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A CASE STUDY OF CULTURALLY RESPONSIVE TEACHING
IN MIDDLE SCHOOL MATHEMATICS

A Dissertation

Presented to

the Morgridge College of Education

University of Denver

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

by

Rosanne Fulton

August 2009

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Title: A CASE STUDY OF CULTURALLY RESPONSIVE TEACHING IN MIDDLE SCHOOL MATHEMATICS
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Abstract

This dissertation is a case study of culturally responsive teaching in middle school mathematics. The study contributes to the emerging definition of learning experiences in mathematics that support all middle school students through the use of culturally responsive teaching strategies. These experiences are organized to actualize the balance between accommodating the individual student's culture, needs and interests and supporting the attainment of appropriate mathematics learning goals.

The research site was chosen because of its diverse and changing student demographics, and because of the achievement and growth rates of these students. Data collected from classroom observations of three middle school mathematics teachers at this site; observations of school activities; interviews with these teachers and their school leaders; a student focus group with representative students from the three teacher's classrooms; and, a review of school and classroom artifacts contributed to the findings for this study. All data were collected during the period of December 2008 through March 2009.

Results of this study give evidence of the significance of a strong school culture that supports the development of understandings in mathematics for each learner. These three teachers provided learners with regular and comprehensive opportunities to learn by organizing strong learning communities in their classrooms; by encouraging students to help each other; by adjusting their instruction based on students' needs; and, by

establishing and acting on challenging learning goals for all students. Additionally, the teachers gave students regular opportunities to make sense of the mathematics they were studying and to share leadership and decision-making within the strong learning community that they established and maintained with each section of students that they taught.

Leaders and others may believe that the components of culturally responsive teaching do not apply in a mathematics classroom. Thus, the findings from this study further educators' reflection about these ideas. The results of culturally responsive teaching include not only deeper learning of content, but also, an opportunity for students' to learn to value their own and each other's differing perspectives that supports the development of stronger democratic citizenship.

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Thank you, leaders, teachers, staff, and students at City Middle School. You have created a respectful and high-performing learning community that serves as an influential model of how public schools can be a foundation for a strong democracy. I treasure the time I spent with you.

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Chapter 1

How one person's abilities compare in quantity with those of another is none of the teacher's business. It is irrelevant to his work. What is required is that every individual shall have opportunities to employ his own power in activities that have meaning (Dewey, 1916, p. 203)

Diversity provides complexity, depth, multiple perspectives, and equity to relationships, thereby extending human and societal possibilities. If we do not understand each other as equal—in the sense of having something of value to bring to the learning process—we cannot form relationships that contribute to growth and purpose. When the multiplicities of our own thoughts and those of participants working in equitable relationships are liberated, we can conceive of more sophisticated resolutions to challenges. (Lambert et al., 2002, p. xiii)

Introduction

America's capacity to thrive as a strong democracy depends on a public education system that provides all children and youth with the support needed to develop their intellectual capacity in order to have free and independent thoughts. According to Greene (1984), schools must create the kinds of conditions in which children and youth can be themselves. Eisner (2004) related the simple but seemingly elusive fact that the goal of school is not to do well in school but to do well in life. In her book, *The Power of Their Ideas*, Deborah Meier (2002) shares her beliefs that democracy demands that people acknowledge everyone's capacity to be an inventor, dreamer, and theorist and that people expect each individual to count in the larger scheme of things. She explained

My vision of schooling is that all children could and should be inventors of their own theories, critics of other people's ideas, analyzers of evidence, and makers of their own personal marks on this most complex world. The task of creating

environments where all kids can experience the power of their ideas requires unsettling not only our accepted organization of schooling and our unspoken and unacknowledged agreement about the purposes of schools. Taking this task seriously also means calling into question our definitions of intelligence and the ways we judge each other. And, taking it seriously means accepting public responsibility for the future of the next generation. (p. 4)

Learning environments must enable each student to attain his/her greatest potential and to determine how he/she wants to make a contribution to each other and their communities. As James Banks (2001) noted:

Democratic societies are fragile and are works-in-progress. Their existence depends upon a thoughtful citizenry that believes in democratic ideals and is willing and able to participate in the civic life of the nation-state. Public schools are essential to maintaining our democratic way of life. The increasing diversity within the nation and its schools poses serious challenges as well as opportunities. To forge a common destiny, educators must respect and build upon the cultural strengths and characteristics that students from diverse groups bring to school. At the same time, educators must help all students acquire the knowledge, skills, and values needed to become participating citizens of the commonwealth. Cultural, ethnic, and language diversity provide the nation and the schools with rich opportunities to incorporate diverse perspectives, issues, and characteristics in order to strengthen both. (p. 5)

Goals of Schools in a Democracy

Some of the researchers in the literature reviewed contend that important goals of schools in a democracy should be to produce citizens who treat each other with respect: who value the contributions of others with whom they interact irrespective of their race, class, or gender, as well as who act with a sense of justice in considering the needs of others in society (Banks, 2001; Gay, 2000; Weisglass, 1998). Further, in considering the role of American democracy from a global perspective, many scholars (Boaler, 2008; Gardner, 2004; Noddings, 1997; Resnick, 1987; Ritchhart, 2006) unite in calling for additional opportunities on behalf of students to learn to think analytically and creatively,

to work across disciplinary boundaries, and to interact productively with individuals from different cultural backgrounds.

In our representative democracy, schools need to play a significant role in providing all learners with the knowledge and skills they will need to participate in sustaining and improving the communities in which they live (Glickman, 1993). Thus, Glickman suggested that K–12 education leaders and teachers be innovative and persistent in their efforts to provide all students with personally meaningful learning opportunities that help them realize their greatest potential.

In the late 1970s and the early 1980s, John Goodlad (1984) and his colleagues conducted one of the most comprehensive research projects involving many hours of structured and sustained classroom observations across the country in all types of schools. He and his team found that “schooling is everywhere very much the same (1984, p. 264).” According to this research, conventional classroom interactions usually consist of: students primarily playing a passive role; teachers using whole-group instruction as the primary method of instruction; teachers largely controlling what goes on in the classroom; and, teachers spending a great deal of time talking. Seating arrangements, materials being used, teachers’ roles, students’ roles, and teaching methods gave these researchers reason to conclude that there were significant similarities among schools. Students were more often valued for their academic aptitude rather than for their unique characteristics as individual persons. In Sizer’s forward to Goodlad’s 2004 edition, he noted that Goodlad found many well-intentioned teachers who were detached from the “other lives” of their students; that is, the lives they lived outside of the classrooms. Further, these inadequacies of schooling increased as students grew older where these

researchers witnessed little engagement in schools; 70% of class time was talk—usually teacher to student—and only 5% was dedicated to student responses that required reasoning or opinions from the learners (pp. 165–166). Given the magnitude of this study, with 14 foundations and agencies funding the work, these conclusions have influenced educators since the original study.

Twenty years later, when Goodlad (2004) was persuaded to republish these study results, he wrote in the afterword that the past 20 years of reform and the national, state, and local standards movement have had “little impact on the deep structures of schooling” (p. 369) and a similar study of schooling “conducted now would result in findings much as they were before” (p. 370). There remains a serious disjuncture between schooling and society—that is, between the school curriculum and the students’ classroom experiences and the lives students live outside of school.

As they currently function, “the mission of our schools is confused and they are not able to support the acquisition of our democratic goals including freedom, equality, and justice for all” (Goodlad, 2004, p. 370). From a logical perspective, schools must do educationally what the rest of society does not do or does not do well. Primarily, that means educate youth in democratic character “including a publicly supported apprenticeship in democracy” (p. 373). Goodlad defined components of schooling that are in urgent need of change. One component—the use of teaching practices that meet the needs of all students—is applicable to the current study.

All Means All

Asa Hilliard (Perry & Hilliard, 2003), renowned advocate for opportunities to learn for all students coined the phrase, “All Means All”. Through his lectures and writings,

Hilliard noted that successful educators, those who achieve excellence and results, “worry more about their students’ opportunities to learn and about their own teaching than about the students’ intelligence or capacity” (Perry & Hilliard, 2003, p. 142). He regrets that professional literature is still filled with student, family, and cultural deficit theories and proposed minimum competency remedies that reflect pessimism about the power of teachers, schools, and children.

Hilliard (Perry & Hillier, 2003) asks educators to be clear about different definitions of achievement gaps, and proposes that the important gap to study and remedy is the gap between current levels of achievement and high academic standards for any specific group of students (p. 143). Too often, the achievement gap is defined as the achievement of one group of students compared to the achievement of another group that is performing poorly or significantly lower than their potential. This definition has the potential to limit thinking about all that is possible because current achievement results are used unconsciously to reset the levels of achievement that are possible.

