualitative counterpart to external validity (Lincoln & Guba, 1985). The qualitative researcher does not seek to set strict limits on how the results of a naturalistic study can be applied to another context. However, transferability is the criterion used to describe a context in sufficient detail to enable the reader to reach his or her own conclusion about whether transfer is a possibility to another. Therefore, I sought to use the "thick description" (Geertz, 1973) to paint the detailed picture necessary for the reader to be able to draw his or her own conclusions regarding the transferability of the results to another situation.

Confirmability

Confirmability is the qualitative counterpart to objectivity (Lincoln & Guba, 1985). This term applies to the extent that the data accurately reflect the views of the participants rather than the researcher's biases. In addition to the use of member checking as previously described, I kept an audit trail to establish confirmability. An audit trail is based on keeping a careful accounting of all the raw data collected during the

study. I kept all original videotapes, audiotapes, and transcriptions of those tapes in a safe place, while working with the copies. A uniform system of coding that identifies each piece of data will allow interested readers to identify the source of quotes, interpretations, and research findings.

Dependability

Dependability is the qualitative counterpart to reliability. In their discussion on establishing the dependability of a qualitative study, Lincoln and Guba (1985) assert the following, "Since there can be no validity without reliability (and thus no credibility without dependability), a demonstration of the former is sufficient to establish the latter" (p. 316). Therefore, the activities previously described to establish the credibility of my study, such as prolonged engagement, persistent observation, member checking and triangulation, will establish the dependability of this study as well.

Summary

I studied the cases of three preservice secondary mathematics teachers during their student teaching. These participants were all a part of the same certification program for students who already had a non-education undergraduate degree in a math-related field. In addition, they had all been assigned to the same high school for their student teaching. I focused on the various aspects of equity pedagogy as practiced in their classrooms. I also sought to understand the obstacles or challenges they faced in trying to implement equitable teaching practices, and the influence of their teacher education program.

The qualitative methods that I used were participant observations, individual and group interviews, and document analysis of their teaching portfolios, which included

their reflection journals. I observed and videotaped three full classes for each student teacher during the time they were teaching a full load of five classes. I also took field notes during these observations. Following the observations, I allowed the participants to view the videotapes of their lessons, and I interviewed them both individually and as a group. I employed categorical aggregation techniques to analyze the data sources. I used prolonged engagement, persistent observation, member checking, triangulation, thick description, and an audit trail to establish trustworthiness of the data. I used the Ladson-Billings (1994) theory of culturally relevant pedagogy as a theoretical framework for this study and Zeichner et al.'s (1998) curriculum and design principles to refine my focus of equity pedagogy in the secondary mathematics classrooms of three preservice teachers.

CHAPTER 4

RESULTS

In this chapter, I present the cases of three preservice teachers in their secondary mathematics classrooms. In the first section, I present the cases of each preservice teacher. Each case includes a description of the teacher's understanding of equity pedagogy and the aspects of equity pedagogy the teacher practiced. While understanding of equity pedagogy was not specifically addressed by my research questions, I think that understanding each teacher's notions of equity pedagogy helped me to interpret their actions in their classrooms. The three individual cases are then followed by a cross-case summary. The next section is a description of the obstacles and challenges that the interns faced in implementing equity pedagogy in their classrooms. I conclude with aspects of their teacher education program that influenced their implementation of equity pedagogy.

The Individual Cases

This section contains a description of the three cases as reflected in classroom observations, reflective journals, individual interviews, and focus group interviews. Following a description of each teacher's understanding of equity pedagogy, I use my adaptation of Zeichner et al.'s (1998) curriculum and instruction principles as an organizing framework for describing the teacher's experiences with implementing equity pedagogy in their secondary mathematics classrooms. These principles are (a) building on prior knowledge, (b) high expectations for diverse learners, (c) knowing students well,

(d) culturally responsive pedagogical skills, (e) critical consciousness, (f) sharing of power, and (g) multiple funds of knowledge.

Patricia's Case

For Patricia, equity pedagogy in the mathematics classroom meant “making students aware of the minorities and women that have made significant contributions to mathematics” (PI, 4-16, p. 6). Minority students need role models to give them hope that they can also succeed in mathematics. For her, equity pedagogy also meant dealing with her students as individuals. She stated,

when I talk about diversity, I don't specify race. Diversity to me means every student is different no matter what their color is, or their religious beliefs are, what their family life is like. Everyone is different and everybody brings something different to the classroom. And I think for me, my role as a teacher is to get to know the kids for who they are, and know what their interests are, and know how they learn. And then once I know that, then I can incorporate all those different things in my lessons to address all the different students that I have. (PI 4-16, p. 7)

Although, Patricia recognized the need for her diverse learners to have role models who are members of their racial or ethnic group, she only took their individual characteristics into consideration when planning instruction. When asked if she thought understanding her students' cultural backgrounds could help her better explain mathematical concepts to her students, her response was

in a superficial sense. I think some Asian students, that maybe English is not their first language, realizing that me explaining something to someone who lives in this country and knows English very well is different from explaining something to someone who doesn't have the same vocabulary that other students have. I think those are issues that I would think of. But I can't think of any others right now. (PI 4-16, p. 17)

This understanding of equity pedagogy supports the results of other studies (Barry & Lechner, 1995; Cho & DeCastro-Ambrosetti, 2005; Finney & Orr, 1995; Milner, 2005;

Olmedo, 1997; Santoro & Allard, 2005) that conclude that preservice teachers subscribe to colorblind ideologies by ignoring the saliency of race and culture in instructional decisions. Her insistence on knowing her students only as individuals prevented her from seeing her students as members of a larger group, blinding her from the realities of the oppression that comes with being a member of that group. She could only see racist and prejudiced individuals, not the effects of racist and oppressive institutions, such as schools. For example, when asked what role did racism, sexism, and classism play in the educational process she responded,

I think it is apparently in the educational system. It just depends on the person. I mean, to me, I don't think I am any of what you mentioned, but I'm pretty sure there are plenty of people that are. Unfortunately, it's just their nature I think it's just the people. . . . I think some things in a book might encourage some kind of racism by not incorporating enough minorities and females in their textbooks. I mean that's been an argument and a debate, but other than that, I really believe it's just the people. (PI 4-16, p. 10)

When asked to identify instances of racism, sexism, or classism at her school, she was aware of none. Yet her classes were racially divided along ability levels. She taught three Honors Geometry classes, which had very few minority students; and her two Tech Math II (lower level) classes had mostly African American and Hispanic students, with only a few White students. Her focus on her students as individuals prevented her from seeing the obvious inequity that had resulted from the years of tracking in her school district (Oakes, 1985).

Patricia's enthusiasm for teaching was evident in her classroom. The atmosphere of her Tech Math II class was warm yet orderly. Patricia could be described as your typical over-achiever. She made sure that her lesson plans were detailed and timely and that they reflected her own creativity. I chose to observe her Tech Math II classes

because of the high percentage of diverse learners in these classes. Although Patricia was a White woman, there were no White female students in either of her Tech Math classes.

Building on prior knowledge. Building on prior knowledge involves using students' prior knowledge, both personal and cultural, as resources for creating new knowledge. Patricia demonstrated minimal use of building on prior knowledge. In one of her classes, she used a scale as frame of reference to demonstrate how to solve algebraic equations. However, she did not show evidence that she took the time to know if that was an appropriate frame of reference. I doubt that many of her students actually had very much experience with the type of balancing scale that she referred to, other than in a science class.

Patricia often failed to take the time to assess previous knowledge before teaching a lesson. Her failure to access her students' background knowledge became evident on several occasions.

Today I gave some challenge problems on surface area and volume of cylinders to my geometry kids. I gave them five problems to be completed by the end of class. I thought these problems would give many of them trouble setting them up, so I was expecting to help them with that. I was shocked to find out that many of them couldn't solve for one variable because their algebra is so bad. Many of them didn't know how to multiply $2xh(1/2)h$. Some didn't know how to add $2\pi r^2h + 4\pi r^2h$. I was shocked! The main reason why they have so much difficulty is because they have very poor algebra skills. I am struggling as to how to approach this. I can't go back and reteach algebra, but I think it is good for them to get the exposure again because they definitely need the extra help. I am worried about how they're going to manage Algebra II. (PJ 3-21)

She was unable to provide the scaffolding that her students needed. Culturally relevant teachers see it as their responsibility to provide that scaffolding (Ladson-Billings, 1994).

Patricia described her frustration at not being able to connect the abstract math concepts to the lives of her students.

I know that it helps to make real-life connections and use other ways to motivate, but there are many things in math that you have to just learn algebraically. The kids have such a hard time with the abstract thinking. I truly believe that some of these kids just aren't at this stage of learning. I know that I will be very frustrated when I take over because the lessons aren't getting any easier. (PJ 2-11)

She ascribed their understanding of these concepts to the students' lack of ability rather than her lack of pedagogical content knowledge to be able to bridge the abstract math concepts with concrete examples.

On another occasion, Patricia mentioned that the number of Fs on a test was because of “careless errors and not remembering previously learned concepts, like special right triangles” (PJ 3-28). In another instance, she remarked, “They are forgetting previously learned knowledge, so it is hurting them now” (PJ 3-13). She had not taken the time to make sure the prerequisite knowledge was there before trying to build upon it. Yet as she reflected on her teaching, she seemed to be aware of the negative consequences of not adequately assessing prior knowledge.

I was really surprised today that most of the geometry kids did not get their homework. . . . I did not think these concepts were very difficult. They were expected to take the cube root of some of the problems and many did not know how to do that. I definitely thought that that was something they learned in Algebra 1, but I guess the majority of them forgot it. I guess this is a lesson for me to learn not to assume anything when it comes to previously learned math skills (algebra). (PJ 3-8)

Although, Patricia often did not use her students' prior knowledge as resources for creating new knowledge, she did seem to be aware that skipping this important step could make her less effective.

High expectations. Having high expectations means avoiding deficit views of diverse learners. It includes giving positive feedback, setting and maintaining high standards and rigor, and avoiding negative stereotypes associated with diverse students. Patricia demonstrated high expectations for her students at the beginning of the semester, but had difficulty maintaining those expectations when her students failed to perform as expected. Patricia communicated high expectations for her diverse learners in her reflective journal at the beginning of her student teaching semester.

I have noticed that the Tech math classes are made up mostly of Hispanics and African-Americans. They are somewhat of a quiet bunch, especially the Hispanic girls. I am very glad to see that the Tech classes are made up of kids who want to learn and are very eager to listen to their teacher and do their work. (PJ 1-16)

She even recalled the time that she gave one of her low-performing African American male students tougher word problems than the rest of the class because he asked for more challenging work. She wrote,

I actually made up some tougher problems for him to work on during class and he really tried hard to solve them. He even got most of them right. He seemed very appreciative of the challenging work he was given. It is so nice to see a class like this who certainly does not fit the stereotypical perception that many kids in the lower-level classes are troublemakers and do not want to learn. I think that I am really going to enjoy working with these kids. (PJ 1-16)

During class observations, I noticed that she gave frequent positive feedback, making comments like, “Good job!” “You’re just good at this now,” and “I think you’re doing really well with this” (PO 3-12). She consciously sought to include all of her students in the lesson. Patricia also communicated high expectations of her students by not letting them get away with what she perceived as laziness. She would often walk

over to the desks of students who were not working and seek to engage them in the class activities. She recalled one such experience in her journal.

I had to have a firm talk with third period Tech today. One girl almost refused to get out of her seat to work a problem on the board. She kept saying, "I'm too tired to get up. Let someone else do it." Without a good excuse, I kept pressing her to get up there and she finally did. I don't have many problems with the Tech kids getting up to work problems, but I am used to most of them being pretty lazy. (PJ 2-27)

However, her persistence in this way was not always received favorably by her students.

I have had a couple of comments from two black boys in third period who are both failing and usually try to get away with not doing any work. So, I call on them a lot to keep them with me and I asked them to put problems on the board just like everyone else. I keep hearing "You are just picking on me/calling on me because I am black." It is kind of pissing me off. I made sure they understood why I call on them and asked them to participate just like everyone else. I think it is rude of them to make statements like that to my face. I believe it is disrespectful and an inappropriate comment to make. (PJ 2-27)

There was an obvious disconnect between the teacher's intentions and perceptions of the students. Her students did not perceive her efforts positively and therefore lashed out at her. Delpit describes this conflict as lack of cultural synchronization. As Patricia continued to experience a disconnect between her students' performances and her expectations of them, she found it difficult to maintain the high expectations that she held at the beginning of the semester.

Today, the Tech Math II classes received their tests back on slope and equations of lines. Even though we have been going so slow on this section (it is the only thing that they have been doing for the three weeks I've been here) the results were terrible. Just about everyone failed miserably. The highest score in third period was a 75. When the tests were handed back, most of the kids were laughing about how bad they did. None of them seemed to be upset about their grade at all. . . . I am very disappointed in these classes. For the most part, they appear to want to learn, but fail to put in the extra effort outside class to do well. I wonder if

they're just so used to not doing well, that they just don't care and their parents don't care. . . . I was hoping these Tech math classes would prove the stereotypes wrong. So far, I am not seeing that much that does. (PJ 1-31)

She further communicated a deficit view of her students when making note of their lack of achievement on a quiz.

I was disappointed to see many of the students missed some of the easier problems such as recognizing the coordinates for a point on the graph and recognizing the slope and y-intercept when given an equation in slope intercept form. To me, these seem like such basic problems. It would seem that if the students can't get these problems correct, how in the world can they do the harder problems. (PJ 2-5)

She fell into the trap of thinking that students that perform at lower levels are incapable of achieving at higher levels. However, she contradicted that rationale with her very next sentence. "But, many of the students did much better on those harder problems. I think on the original test, they made a lot of careless errors. They were more careful this time, for the most part" (PJ 2-5).

Patricia began her student teaching semester with high expectations for her students but later adopted deficit views of her students' motivation and ability when they consistently did not meet her expectations. Rather than attribute their lack of achievement to her limited repertoire of instructional strategies, she blamed their low achievement on laziness or lack of parental support.

I wonder if they're just so used to not doing well, that they just don't care and their parents don't care. If I brought a grade home like that to my parents, there definitely would have been some consequences involved. I would bet money that most of these kids won't hear anything from their parents about being disappointed or being grounded. If they did hear it, I suspect there would be much more effort on their part to do well in class. (PJ 1-31)

She was unable to maintain positive expectations of her students in the face of their poor performances.

Knowing students well. Knowing students well includes learning about students, their families and their communities for the purpose of improving instruction. Patricia communicated her desire to know her students as individuals. During her interview she stated, “Knowing who our students are is a big part of being able to teach to the diverse learners that we have” (PI 4-16, p. 8). Furthermore she states,

And I think for me, my role as a teacher is to get to know the kids for who they are, and know what their interests are, and know how they learn, and then once I know that, then I can incorporate all those different things in my lessons to address all the different students that I have. (PI 4-16, p. 7)

She demonstrated her willingness to learn more about her students in order to improve instruction. In her journal, she referred to her desire to learn more about two Asian students who had consistently performed well on her tests. She wrote, “I would be interested to know more about the values of the Asian culture, so I could try to instill some of these values with my students” (PJ 1-28). She demonstrated an interest in knowing more about these students for the purpose of helping her with all of her students.

During the phase of her student internship where she observed the classes of her mentor teacher, Patricia perceptively noticed the different class dynamics.

It is interesting to see the classroom dynamics, especially between the grades. The freshmen seem to have more of a need to express their feelings out loud. They are more likely to be silly, talk or sing to themselves. The upper classmen just talk. I am working with mostly freshman, so I'll have to manage more of the side comments. (PJ 1-27)

Patricia used her knowledge about the varying behavior of her students to plan for the appropriate adjustments she would have to make to teach them more effectively. It is interesting to note that while she readily drew conclusions about her students as a group

of freshmen or upper classmen, she was reluctant to ascribe group characteristics along racial or cultural lines. Her reluctance to acknowledge the cultural differences of her students that resulted from group membership prevented her from knowing an important characteristic of her students.

Culturally responsive pedagogical skills. Culturally responsive pedagogical skills include using multicultural materials; selecting activities where students are actively engaged, such as cooperative learning and inquiry-based instruction; using examples from students' daily lives; using culturally sensitive classroom management styles; and using a variety of assessment techniques. Patricia made use of multicultural materials, actively engaged her students in lessons, implemented cooperative learning groups, and made a concerted effort to make sure her class environment was one where students felt comfortable asking questions and seeking out help. She was a firm believer in hands-on activities. She believes that teaching mathematics to diverse learners means teaching the mathematical concepts in many different ways in order to reach as many students as possible. She recalls her mother's school experience with mathematics.

I think of people like my mom, who [pause] she never did well in math. But I don't think that she was encouraged to try to, you know she's just didn't get it the way it was taught, so tough luck. And I think these Standards help you to understand that there are different ways of teaching and different ways of assessing that encourage students to be able to express their knowledge in different ways. (PI 4-16, p. 15)

When asked what characteristics of her students she took into consideration when modifying instruction, she responded as follows:

I take into consideration their learning styles. I try to incorporate hands-on activities for people that need concrete examples. I think a lot of people need different ways of being shown how to do something, whether it be algebraically, or doing it on a graph, or modeling something with your hands, working on a problem that incorporates pulling information

from different places, their prior knowledge; just different ways of assessing the same concepts. (PI 4-16, p. 7)

During one of my classroom observations, she used algebra tiles with her students as a means of solving systems of equations.

Patricia made attempts to make real-world connections in her lessons. One of her lessons involved resizing a box for Crunchlexia Cereal to fit a certain size shelf. By her own admission, she says,

I thought it was a good real-life problem where they would have to use their knowledge of surface area. This problem was wordy, so many students didn't even attempt it. Those who did took much longer than I expected. Next time, I will send this home for them to turn it in the following day. (PJ, 3-12)

On another occasion, making real life connections seemed to help Patricia teach a lesson exploring linear inequalities.

I made some fun worksheets, or at least I thought, that used real world problems dealing with linear inequalities. I think most of the kids appreciated the extra thought. I found some kids laughing at some of the problems. I think they found the situations funny. The kids seem to pick up the concept very quickly. I got thru more of the lessons than I thought. (PJ, 2-18)

Her rationale behind using a variety of assessments in addition to traditional tests was, "Because some kids aren't good at test taking so they need different ways to show that they understand the material" (PI 4-16, p. 15).

So as a teacher I think you need to offer a variety of ways for kids to express their talents. Whether they're creative artistically or great at crunching numbers, doing something that gives these kids an opportunity to say that I'm good at something and I can choose something to make them feel good about themselves.

Patricia's students often worked in cooperative groups when solving problems. In her interview she noted, "I offered a lot of ways for students to work together, to think

about . . . offer critical thinking problems, where they really had to come together and put their heads together to come up with a solution.” She seemed pretty committed to allowing her students to learn cooperatively, even though they tended to engage in more social chatter when they were allowed to choose their own groups. She chose to resolve this issue by choosing the groups for them.

For Patricia, using multicultural materials meant,

making students aware of the minorities and women that they had made significant contributions to mathematics. I actually did a project where I included [pause] I mean I think a lot of people need role models. It's just to get some of these students a hope that you can succeed just like these people have. That there are people like that that have achieved great success and have made great accomplishment and contributions to give others hope that they can do the same. (PI 4-16, p. 6)

Her project included selecting and drawing a picture of a mathematician from a teacher provided list. Students were also required to read an article about two of the mathematicians and provide information about significant contributions that were made to the field of mathematics. Her list included Hypatia as well as African American women, Evelyn Boyd Granville and Marjorie Lee Browne.

In keeping with culturally relevant teachers, Patricia expressed a desire to develop rapport with her students rather than try to control them. She states, “I wish I could see how teachers begin their rapport with their students at the beginning of the year” (PJ, 2-28). When observing her classroom, I noticed that her classroom environment was warm and friendly and that her students seemed to feel free to ask questions and get assistance from her as needed.

Patricia sought to reach her diverse students by providing multicultural role models in the curriculum and by attending to learning styles by including concrete,

hands-on activities. She also included cooperative activities for problem solving and used a variety of assessments to evaluate the achievement levels of her students. She attempted to create a warm learning environment for her students by developing positive rapport with her students.

Critical consciousness. Teachers who demonstrate critical consciousness work to promote greater equity and social justice in schooling and society. They do this by personally committing to become change agents for their students. Moreover, they encourage their students to do likewise. Patricia demonstrated critical consciousness by becoming personally responsible for the success of her students, especially her diverse learners. A critically conscious teacher sees equity as a personal quest, not just a school or an institutional responsibility. Examples of this personal responsibility were demonstrated in several ways. In her interview, Patricia noted that, “I have to think in a totally different way now in order get these kids to learn what they need to learn. It's not going to jump from my head to theirs” (PI 4-16, pp. 16-17). Patricia recognized that she had to be the one to change her way of thinking first before she could expect her students’ thinking to change. She took responsibility for adapting to her students so they could understand and master the concepts.

On another occasion, Patricia did not leave it up to her students to tell that they did not understand something. She took it upon herself to make sure they understood the lesson by questioning them.

Sometimes I try to explain something, and you still see that confused look, and you're like grabbing at things in your head, “Okay, how else can I try to explain this.” . . . So it's important to ask questions to make sure that they really understand it. (PI 4-16, p. 17)

While Patricia demonstrated a personal commitment to promoting equity in her classroom, she did not show evidence of encouraging her students to do likewise. I did not observe her attempt to develop that same critical consciousness in her students.

Sharing of power. Sharing of power means moving away from teacher-centered activities to more student-centered ones where students make choices about things that are important to them. Patricia demonstrated sharing of power by giving her students choices. When assigning the project where her students were to draw a mathematician, she allowed them to choose the mathematician they wanted to draw. The following paragraph describes another situation where she extended choices to her student

So I started class by telling them that my patience was thin today and they could either listen the first time or not listen at all but sit quietly. I told them it was their choice. I was pretty surprised because most of them became quiet and listened. Of course, there were some that did their own thing, but they were quiet. Those who did their own thing were doing math problems that I assigned so I was still pleased. (PJ 3-20)

Patricia demonstrated the power of student choice. Rather than get into a power struggle with her students, she gave them the power to choose their activities, which in turn yielded their cooperation.

Patricia also demonstrated a sharing of power with her students by recognizing the limitations of her lesson plan. She had planned a lesson to teach her students how to find the surface area of a cone.

Well, I'm thinking of one particular thing, activity that I tried to do where students try to discover the surface area for a cone. And the activity just totally confused them, and I personally did not find it confusing at all. So when I gave them the activity I thought it would be a good way for them to realize where the formula came from. And they were so lost that I ended up (I think they already know what the concept of surface area was. They could tell me the surface area or the area of a circle, but then to find

the lateral area), I just gave them the formula, because the only way that I knew to explain it, was doing this activity. . . . I was kind of disappointed that I wasn't able to get them to fully understand how to develop the concept, but I felt comfortable moving on just giving them the formula. . . . I wish I knew another way that I could teach that, but I haven't found anything. (PI 4-16, pp. 12-13)

In this case, Patricia relinquished her idea of what she thought would be good for her students and allowed her students' needs to determine the direction of her instruction. By giving them the formula, she gave them access to the content on surface area, even if it was not at the level of understanding that she desired for them. Instead of blaming her students for the failure of the activity, she acknowledged her limited pedagogical knowledge and simply made a modification to her instructional strategy to give her students access to the content. As Patricia recognized her students' confusion, rather than stubbornly sticking to her lesson plans (retaining all the power as a teacher), she chose to share her power by allowing the needs of her students to guide her instruction.

Multiple funds of knowledge. Students often view their textbooks and teachers as the only sources of knowledge in the mathematics classroom. Consequently, Patricia encouraged her students to use multiple funds of knowledge by seeking other resources of knowledge, such as the Internet, fellow classmates, and even parents. During her interview, she acknowledged the difficulty she had in helping all of her students understand certain mathematical concepts. She did not set herself up as the sole authority. She accepted the fact that some of her students might have been able to explain some things better than she could.

During an observation of her mentor teacher, Patricia noted in her journal that the students prefer that the teacher explain all of the problems because "she does such a good job of making it easy for them to understand" (PJ 1-18). In spite of this preference,

Patricia still recognized the need for the teacher not to be the sole authority and did so by actively engaging her students in cooperative learning groups and allowing them to explain problems to each other. However, she was very realistic about the resistance she would face from her students because they were used to being passive recipients of knowledge rather than active participants. In essence, her students were used to what Ladson-Billings referred to as a banking paradigm of education where they expected the teacher to pour in the right kind of knowledge. Patricia's efforts to get her student's more actively engaged in their learning more accurately reflected the views of a culturally relevant teacher who values the knowledge that students bring with them to the classroom, and sought to pull knowledge out of them through active engagement.

While Patricia showed evidence of all seven aspects of equity pedagogy, she demonstrated high expectations and culturally responsive pedagogical skills more frequently than the other categories. She frequently gave positive feedback and required all of her students to engage in the activities of the class. She used multicultural materials, manipulatives, cooperative groups, and a variety of assessments. Building on prior knowledge was the category that she demonstrated the least. Because she failed to assess the prior knowledge of her students, Patricia often was unable to provide the scaffolding her students needed to learn the mathematics that she wanted to teach them. Although, Patricia genuinely cared about her students and communicated her high expectations of them frequently, she found it difficult to use the prior knowledge of her students to create new knowledge. Connecting the mathematical concepts of her lesson to the lives of her students provided the greatest challenge for her.

Katie's Case

Katie thought of equity pedagogy in individual terms as well. She stated, most of it is each person is unique in their own way. Not just by culture or race or the concrete things, but as an individual; no two people are alike. Nobody is going to have the same experiences as another student. So I focus more on that than on the cultural ethnic differences, those kind of diversities, because those come into play automatically; whereas if you just focus on the individual, you can tailor your lesson. You know the focus is on individual rather than on whether it's an Asian male who grew up in a two-parent home. That's not really coming into play as much. . . . (KI 4-16, p. 8)

When making pedagogical decisions, Katie considered audio, visual, or tactile learning styles, motivational levels, and academic skill levels. In her interview she stated,

You're going to have different students from different levels all learning, different types of learners in your classroom. Not every child is going to be the same. You have to be able to fluctuate and give-and-take. If one person may be a more visual learner and the others more audio learner, you have to be able to gear your teaching to both of those. You can't gear all of your teaching to one specific thing, because then the other kids in the class, they're going to be lost. And so the teacher has to be able to fluctuate to different learning styles different backgrounds because not everyone comes to the classroom with the same stuff. (KI 4-16, pp. 5-6)

Katie also was reluctant to take racial, ethnic, or cultural factors into consideration when planning for instruction. When discussing the disparities in the mathematical achievement of racial and ethnic minorities, females, and students from low income families, Katie mentioned, "I'm not sure why there is such a focus just on that because I think people have problems with math across the board. It's not just low income families that have a problem, but it seems that they don't get the support and strength to boost it, so they stay lower" (KI 4-16, p. 4). When she did mention the race or ethnicity of a

student, she appeared to make an extra effort not to stereotype. As she described an Asian male she remarked,

people automatically think that because it's an Asian male that's he's automatically a highly intelligent young man. And that's not necessarily the case that he strives to be the best. Yes, he may be a very intelligent young man but that doesn't mean that he wants to be. You know in my personal experience, my brother came home one day and said "I don't want to be smart." So, you have to know that each person is unique (KI 4-16, pp. 8-9).

Katie's bubbly personality was infectious. She smiled frequently and seemed to really enjoy teaching mathematics to her students. Even though she taught both Algebra I and Gifted Algebra II, I chose to focus on her Algebra I classes because of the racial and cultural diversity of these classes.

Building on prior knowledge. I observed only one incidence of Katie making an attempt to build on her students' prior knowledge. During a lesson on graphing linear inequalities, she stated, "Does anyone remember what an inequality is?" (KO 3-12, 4:00). When the response of the students did not convince her that they had the satisfactory background knowledge for the lesson, she proceeded to "refresh" their memory. For the most part, however, Katie failed to assess her students' prior knowledge before beginning instruction. As a result, she could not effectively connect the new material to previously learned content. For example, in her journal, Katie described her difficulty in teaching the concept of negative exponents.

Class today was . . . interesting, to say the least. I went over exponential functions. . . . I tried to explain the use of negative exponents by using the illustration that if you continue to jump halfway of the distance that you will never actually reach the goal. A few of them got it, but for the most part, most of them were lost. I do think that I could have explained it better. (KJ 1-22)

While she admitted that her illustration was not understood by most of her students, she was unable to connect the abstract concept of negative exponents to the prior knowledge of her students. The illustration she gave held little practical application to the lives of her students. Her exclusive focus on her students as individuals prevented her from accessing the cultural and family backgrounds of her students as resources from which to build upon. She was unable to scaffold their learning because she had no prior knowledge to build upon.

Instead of using the previous illustration, before explaining the use of negative exponents, Katie could have helped her students create their own experiences with negative numbers by discovering the patterns described in the lesson *Bigger and Smaller – Exponent Rules* (see Appendix E). This lesson also connects negative exponents to the Disney movie *Alice in Wonderland*. For students not familiar with this movie, she could simply explain how to use negative exponents and then ask her students, “What does this remind you of?”