Significance of this Study—

Meeting the Needs of All Learners in an Increasingly Culturally Diverse Population

In the United States, the number of students of color, and biracial, multiracial, and multilingual students will continue to increase. In 1995, 35% of learners enrolled in United States’ schools were students of color. By 2020, if demographic trends continue, Banks (2001) suggests that 46% of learners enrolled will be students of color. Since 1990, the number of English Language Learners who are not able to participate fully in mainstream classes has increased from 1 in 20 to 1 in 9; by 2018, it will be 1 in 4

(Goldenberg, 2008). America's thriving democracy depends on using our collective expertise to service the needs of these growing numbers of students.

As leaders have worked to create systems of schools that meet the needs of all students and offer all students access to instruction based on content standards that are rigorous and comprehensive within each discipline, too many students' needs are not met nor are they achieving at high levels (Darling-Hammond, 1996; Elmore, 2005; Gay, 2002; Sinclair, 1987). Often, these students on the margins are students of color, students from low socioeconomic status families, and students who speak English as their second language. There are many reasons for this reality, including individual student perceptions and dispositions (Cushman, 2005; Meier, 1995); the impact of district and school administrators, teachers and others who hold colorblind ideas about students' potentials and their own leadership responsibilities (Perry, et al., 2003; Schofield, 1995); and, the complexity of learning and teaching challenging content as in the case of understanding mathematical concepts (Boaler, 2008; Gutstein, 2003; Noddings, 1993; Resnick, 1987). Because mathematics achievement is a cornerstone to further academic success in school and living a higher quality of life (Huebner, et al., 2008), it is important to study and document successful efforts to raise the achievement levels among students of color and others who have been marginalized within mathematics classrooms.

All Means All in Mathematics

It has been documented repeatedly that students' success in secondary mathematics is important to their quality of life and life successes. Success in algebra is a gateway to later achievement. "Students who do not take and pass a rigorous math sequence in high school—generally, Algebra I, Geometry, and Algebra II—are ineligible

for admission to many four-year colleges and universities” (Huebner & Corbett, 2008, p. 1). Success in Algebra, Geometry, Algebra II, and higher level courses correlates powerfully with access to college, graduation from college, and earning an income in the top quartile of the overall population. In fact, students who complete Algebra II are more than twice as likely to graduate from college than students with less mathematical preparation. Further, two-thirds of all future jobs will require college-level math skills. Consequently, students who identify themselves as unable ‘to do’ mathematics are at an increasingly greater disadvantage. The National Science Board reported that the growth of jobs in the mathematics-intensive science and engineering workforce is outpacing overall job growth by 3:1 (Huebner, Corbett, & Zimmerman, 2008). While scores on the National Assessment of Educational Progress (NAEP), considered the only nationally representative assessment of what students know and can do in various subjects, indicate positive trends at Grades 4 and 8, results in 2005 indicate that more than 75% of high school seniors taking the exam scored below proficient in mathematics. Three years later, 2008 results show that only 23% score at or above the proficient level in mathematics in grade 12 (Perie, as cited in Huebner, et al, 2008).

Additionally, in Colorado, data from the Colorado State Assessment Program (CSAP) revealed similar realities (Colorado Department of Education website). In 2007, 65% of the fifth graders scored at the proficient and advanced levels on the mathematics portion of the test, while 38% and 31% of the ninth and tenth grade students scored at those levels respectively. Consistent with these findings is the growing demand for remedial mathematics education among students entering four-year colleges and community colleges across the nation (Huebner, et al, 2008). Strengthening the support

we provide “to all students in mathematics matters to our democracy at large and to individual students and their families, because it opens doors and creates opportunities” (National Mathematics Advisory Panel, 2008, p. xi).

Researchers suggest that middle school programs can be designed to support greater achievement for all students that will eliminate the gaps in achievement among groups of students. A dual focus of increasing the percentage of students who score proficiently on state and national tests and who leave eighth grade ready for college preparatory work in high school is supported by various organizations that advocate for middle school students. Groups of middle school leaders and staff have been utilizing strategies such as:

...implementation of an academic core curriculum aligned to rigorous content and performance standards; the definition and use of a comprehensive guidance and advisement system that connects students and families to the school and that helps students develop educational and personal growth plans for the future; high expectations for all students and a system of extra help and time for learners who need it; classroom practices that actively engage students in their learning; teachers working together supported by time and structure; and using technology to advance learning (Making Middle Grades Work website, 2008).

Teaching To and Through the Strength of Students

During the last three decades, researchers have examined ways that teaching can better match the home and community cultures of students of color and English language learners who have not had academic success in schools. Au and Jordan (1981) termed “culturally appropriate” (p. 139) the pedagogy of teachers in a Hawaiian school who incorporated aspects of students’ cultural backgrounds into their reading instruction. “Culturally congruent” (Mohatt & Erickson, 1981, p. 110) instruction developed from these ideas and was more explicit in bridging the students’ home language with the

language used in school. “Culturally compatible” (Ladson-Billings, 1995, p. 467) was used to describe the ways in which teachers were able to include aspects of the students’ cultural environment in the organization and instruction of the classroom. Each had as the main goal supporting students in the acquisition of academically desirable behaviors. Ultimately, all of these strategies are limited in that they promote the goal of education for students of diverse cultures focused on those skills needed to succeed in mainstream society without attention to honoring a student’s “natal culture” (Singer, as cited in Ladson-Billings, 1995). At times, the students’ academic success comes at the expense of their cultural, psychological, and social well-being.

Applied to the study of mathematics, researchers have reported various ways that teachers help students who have cultural or linguistic uniqueness in learning and understanding. These include teaching mathematics in culturally relevant ways (Gutstein et al., 1997; Ladson-Billings, 1995); teaching in critically literate ways (Frankenstein, 1997); and, using students’ and their community’s funds of knowledge in the development of curriculum (Gonzalez et al., 1993).

As researchers have studied the characteristics of classrooms and teaching strategies that are better able to support achievement for all students, work has been done to define a comprehensive pedagogy termed *culturally responsive* or *culturally relevant*. Here, using the cultural knowledge, prior experiences, frames of reference, and performance styles of ethnically diverse students to make learning encounters more relevant to and effective for them, educators employ culturally responsive teaching strategies which respond to the strength of students (Ladson-Billings, 1995). Such strategies are “culturally validating and affirming” (Gay, 2000, p. 29). In connecting the

goals of schools in a democracy to mathematics teaching and learning, the question becomes, according to Goodlad (2004): Can the deep structures of schools and the regular routines used in middle school mathematics classrooms be altered and adjusted to honor and accommodate the unique characteristics of students and their current levels of understandings based on their cultural experiences?

A better understanding of culturally responsive teaching strategies among mathematics teachers is needed. For this reason, the current research study is designed to answer the question:

How do effective middle school mathematics teachers employ culturally responsive teaching strategies?

Three subsequent questions that are used to organize data collection and analysis include:

1. How do these teachers provide every student with a regular and respectful opportunity to learn challenging content at a deep level?
2. How do these teachers facilitate purposeful student interactions regarding student generated solutions and solution methods focused on understanding mathematics?
3. How do these teachers share decision-making and leadership with all students?

The purpose of this study is to contribute to the emerging definition of learning experiences in mathematics that support middle school students through the use of culturally responsive teaching strategies. These experiences are organized to actualize the balance between accommodating the individual student's culture, needs, and interests, as well as to attain appropriate mathematics learning goals. Overall, such definitions can further more sustained consideration of equality of opportunities for learning; of the purpose of public schooling; and of the nature of learning in a democracy. Ultimately, access to equal educational opportunities can be an influence on students' capacity to act

equitably—that is—develop a sense of “otherness” (Meier, 1995, p. 142) and a commitment to social justice. Whether the teaching of respect and social responsibility is employed through a curriculum area such as citizenship education or a pedagogical approach such as group work, there is a growing awareness of the need to teach students about respectful human relations, especially across different cultural groups and genders (Boaler, 2008, p. 172).

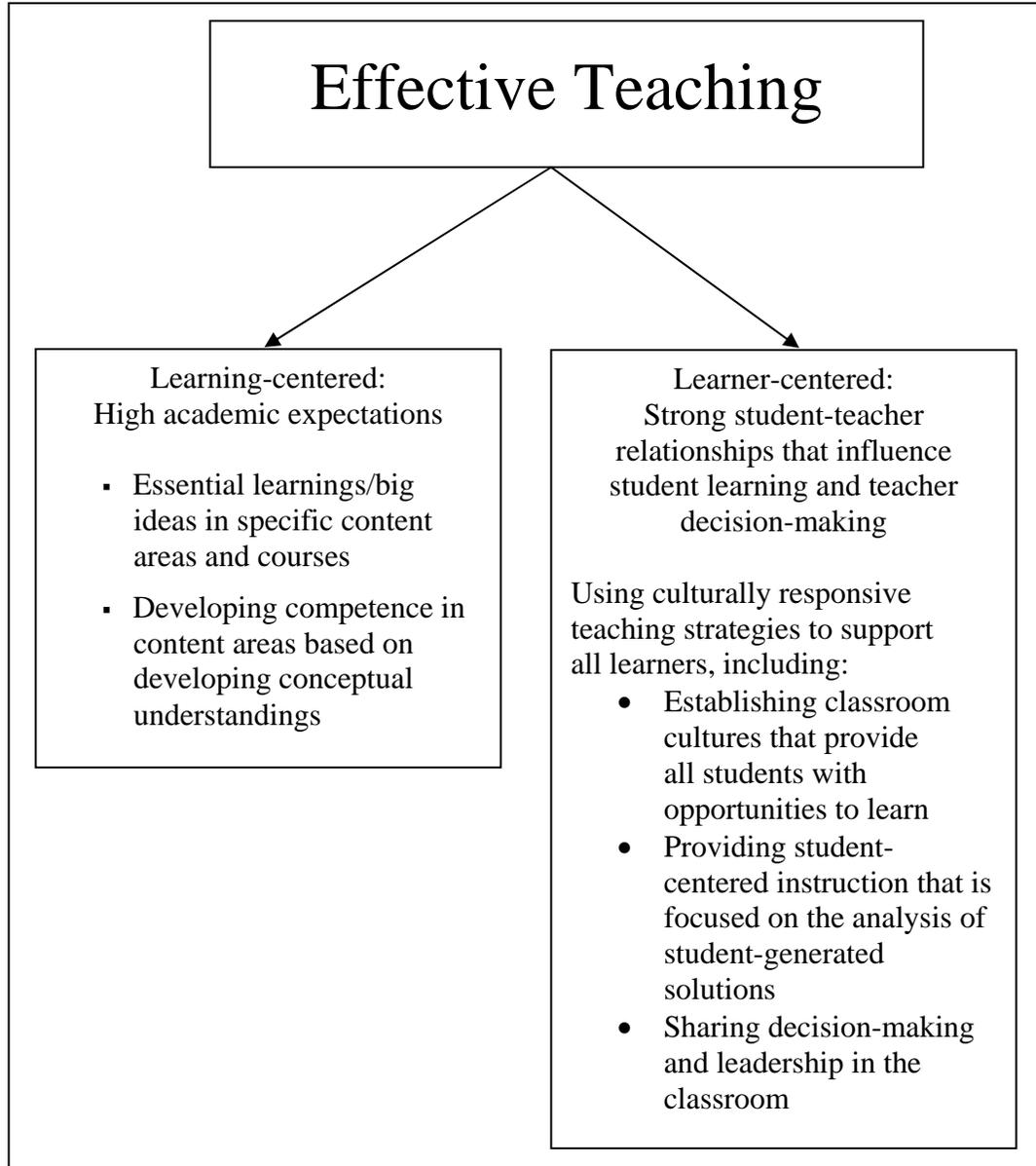
The current research is based on the belief that learning experiences within content area classes—such as mathematics—can contribute to the actualization of goals such as these. A secondary purpose for this study is to assist in the refinement of questions that can motivate future research projects.

This study was guided by a conceptual framework created from Linda Darling-Hammond’s (1996) definition of the complexity of effective teaching focused on establishing learning-centered classrooms, including challenging curriculum goals for all students; and learner-centered classrooms, attentive to the needs and interests of individual learners. Darling-Hammond maintains that teachers who are successful with all students maintain two intertwining strands of thought at all times and continuously ask themselves the question:

How am I doing at moving the students toward high levels of understanding and proficient performance, and how am I doing at taking into account what students know and care about in the process of moving them toward these curriculum goals *and* developing their individual talents? (p. 9)

Figure 1 defines several of the variables involved in thinking about this important question.

Figure 1: Effective Teaching



Culturally responsive teaching in middle school mathematics requires striking the balance that Darling-Hammond (1996) defines amid differences in culture, interests, and achievement levels among students. The current study is focused on the learner-centered portion of this question rather than investigating the learning-centered portion or a combination of the two.

Culturally Responsive Teaching

What we now call multicultural education originated in the 1960s as a corrective strategy to the long-standing de facto policy of assimilating minority groups into the “melting pot” of dominant American culture (Sobol, 1990). Supporters believe that giving all students opportunities to learn about their own and others’ cultures leads to a more informed citizenry and a stronger democracy (Banks, 1994; Sleeter, 1992). They advocate for allowing people to maintain attachments to their own cultural communities as well as participating effectively in a shared national culture. “Diversity without unity leads to the fracturing of the nation-state and unity without diversity results in cultural repression and hegemony” (Banks, 2003, p. 19). Though opponents of multicultural education worry that it threatens to divide students along racial and cultural lines, rather than serving to unite them as Americans (Nieto, 1992), the implementation of multicultural strategies in education have had an important influence (Gay, 2000; Glickman, 1993; Perry, 2003).

As a specific component of multicultural education, multicultural literacy (Banks, 2003) is defined as a high priority—as high as proficiency in reading and writing—for democratic citizens in a multicultural society. Multicultural literacy includes the dimensions of identifying the creators of knowledge and their interests (Banks, 1994) and therefore, viewing knowledge from diverse ethnic and cultural perspectives. Such skills can support learners in formulating possibilities for action to create a more humane and just world. Comprehensive culturally responsive teaching supports the development of multicultural literacy (Banks, 2001, 2003; Gay, 2000, 2002; Ladson-Billings, 1995; Shade et al, 1997).

Goals and Components

Ideally, strong culturally responsive teaching provides for high academic achievement; acquiring and maintaining individual self-worth; cultural affirmation and competence; personal connections and community building; and, developing an ethic of caring. Students who are the recipients of such teaching are better able to “both understand and critique the existing social order” (Ladson-Billings, 1995, p. 474).

Students often report that when teachers facilitate genuine exchanges of ideas and support between themselves and their classmates, they can develop together a sense of connectedness in the classroom and responsibility for one another (Ladson-Billings, 1995). In the end, no one is left to struggle alone. Teachers who create opportunities for students to talk through learning tasks together and share their personal preferences about issues under discussion (Gay, 2002) further the acquisition of the goals of culturally responsive teaching. Teachers help students develop positive self-concepts, social interaction skills, cultural pride, and community building skills (Shade, 2001).

Formed in 1999, the Minority Student Achievement Network (MSAN) currently consists of more than 20 middle- and upper-middle-income school districts in nine different states. Leaders in these districts jointly seek ways of narrowing gaps between European-American and Asian-American students on the one hand and Hispanic and African-American students on the other. Students from these districts in grades 7 through 11, including 7,120 African Americans, 17,562 European Americans, 2,491 Hispanics, 2,448 Asians, and 4,507 mixed-race students responded to the “Ed-Excel Assessment of Secondary School Student Culture Survey” during the 2000–2001 school year. Sample questions included: How much of the material that you read for school do you understand

very well? and, What percentage of the time do you completely understand the teacher's lesson? Demographics information included grade-point average, access to a computer at home, and books in the student's home. Findings concerning teacher and student relationships and teacher encouragement focus attention on the possibility that effective teacher-student relationships may be especially important resources for motivating all learners, particularly African American and Hispanic students. Within caring communities, students may seek help more readily, be engaged more deeply, and, ultimately, overcome skill gaps that hinder their success. Results from this survey revealed that nonwhite respondents depend on teacher encouragement as distinct from teacher demands for their security and success in learning environments. Such teacher-student relationships are an important source of achievement motivation for these students in particular.

The Dilemmas for African Americans

Fordham and Ogbu (1986) identified a phenomenon entitled "acting white" where academically successful African American students were ostracized by their peers (p. 176). These two researchers define the long standing quest for a literate populace among African Americans that contradicts the glib pronouncements of, "Black people don't value education" so commonly heard even within the past decades.