High expectations. Katie consistently demonstrated high expectations for all her students. Like Patricia, she also communicated high expectations for diverse learners in her reflective journal at the beginning of her student teaching semester. “I am really enjoying all of my students. There is such a variety in each class and each class is so different. The variations of the classes will make for a very good experience and will keep me on my toes for sure!” (KJ 1-19). She did not view the diversity of the student population as a problem. Rather she considered the variety of cultural and ethnic backgrounds as an asset to the learning process.

Katie insisted on not just telling her students the answers to their questions but maintained high expectations of them by making them think and search for the answers themselves.

The other classes are not necessarily at that higher level so you have to ... you don't spoon feed them . . . but you have to ask questions to really make them think and search for the answers and not just tell them, and that can be challenging for them, but those skills are also going to help them later on in life and not just in math. (KI 4-16, p. 7)

Even though she recognized that some of her students functioned at a lower skill level, she made cognitive demands of all of her students.

Katie felt it was important to communicate high expectations for students even when they did not have expectations for themselves. She often communicated her frustration with teachers who communicated lowered expectations by allowing students to get away with low achievement or lack of effort.

A few students had been complaining that they "couldn't do it". I told them that they could if they thought they could or told them "if at first you don't succeed, try, try again". They didn't know how to react. They aren't used to someone being so positive, it seems. Have they really been able to get out of so much work by whining and having so little faith in themselves? It makes me so sad that past teachers have let them get away with so much. They may have had faith in certain students, but not in all students. One must have faith in all of them. This faith must shine through in the classroom. Most students need to be pushed. That little extra umph of knowing that a student can do the work can really boost their self-confidence. (KJ 2-15) And I don't know why people let some of the students get away with what they do in a classroom. That drives me nuts. (KI 4-16, p. 14)

Katie found that pushing her students beyond their comfort zone was often necessary in order to maintain high expectations for her students. Although her students sometimes resisted this pushing, she felt it was necessary for their continued success in the mathematics classroom.

Although both Patricia and Katie both had expectations at the beginning of the semester, Katie was able to maintain those expectations, in spite of the poor performance of some of her students. After giving her students a pop quiz, she recorded in her journal “Most of them did fine, but some did worse than I expected” (KJ 2-6). Her statement reveals that she did not have the expectation that it was inevitable that some students would fail. When her students did not meet her expectations on a quiz, she still communicated the expectation that the tests would be better. Unlike Patricia, Katie was able to avoid deficit views of her students throughout the semester, even when they did not meet her expectations of them. She attributes her ability to do this to a diversity session in one of the methods classes.

The thing that sticks out in my mind the most from all of that was the diversity one. There were two women who came to talk to us, and I don't know who they were or where they were from. I have no idea. But one of them said, “Be sure that you find one thing that you like about every student. You may not like all your students, but be sure to find one thing that you like, whether it be how they do their nails or the earrings that they're wearing or the way they talk to someone in the hall. Find one thing that you like and that will help you immensely. And I think that's helped me the most this semester, because there are certain students that I don't particularly care for because they get on my nerves. You know. There's always going to be somebody that just gets on your nerves. And I just remember her saying that, “Find one thing that you like about them.” And I'll stop and think, “She may be talking, but at least she's not writing notes, at least she's paying attention or her hair looks good today or he looks well-dressed today.” I just find one thing to focus on to help me get through that class, and not go off the edge. I'll always remember her saying that. Find one thing that you like about your students. And that will help. (KI 4-16, p. 17)

Capitalizing on the advice of these two women, Katie was able to communicate consistently her high expectations for all her students, even when their behavior and academic performance did not meet her expectations. She simply continued to have faith in them until they became successful.

Knowing students well. Katie made a concerted effort to know her students' interests so that she could more effectively teach them. At the beginning of the semester, she had all of her students fill out note cards about themselves. She asked them about their "favorite subject, favorite snack food, hobbies, and something a past teacher did to help them learn that they enjoyed" (KJ 1-19). In her interview, she gave her rationale for this activity.

But you got to find out things about them. If their interested in one particular thing, in one of your lessons, mention that. Don't say, "Well so and so likes this." but just kind of throw it in there somehow, and know they'll perk up and like "Hey, I know what this is," and you know, they can get involved. (KI 4-16, p. 9)

She not only knows her students interests, but also notices the differences in maturity level between her Algebra I and Algebra II students. She quickly identified who were the "talkers" and who the shy ones were. She also found out how receptive her students were to teaching by asking them questions and monitoring their responses. She noticed that her students responded more favorably to her as the semester progressed. Moreover, Katie ascertained the motivation level of her students on a daily basis.

Well, some days they come in and they're very . . . they don't want to be there, they don't want to do anything. Some days they're very excited, and they want to be there, and they want to learn. So each day is a new feat to overcome. I know that I . . . I get a feel for my students whenever they walk into the room. (KI 4-16, p. 6)

Although Katie did not use the racial and cultural identities of her students as resources to improve instruction, she used many individual characteristics to help her teach all of her students equitably.

Culturally responsive pedagogical skills. While I did not observe her use of multicultural materials, Katie demonstrated culturally responsive pedagogical skills in a variety of other ways. She constantly worked on new ways to engage her students and

make them excited about learning algebra. She had a good relationship with her students and a warm relaxed atmosphere in her classroom. Her classroom management style was not authoritarian, and was very positive with her students. She recorded the following in her journal:

I am learning a lot . . . especially today! I am really loving my class. . . .
And I am working on some new ways to engage the students and make them excited about learning Algebra. I really want my passion for the subject to shine through. (KJ 2-1)

When disciplining her students, she focused on their good traits instead of their negative behaviors.

I am also very positive to my students. I think they really like that. Yes, some of them can drive me nuts, yet others are fine. I try to find something good about each of them and usually that isn't very hard. Some days, I just have to remember those special qualities when they won't stop talking or are doing something else. (KJ 2-27)

The following statement indicates that she recognized the need to balance sensitivity to her students with the need for their respect as well. "I am slowly learning effective disciplinary actions, which is somewhat difficult because of my personality. Hopefully they won't take advantage of my ways with the students" (KJ 2-27).

In addition to traditional tests and quizzes, Katie informally assessed her students by regularly checking for understanding through her questioning (KI 4-16, p. 11). Katie showed evidence of culturally responsive pedagogical skills by actively engaging her students, having a relational and caring classroom management style, using cooperative groups, varied assessments, and providing motivation for her students to learn the lesson.

Critical consciousness. Katie made several statements that demonstrated her personal responsibility for making sure all of her students succeeded in her mathematics class. As a woman studying college mathematics, Katie had to overcome difficulties

with people not believing she could be successful in mathematics because she was female. Katie spoke about being an advocate for the female students in her classes by “pushing them along and having someone believe in them” (KI 4-16, p. 4). If her students did not understand something from her lesson, she did not place blame on her students for misunderstanding. She personally took responsibility to adjust her instruction.

Some students were very quiet and didn't come out of their shell very much, but yet others ran the show. And to try to be sure that I got to those students, I had to talk with them more one-on-one than in the classroom, and just kind of get a feel for them, for their personalities, other than just sitting there copying notes or not saying much in my class, and trying to gear [pause]to make sure I'm reaching them with my teaching. And if I wasn't, I would have to adjust and think “Okay, I have to change something up.” (KI 4-16, p. 10)

When asked about what kind of adjustments she would make for her students who appear to be quiet and not engaged in classroom activity, she responded:

I'll walk through while they're doing work and watch them, and if I notice that they don't say anything, I just kind of stop by and look over their paper and just ask them a question or two. And if they seemed like they're very lost, I would help them, because they're not necessarily going to come to me for help, because not all students do, are willing to go to the teacher, because they might think that they're doing it all correctly, and they could be so off track that you have to reel them back in. I think that by me walking around and observing them throughout the class and not just going and sitting behind my desk and saying, “OK, they're doing work, now I can go do work.” I have to be active in the class to make sure they learn and are on task, and doing their work and really getting a grasp of some of the material, so they can build on it later, hopefully. (KI 4-16, p. 12)

Katie did not depend upon her students to tell her they did not understand something. She proactively sought out her more withdrawn students to make sure they were making progress. This is especially important for diverse learners who may withdraw because of the lack of synchronization between their home and school lives.

Like Patricia, Katie demonstrated critical consciousness by taking personal responsibility for the success of all of her learners. However, under the category of critical consciousness, I looked for both personal and collective instances of the commitment to be change agents. I saw no examples of where she encouraged her students to collectively take responsibility for reducing inequity in society or to promote social justice.

Sharing of power. I observed one example of sharing of power for Katie. A few of her students communicated that they wanted to play a review game rather than complete the review sheet. Therefore, Katie decided to accommodate her students' request, and instantly changed her plans to include a review game. She was flexible enough to respond to the needs of her students rather than sticking to her original plans. She allowed them some input in how they reviewed. She most often restricted the choices of her students based upon the frequency of their off-task behavior. Sometimes she began a group activity by allowing the students to choose their groups and choose their seats. However, she eventually took back the power of choice because they were too talkative, or complained too much. She felt the need to control their off-task behavior was more important than giving them personal choices.

Multiple funds of knowledge. Katie found it very important that her students not view her as the only source of knowledge in the classroom. She frequently encouraged her students to use fellow classmates as a resource for learning. In her journal, she described her students reviewing for a test by working together on review sheets (KJ, pp. 3-1). Although she assisted them with questions they had, she was convinced that having

them explain the problems to each other was very beneficial to the students. She described another time where she allowed her students to take a quiz with a partner.

I did do something a little different with the quiz. I allowed them to work together. This really gave them the opportunity to talk through the different types of problems with one another. I was very impressed with how well they worked together. They guided each other through the steps. They didn't just copy one another, thankfully. They would try to ask me questions. All I told them was to ask the class if their teammates were unsure. I stayed out of it and made them really think their way through the material. Overall, I think it went very well and I would definitely do it again, of course, depending on the material. (KJ, pp. 3-8)

Katie communicated to her students in both word and action that they could be resources for each other. She was willing to relinquish some control over the testing environment by allowing her students to work together. In this example, she not only demonstrated multiple funds of knowledge, but she also demonstrated high expectations, sharing of power, and varied assessment.

Katie's ability to maintain high expectations of her students was her greatest strength. She did not succumb to the temptation just to tell her students the answers to their questions but encouraged them to think and to search for the answers themselves. She continued to enjoy her classes by focusing on the positive traits of her students, even when they did not meet her expectations. The category with the second highest number of incidences was critical consciousness. Because of her own negative experiences with sexism in the mathematics classroom, Katie advocated for the females in her classes. When her students did not understand something from her lesson, she personally took responsibility for adjusting her instruction. Katie demonstrated building on the prior knowledge of her students when she asked them if they remembered the characteristics of an inequality, and proceeded to refresh their memory when she did not receive a

satisfactory response. She shared her power when she allowed a group of her students to play a review game rather than complete the review sheet that the rest of the class was assigned. These last two categories were the ones that I observed the least number of incidences.

Mike's Case

Mike's understanding of equity pedagogy was greatly influenced by his own background as an English language learner. He, like the other participants, was hesitant to acknowledge race as a salient factor in making instructional decisions. In his interview he stated. "Well, my main concern is, you know, I don't care about color. Well, like I say, the key thing I look for is, number one, is their learning ability, of course" (MI 4-16, p. 10). Although his focus was still on the individual, he was more willing to acknowledge the cultural and socioeconomic backgrounds of his students. While describing his diversity plan he remarked,

The word diversity doesn't just mean Black and White and gender and race, it really means diverse learners. To me the word diversity really perpetuates my students in the classroom of the way they are learning, whether it is socioeconomic factor, whether it is culture, whether it is gender, there are so many things that encapsulates this concept. It is my responsibility as an educator to make sure that, after recognizing [*sic*] (I don't know what time period it's going to take to get to know my students) to, as soon as I can, to come up with a plan that covers [*sic*] that I can reach as many students in my class. (MI 4-16, p. 11)

For Mike equity pedagogy was an ideal that he desired to attain.

To me equity is a paramount. To me equity is something that has to be implemented, regardless. Equity is something, is that big picture that every single student in my classroom equally are given and learn from my teaching mathematics. And I have to do whatever it takes to implement that Kwan, that idealistic. I'm an idealist, and I think equity is one of my . . . is the heaven. So, basically what this program has done is has gotten me closer, and closer to equity. Have I got there completely? No. (MI 4-16, p. 19)

When considering diverse learners during lesson planning, he did not focus on their socioeconomic status or gender, but rather on their academic abilities. “When I was doing the diversity plan for my lesson plans, I really didn’t focus, per se, on the student socioeconomic or gender, rather I . . . my intentions were heavily based on their academic ability” (MI 4-16, p. 12).

Mike’s background as an immigrant influenced his passion to promote equity in his secondary mathematics classroom. His passion was very evident whenever I spoke with him about issues of diversity and equity. However, his passion was not always channeled into ways that could benefit his students. The thing that made him passionate about equity also put him at a disadvantage when it comes to knowing or understanding the cultural knowledge that his students brought with them to the classroom. As an immigrant, Mike had to work the hardest to become familiar with his students’ backgrounds. He demonstrated no examples of building on prior knowledge, no evidence of sharing of power, and no indicators of multiple funds of knowledge.

High expectations. Even though Mike’s students were in a low-level algebra class, he communicated his expectation that his students go to college. In his journal he describes the following:

I brought them a copy of USU’s [pseudonym] freshman level exam in which was very close to what my honors algebra students were learning at the time I tried to stress the fact that there is no need for them to repeat the same concepts again in college. Also I attempted to raise their confidence level by having the students solve a couple of problems from that college exam. As the week progressed, I became aware of the fact that it was very emotionally difficult to accept. Our math Tech three students (low-level algebra) do not take their textbooks home with them. They are not only [not] given any homework but also they are not challenged enough. I asked my mentor teacher, and he said that the county doesn’t require that homework should be assigned. For the issue of the textbooks, he informed

me that if they take their books home either they'll lose it or leave it in their lockers. This remains a very critical issue! (MJ Week 2)

His emotional response to the low expectations of his mentor teacher indicated his passion to raise the expectations for his diverse students.

Knowing students well. Mike communicated the importance of getting to know his students well. He stated that it was important to be aware of all the different cultures, but not to stereotype. He realized that his lower-level students (who were predominately African American and Hispanic) had more of a motivation problem than ability. After observing that his students got easily distracted after a short period of time, he recognized that he had to change the activity from a lecture to allowing his students to work at their desks. He acknowledged that being an English Language Learner himself gave him first-hand knowledge of what the challenges other English Language Learners in his class experienced. He admits that he would have been better prepared if he had more of a background knowledge of his students.