Some researchers argue that there are extra social, emotional and cognitive competencies required of African American students—precisely because they are African American—if they are to succeed in our public schools (Banks, 1992; Perry, 2003; Ladson-Billings, 1994, 2005). In their important book, *Young Gifted and Black*, three

African American authors claim that African American students continuously face dilemmas that influence their achievement results such as:

- How do I commit myself to do work when African American intellectual inferiority is so much a part of the taken-for-granted notions of the larger society? Even good well-intentioned people register doubts about my intellectual competence.
- Will I be willing to work hard over time given the unpredictability of my teachers' responses to my work?
- Can I commit to work hard even if my accomplishments are not likely to alter the African American caste like position in society? I still will not be able to get a cab. I still will be followed in department stores. I still will be stopped when I drive through certain neighborhoods. I still will be viewed as a criminal, a deviant, and an illiterate.
- Can I commit myself to hard work and achieve at high academic levels if the results may be that I am separated from the culture of my reference group? (Perry, 2003, pp. 4–5)

For African American youth to succeed, they need strong school cultures that are focused on achievement and accomplishment, and they “need to be immersed in a consistent public counter narrative—a narrative that helps them to grapple with the dilemmas listed above” (Perry, 2003, p. 92). These narratives can help individuals develop identities that are focused on achievement and build “effort optimism” (Perry, 2003, p. 60)—that is, the relentless desire to keep trying even though you are not always rewarded for your effort or your achievement. Perry discusses the importance of helping students build cultural capital without passing judgment about their lack of background knowledge or experience, and the importance of accepting individuals for the talents they have cultivated and experiences they have had.

Steele and Hilliard extend Perry's desire to help the reader understand how challenging schooling is for African American students in an “allegedly open and integrated society” (p. 100). Steele defines the concept of stereotype threat and how it can

impact achievement for individuals. Any person can be threatened by the concrete fear of being judged and treated poorly in settings where a negative stereotype about one's own group applies (p. 112). For example, one could think, "Because I was raised in a poor community, if others find out, will they doubt my ability to lead this team?" or "Because I am African American, will the parents of my students doubt my ability to help them learn?"

Steele (2003) claims that for those who care about supporting learning for all students, the question becomes, "Can any educational experience be designed to lessen the impact of such stereotype threats so that academic achievement is not negatively influenced?" (p. 127) His research results suggest that by defining high standards of performance and providing specific feedback to learners within trusting environments, school leaders can reduce the impact of such threats and fears.

It remains true that "the fewer black males in a school in proportion to the number of white students, the more likely those young African American males will have access to the resources needed for them to graduate on time and be prepared for college work" (Holzman, 2007). But, schools remain segregated, and many African American students attend schools with large numbers of other African Americans (Kozol, 2008). Beyond these realities in public schools, African Americans are still less healthy than whites, have shorter lives, and are sent to prison at rates many orders of magnitude higher than that of whites for similar activities (Holzman, 2007).

Quality Teaching Matters

Teachers and other leaders in schools can have a dramatic impact on the achievement of all students even as school populations become more and more diverse.

Recognizing and learning about differences can lead people to greater respect for those around them. Teachers who have learned about students' cultural backgrounds are better able to meet their students' needs, and they develop sensitivities that influence their daily teaching (Cushman, 2005; Howard, 1999; Shade, 2001). It is often the case that the more they learn about others, the more they want to learn, and the more they realize they have to learn.

More than 50 years ago, John Dewey defined three tasks for teachers in relation to supporting student growth:

- a) He wanted teachers to appreciate the incompleteness of the ways of a child **and** the great potentiality of childhood. Therefore, teachers must find ways to enrich, balance, and clarify the experiences of children.
- b) Unguided discovery takes a learner only so far. Learners benefit from reflection about the relationships between experiences.
- c) Connecting learners' experiences to their culture and heritage, and the subject disciplines can enhance the achievement of growth targets (Skilbeck, 1970).

He was forever and always an optimist about the tremendous potential of each child. To attain their highest potential, he said, learners need others to pay attention to their developing capacities. Dewey's beliefs and actions live on in the beliefs and actions of Jonathon Kozol. Kozol (2007) prods educators to take time "to forge the subtle bond that will permit students to reveal themselves" (p. 70). And Geneva Gay (2000) agrees that such bonds are essential—"particularly for African American youth—because a child cannot be taught by anyone whose demand, essentially, is that the child repudiate his experience and all that gives him sustenance, and enter into a limbo in which he will no longer be black" (p. 85).

Multicultural researcher Pang (2001) confirms that the attitudes and behaviors of classroom teachers profoundly influence the academic success of culturally diverse

students. In this study, the students themselves—from culturally diverse and socioeconomically impoverished communities—all attributed their achievement to self-efficacy, educational relevance, and teacher support and encouragement. In a separate case study of a fifth grade inclusive classroom project, the researcher found that when teachers provide a nurturing classroom environment for all students and include student voices—by defining the connections within the curriculum to student’s life experiences—all students have a greater opportunity for success (Brown, 2002). Their academic achievement is influenced and they develop a sense of respect for themselves and others in their community.

Learning experiences can be organized to assist teachers and students in seeing that groups are composed of individuals with their unique characteristics who may be similar to and different from those in both their in-group and in out-groups (Schofield, 1986). Individuals can learn to diminish the tendency to stereotype and the tendency to see group membership as defining individuals’ characteristics (Banks, 1994; Perry, 2003). Ultimately, culturally responsive teaching can “provide students with opportunities to build shared identities as members of the school, the community, and the nation that complement and supplement—rather than replace or undermine—their identities as members of specific social groups” (Schofield, 1986, p. 251).

In another project, the common thread of caring for eight teachers studied in Ladson-Billings’ research was their concern for the implications that their work had on their students’ lives, the welfare of the community, and unjust social arrangements. Each of the teachers spoke about the importance of their work “for preparing the students for confronting inequitable and undemocratic social structures” (Ladson-Billings, 1995, p.

474). Each of these teachers worked from a strong ethic of care and hoped to teach all of their students to care.

An analysis of learning environments that support quality learning and teacher moves that support such learning leads to a greater value of the four components of developing an ethic of care in others that Nel Noddings (1992) defines in her book, *The Challenge to Care in Schools*. Noddings believes that we—ideally—learn to care for family at home, and then expand our circle of caring to include friends, acquaintances, and eventually to care about and for those we can't care for directly. She considers education as central to the development of a caring society. Noddings (1992) believes that we can teach people to care through **modeling**, where educators demonstrate caring in their own interactions with students; **dialogue**, where educators engage in and encourage dialogue about caring to improve upon the practice of it; **practice**, where educators provide opportunities for learners to engage in and reflect upon caring; **confirmation**, where educators seek to understand what motivates learners, and **confirm**, the individual steps and attitudes that lead to their evolution into caring beings. Caring relationships allow one to deal with the ambiguity necessary for a greater good to occur. Specifically, in mathematics education, Noddings (1993) defines the results of acts of caring on the part of teachers:

Understanding and accepting student purposes, we ask different questions of different students and urge them to design their investigations so that they are adequate for their own well-considered purposes (p. 35). Our goal is to move students toward ever more powerful constructions. Turning students loose “to construct” will not in itself ensure progress toward genuinely mathematical results. Teachers must ask questions that challenge ill-formed hypotheses and weak conjectures. They must pose new problems that require the revision of old constructions and sometimes they simply must show how things are done. In the last case, wise teachers

take note of their own decision to tell or show and watch for later opportunities to encourage construction (p. 42).

Caring requires us to elicit and listen to how students are feeling, and to evaluate their purposes in order to help them to engage in self-evaluation, and to help them grow as participants in caring relations (p. 45).

Promising Practices in Mathematics Education

Equity and Opportunity for All

The National Council of Teachers of Mathematics (NCTM) published the initial *Curriculum and Evaluation Standards for School Mathematics* 20 years ago (1989) and established equity as an aim of mathematics education reform within the goal of opportunity for all. The *Standards* stated that “the social injustices of past schooling practices can no longer be tolerated” (p. 4) and embraced democratic citizenship with mathematical literacy as a key component.

The revised *Principles and Standards* (NCTM, 2000) defines six unifying principles and promotes equity as the first among them. This prioritization demonstrates a deeper concern for equitable outcomes than in the earlier document and reiterates a strong stand against tracking and other forms of differentiated curriculum for various groups of students. Grouping practices that separate learners into tracks diminishes some students’ hopes, goals, and opportunities (Boaler, 2008; Meier, 1995; Oakes, 1985; Sinclair, 1987). The authors insist that all students have access to high-quality curriculum; technology and highly qualified teachers with adequate resources and subject-matter knowledge. They promote uniformly high expectations of all students.

Since its publication, leaders and mathematics education community members nationally grapple with the challenge of how to transform inequitable mathematics classrooms into equitable ones. While confronting this challenge, they have raised

questions about how to achieve the principle purpose outlined in these documents—a just society—and what specific role mathematics teachers and mathematics education can play in reaching that goal (Apple, 1992; Boaler, 2005, 2008; Gay, 2002; Perry, 2003). Learning mathematics can help students better understand the context of their own lives, and understanding the injustices and reality of their own lives can motivate a deeper study of mathematics (MacLeod, 1991 in Gutstein, 2003).

During the past 15 years, much has been done to “democratize access to mathematics courses and learning opportunities” (Triesman, 2008). Now, 20 of 24 states participating in a mathematics reform initiative that he leads require Algebra II for all high school graduates compared to 15 years ago when Algebra I was the highest course taken by 55% of high school students. Then, many students were enrolled in courses like ‘General Math’ ‘Consumer Math’ and ‘Career Math’ which only offered students access to a basic skills curriculum. Presently, determining how to support the learning of higher level mathematics for a much more diverse group of students is a compelling task.

We live in a time of great change in mathematics education. The National Council of Teachers of Mathematics (NCTM) Standards and other influential reports have called for radical reform in U.S. school mathematics in order to prepare *all* students to meet the mathematical demands of today’s society...This new focus departs radically from the way mathematics has traditionally been taught. (Foundations—National Science Foundation, 2002)

Perhaps the most significant changes are needed where traditions are the strongest—in middle school and high school classrooms.

Valuing Multiple Dimensions of Mathematical Work in High School Classrooms

Too often, secondary mathematics teachers rely on traditional teaching methods that do not support learning for all students, especially children of color and those from

lower socio-economic status families. The sequence of events in traditional mathematics classes is familiar. The class period begins with either a review of the lesson from the previous class or time is devoted to checking answers on assigned homework problems. Next, the teacher uses direct instruction to explain new types of problems, allows the students to try some examples, and expects learners to begin working individually on the next problem set.

Often times, “coverage of material is a higher priority than helping students develop mathematical understandings” (Schoenfeld, 1988, p. 153). And, without a focus on helping students develop understandings, some educators are concerned about what students really learn. In many cases, they learn isolated procedures and facts and they develop ways of being successful in mathematics classes that have no mathematical value. For example, students will solve problems using proportions because the chapter in the textbook is about proportions. Or, if they encounter a word problem where one number is large and the other is small, they divide. But if the numbers don’t divide evenly, they multiply.

It is common to observe math teachers who for 15 or 20 minutes stand at the board, ask questions, and then answer their own questions. Periodically, a student gives a one or two word answer, and the teacher interprets that limited interaction to mean that everyone understands. Therefore, they move on and cover more content. The teacher pays little attention to who answered, and many students become accustomed to being invisible. In such settings, students only know they are doing well if they are doing better than others, which impacts the way students think about each other (Cushman, 2003, 2008).

In a comprehensive five-year longitudinal study of three high schools in California including more than 700 students, Boaler (2008) found that in one of the schools, in particular, students achieved at high levels, learned effective problem-solving behavior, and learned to respect students from different cultural groups, social classes, and genders. Importantly, the goals of high equitable achievement and equity-minded learners who treated each other with noteworthy degrees of respect were achieved simultaneously through a mixed-ability mathematics approach (2008, p. 168). Though the use of curriculum materials that are designed to connect with students' cultures has been proven to be effective (Gutstein, 1997; Lee, 2001), the high achievement results in Boaler's study were more the result of a focus on multiple solution methods and paths, and support for substantial discussion and negotiation among the learners. The teachers in her study paid explicit attention to the ways in which students would need to work, including "starting projects by outlining what successful work looked like and stopping students to highlight a productive way of working" (Boaler, 2008, p. 171).

Teachers used a multi-dimensional instructional approach that included assigning student roles in small group work so that they learn to take responsibility for themselves and each other, acting on high expectations for each student, defining success in mathematics in multiple ways, and regularly emphasizing effort over innate ability as a cause for increased learning and high achievement (Boaler, 2006). Multi-dimensional approaches to instruction award students for using different methods, asking questions, representing ideas and having good discussions in addition to completing tasks and executing procedures.

When the classroom activities and procedures are multi-dimensional, more students may be good at some of the activities and regarded as contributing in important ways. Teachers and students can give lower status learners—those who are traditionally marginalized in learning environments—public and specific feedback that is focused on the learning and growth experienced by each student. This regular acknowledgement honors individual contributions and nurtures their motivation. Additionally, when teachers carefully orchestrate student interactions in the classroom, “students can assume a more active role in explaining and learning mathematics. Often, conversations that originate with the teacher result in dialogue that in uni-dimensional, mostly provides factual information, and minimally results in sense-making opportunities. If teachers encourage students to persist in their own questioning, they are provided with more detailed explanations, new examples, and various solution methods from their peers or their teacher” (Piccolo, 2008, p. 376).

Such attention to individual students and their reasoning contributes to the attainment of “democratic equality” defined as an individual standing as an equal over the course of an entire life (Anderson, 1999). One common behavior of students while learning mathematics is their willingness to ‘give up’ easily because of their belief that success in mathematics is largely a matter of inherent talent or ability, not effort (National Math Advisory Panel, 2008). Effective mathematics teachers can help students and parents understand that increased effort is related to improved mathematics achievement.

Boaler and her fellow researchers observed over 600 hours of lessons in three high schools, and analyzed assessment results, answers on questionnaires, and student

interview data yearly to come to the conclusions that they report. At Railside High School, the students were from diverse ethnic and cultural groups and largely from low-income homes. The chart in Figure 2 includes details about the mathematics learning opportunities and achievement results for students at the three high schools included in their study.

Figure 2: Mathematical Work in High School Classrooms

Category	Traditional Approach— Hilltop and Greendale High Schools	Multi-dimensional Approach— Railside High School
Classroom time teacher lectures/demonstrates solution methods	21%	4%
Classroom time teacher asks questions of students in large group	15%	9%
Classroom time students practice problems independently	48%	0%
Classroom time students solve problems in small groups	11%	72%
Classroom time students do presentations	0.20%	9%
Average time students work on each question	2.5 minutes	5.7 minutes
Students who report a sense of responsibility for their classmates	5%	59%
Students who agree: “Anyone can be really good at math if they try.”	52%	84%
Student achievement results	While Railside High School students began High School with lower math scores than students at Hilltop and Greendale High Schools, within two years, these students outperformed the students at Hilltop and Greendale High Schools.	
Seniors in advanced placement Mathematics classes	27%	41%
Achievement differences between groups	Achievement differences between White and Hispanic students (two main groups represented) remained.	Achievement differences between White, Black, and Hispanic students disappeared.

The results at Railside High School included students who learned to value the act of helping and to care about the learning of other students. Students took responsibility for their peers' learning including helping others stay focused, persist, and stay motivated to learn. Students explained that "the purpose for learning and knowing was not so that you could be better than others, but so that you could help others who had not learned what you knew"(Boaler, 2008, p. 189). They realized that the act of explaining work deepened their own understandings. The students learned that they could solve complex problems through persistence and collaboration with others. They learned to value the different and varied ways in which different people solved problems. They learned "to respect students from different ethnicities, genders, and social classes and they learned effective methods of communication" (Boaler, 2008, p. 190). They saw the value of collective knowledge and expertise compared to individual achievement that is so much a part of traditional classrooms.

The reality that heterogeneous groups of students produced these sorts of results "where no one was left struggling or feeling bored was due to the careful work of the teachers" (Boaler, 2006, p. 182). The Railside teachers showed that "mathematics is as open as any subject to the opportunities for students to learn powerful forms of communication, as well as positive and respectful intellectual relations" (Boaler, 2006, p. 189). The pedagogical practices resulted in the diminishment of achievement differences between students from different cultural groups and the increase in socially just dispositions.

Reasoning and Sense-Making in Mathematics

Reform-oriented practices refer to a comprehensive approach to mathematics instruction centered on teaching for understanding and enabling all students to engage with meaningful problems and “big ideas” in mathematics (NCTM Standards 1989, 1991, 1995, 2000, 2008). Studies that have monitored the impact of conceptually oriented mathematics materials taught well and with consistency have shown higher and more equitable results for participating students than procedure-oriented curricula taught using a demonstration and practice approach (Boaler, 1997, 2000; Brains and Resnick, 2000). Effectiveness in mathematics teaching at the secondary level depends on the use of strong teaching skills and solid knowledge of the subject matter of mathematics (Ball, 1991; Hill Rowan, and Ball, 2005), especially when many students enter middle school and high school performing several years below grade level (Neild and Balfanz, 2006).

In his important book, *Sensible Mathematics*, Leinwand (2000) lists eight characteristics of sensible, sense-making mathematics:

- **Access.** Mathematics is taught in an environment that gives students access to mathematics and invites them to learn.
- **Learning.** Mathematics is taught in ways that use alternative approaches and multiple representations to develop understanding among students with diverse learning styles.
- **Skills.** Mathematics curriculum and instruction acknowledges that there is a rational set of skills that all students need to master, but that many of the skills once considered essential are today obsolete and must be purged from the curriculum.
- **Tasks.** Mathematics makes extensive use of high-quality instructional and assessment tasks to introduce, develop, reinforce, connect, and assess understanding of key mathematical concepts.
- **Language.** Mathematics relies on language—both oral and written—to support the development of mathematical understanding in language-rich classrooms.
- **Integration.** Mathematics is taught in ways that consistently connect the mathematics being learned to other mathematical ideas as well as to other disciplines.