Culturally responsive pedagogical skills. Mike employed cooperative learning, hands-on activities, and actively sought out different alternatives to solve a problem. He created a collaborative classroom by randomly calling on students, rather than just taking volunteers. He liked a student-centered classroom. When students were at the board, the whole class helped the designated student to solve the problem on the board. He personally took responsibility for placing abstract math concepts in contexts that his students could understand. He used cooperative learning by allowing his students to work together on a group project. At the end of the project, each group sent a representative to the board to solve the problem.

Critical consciousness. Mike demonstrated a high sense of personal responsibility for the success of his students. Mike stated in his interview, “I really think that it's our responsibility to make it very clear to the kids that this [education] is indeed the ticket out” (MI 4-16, p. 7). He also recognized that other teachers did not share his passion. In his journal he remarked, “God, I hate those teachers who just suffocate those kids. We have such a crucial job” (MI 4-16, p. 22). He also understood his need to adapt his instruction for the success of his students in the following remark.

I have noticed that when I ask a question from my students sometimes I don't give them enough time to respond. I have to be more aware, because they might get used to such behavior, and it certainly [is] not a healthy one. (MJ 3-15)

Mike's strengths were his critical consciousness and culturally responsive pedagogical skills. His experiences in the United States as an immigrant made him more sensitive to the needs of the diverse learners in his mathematics classroom. However, I observed no incidences of building on prior knowledge, sharing of power, or multiple funds of knowledge in Mike's classroom practices.

Cross-case Summary

Overall, the category with the highest number of incidences was culturally responsive pedagogical skills (See Table 3). Although Patricia was the only one that I observed using multicultural materials, they all seemed quite comfortable with actively engaging their students, using real world examples, assessing learning in ways other than quizzes and tests, cooperative learning, and nonauthoritarian styles of classroom management. Mike tended to do the most to connect with the pop culture of his students by using their language and phrases to communicate both interest and understanding in his mathematics classes.

Table 3

Cross-case Summary: Number of Incidences of Equity Pedagogy

	Building on prior knowledge	High expectations for diverse students	Knowing students well	Culturally responsive pedagogical skills	Critical consciousness	Sharing of power	Multiple funds of knowledge
Patricia	0	7	8	12	3	3	2
Katie	1	11	6	3	9	1	5
Mike	0	3	6	11	13	0	0
Total	1	21	20	26	25	4	7

The category with the lowest number of incidence was building on prior knowledge. Only Katie showed any evidence of building on prior knowledge, which I observed only once. Their failure to build on prior knowledge was problematic for two reasons. Firstly, by ignoring the racial and cultural characteristics of their students, the student interns were prevented from accessing a wealth of cultural referents that could have been used to connect the abstract mathematical concepts to their prior knowledge. They could not make the material relevant to the lives of their students because of the lack of knowledge of the lives of their students. Mathematics has often been perceived by students as having nothing to do with the “real” world and simply a collection of meaningless facts. All of the participants noted laziness and/or lack of motivation as factors that negatively affected their lower level students (KJ 1-23, PJ 2-19, MJ Week 7).

However, they did not realize the powerful motivation that cultural contexts can provide for students to learn because of their unwillingness to acknowledge their students’ culture as a salient to effective mathematics instruction. Their fear of stereotyping their students had cut them off from a wealth of cultural knowledge that could later be used as a foundation to build new knowledge.

Secondly, ignoring the prior knowledge of their students meant that the student interns had to make assumptions about their students’ prerequisite skills. In order for students to have an adequate understanding of mathematical concepts, teachers need to help them reorganize the information they already know (including misconceptions), while simultaneously helping them to acquire new material (Zeichner et al., 1998). Teachers cannot adequately facilitate this process if they have not effectively assessed the knowledge that students bring with them into the lesson.

The next lowest category was sharing of power. In most instances where students were given choices about seating arrangements or who they wanted to work with, the teacher decided to take back that power of choice because of the students' inability to stay on task. This seemed to be a dilemma for all three of them.

While they all expressed a desire to know their students well, they confined their knowledge of their students to individual characteristics, such as auditory, visual, or tactile learning styles, artistic or creative talents, or academic and/or motivational levels. I saw no evidence of their making attempts to get to know the families or cultures of their students. Patricia made mention that she would like to know more about how Asian parents influence their children to be successful, but I saw no attempt on her part to find out that information.

Mike had the most instances of critical consciousness. Collectively, their critical consciousness manifested itself in only personal ways. Their reluctance to acknowledge the cultural backgrounds of their students kept them from seeing the ways that inequities were perpetuated in their school setting. Therefore, they did not act in ways that promoted social change in collective ways, just individual ways. This is in keeping with their focus on students as individuals, and not as members of a cultural group.

Katie had the highest incidence of high expectations for diverse learners. As mentioned earlier, she was able to maintain high expectations for her diverse learners by focusing on their positive points, rather than on their frustrating behaviors or performances. Patricia had the most difficult time maintaining high expectations when the performances of her diverse learners did not meet her level of expectation.

Obstacles and Challenges

The major obstacle to implementing equity pedagogy was the colorblindness of the participants. This colorblindness negatively impacted their ability to know their students well. Their inability to know their students well made it very difficult for them to build on the prior knowledge of their students, which in turn led to low student performance. In the face of low performance, the participants who began their student teaching semester with high expectations eventually adopted deficit views of their students' motivation.

Colorblindness

This study confirms the findings of previous studies (Barry & Lechner, 1995; Cho & DeCastro-Ambrosetti, 2005; Finney & Orr, 1995; Milner, 2005; Olmedo, 1997; Santoro & Allard, 2005) that many preservice teachers embrace a colorblind stance. The “colorblindness” of the participants hindered their ability to know their students well because they chose to only see their students as individuals and not as part of a larger cultural group. Therefore, they were cut off from a wealth of knowledge about their students that could have been used to help them provide the scaffolding necessary for learning. Mike acknowledges in his interview his desire to have learned more about the backgrounds of his students, even though he was referring to their individual background knowledge.

I feel like if I would have done more research or if I had asked my mentor teacher to give me, but it was hard for me to ask him, maybe it was my responsibility, to have more background information on the students. You know, it's funny. I would do a certain thing, and don't understand why the kid is reacting that way, and _____ would call me, “Come here” and would tell me in two minutes the background. And like “Ohh” See all those “ohh's” could be gone if I had my own classroom, and a little background like we talked about in the beginning. So if I know my own

group, then I can be more prepared to feed them whatever they have to be fed. See what I mean. So to answer your question, if I were to know the logistics and demographics of the class in a way of their personalities and their academic background, perhaps that would have helped more. (MI 4-16, p. 23)

Mike felt that if he had better background knowledge on his students before he began his student teaching experience, then he would have avoided some of the negative confrontations with his students. This situation indicated that he needed more explicit instruction in how to find out information about his students that could impact instruction. While he depended on his mentor teacher to give him some of that information, he could have gathered that information from phone calls home, or home visits.

Not knowing their students well, consequently, hindered their ability to build on prior knowledge by preventing them from accessing cultural knowledge that could have been used to communicate mathematical concepts, which contributed to an insufficient pedagogical content knowledge (Shulman, 1987) for their diverse learners. Hilliard (1995) asserts that teachers can enhance the learning process and enrich the mathematics learning environment by having an appropriate sensitivity to cultural styles in information processing that is compatible with family cultural patterns.

The participants in this study were unable to use the culture of their students as vehicles for learning, because they ignored the saliency of that culture with regard to mathematical instruction. Their fear of stereotyping their students cut them off from a wealth of cultural knowledge that could later be used as a foundation to build new mathematical knowledge. They could not make the material relevant to the lives of their students because of their ignorance of their students' lives outside of the classroom.

Because mathematics is often perceived by students as having nothing to do with the “real” world and simply a collection of meaningless facts, it is especially important for mathematics teachers to be able to connect abstract mathematical concepts to concrete examples familiar to the students. Ignoring a students’ cultural background makes this task almost impossible. For example, Patricia tried to explain the importance of the equality property for solving algebraic equations by using the example of a balance or scale. Yet she did not critically reflect on the appropriateness of this example by considering the fact that most of her students had very little experience with a balance or scale, outside a science class setting. While the participants were able to teach mathematics using a variety of strategies, they were unable to connect these strategies to the students understanding because of the lack of an effective “hook” that would bridge the previous knowledge of her students to new knowledge; thus they were unable to use the powerful motivator that culture provides.

When teachers fail to build on the prior knowledge of their students, their students often begin to experience academic failure. When faced with the poor performance of their diverse learners, the participants then began to develop deficit views of them. When teachers, whose cultural backgrounds differ from their students fail to ascertain and value the knowledge and skills that students bring with them, they must resort to making assumptions about their students, which are often based upon stereotypes and misinformation (Tatum, 1997). Therefore, when faced with low performances of their students, the teacher tends to blame the student (i.e., laziness, lack of motivation, lack of support at home) rather than implicate their lack of pedagogical knowledge.

The colorblind stance of the participants also hindered their ability to develop a critical consciousness based upon social justice. While the participants demonstrated a high degree of personal responsibility for the success of their students, their focus upon the individual hindered their ability to see the need for collective action or the need for the redistribution of power, or even to encourage their students to think critically about the inequities built into educational institutions. By ignoring the saliency of culture and race in instructional decisions, they unknowingly privileged the norms of the dominant group to the detriment of their diverse learners. They could not see the effects of institutional or structural racism and therefore could not act as collective agents of change.

This lack of critical consciousness on a social level affected their view of sharing of power. Rather than seeing cooperative grouping or student choice as a means of modeling the redistribution of power, the student interns saw it as just another instructional strategy to meet the needs of their individual students. Similarly, multiple funds of knowledge were simply practices that provided variety to a curriculum to meet the needs of individual students rather than as means to privilege the voices of previously marginalized groups. I have drawn a diagram illustrating the relationships between colorblindness and the other aspects of equity pedagogy (see Figure 1).

Lack of Appropriate Mentors

Other factors that impeded the participants' ability to know students well was their lack of appropriate mentors to model effective pedagogical practices, and time constraints (see Figure 2). On several occasions, the intern's mentor teacher exhibited