- **Coherence.** Mathematics is taught within coherent programs in which curriculum, instruction, professional development, community expectations, and assessment are aligned and mutually supported.
- **Thinking.** Mathematics is part of a thinking curriculum, as opposed to a parroting curriculum, in which “Why?” and “How do you know?” are pervasive questions in all teacher–student and student–student interchanges (pp. 41–42).

Taken together, these characteristics define classroom environments and experiences that support students’ efforts to become confident and competent in mathematics. And, according to Ruth Parker, these two qualities are the basis for “mathematical power” (1996). The *Standards* document (NCTM, 2000) defines mathematical power as:

Students confidently engage in complex mathematical tasks...draw on knowledge from a wide variety of mathematical topics, sometimes approaching the same problem from different mathematical perspectives or representing the mathematics in different ways until they find methods that enable them to make progress...are flexible and resourceful problem solvers...work productively and reflectively...communicate their ideas and results effectively...value mathematics and engage actively in learning it (p. 3).

Most recently, the Curriculum Focal Points project of the National Council of Teachers of Mathematics promotes the idea of organizing a curriculum around a few major topics or ideas at each grade level (NCTM, 2006). According to NCTM, a well-articulated curriculum gives teachers guidance regarding important ideas or major themes which receive special attention at different points in time. It also gives guidance about the depth of study warranted at particular times and when closure is expected for particular skills or concepts (1989, 2000). The issue for mathematics is not teaching more or teaching less, it is about teaching better. The issue is emphasis, organization, and learning. What is needed at each grade level is a strong, well-defined core set of concepts and skills, which can then support learning across the grades.

According to the National Council of Teachers of Mathematics (NCTM), centering mathematics instruction on problem solving with engaging problems can help all students learn key concepts and skills in motivating contexts (1989, 1991, 2008). NCTM-inspired problems have two important characteristics. First, the problems are “open”—they have no obvious solution and allow students to approach them in a variety of ways requiring creative and complex work. Second, the problems are contextualized in some way—they arise out of a motivating situation that is often applicable to the students’ world outside of the classroom. The use of open contextualized problems seems sensible at many levels because key concepts and skills can be learned simultaneously. Most importantly, they have the potential to be engaging for all students, particularly those who have not been successful in traditional mathematics.

Acquiring Skills and Developing Conceptual Understandings

One important consideration in supporting strong achievement in mathematics is the perceived competing goals of acquiring skills and developing conceptual understandings. People wonder, “Is it possible to balance the acquisition of skills and the development of understanding? Or, do students end up not knowing ‘how to do their times tables’ if they spend time solving non-standard math problems?” Educators, parents, and community members worry that focusing on the overarching goals defined by NCTM will compromise students’ facility with basic skills.

Cobb and colleagues (1991, 1992) made an important contribution to the debate about the possibilities of helping students develop computational proficiency and conceptual understandings at the same time. They carefully studied the effects of changed classroom practices and curriculum on student computational proficiency and conceptual

understandings. The results of their study are important because they give evidence that computational proficiency is an attainable goal even when the focus of instruction shifts to student-centered problem solving. Based on the results of their follow-up study, we have evidence that such proficiencies can endure over time without direct attention.

The initial study determined that second grade students who had experienced instruction focused on developing conceptual understandings in mathematics in fact outperformed their peers on tasks that measured their levels of conceptual development. Project students had constructed more advanced arithmetical conceptions than had non-project students. Additionally, project students were less motivated to be superior to their peers and strongly rejected the conjecture that conformity to the teacher's or peer's solution methods leads to success.

During the next school year, students were heterogeneously grouped by reading scores in the third grade. Though there was no specific ongoing review of each third grade classroom, there also was no indication that any of the 10 third grade teachers deviated their mathematics program from the textbook that they used as a basis for instruction. Complete data sets were obtained for 79 former project students and 111 former non-project students in two of the original three schools. Results revealed that project students continued to demonstrate higher levels of conceptual understandings and they maintained some of the problem-solving dispositions their second grade teachers intended to influence.

Unfortunately, project students came to more strongly value conformity to solutions and solution strategies after a year of traditional classroom experiences than they did at the end of their second grade experiences. These results indicate that

classrooms where students are expected to repeat the teachers' solution method produce learners with decreased intellectual autonomy. Though the project students demonstrated higher levels of autonomy than non-project students at the end of third grade, they were less likely to value finding their own or different ways to do problems as they were at the end of their second grade experience.

Research studies since Cobb's and others have uncovered the mutually reinforcing benefits of developing conceptual understanding, acquiring procedural fluency, and automatically (i.e., quick and effortless) recalling facts. Proficiency means that students should understand key concepts, achieve automaticity, develop flexible, accurate, and automatic execution of the standard algorithms, and use these competencies to solve problems (National Math Panel; National Research Council, 2001). To prepare students for success in Algebra and all math learning that follows, learning experiences must be organized to simultaneously help students develop conceptual understanding, computational fluency, and problem-solving skills. These capabilities are mutually supportive and each facilitates the learning of the other (National Math Panel, 2008; National Research Council, 2001).

Noddings (1993) and others say that it is critical for teachers to develop the ability to press students so that they think conceptually about mathematics. High-quality curriculum materials are not sufficient. Quantitative analyses indicate that "the higher the press for thinking in the classroom, the more students learn" (Kazemi, 2002, p. 44). And various authors call for the need to look at race and class issues (Banks, 1988; Kazemi, 2002; Lubienski, 1998; Moses, 1989; Reyes, 1988; Secada 1992). As educators face changing demographics in many different communities, we have to ask, how do attitudes

about mathematics and types of pedagogies and curricula support or hinder the mathematical learning for different groups? Lubienski and colleagues investigated the relationships between social class and mathematical achievement, especially in classrooms using NCTM-friendly materials. “While higher-SES seventh grade students displayed confidence and solved problems with an eye toward the intended mathematical ideas, the lower-SES students preferred more external direction and sometimes approached problems in a way that allowed them to miss the mathematical point. The lower-SES students more often became ‘stuck’ in the open and contextualized nature of the problems (1998, p. 5).” For students in their second year of the Connected Mathematics Program, a National Science Foundation program designed to embody the vision of the NCTM, class was a factor in students’ comfort with multi-dimensional problems (Treisman, 2008).

One study revealed conflicting results. In a six-day project with an experimental group and control group of seventh graders, the researcher concluded that “... it was evident that traditional mathematics instruction produces significantly higher scores on unrelated-context math problem tests. On the other hand, the data also point out that there is no significant difference between either the problem formulation abilities or the problem solving transfer abilities in students who receive either problem-based instruction or traditional instruction (Griesser, 2001).” Unfortunately, results such as these are used to justify the status quo in mathematics instruction. I say “unfortunately” because this exact study was a six-day long project...hardly substantial enough to yield results worth contemplating. However, research results such as these serve to confuse

people's understanding about the goals of math learning for students and the needs of mathematics teachers.

Looking Inside the Classroom

According to a study of 364 mathematics and science lessons, few students receive exemplary instruction in which “they are engaged with important mathematics or science concepts and their engagement enhances their understanding of those concepts” (Weiss, 2004, p. 25). These researchers observed a troubling pattern of differential quality of instruction across types of communities, in classes of varying proportions of students of color, and in classes of varying ability levels. Compared with lessons taught in suburban and urban schools, those taught in rural schools tended to be lower in quality on such key indicators as intellectual rigor and sense making. Similarly, lessons in classes with high percentages of students of color tended to be lower in quality than lessons in other classes. Finally, lessons in classes composed of students considered “low ability” or “middle ability” tended to be lower in quality than those in heterogeneous and high-ability classes.

These researchers defined components of high quality mathematics and science instruction and used their definition throughout the classroom observation process.

Sample Indicators from this *Inside the Classroom Study* include:

- The mathematics/science content was significant and worthwhile.
- The mathematics/science content was appropriate for the developmental levels of the students.
- Content information provided by the teacher was accurate.
- Students were intellectually engaged with important ideas relevant to the focus of the lesson.
- The degree of “sense making” of mathematics/science content within the lesson was appropriate for the developmental levels/needs of the students and the purposes of the lesson.