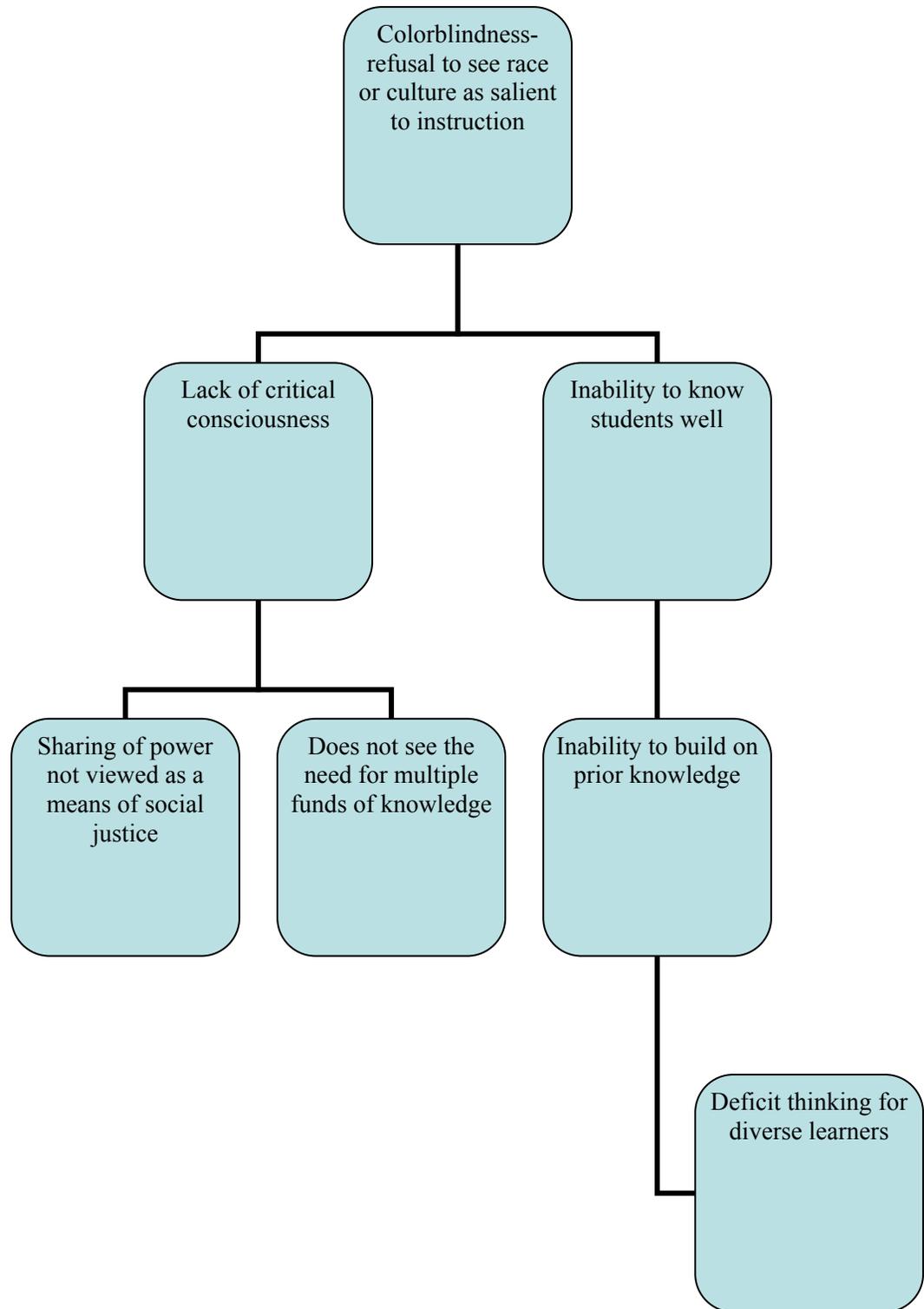


Figure 1. Relationship of colorblindness to equity pedagogy

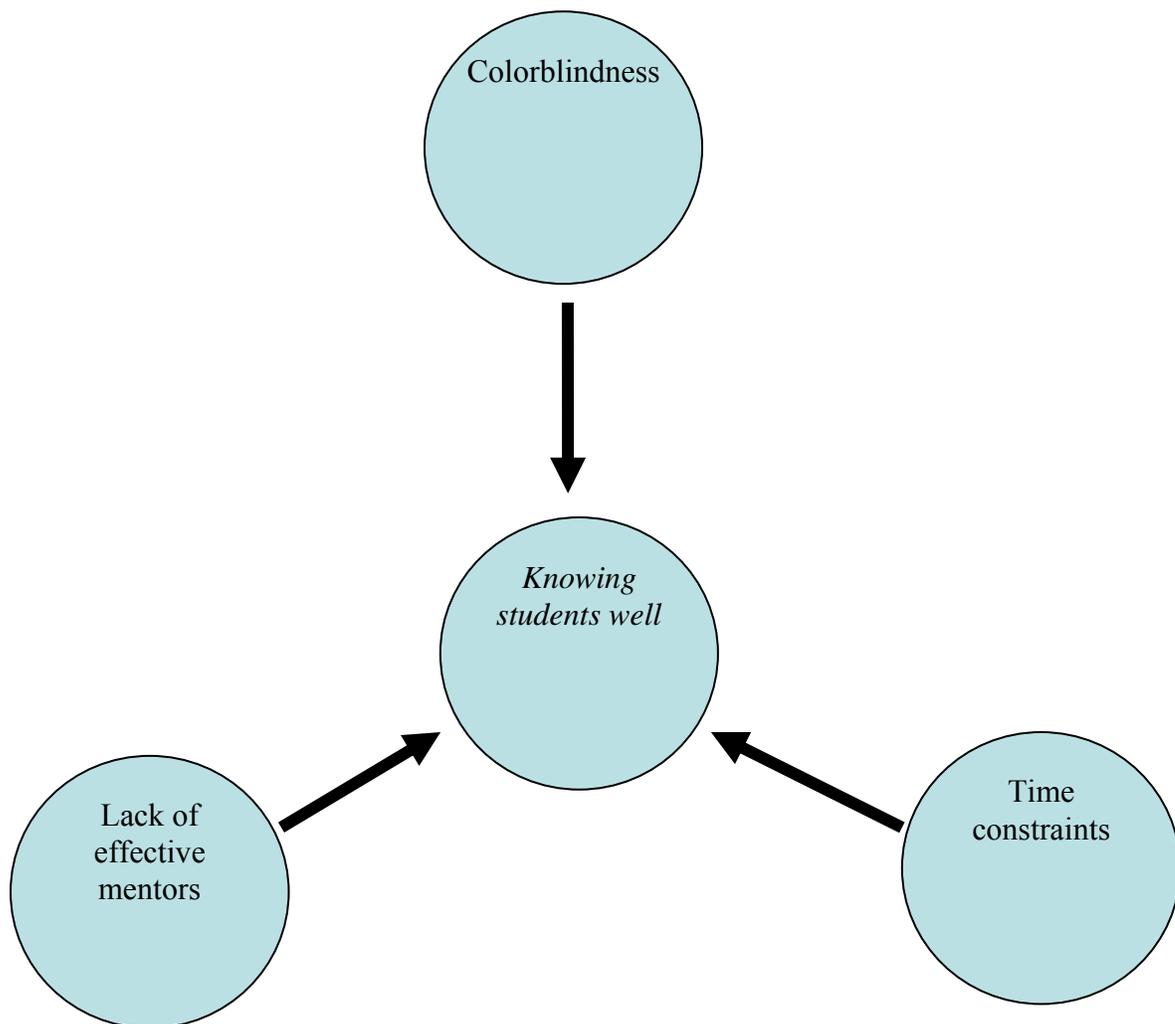


Figure 2. Factors that impede knowing students well

very traditional teaching practices which only reified the inequitable structures of the school. Mike describes one of his practicum mentors during his interview as follows.

And my mentor teacher was just really, really not what we had wanted to be. It was in a way that take whatever he does, and don't do. That's how bad it was. I can go over many, many cases, I tell you. But overall, the reason practicum was interesting for me was that we would learn what we learned in school and come to school and see exactly the opposite. When I say exactly the opposite, God is a witness, I'm not exaggerating. We go to Dr. [William's] (pseudonym) class, we sit there and learn an array of things that we learned in the preceding summer. . . . And we would go to the middle school and see something totally different. (MI 4-16, p. 21)

Simply doing “the opposite of whatever the mentor teacher does” is not a sound pedagogical strategy for training teacher education students. Not having adequate mentors became an obstacle when the student interns failed to have the necessary repertoire of instructional strategies to reach all of their students. Because the preservice teachers were placed with mentor teachers who taught using traditional methods, their opportunities for observing equitable instructional practices were virtually non-existent. Moreover, some mentor teachers were openly hostile to any attempts at implementing reform-oriented pedagogy. Traditional mentor teachers can, at best, step back and provide moral support for the student interns as they struggle on their own to make pedagogical decisions that will be beneficial for diverse learners. At worst, they can become obstacles that actively work against the intern's implementation of equity pedagogy. Katie's mentor teacher was somewhere in the middle of this continuum. While she did not openly resist Katie's attempts to implement equity pedagogy, she did not provide the specific feedback that Katie requested in order to improve her practice.

While it is understood that student interns would not have the same pedagogical knowledge as veteran teachers, the student teaching experience should provide interns the

opportunity to expand their repertoire of instructional strategies. However, if student interns only observe the same traditional methods in which they themselves were taught, they are more likely to replicate traditional instructional patterns, thus perpetuating the status quo. When these methods prove to be ineffective for diverse learners, the student intern will be limited to a hit-or-miss approach to making the necessary accommodations to instruction. Patricia described in an interview her struggle to help her students develop a deeper understanding of surface area than she had in secondary school. Although she knew that her methods were not getting through, she struggled to know what else to do. She remarked, “I wish I knew another way that I could teach that, but I haven’t found anything” (PI 4-16, p. 13). Her lack of knowledge could have been bridged by a more effective mentor teacher.

As her university supervisor, I was able to provide her some suggestions for getting through to her students. For example, students could bring in 3-dimensional objects from their homes, like cereal boxes and oatmeal boxes, that could be cut open to show the 2-dimensional shapes from which they were formed (also called nets). After measuring the dimensions of the nets, the students could then calculate the surface area of the corresponding objects. However, my visitation schedule was not frequent enough to give her the amount of support that she needed to develop an adequate repertoire of instructional strategies to reach all of her students. The university did provide additional support for the student teachers through class postings on their electronic bulletin board. However, she needed someone who could provide support on a regular basis, like her mentor teacher, to help her successfully negotiate her challenges in finding alternate ways to reach her students. Her mentor teacher did not provide that kind of support for her.

Time Constraints

Both Mike and Patricia also referred to time constraints as hindrances to their implementation of equity pedagogy. With the pressures to “cover” the curriculum, Mike found it very difficult to integrate all the aspects of his lesson plan and get to know his students well. While he could have benefited from time management skills, he really needed instruction on how to identify the pertinent parts of the curriculum and focus on a thorough understanding of fewer topics. Patricia noted that a 15-week semester was not long enough to really get to know her students well enough so that she could effectively modify her instruction to meet the needs of her students.

Obstacles Summary

Overall, the colorblindness of the student interns negatively affected six out of the seven aspects of equity pedagogy. Their refusal to see the significance that race and culture play in instruction contributed to their inability to know their students well, which made them unable to build on their students’ prior knowledge, which in turn led to lowered expectations. Their colorblindness also contributed to a lack of critical consciousness on a social level which limited their views on the sharing of power and multiple funds of knowledge. The participants also mentioned that the lack of appropriate mentors and time constraints were obstacles to implementing equity pedagogy.

Influences of Teacher Education Program

All three of the participants communicated the value of their teacher preparation program in helping them prepare for the challenges of being a mathematics educator. Because none of them had previous teaching experience, they found themselves

grappling with many of the issues addressed in their program for the first time. Mike stated that after leaving an engineering university, he had a lot of math knowledge and a heart to teach. “But after this program, I really, really think that it really prepared me in the way of how to distribute that knowledge properly to students” (MI 4-16, p. 17). Katie similarly recalled her first mathematics methods course, Principles of Mathematics Instruction, taken during the summer of her first semester in the program. “That class was the most beneficial class that I have ever taken or ever thought that I would take for education” (KI 4-16, p. 15). Likewise, Patricia’s recollection of the same course was as follows:

I think it made me aware of all those things. I mean this was the first class that we really had that said, “Okay, here are all the issues.” I mean just being a person off the street, not even taken one education class, you really don't fully understand all the components that are involved in teaching. I just learned a whole bunch. (PI 4-16, p. 13)

According to Mike, the program encouraged them to be standards-based teachers. They studied the NCTM (2000) Standards, problem-solving, learning theories, professional standards, assessment, manipulatives, equity, diversity, special needs students, classroom management along with other topics in mathematics education. Encountering these issues in his program allowed him to create a framework for addressing them in his classroom. In his interview, Mike remarks,

Coming here, I wasn’t even thinking about stuff like diversity. I’m not saying that I wasn’t aware of it, but I had no plans to address it, or stuff like using manipulatives, or learning the associations, or classroom management, and on and on and on. . . . In the paradigm, of diversity, we just went over it. It has really opened my eyes to be aware of different learners and how to address them. (MI 4-16, pp. 17-18)

Katie has similar remarks to say about the teacher education program.

That helped me to learn how to engage the students, how to assess the students, figure out ways to make it creative and fun, through technology or cooperative groups, pulling a little bit of everything in, and not just sticking to the chalk talk-like teaching where you just stand up in front of the room and write things on the board and just say, "Okay, this is my lesson." And to make it much more interactive with the students, because the NCTM standards, what they presented then, I had no clue what they were. That was completely foreign to me. Seeing that the Standards are implemented and are really encouraging all teachers to go above and beyond just your traditional style of teaching, and you do have to lecture sometimes, but to make it more interesting to the students, and to help them learn more and to get more out of it. (KI 4-16, 15)

Patricia believed the program helped provide her with the tools that she needed to face the challenges of teaching mathematics to secondary students. In her interview, she remarks,

I think it made me realize that this was going to be a very big challenge. I think I thought, "Oh, this will be fun. I like math and I'll just tell them how to do certain things." And I thought back to how I was taught how to do mathematics, and it's very different. So, it was very challenging for me to have to think about, "Okay, how am I going to address all of these things while I'm teaching?" You know it's just not as easy as just getting up and talking for a little while and students just automatically get it. It's so different from that. So that's been a real challenge for me, but I think having the basic fundamentals gives you some sort of structure and tells you kind of where to go versus then just saying, "You need to do all these things," but there's really no direction. (PI 4-16, p. 14)

The influence of their teacher education program was evident in the variety of instructional strategies used by the participants of the study. Their use of calculators, manipulatives, hands-on activities, cooperative learning, projects, and varied assessments was demonstrated in their classrooms throughout the student teaching semester. This probably explains why I observed the most incidences of the category culturally responsive pedagogical skills. These were the skills that were explicitly taught and modeled in their mathematics methods courses.

In addition to the influence of the NCTM Standards, the integration of the following components served as a framework for their teacher education program: (a) knowledge of pedagogy, (b) knowledge of subject matter content, (c) knowledge of students, and (d) knowledge of environmental contexts for learning. In this study, I found evidence of the first two areas in the classroom practices of the participants, but the last two areas were lacking. As previously mentioned, the participants' colorblindness became a hindrance to them knowing their students well and limited their knowledge of the environmental (i.e. cultural) contexts for learning.

Summary

Using my adaptation of Zeichner et al.'s (1998) curriculum and instruction principles, I presented the cases of three preservice teachers as they implemented equity pedagogy in their secondary mathematics classrooms. Although, the teachers demonstrated these practices to varying degrees, I observed all seven aspects of equity pedagogy by one or more of the participants. I discussed colorblindness, lack of appropriate mentors, and time constraints as obstacles to their implementation of equity pedagogy. I noted that, according to the student interns, the NCTM (2000) Standards and the culturally responsive pedagogical skills modeled in mathematics methods courses had the most influence on their implementation of equity pedagogy in their secondary mathematics classrooms.

CHAPTER 5

CONCLUSIONS

In this study, I have investigated the equitable teaching practices of three mathematics education interns during their student teaching experience in an alternative teacher preparation program. In this chapter, I present an overview of the study and its conclusions. I also discuss the limitations of the study, recommendations for future research, and the implications of this study for teacher education programs.

Overview of the Study

The research questions guiding this study were:

1. What aspects of equity pedagogy do secondary mathematics student interns practice in their classrooms?
2. What are the obstacles and/or challenges interns face in implementing equity pedagogy?
3. Which aspects of the teacher education program do the interns perceive to most influence their implementation of equity pedagogy?

The majority of the literature on preparing preservice teachers to teach diverse learners effectively focuses on preservice teachers' beliefs, attitudes, and perceptions about diversity. This study differs by focusing on the classroom practices of preservice mathematics teachers at the secondary level. Using culturally relevant pedagogy as a theoretical framework and my adaptation of Zeichner et al.'s (1998) curriculum and instruction principles as a framework for data analysis, I analyzed data collected from

classroom observations, field notes, semistructured interviews, and the participants' reflective journals. Although, the teachers demonstrated these practices to varying degrees, all seven aspects of equity pedagogy were observed by one or more of the participants. Colorblindness, lack of appropriate mentors, and time constraints were the factors that most affected the interns' implementation of equity pedagogy. According to the student interns, the NCTM (2000) Standards and the culturally responsive pedagogical skills modeled in their mathematics methods courses were the aspects of their teacher education program that most influenced their implementation of equity pedagogy in their secondary mathematics classrooms.

Because I believe in the old adage that "more is actually caught than taught," I chose not to have a deficit view of my participants. It was important for me to model for my students high expectations. Therefore, I approached this study with the full anticipation that I would see equity pedagogy being implemented by the three participants. Rather than focus on what they were not doing, I chose to focus on what they were doing, so that I could provide a picture of what equity pedagogy looks like, even if in the early stages.

As I mentioned in the introduction, my intention was to help others develop an understanding of what equity pedagogy means in a practical context by providing a model and/or framework from which others can learn how to help diverse learners achieve mathematical success. I believe that I have accomplished this goal, in part, with my adaptation of Zeichner et al.'s (1998) curriculum and instruction principles used during data analysis. I described Patricia's critical consciousness as she communicated that she had to think in totally different ways in order for her students to be successful in

her class. I conveyed Katie's use of multiple funds of knowledge as she encouraged her students to use each other as resources for learning. I also depicted Mike's high expectations for his students as he attempted to raise the confidence level of his students by having them solve some problems from a local university's mathematics exam. These are but a few of the examples that I have presented in this study that show equity pedagogy being practiced in a secondary mathematics classroom.

I am in no way suggesting that the examples of equity pedagogy of these preservice teachers are sufficient or exemplary. I simply described what I saw with the hope it would paint a picture that would generate dialogue about the suitability of these practices, and alternate ways of implementing these aspects of equity pedagogy. My goal was to demystify equity pedagogy by providing concrete examples and to encourage others who may read this to say, "I can do that." It is my hope that this picture can act as a spring board for others to begin the practice of equity pedagogy.