- The pace of the lesson was appropriate for the developmental levels/needs of the students and the purposes of the lesson.
- The teacher was able to “read” the students’ level of understanding and adjusted instruction accordingly.
- The teacher’s questioning strategies were likely to enhance the development of student conceptual understanding/problem solving (the teacher, for example, emphasized higher-order questions, used wait time appropriately, and identified prior conceptions and misconceptions).
- The teacher encouraged and valued active participation of all.
- There was a climate of respect for students’ ideas, questions, and contributions.
- The climate of the lesson encouraged students to generate ideas, questions, conjectures, and/or propositions.
- Intellectual rigor, constructive criticism, and the challenging of ideas were evident (Weiss, 2004, p. 27).

Integration of the Two Bodies of Research

The focus of my study was generated from the intersection of the research findings about culturally relevant pedagogy and standards-based mathematics learning and teaching. The teaching behaviors that exist at the intersection of these two bodies of research define a theoretical model that I refer to as “culturally responsive teaching.” This model supports strong student achievement and encourages students to accept and affirm their cultural identity while developing critical perspectives that challenge existing inequities. Like Boaler and others, the concept of equity that I use in my study focuses the conversations on school outcomes, such as test scores, and the opportunities that students have to learn life-long skills such as respecting others and differing perspectives, and developing confidence and courage to change the aspects of their communities that do not support all members. Mathematics classrooms can become environments that give students the opportunity to experience democratic practices and to become wise, thoughtful democratic citizens (Boaler, 2005, 2006, 2008; Cushman, 2003, 2008; Glickman, 1993; Goodlad, 1984, 2004; Noddings, 1993; Triessman, 2008).

In this study, I further others' proposals that all subjects have something to contribute in the promotion of equity, and that mathematics, often regarded as the most abstract subject, removed from responsibilities of cultural or social awareness, has an important contribution to make (Boaler, 2004; Noddings, 1992; Weissglass, 1998). Some advocate that even mathematics, the most closely defined of all subjects, can include a study of birthrates, incomes, comparative health data, war casualties, the cost of social programs, systems of taxation, and appropriate means for collecting and evaluating such data (Gutstein, 2003; Noddings, 1993; Schoenfeld, 1988).

For the purposes of my study, I have narrowed the focus of my data collection efforts to three components of culturally responsive teaching in middle school mathematics that hold great promise for impacting deep learning for all students, including: establishing classroom environments and cultures that support strong intergroup relations and student satisfaction and provide all students with opportunities to learn; student-centered instruction that supports analysis of student-generated strategies and solutions to problems and facilitating student discourse that focuses on sense-making, mathematical meaning and developing understandings; and, sharing decision-making and leadership between teachers and students in the classroom. Each of these components is defined in the following sections of this chapter.

Classroom Cultures that Provide All Students with Opportunities to Learn

In 2004, the National Curriculum Council (NCC) promoted citizenship as a core subject, along with English, mathematics, science, information and communications technology and physical education. Their documents include attention to student relationships with teachers and other students and the respect students learn for

differences between people. Students benefit from opportunities to think about, express and explain views that are not their own (NCC, 2006), a key feature of mathematics instruction that produces higher student achievement and understandings about living in equitable communities (Boaler, 2008). For the purposes of my study, this component of culturally responsive teaching includes teachers using encouragement, rather than demands, to support student learning; teachers holding and acting on their high expectations for each student; and, teachers adjusting their instruction based on the needs of the students.

Establishing middle school mathematics classrooms that assist students in developing strong intergroup relations depends on teachers who are personally inviting and dedicated to learning about their students' interests, cultures, learning preferences, and academic understandings and needs; teacher and student relationships that are caring and focused on negotiating cultural differences; and, genuine respect by teachers and students for the unique ways in which people solve problems and connect their solution strategies and new understandings to their past experiences (Ladson-Billings, 1995; Boaler, 2008). Giving all students an opportunity to achieve can be accomplished by encouraging students to learn collaboratively and to be responsible for one another (Ladson-Billings, 1995). Students report that when the management within classrooms is firm and consistent and learners are encouraged, rather than expected to respond to demands from teachers (MSAN, 2008), they can learn more.

So much depends on teachers' ability to act on their high expectations for every student while giving each learner equal status. The teacher's own belief in each learner contributes to the establishment of a community of learners who demonstrate respect for

each person's intelligence and who build strong intergroup relations. Students need to have opportunities to express their ideas and to be heard. Learners can better see the value of differences in thoughts when their teacher uses flexible grouping structures, and schools avoid tracking practices that sort students by ability for extended periods of time (Boaler, 2006; Perry, 2003; Reyes, 1999). Interactions within the classroom that simultaneously stress collectivity and individuality can contribute to stronger communities of learners who can support one another, especially when the concepts to be learned are challenging. Time for students to think privately allows them to feel more secure as they organize their thinking and ideas (Shade, 1997). By using this strategy, teachers act on the reality that all students are capable of doing appropriately challenging mathematical tasks. Learners can help each other realize that achievement is improved through hard work and effort. Students can develop understanding of their dual responsibility to help others who need help and to ask for help if they need it.

It is often the case that teachers, in the name of meeting individual student needs, ask learners to do tasks that are repetitive of earlier years in the curriculum. In culturally responsive teaching, students who have "holes" in their knowledge and skills are provided extra time to learn them while they continue learning with their peers at their grade level. In this way, all students have access to grade-level curriculum every day. Students with fewer or less established understandings are not permanently grouped together. Teachers adjust their instructional plans based on the understandings their students demonstrate and their students' learning needs.

When teachers perceive that students do not enter school ready to learn, they sometimes subscribe to beliefs about educational risk factors such as poverty, limited

English proficiency, or family systems that don't value education as causes for these students' underachievement. Such views are termed deficit thinking, as opposed to an additive view in which the cultural and ethnic background of students is seen as strength to build upon. With these beliefs about the limitations that students bring to a learning experience, teachers are less likely to think about their own influence on student learning or to look for solutions to the dilemmas that achievement gaps illuminate within the educational system itself. Deficit thinking on the part of teachers reflects pessimism about students' potential (Ginsburg et al, 2000; Ladson-Billings, 1994; Perry et al, 2003).

Without careful attention to the unique characteristics of students, schools implement programs designed for historically successful students and families with students and families from low-income and culturally diverse communities. When these efforts do not produce the desired results, teachers fall back on their beliefs about factors external to the school or to themselves as the cause of the students' underachievement (Garcia, 2004, p. 151). These ideas limit teachers' ability to appreciate the resources or funds of knowledge in every family, and they limit the teachers' sense of efficacy related to the achievement of the students.

Although there is a growing body of literature focused on multicultural education and teaching practices that include culturally responsive pedagogy (Banks, 2001; Gay, 2000, 2002), there is not as much said about hidden dimensions of culture and of communication that can pose dilemmas for culturally and linguistically diverse students and for their teachers in mainstream classrooms (Elmore, 2005; Garcia et al, 2004; Gilchrist et al, 2005). When students appear unengaged or unmotivated, teachers believe that they have to take care of students' emotional needs before they can help them with

their academic needs. They appear to have written off the learning potential of their students because they offer minimal access to challenging curriculum and learning opportunities.

Student-Centered Instruction that Is Focused on the Analysis of Student-Generated Solutions

This component of culturally responsive teaching recognizes that teachers and students are all integral sources of authentic academic information and, therefore, important players in any learning environment. Social learning and distributed intelligence can influence each person's growth (Briars, 2000; Elmore, 2005). Learning is better supported when socializing among all members of the learning community is focused on instructional conversations that support deep inquiry and self-reflection about the development of mathematical understandings. Contemporary learning theories—including constructivism, cognitive theory, and sociocultural theory—share several core principles. “Most important are two ideas: that we construct knowledge and that learning and development are culturally embedded, socially supported processes” (Shepard, 2005, p. 66).

Within interactive and socially supportive classrooms, each person can benefit from the realization that they are capable of constructing knowledge through their own conjectures and through the analysis of the contributions of others. Teachers show their commitment to helping students develop understandings through genuine communication when they ask students to persist in the solution of personally challenging problems; explain their own solution methods to their partners; listen and try to make sense of a partner's explanations; and, attempt to achieve consensus within their small group about

a specific answer, (Cobb et al, 1992). Mathematics educators and researchers of culturally responsive teaching agree that helping students develop strong small-group relationships and facilitating mathematical dialogue between students are critical strategies for effective learning (Ball, 1991; Cobb, 1992; Gutstein, 2003). Teachers have an important responsibility to keep the demands of each lesson intellectually high by providing complex problems followed up with high-level questions (Henningesen, 1997). Through student-to-student and student-to-teacher discourse meaningful formal mathematical representations emerge and continue to develop (Hufford-Ackles, 2004; Lannin, 2008). Though usually very challenging work, students can be supported in their efforts to define generalities of their findings.