Conclusions

Viewing the practice of equity pedagogy on a continuum, where more and more of the seven categories are demonstrated, and at a more sophisticated level within the categories, I concluded that each of the participants were well on their way to developing multicultural competencies. These participants were in no way near being traditional teachers. Although, they implemented the other six aspects of equity pedagogy to varying degrees, they all seemed quite comfortable with the culturally responsive skills of actively engaging their students, using real world examples, assessing learning in ways other than quizzes and tests, cooperative learning, and nonauthoritarian styles of classroom management.

These strategies were ones that were emphasized and modeled for them during their methods courses. Because they had the opportunity to view and personally experience these types of instructional activities, they were able to implement them in their own classrooms consistently. These results indicate that providing prospective teachers with guidance in the form of concrete strategies on how to integrate culturally relevant pedagogy with mathematical content can translate in successful multicultural practices, even in secondary mathematics classrooms.

On the other hand, the preservice teachers' limited implementation of building on prior knowledge, critical consciousness, sharing of power, and multiple funds of knowledge indicates that these areas were addressed in more abstract terms in their methods courses, leaving the preservice teachers without sufficient examples, models, or experiences for their successful implementation. These results confirm the conclusion of the Ruggles et al. (1999) study that suggests that limited opportunities to see multicultural mathematics content implemented during teacher education programs makes it very difficult for prospective to implement multicultural mathematics lessons.

Additionally, because they did not take a separate multicultural education course, they did not seem to have the framework with which to grapple with the issues of institutional racism or social justice. They were missing that piece of critical reflection on these issues. They had been informed about them in their methods courses, but they had not had sufficient breadth, depth, or time to reflect more deeply on these issues and the implications they have for them to be agents of social change, not just saving individual students from the grips of prejudices and stereotypes.

Closely related to the student interns' limited implementation of building on prior knowledge, critical consciousness, sharing of power, and multiple funds of knowledge was their lack of recognition of culture—race, ethnicity, or socioeconomic status—as salient features to consider when making instructional decisions. This result confirms the conclusions from Sawyer's (2000) study that preservice teachers are reluctant to consider race, ethnicity, or socioeconomic status as significant factors in mathematics instruction. They were much more willing to discuss individual students, student abilities, motivational levels and student learning styles as student differences they considered in their teaching. This colorblindness negatively affected the ability of the participants to know their students well. Their inability to know their students well made it very difficult for them to build on the prior knowledge of their students, which in turn led to low student performance. In the face of low performance, the participants who began their student teaching semester with high expectations eventually adopted deficit views of their students' motivation.

According to Milner (2005), prospective teachers rely on internalized stereotypes that have been communicated through media, family members, or other members of their communities. These stereotypes are so internalized that they are rendered invisible to the prospective teacher, but present, nonetheless. In the absence of cross-cultural experiences, these stereotypical images then translate into deficit thinking and beliefs about diverse learners. Mathematics teachers may lower their expectations and “water down” the curriculum because they believe that a certain group of students cannot handle the rigor of higher level mathematics. Therefore, deficit thinking occurs when teachers focus on what students do not know, rather than what they do know.

Prospective teachers need support in learning how to overcome deficit thinking. They need an environment where it is safe to acknowledge deficit views for the purpose of overcoming them. Simply telling student teachers not to “water down” the curriculum and to maintain high expectations for all of their students is insufficient, especially when facing evidence that confirms their stereotypes. Using Tatum’s (1997) smog metaphor can be effective at providing that safe environment because its purpose is not to find fault or induce feelings of guilt. Tatum describes prejudice as an inescapable consequence of living in a racist society. Even though it is not our fault that all of us, including people of color, have internalized stereotypes, misinformation, and omissions to some degree, we are all responsible for actively examining and challenging our own prejudices, less we be guilty of perpetuating and reinforcing the negative messages so pervasive in our society.

Once that safe learning environment has been established then teacher educators should provide strategies for helping prospective teachers maintain high expectations, even when their students perform poorly. Taken from Ladson-Billings’s (1994) culturally relevant pedagogy framework, one such strategy is valuing the knowledge, both cultural and personal, that students bring to the learning environment. When teachers actively seek to build on the strengths of their students, rather than focus on their deficiencies, high expectations are more easily maintained. As indicated in the following statement, Katie’s ability to maintain high expectations of her students was bolstered by her focus on the positive, rather than the negative: “I just find one thing to focus on to help me get through that class, and not go off the edge. I’ll always remember her saying that, ‘Find one thing that you like about your students, and that will help’” (KI 4-16, p. 17). Because research (Case & Hemmings, 2005; Lewis, Collins, & Pitts, 2000;

Ukpokodu, 2004) shows that preservice teachers come to teacher education programs with deficit views of diverse learners that are often difficult to overcome, it is important that they not be left on their own to figure out how to maintain high expectations for their diverse students.

Limitations of the Study

The major limitation to my study was that I, as their university supervisor, did not have any input in the design or development of the courses that the student interns took before my study. Because this case study was bounded in time to the semester of their student teaching, I was limited simply to observing the influences of a program that had already been developed by others. This fact affected my study in two ways.

Because I conducted my study during the student teaching phase of their teacher education program, I was not afforded the luxury of being a participant observer during their methods classes taken the previous two semesters. Therefore, I had to make inferences about those courses through course syllabi, personal communications with the course instructors, and the voices of participants of the study. Because I did not experience those courses firsthand, my interpretations of how these courses may have influenced the classroom practices of the participants were limited. For this reason, I chose to discuss the student interns' perceptions of the influences of their teacher education program on their equitable teaching practices.

Secondly, my participation as an African American researcher may have limited the responses of my participants. In their study on the distancing strategies White preservice teachers use when approaching issues of race, Case and Hemmings (2005) noted that the real opinions of White students surfaced only when everyone in the class

was White. When the class was racially mixed, White students worried about offending the Black students and therefore become overly cautious in what they said. The participants in my study may have hidden their true feelings or said only what they thought would not offend me. Because I did not address this issue directly with my participants, I have no way of knowing if this indeed was the case.

I also believe my dual role as university supervisor and researcher limited the amount of support that I would have normally provided for the student interns. Because the participants were not made aware of the framework for which I used to analyze their implementation of equity pedagogy, they were denied the opportunity to make a conscious effort to reflect those seven aspects of equity pedagogy in their practice. While we did have plenty of conversations about issues of equity, diversity, and mathematics instruction, I never explicitly exposed them to Zeichner et al.'s (1998) curriculum and instruction principles that I used to analyze my data. If I had it to do all over again, I would have liked the opportunity to have introduced Zeichner et al.'s curriculum and instruction principles during their summer or fall semester methods course before they began the study.

I also acknowledge the blinders that kept me from seeing my own inadequacies as a university supervisor who should have been able to provide those adequate models of equity pedagogy but was unable to because I did not know how to. I did not make explicit the seven aspects of equity pedagogy because I was not aware of them during the time of data collection. I only had the frameworks of culturally relevant teaching and critical theory to view their practices. It did not take me long to realize the necessity of a

more descriptive and detailed framework with which to view their pedagogical practices in the classroom.

I believe that my adaptation of Zeichener's Curriculum and Design Principles was the turning point in this study in which my vision became clearer than it ever had before. I only wish that my participants had that same opportunity during the time of the data collection, rather than afterward. I dare not judge my participants because when I see their inadequacies, I am reminded of my own. Therefore, I put myself into this picture that I am creating and reveal my own lack of knowledge as well. However, I am encouraged that just as my vision has been refined, so too can the vision of future preservice teachers be refined by having access to this framework on the front end, in their methods courses, in conversations with their mentor teachers, and university supervisors. I too am a learner in this process. I am thankful for Patricia, Katie, and Mike's willingness to open their classroom practices and thoughts to critique.

Recommendations for Future Research

More studies are needed that address the question, "What do equitable mathematics classrooms look like at the secondary level?" Studies should be conducted that demonstrate the results of teacher education programs efforts to prepare secondary mathematics teachers to teach an increasingly diverse population. Studies similar to the one at the University of Florida where the exemplary practices of a culturally relevant teacher, Gloria Merriex (personal communication, December 2006), are analyzed should also be conducted with secondary mathematics teachers. It is essential that research be conducted that assists both student teachers and teacher educators in bridging the gap between theory and practice. In addition to the contributions of multicultural educators,

mathematics educators must also contribute to this research base if prospective mathematics teachers are going to be adequately prepared to teach all students successfully.

Implications for Teacher Education

It is important that teacher educators model the equitable teaching practices they want to develop in their student teachers. In Brown's (2004) study that investigated factors that precipitate change in prospective teachers' cultural diversity awareness, she concluded that the method of instruction made more of an impact on student teachers than the message. Therefore, teacher educators who are really interested in helping their student teachers increase in their cultural awareness must focus more on becoming practitioners of multicultural education, rather than simply teachers of multicultural education. Here are my recommendations for doing so.

Teachers need time to develop multicultural competencies (Ukpokodu, 2002). In the spirit of modeling high expectations for all students, it is important that teacher educators avoid deficit views of their prospective teachers by encouraging them in their development wherever they happen to be in the process of becoming promoters of equity and advocates for diverse learners. Lamenting the lack of cultural awareness or resistance to multicultural education of student teachers will not help move them up the continuum of equitable teaching practices. Prospective teachers cannot adequately build on the prior knowledge of their students if they do not know what kind of prior knowledge is important for the learning process, and how to gather that kind of knowledge.

Teacher educators need to help their students develop the skills of an ethnographer—one who seeks to understand the behavior, values, and meanings of any given individual (or group) within a cultural context (Massey, 1998). As ethnographers, teachers should ask the following questions of themselves and of their students: What cultural assumptions do I bring into the classroom? What groups do my students belong? What does it mean to be a member of this group? What makes someone an insider or an outsider of this group? Am I perceived as an insider or outsider? Can one's outsider status change? How? The openness of the teacher to learn from her students, and her willingness to suspend premature judgment about them will determine the success of these efforts.

Teachers from all disciplines, including mathematics, should have the opportunity to develop the skills of an ethnographer. However, I am not sure that a mathematics methods course is the most appropriate place to teach these skills. I would speculate that most mathematics teacher educators would need additional training in developing their skills as ethnographers before they could help their students develop these same skills. These skills could be more appropriately addressed in general education courses like social foundations of education or multicultural education. This recommendation suggests that providing the necessary supports for prospective teachers in colleges of education will require a greater collaboration of education faculty and those who teach within their academic disciplines. A teacher education program where issues of diversity are addressed in a general education course and infused throughout their methods courses can provide the necessary framework for prospective mathematics teachers to reflect critically on their instructional practices through an equity lens.

In addition to offering the appropriate coursework, teacher educators should model building on prior knowledge, high expectations, knowing students well, culturally responsive pedagogical skills, critical consciousness, sharing of power, and multiple funds of knowledge in their classrooms. They should not only model these practices themselves, they should also open these practices to the critique of their students, and engage them in the development of their own examples of these practices. Thus, the college classroom itself becomes a laboratory for the redistribution of power, and a catalyst for social change.

Once a teacher educator has made the commitment to become a model of multicultural education, finding suitable mentors for student teachers must become a priority. Fellow student teachers can be a great place to start. Students can create an “equity toolbox” of sorts that can be posted electronically where students teachers can share and access specific lessons and/or activities that have been effective with diverse learners. In addition to support from their peers, prospective teachers need effective mentor teachers during their teaching internships. Colleges of education should collaborate with school districts to establish effective incentive programs with the purpose of attracting potential mentors for their future teacher candidates. No longer should student teachers have to settle for anyone who will take them in. If these programs are unable to attract enough suitable mentors, then teacher educators should take advantage of the distance learning technologies that allow student teachers to view video clips or live broadcasts of exemplary practices of equity pedagogy. Of course, the student teachers themselves should be involved in the process of defining and critiquing “exemplary” practices of equity pedagogy. Fellow student teachers, incentive programs,

and distance learning technologies are all resources that teacher educators can use to help alleviate the problem of finding effective mentor teachers for prospective mathematics teachers.

In closing this study, I am reminded of the critical task that mathematics educators have to provide all students with the mathematical and critical thinking skills that will enable them to be productive citizens in a technological and global society. On one hand, I am saddened by the statistics that demonstrate that we have failed to educate adequately a significant portion of our nation's cultural and ethnic minorities. Yet, I am encouraged by the direction of the research (Grant & Tate, 1995; Gutstein, 2003; Secada, Ortiz-Franco, Hernandez, & De La Cruz, 1999) that is illuminating promising practices that I believe will help us accomplish our goal of providing enriching mathematical experiences for all students. This study is my contribution to that body of research.

This research has been about blinders, first recognizing them and the process of removing them, beginning with me the researcher, moving on to the blinders of the participants, to an attempt to remove the blinders of the readers, and ultimately the blinders of those in society that perpetuate an inequitable educational system that privileges those who are White and middle-class at the expense of diverse learners. I understand the danger that is inherent in trying to remove blinders for others, especially for those who benefit the most by keeping those blinders on. However, I am compelled to find answers, and believe that I cannot find these answers by myself. I do not believe that my efforts alone are sufficient for solving the problem of poor mathematical achievement amongst diverse learners. I do not believe that my vision will ever be perfect or that my interpretations will not have to be adjusted. For as soon as my vision

becomes focused, the landscape will probably change and I will no longer be looking at the same thing. However, I believe that my vision of equity pedagogy is clearer now than when I began this study. I see my participants in a new way. My hope is that others reading this study will see more clearly by taking off the blinders in the secondary mathematics classroom that privileges the culture of White middle-class students while ignoring the role that cultures plays in the learning process. While doing this study has raised even more questions than it has answered, I am convinced that this process of discovery and insight has definitely been worth the effort.

References

- Aaronsohn, E., Carter, C. J., & Howell, M. (1995). Preparing monocultural teachers for a multicultural world: Attitudes toward inner-city schools. *Equity & Excellence in Education, 28*(1), 5-9.
- Apple, M. W. (1996). *Cultural politics and education*. New York: Teachers College Press.
- Artiles, A. J., & McClafferty, K. (1998). Learning to teach culturally diverse learners: Charting change in preservice teachers' thinking about effective teaching. *Elementary School Journal, 98*(3), 189-220.
- Au, K. H. (1998). Social constructivism and the school literacy learning of students of diverse backgrounds. *Journal of Literacy Research, 30*(2), 297.
- Avery, P. G., & Walker, C. (1993). Prospective teachers' perceptions of ethnic and gender differences in academic achievement. *Journal of Teacher Education, 44*(1), 27-37.
- Banks, C. A. M., & Banks, J. A. (1995). Equity pedagogy: An essential component of multicultural education. *Theory into Practice, 34*(3), 152-158.
- Banks, J. A. (1997). Multicultural education: Characteristics and goals. In J. A. Banks & C. A. M. Banks (Eds.), *Multicultural education: Issues and perspectives* (3rd ed., pp. xvi, 446). Boston: Allyn and Bacon.

- Barry, N. H., & Lechner, J. V. (1995). Preservice teachers' attitudes about and awareness of multicultural teaching and learning. *Teaching and Teacher Education, 11*(2), 149-161.
- Boyle-Baise, M. (2005). Preparing community-oriented teachers: Reflections from a multicultural service-learning project. *Journal of Teacher Education, 56*(5), 446-458.
- Brown, E. L. (2004). What precipitates change in cultural diversity awareness during a multicultural course: The message or the method? *Journal of Teacher Education, 55*(4), 325-340.
- Brown, E. L. (2005). Service-learning in a one-year alternative route to teacher certification: A powerful multicultural teaching tool, *Equity and Excellence in Education* (Vol. 38, pp. 61-74).
- Brown, T. J. (1986). *Teaching minorities more effectively: A model for educators*. Lanham, MD: University Press of America.
- Bullock, P. L., & Freedman, D. M. (2006). (Re)visions to a secondary teacher education course: Trials and triumphs in attempting to disrupt hegemonic understandings and performances of education. *Teaching & Teacher Education, 22*(2), 135-149.
- Case, K. A., & Hemmings, A. (2005). Distancing strategies: White women preservice teachers and antiracist curriculum. *Urban Education, 40*(6), 606-626.
- Causey, V. E., Thomas, C. D., & J. Armento, B. (2000). Cultural diversity is basically a foreign term to me: The challenges of diversity for preservice teacher education. *Teaching and Teacher Education, 16*(1), 33-45.

- Cho, G., & DeCastro-Ambrosetti, D. (2005). Is ignorance bliss? Pre-service teachers' attitudes toward multicultural education. *High School Journal*, 89(2), 24-28.
- Cook-Sather, A., & Reisinger, O. (2001). Seeing the students behind the stereotypes: The perspectives of three preservice teachers. *Teacher Educator*, 37(1), 16-26.
- Cooney, M. H., & Akintunde, O. (1999). Confronting white privilege and the "color blind" paradigm in a teacher education program. *Multicultural Education*, 7(2), 9-14.
- Council of Chief State School Officers. (1992). *Model standards for beginning teacher licensing and development: A resource for state dialogue*. District of Columbia: Interstate New Teacher Assessment and Support Consortium.
- Creswell, J. W. (1998). *Qualitative inquiry and research design: Choosing among five traditions*. Thousand Oaks, CA: Sage Publications.
- Deering, T. E., & Stanutz, A. (1995). Preservice field experience as a multicultural component of a teacher education program. *Journal of Teacher Education*, 46(5), 390-394.
- Delpit, L. D. (1995). *Other people's children: Cultural conflict in the classroom*. New York: New Press : Distributed by W.W. Norton.
- Editors of The American Heritage Dictionaries (Ed.). (2004). *The American heritage college dictionary* (Fourth ed.). Boston: Houghton Mifflin.
- Finney, S., & Orr, J. (1995). "I've really learned a lot, but...": Cross-cultural understanding and teacher education in a racist society. *Journal of Teacher Education*, 46(5), 327-333.
- Flanigan, J. (1933). *Flanigan's History* (Vol. 1). Hapeville, GA: Tyler & Co.

- Freire, P. (2000). *Pedagogy of the oppressed* (30th anniversary ed.). New York: Continuum.
- Frykholm, J. A. (1997). A Stacked Deck: Addressing Issues of Equity with Preservice Teachers. *Equity & Excellence in Education*, 30(2), 50-58.
- Gay, G. (2000). *Culturally responsive teaching: Theory, research, and practice*. New York: Teachers College Press.
- Gay, G., & Kirkland, K. (2003). Developing cultural critical consciousness and self-reflection in preservice teacher education. *Theory into Practice*, 42(3), 181-187.
- Geertz, C. (1973). Thick description: Toward an interpretive theory of culture. In C. Geertz (Ed.), *The interpretation of cultures; selected essays* (pp. ix, 470). New York,: Basic Books.
- Giroux, H. A. (2001). *Theory and resistance in education: Towards a pedagogy for the opposition* (Rev. and expanded ed.). Westport, Conn.: Bergin & Garvey.
- Giroux, H. A., & McLaren, P. (1989). *Critical pedagogy, the state, and cultural struggle*. Albany: State University of New York Press.
- Grant, C., & Tate, W. (1995). Multicultural education through lens of multicultural education research literature. In J. A. Banks & C. A. M. Banks (Eds.), *Handbook of research on multicultural education* (pp. 149-166). New York: Simon & Schuster Macmillan.
- Gutstein, E. (2003). Teaching and learning mathematics for social justice in an urban, Latino school. *Journal for Research in Mathematics Education*, 34(1), 37.

- Gutstein, E., & Lipman, P. (1997). Culturally relevant mathematics teaching in a Mexican American context. *Journal for Research in Mathematics Education*, 28(6), 709-737.
- Gutstein, E., Middleton, J. A., Fey, J. T., Larson, M., Heid, M. K., Dougherty, B., et al. (2005). Equity in school mathematics education: How can research contribute? *Journal for Research in Mathematics Education*, 36(2), 92-100.
- Hale-Benson, J. E. (1982). *Black children, their roots, culture, and learning styles*. Provo, Utah: Brigham Young University Press.
- Hartley, N. K., Cruz-Janzen, M., Oltjenbruns, K., & Farmer, J. (1999). Meeting the challenges of diversity in a context of reform. In M. L. Powers & N. K. Hartley (Eds.), *Promoting excellence in teacher preparation: Undergraduate reforms in mathematics and science* (pp. 65-86). Fort Collins: Colorado State University.
- Herrnstein, R. J., & Murray, C. A. (1994). *The bell curve: Intelligence and class structure in American life*. New York: Free Press.
- Hilliard, A. G. (1992). Behavioral style, culture, and teaching and learning. *Journal of Negro Education*, 61(3), 370-377.
- Hilliard, A. G. (1995). Mathematics excellence for cultural "minority" students: What is the problem? In I. M. Carl (Ed.), *Prospects for school mathematics: Seventy-five years of progress* (pp. 99-114). Reston, VA: National Council of Teachers of Mathematics.
- Hofstadter, R. (1959). *Social Darwinism in American Thought*. New York: George Braziller, Inc.

- Hsiung, Y.-L., Arvold, B., Johnson, N., & Wojtowicz, P. (2003, April 21-25). *Students' and cooperating teachers' perceptions of the secondary teacher education program*. Paper presented at the Annual Meeting of the American Educational Research Association, Chicago, IL.
- Ikpa, V. (2004). Leaving children behind the racial/ethnic achievement gap. *Research for Educational Reform, 9*(2), 3-13.
- Irvine, J. J. (1990). *Black students and school failure: Policies, practices, and prescriptions*. New York: Greenwood Press.
- Joseph, G. G. (2000). *The crest of the peacock: The non-European roots of mathematics*. Princeton, N.J.: Princeton University Press.
- Kaste, J. A. (2004). Scaffolding through cases: Diverse constructivist teaching in the literacy methods course. *Teaching & Teacher Education, 20*(1), 31.
- King, J. E. (1991). Dysconscious racism: Ideology, identity, and the miseducation of teachers. *Journal of Negro Education, 60*(2), 133-146.
- Ladson-Billings, G. (1994). *The dreamkeepers: Successful teachers of African American children* (1st ed.). San Francisco: Jossey-Bass Publishers.
- Ladson-Billings, G. (1998). Just what is critical race theory and what's it doing in a nice field like education? *International Journal of Qualitative Studies in Education, 11*(1), 7-24.
- LeCompte, K. N., & McCray, A. D. (2002). Complex conversations with teacher candidates: Perspectives of whiteness and culturally responsive teaching. *Curriculum & Teaching Dialogue, 4*(1), 25.

- Lee, J. (2004). Multiple facets of inequity in racial and ethnic achievement gaps. *Peabody Journal of Education*, 79(2), 51-73.
- Lewis, B. F., Collins, A., & Pitts, V. (2000, April). *An investigation of preservice teachers' perceptions of African American students' ability to achieve in mathematics and science*. Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA.
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Beverly Hills, Calif.: Sage Publications.
- Lubienski, S. T. (2002). Research, reform, and equity in U.S. mathematics education. *Mathematical Thinking & Learning*, 4(2/3), 103-125.
- Massey, A. (1998, September 7-8). *"The way we do things around here": The culture of ethnography*. Paper presented at the Ethnography and Education Conference, Oxford University Department of Educational Studies.
- Matthews, L. E. (2003). Babies overboard! The complexities of incorporating culturally relevant teaching into mathematics instruction. *Educational Studies in Mathematics*, 53(1), 61.
- McDonald, M. A. (2005). The integration of social justice in teacher education: Dimensions of prospective teachers' opportunities to learn, *Journal of Teacher Education* (Vol. 56, pp. 418-435).
- McLaren, P. (1998). *Life in schools: An introduction to critical pedagogy in the foundations of education* (3rd ed.). New York: Longman.
- McNeal, K. (2005). The influence of a multicultural teacher education program on teachers' multicultural practices. *Intercultural Education*, 16(4), 405-419.

- Merriam, S. B. (1998). *Qualitative research and case study applications in education* (2nd ed.). San Francisco: Jossey-Bass Publishers.
- Middle/Secondary Education and Instructional Technology Department. (2005). *Teacher education environments in mathematics, science, English and social studies handbook and curriculum guide for mathematics education*. Atlanta: Urban State University.
- Milner, R. H. (2005). Stability and change in US prospective teachers' beliefs and decisions about diversity and learning to teach. *Teaching and Teacher Education: An International Journal of Research and Studies*, 21(7), 767-786.
- Moore, J. A. (1996, February 21-24). *Empowering student teachers to teach from a multicultural perspective*. Paper presented at the Annual Meeting of the American Association of Colleges for Teacher Education, Chicago, IL.
- Mujawamariya, D., & Mahrouse, G. (2004). Multicultural education in Canadian preservice programs: Teacher candidates' perspectives. *Alberta Journal of Educational Research*, 50(4), 336-353.
- National Center for Education Statistics. (2001-2002). Common core of data: America's public schools. Retrieved March 29, 2005, from <http://nces.ed.gov/ccd/bat/Result.asp?view=School&id=528739080&ar=>
- National Commission on Excellence in Education. (1983). *A Nation at risk: The imperative for educational reform*. Washington, D. C.: U. S. Government Printing Office.

- National Council of Teachers of Mathematics. (1991). *Professional standards for teaching mathematics*. Reston, VA: National Council of Teachers of Mathematics.
- National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: Author.
- Oakes, J. (1985). *Keeping track: How schools structure inequality*. New Haven: Yale University Press.
- Olmedo, I. M. (1997). Challenging old assumptions: Preparing teachers for inner city schools. *Teaching and Teacher Education, 13*(3), 245-258.
- Pool, H., & Page, J. A. (1995). *Beyond tracking: Finding success in inclusive schools*. Bloomington, IN: Phi Delta Kappa Educational Foundation.
- Presmeg, N. C. (1998). Ethnomathematics in teacher education. *Journal of Mathematics Teacher Education, 1*(3), 317-339.
- Reid, D. K., & Stone, C. A. (1991). Why is cognitive instruction effective? Underlying learning mechanisms. *Remedial and special education, 12*(3), 8-19.
- Rodriguez, Y. E., & Sjostrom, B. R. (1995). Culturally responsive teacher preparation evident in classroom approaches to cultural diversity: A novice and an experienced teacher. *Journal of Teacher Education, 46*(4), 304-311.
- Rogoff, B. (1990). *Apprenticeship in thinking: Cognitive development in social context*. New York: Oxford University Press.
- Ruggles, J., Taylor, M. J., & Buck, J. (1999). The genesis of change: Teacher preparation to promote implementation of multicultural math. In M. L. Powers & N. K.

- Hartley (Eds.), *Promoting excellence in teacher preparation: Undergraduate reforms in mathematics and science*. Fort Collins, CO: Colorado State University.
- Santoro, N., & Allard, A. (2005). (Re)Examining identities: Working with diversity in the pre-service teaching experience. *Teaching & Teacher Education*, 21(7), 863-873.
- Sawyer, R. D. (2000). Adapting Curriculum to Student Diversity: Patterns of Perceptions Among Alternate-Route and College-Based Teachers., *Urban Review* (Vol. 32, pp. 343): Kluwer Academic Publishing.
- Secada, W. G., Ed., Ortiz-Franco, L., Ed., Hernandez, N. G., Ed., & De La Cruz, Y., Ed. (1999). *Changing the faces of mathematics: Perspectives on Latinos*. Reston, VA: National Council of Teachers of Mathematics.
- Seidman, I. (1998). *Interviewing as qualitative research: A guide for researchers in education and the social sciences* (2nd ed.). New York: Teachers College Press.
- Shulman, L. S. (1987). Knowledge and teaching: Foundations of the reform. *Harvard Educational Review*, 57, 1-22.
- Sleeter, C. (1997). Mathematics, multicultural education, and professional development. *Journal for Research in Mathematics Education*, 28(6), 680-696.
- Stanic, G. (1991). Social inequality, cultural discontinuity, and equity in school mathematics. *Peabody Journal of Education*, 66(2), 57-71.
- Steinberg, S. (1981). *The ethnic myth: Race, ethnicity, and class in America* (1st ed.). New York: Atheneum.
- Tate, W. F., IV. (1997). Race, SES, gender, and language proficiency trends in mathematics achievement. *Journal for Research in Mathematics Education*, 28(6), 652-679.

- Tatum, B. D. (1997). *"Why are all the Black kids sitting together in the cafeteria?" and other conversations about race* (1st ed.). New York: Basic Books.
- Taylor, S. V., & Sobel, D. M. (2001). Addressing the discontinuity of students' and teachers' diversity: A preliminary study of preservice teachers' beliefs and perceived skills. *Teaching and Teacher Education, 17*(4), 487-503.
- Tharp, M. L., & Lovell, C. (1995, October 21-24). *Achieving cognitive equity in the mathematics classroom*. Paper presented at the Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education, Columbus, OH.
- Ukpokodu, N. (2002). Breaking through preservice teachers' defensive dispositions in a multicultural education course: A reflective practice. *Multicultural Education, 9*(3), 25-33.
- Ukpokodu, N. (2004). The Impact of shadowing culturally different students on preservice teachers' disposition toward diversity. *Multicultural Education, 12*(2), 19-28.
- Vaughn, S., Schumm, J. S., & Sinagub, J. (1996). *Focus group interviews in education and psychology*. Thousand Oaks: Sage Publications.
- Villegas, A. M., & Lucas, T. (Eds.). (2002). *Educating Culturally Responsive Teachers: A Coherent Approach. SUNY Series, Teacher Preparation and Development*. U.S. New York.
- von Glasersfeld, E. (1991). *Radical constructivism in mathematics education*. Boston: Kluwer Academic.

- Wagner, L., Roy, F. C., Ecatoiu, E., & Rousseau, C. (2000). Culturally relevant mathematics teaching at the secondary school level: Problematics features and a model for implementation. In M. E. Strutchens, M. L. Johnson & W. F. Tate (Eds.), *Changing the faces of mathematics: Perspectives on African Americans* (pp. p.107-122). Reston, VA: National Council of Teachers of Mathematics.
- Willis, M. G. (1992). Learning styles of African American children: A review of the literature and interventions. In Hoard, Burley, Banks, McAdoo & Azibo (Eds.), *African American psychology: Theory research and practice*. Newbury Park, CA: Sage.
- Wilson, W. J. (1998). The role of the environment in the black-white test score gap. In C. Jencks & M. Phillips (Eds.), *The black-white test score gap*. Washington, D. C.: Brookings Institution Press.
- Woodson, C. G. (1930/1990). *The mis-education of the Negro*. Trenton, N.J.: Africa World Press.
- Zaslavsky, C. (1998). Ethnomathematics and multicultural mathematics education. *Teaching Children Mathematics*, 4(9), 502-503.
- Zeichner, K. M., Grant, C., Gay, G., Gillette, M., Valli, L., & Villegas, A. M. (1998). A research informed vision of good practice in multicultural teacher education: Design principles. *Theory into Practice*, 37(2), 163-171.
- Zeichner, K. M., & Tabachnick, B. R. (1981). Are the effects of university teacher education 'washed out' by school experience? *Journal of Teacher Education*, 32(3), 7-11.

APPENDIXES

APPENDIX A

Practicums II and III

Student Teaching in Secondary Mathematics

Unit Theme: *Creating Effective Contexts for Learning*
Program Theme: *Teacher as Facilitator of Learning in a Supportive Environment*

Required Textbook:
Urban State University Student Teaching Handbook

Course Overview:

Student teaching is designed to be the culminating experience in a teacher education program. This experience should be viewed as a natural extension of your earlier methods and clinical experiences. It will require you to apply various aspects of your professional education preparation in an actual school over a prolonged period of time. Student teaching provides you the first significant opportunity for doing what you have been preparing to do in your university studies under controlled conditions, under the supervision of a mentor teacher and a college supervisor.

The major purposes of student teaching are to:

1. Provide direct experience in teaching and an opportunity to practice the professional responsibilities associated with teaching.
2. Provide opportunities to apply, test, and to reflect on learning and teaching in secondary mathematics classrooms.
3. Provide opportunities for demonstrating competence in a full range of teaching functions.

Course Requirements:

During this course you will be expected to:

1. Read and be thoroughly knowledgeable of the contents in the *USU Student Teaching Handbook*.
2. Be present at the assigned school every day of the semester: all absences must be made up at the end of the semester.

3. Maintain a portfolio which includes the course syllabus, all lesson plans with supporting instructional materials and student assessment materials, your final unit plan, the reflection journal, supervising teacher's evaluations and college supervisor's evaluations. The portfolio should be kept in a 3-ring binder with each section clearly labeled. **The final student teaching portfolio is due to your college supervisor at the closing evaluation as set by the college supervisor but not later than April 17.**
4. Develop written lesson plans for every lesson that you teach.
5. Develop a four-week unit plan for the four consecutive weeks of teaching, including instructional support materials and student assessment instruments. At least three of the lessons must demonstrate competency in three or more of the following areas: technology, cooperative learning, interdisciplinary approaches, diversity, or special needs students. A rough draft of the unit is due to the college supervisor and mentor teacher one week prior to teaching the unit. All lessons must be implemented in the classroom during your student teaching experience. On each lesson note the date that it is taught. A final clean copy of the unit must be included in the portfolio.
6. Keep a reflective journal of your experiences. In the journal discuss your feelings about your experiences, but concentrate on a critique of your actual teaching. Reflect upon what worked well, what did not and what you will do to improve the lesson. The journal must include an entry for each day that you teach and a least three entries per week during the period that you are not teaching. The journal must be available to the college supervisor upon each visit to the school as a component in the student teaching portfolio.
7. Teach in a satisfactory manner the supervising teacher's complete load or the equivalent for a minimum of four weeks.
8. Attend student teacher seminars required by the Department, College or those conducted by the college supervisor.
9. Demonstrate a thorough knowledge of the subject matter and subject matter pedagogy.

Procedures:

The college supervisor will make approximately six (6) visits for conferences or observations during the semester: initial conference, 3-4 observations, and a final conference. The student teacher must provide a seat and the portfolio for the college supervisor for each observation. Be certain that the lesson plan and the materials used in the lesson are in the portfolio and are clearly visible and labeled. For each observation a

written evaluation will be completed by the college supervisor and made available to the student teacher.

Tentative Schedule:

Weeks One through Three	Observe/Assist
Weeks Three through Five	Begin taking on classes 1-2
Weeks Six through Ten	Teach full load
Weeks Eleven through Twelve	Teach 1-2 classes
Week Thirteen	Observe/Assist .

Evaluation:

The student teacher will be evaluated in the general areas planning, instruction, evaluation, management, and professionalism. Refer to the *Student Handbook* for indicators relating to assessment for each of these areas. Excellent teaching is also based, however, on intangible areas such as energy, enthusiasm, attitude, and commitment. The observations of the college supervisor, the evaluations of the cooperating teacher, your participation in the seminars, and your portfolio will provide evidence upon which the assessment will be based. Student teachers demonstrating excellence in the areas listed on page 14 of the *Student Handbook* will receive an "A." Those rated good will receive a "B." Average work will be awarded a "C." A rating of "poor" will result in a "D," and an unacceptable teaching performance will be given an "F."

Grades will be derived through consensus of the cooperating teacher and the college supervisor. However, the final grade will be determined by the college supervisor.

Seminars:

You are required to attend the scheduled seminars on Wednesdays at 7:U p.m. in room 252 in the College of Education. Absences will impact your final grade in student teaching. The seminar dates are: **January 9, February 6 and 27, March 6 and 27, and April 17.**

Your program portfolio is due on April 17. One seminar will be dedicated to the completion of the program portfolio. The student teaching portfolio and the program portfolio are two different portfolios. Items from the student teaching portfolio may be included in the program portfolio as artifacts.

Web CT:

The course syllabus, calendar and a discussion board will be available for this course via Web CT. You must visit the site on a weekly basis for information regarding the seminars. Required readings for the seminar and other pertinent information will be posted. Seminar topics will be announced via Web CT. Scheduled topics include: Classroom Management, Program Portfolio, and National Board Certification.

In addition to placing a copy of your reflections in the student teaching portfolio, you are required to post reflections to the discussion board. Decide what you would like to share from your portfolio each week and post to the discussion board. Postings should be completed each Tuesday beginning Tuesday, January 15 and ending Tuesday, April 16.

You are encouraged to read the reflections of your colleagues and interact via the discussion board.

Additional Information:

1. The course syllabus provides a general plan for the course; deviations may be necessary.
2. Your grade is neither a judgment of you as a person nor necessarily of the amount of time spent in preparation. Rather it is an assessment of the quality of your work.
3. The Academic Honesty Policy as presented in the current university catalog is followed in this course.
4. The last day to withdraw passing is March 11.

APPENDIX B

Observation Data Sheet

Building on prior knowledge	High expectations	Knowing students well	Culturally relevant pedagogy	Critical consciousness	Sharing of power	Multiple Funds of Knowledge
Using students' prior knowledge, both personal and cultural, as resources for creating new knowledge	Avoiding deficit views of diverse learners	Learning about students, their families and their communities for the purpose of improving instruction	Multicultural materials; active engagement, cooperative learning, inquiry, students' daily lives; culturally sensitive classroom management; varied assessment	Working to promote greater equity and social justice in schooling and society, by committing to become change agents wherever they are	Allowing students to make choices about things that are important to them	Extending beyond the textbook and teacher as authorities, to validating multiple types and sources of knowledge
<i>Asking what students already know about a concept; making references to things they already know to teach new concepts</i>	<i>Giving positive feedback, setting and maintaining high standards & rigor, avoiding stereotypes, calling on males & females equally</i>	<i>Asking about students lives outside the classroom such as sports, family life, where they live, etc.</i>	<i>Pointing out materials where minorities, and females are favorably portrayed, cooperative learning, signs of caring for student as a person, active engagement, real life examples</i>	<i>Statements indicating they are advocates for students like "I must see to it personally that ... gets help."</i>	<i>Allowing students to choose partners, assignments, who will share in class, etc.</i>	<i>Referring to classmates, internet, partners, parents, as resources for right answers.</i>

APPENDIX C

Individual Interview Guide

Background questions

- Tell me about yourself. Describe your family and cultural background.
- What were you doing prior to this program?
- What factors influenced your decision to teach mathematics?

Research questions

1. What aspects of equity pedagogy do preservice secondary mathematics teachers practice in their classrooms?
 - In the United States, racial and ethnic minorities, females, and students from low-income families do poorly in mathematics in disproportionate numbers. What factors do you believe contribute to the poor performances of these groups?
 - James Banks describes equity pedagogy as teachers modifying their teaching in ways that will facilitate the academic achievement of students from diverse racial, cultural, gender, and social-class groups. What does this mean to you, in your own words?
 - What characteristics of your students do you take into consideration when modifying your instruction? Explain.
 - Describe your diversity plan.
 - How did your diversity plan fit into your perception of equity pedagogy?

APPENDIX C (continued)

2. What school factors do the interns perceive to influence their decisions in implementing equity pedagogy?
 - Were you able to implement your diversity plan? Why or why not?
 - In what ways have you implemented equity pedagogy in your classroom?

After participant has viewed clip of his/her own lesson ask:
 - Was the pedagogy of this lesson equitable?
 - Was equity pedagogy maintained throughout the entire lesson?
 - If so, how was it maintained? If not, in what ways did it decline?
3. Which aspects of the teacher education program do the interns perceive most influence their implementation of equity pedagogy?
 - You did these things during the Summer 2001 semester (naming them). How did these things prepare you to teach all students successfully?
 - You did these things during the Fall 2001 semester (naming them). How did these things prepare you to teach all students successfully?
 - How could you have been better prepared to implement equity pedagogy this semester?

APPENDIX D

Focus Group Interview Guide

1. Read Patricia's paraphrase of equity pedagogy, and then show video clip. Ask the other two interns the following questions:
 - Does this clip reflect Patricia's definition of equity pedagogy? Why or why not?
 - Allow Patricia to respond once the other interns have answered.
2. Read Mike's paraphrase of equity pedagogy, and then show video clip. Ask the other two interns the following questions:
 - Does this clip reflect Mike's definition of equity pedagogy? Why or why not?
 - Allow Mike to respond once the other interns have answered.
3. Read Katie's paraphrase of equity pedagogy, and then show video clip. Ask the other two interns the following questions:
 - Does this clip reflect Katie's definition of equity pedagogy? Why or why not?
 - Allow Katie to respond once the other interns have answered.
 - How would you change the program to better prepare student teachers to implement equity pedagogy.

APPENDIX E

Bigger and Smaller - Exponent Rules Lesson Plan

(<http://www.learner.org/channel/workshops/algebra/workshop6/lessonplan2b.html>)

Supplies:

Students will need the following:

- Scientific or graphing calculators

Steps

Introductory Activity:

1. Have students consider the following problem individually before the lesson begins:

Rallods in Rednow Land

Which is more money?

- a. One billion rallods
- b. The amount obtained by putting 1 rallod on one square of a chessboard, 2 rallods on the next square, 4 on the next, and so on, until all 64 squares are filled.

(NOTE: To find the total number of rallods on the chessboard, students must add $1 + 2 + 4 + 8 \dots + 2^{63}$. Finding the total on all 64 squares is not necessary to answer the question, since the running total surpasses 1 billion well before the 64th square.)

2. Have students discuss their intuition regarding this situation. Without calculating, which scenario do they think would yield more rallods, a or b?

3. Allow student groups a few minutes to calculate and discuss the result in choice b.

4. Have students consider the following problem:

On what square of the chessboard would the total number of rallods first exceed 1 billion?

5. Give student groups a few minutes to calculate an answer to this question. Then, have the groups share their results and discuss their methods for obtaining the answer (which is the 31st square, since $2^{30} = 1,073,741,824$). Students may also use guess-and-check and

say it would be on the 29.9^{th} square. Although this answer doesn't make sense in the context of the problem, it will allow for a discussion as to whether or not it is okay to have decimal exponents.

Learning Activities:

1. Have students discuss the effect of cake and beverages on Alice's height in *Alice in Wonderland*. Have a student from each group describe his or her group's discussion to the class. Students should understand that when Alice eats an ounce of cake, her height doubles, and when Alice drinks an ounce of beverage, her height is halved.

2. Give students time to discuss the problems below in their groups:

- a. What happens when Alice eats several ounces of cake and drinks the same number of ounces of beverage?
- b. Find several combinations of cake and beverage that will cause Alice to be 8 (or 2^3) times her normal height.
- c. Find several combinations of cake and beverage that will cause Alice to be 32 (or 2^5) times her normal height.
- d. Find several combinations of cake and beverage that will cause Alice to be 4 (or 2^2) times her normal height.
- e. What happens if Alice consumes more ounces of beverage than ounces of cake?
- f. If Alice eats c ounces of cake and drinks b ounces of beverage, what is her height? Describe her height using a mathematical expression.

3. Have a volunteer from each group present the group's solutions for each of the above questions.

4. Use the students' solutions to develop the rules for negative exponents and for divisibility of exponents: $2^m/2^n = 2^{m-n}$. For instance, in question b, students may have shown that eating 7 ounces of cake and drinking 4 ounces of beverage would cause Alice to be eight times as tall, or $2^7 \times (1/2)^4 = 2^3$. Rewrite this as $2^7 \times 2^{-4} = 2^3$ and as $2^7/2^4 = 2^3$.

5. During the discussion for question f, be sure to elicit the general formula $2^c \times (1/2)^b = 2^{c-b}$. This formula will lead to the rule for negative exponents, $2^{-b} = 1/2^b$, as well as to the general rule for divisibility, $2^c/2^b = 2^{c-b}$.

6. Assign practice problems for homework.