Student-centered learning environments that focus on sense-making and developing mathematical understandings are essential to support growth for all students. Through the use of interactive learning opportunities, such as, projects, experiments, presentations, and conversations, students have greater opportunities to develop understandings and strengthen their confidence in their abilities to be successful. When the guiding questions are focused on the mathematics content to be learned, student discourse and thinking can be channeled and valuable to the construction of knowledge among learners (Briars, 2000; Brooks, 1999; Cobb, 1991, 1992).

The conversation in the classroom becomes less about behaviors, rules, classroom management issues, and homework, and more about the learning targets and students' understanding of them and their understanding about their classmates' unique understandings, strengths, and needs. Engaging discourse, regularly, builds students'

belief in their capacity to figure things out over time. Computers, calculators, and other 21st century learning tools contribute to such active learning of the type suggested here.

Sharing Leadership and Decision-Making in the Classroom

This component of culturally responsive teaching encompasses formative assessment processes so that students have first-hand information about the progress they are making and adjust their learning strategies accordingly; student efficacy and agency; and, sharing leadership and decision-making within the learning environment between the teacher and the learners. Assessment methods can support student efforts to realize their learning goals. When assessment is formative and used as a diagnostic tool to improve teaching and learning by teachers and students, students build greater capacity to manage the satisfaction of their learning needs. When teachers partner with students and see their role as facilitators of learning and growth for every learner, they can help students understand how they can construct knowledge from their life experiences. Students learn more mathematics more deeply and they develop confidence in themselves as learners.

The main tenets of formative assessment are that students “must have a clear sense of the characteristics of high quality work, a clear sense of the place they have reached in their current work, and an understanding of the steps they can take to close the gap between the two” (Black and Wiliam, 1998, p. 142). Portfolios can be used as a means for collecting evidence of learning over time through a variety of artifacts, and students can be supported in the creation of portfolios so that they compile clear evidence of their past accomplishments and future goals. In this way, teachers can attend to a student’s understanding of the ways they need to work so that they can be successful.

Students can use the information that they receive about their own growth to take ownership of their accomplishments, rather than comparing their progress to that of their peers.

Researchers have established a positive correlation between academic achievement and positive self-efficacy or a person's confidence in their capacity to attain the goals they set for themselves (Marat, 2008). Past experiences, and for too many students of color, past failure in mathematics usually dictate learner opinions about their ability to be successful in the future. Lower notions of efficacy affect a learner's emotion and motivation to self-monitor their effort and work habits. Coupled with self-efficacy, personal agency—or the belief in one's power to attain his/her goals impacts learning outcomes for individuals. A particular student could be efficacious without strong agency. Students who have positive self-efficacy and a strong sense of agency participate more readily, persist longer when they encounter difficulties, and usually achieve at higher levels. To enhance student's feelings of efficacy, teachers can assist students in setting relevant and challenging learning goals and providing feedback about accomplishments. Teachers can develop more interactive ways of discussing work and performance criteria with students as a means to redistribute power in a learning environment and establish more collaborative relationships with students (Shepherd, 2005).

Sharing leadership with all students and involving them in decision-making at various levels in the classroom is a strong component of effective mathematics instruction (Boaler, 2005, 2008; Gresalfi, 2009; Smith, 2004; Weissglass, 2004) and culturally responsive teaching (Banks, 2003; Brown, 2002; Cushman, 2003, 2008; Gay,

2000; Ladson-Billings, 1994; Reyes et al, 1999; Shade et al, 1997). It is important for teachers to make explicit the unarticulated rules governing classroom interactions through the collaborative creation of rules and the regular public explanation of learning expectations. In this way, students can be more actively engaged in classroom routines so that they can take responsibility for their own and each other's learning. Students who learn to recognize their individual academic and social strengths are better prepared to minimize the influence of negative peer behaviors and to see themselves as leaders among their peers.

Establishing a learning community in which the math-talk is sophisticated depends on the questions asked, the mathematical explanations that are offered and reviewed, the sources of the mathematical ideas that are acceptable, and teacher and student dedication to sharing the responsibility for learning of all participants (Ackles et al, 2004). The development of a discourse community in each mathematics classroom gives teachers the opportunity to learn about each of their student's thinking processes (NCTM, 2000) and then to match the instructional activities to the needs of their students.

There are challenges to establishing such math-talk or discourse communities. Teachers may find that students disengage somewhat as they use more challenging tasks (Romagnano, 1994; Henningsen, 1996). As teachers incorporate diverse ideas for solution methods from students, they find it more challenging to direct the instructional path and they sometimes find that students make claims that are mathematically incorrect (Ackles et al, 2004). The impact of these dilemmas can be reduced by sharing the leadership of the discourse community with all of the participants, recognizing that all

learners have something to contribute—academically, culturally, or socially—to the growth of their fellow community members.

Summary

In this chapter, I have synthesized various researchers' conclusions about effective mathematics instruction and culturally responsive teaching. Providing students with conceptual examples that serve to connect abstract ideas with their life experiences; delivering curricula through multiple pathways that reflect the experiences, contributions, and learning style preferences of different individuals and cultural groups, and supporting students with opportunities to learn rigorous content, and aligning these learning goals to the student's interests, cultures, and current understandings to produce the greatest learning gains. Systemic reform must be undertaken that deal with multiple aspects of achievement—academic, social, psychological, emotional—within different subject areas—math, science, reading, writing, social sciences across school levels, and through different aspects of the educational experience—curriculum, instruction, assessment, administration, and extra-curricular experiences. Over time, these reorganization efforts can build teacher and student sensitivities and strengthen their resolve to work for the equality of learning opportunities.

The focus of my study is the teaching behaviors that support the development of deep mathematical understandings for every learner and the strategies that honor students' cultural and social realities so that they also develop confidence in their own ability to contribute as democratic citizens who have competence as members of multicultural communities.

Chapter 2: Methodology

Rationale for Qualitative Research Strategies

In this study, I looked into the classrooms of excellent teachers—through the reality of those teachers, the perspectives of their students and my own reality to answer the following questions:

1. How do effective middle school mathematics teachers employ culturally responsive teaching strategies?
2. How do these teachers provide every student with regular and respectful opportunities to learn challenging content at a deep level?
3. How do these teachers facilitate purposeful student interactions regarding student-generated solutions and solution methods focused on understanding mathematics?
4. How do these teachers share decision-making and leadership with all students?

Given the many dimensions of the answers to my research questions, I chose to use qualitative research strategies. By conducting this type of research, I wanted to respond to other researchers' requests for descriptions of successful teachers for African Americans and other students who have been poorly served by our schools (Ladson-Billings, 2001), specifically in the mathematics classroom. Such descriptions can be used to further more sustained consideration of equality of opportunities for learning (Darling-Hammond, 1996; Oakes, 1985), the purpose of public schooling (Goodlad, 1984), and the nature of learning in a democracy (Glickman, 1993). Ultimately, equal educational

opportunity can be an influence on students' capacity to act equitably (Boaler, 2008).

Leaders and others may believe that the components of culturally responsive teaching do not apply to mathematics teaching; thus the findings from this study will further educators' reflection about these ideas.

Characteristics of Qualitative Research Design

I used a traditional qualitative case study design to organize my research. Stake (1995) believes that the major differences in qualitative and quantitative research methods include the distinction between understanding and explanation as the purpose of inquiry; the distinction between a personal and impersonal role for the researcher; and, the distinction between knowledge constructed and knowledge discovered.

Case study methodology is a study of the complexity and particularity of a single case. As a specific example of qualitative research, case study research develops an in-depth analysis of a single case or multiple cases to make deductions (Creswell, 1998). In case studies, researchers strive to notice and interpret subtleties and differences in complex environments. Specifically, case study research involves "conducting an empirical investigation of a contemporary phenomenon within its natural context using multiple sources of evidence" (Yin, 2003, p. 15). These methods are flexible, exploratory, and discovery-oriented. I did not choose a case study design to produce generalizations, but rather to give specificity to complex theories related to middle school mathematics teaching that meets the needs of all students.

I referenced Elliot Eisner's (1998) six features of qualitative studies as I conducted my research, including:

1. Qualitative studies tend to be field focused involving visits to schools, classrooms, and other pertinent settings;
2. Qualitative studies include the perceptions of the researcher within some frame of reference and set of intentions;
3. Qualitative researchers interpret the data they collect from their own perspective or from the perspective of those in the situations studied;
4. Qualitative researchers use the first person singular voice which furthers the readers' understandings and creates empathy;
5. Qualitative researchers describe the distinctions and uniqueness of the case.
6. Qualitative research is believable because of its coherence, insight; and, instrumental utility (pp. 32-40).

“Every classroom, school, teacher, student, book, or building displays not only itself, but features it has in common with other classrooms, schools, teachers, students, books, or buildings That is, every particular is also a sample of a larger class” (Eisner, 1998, p. 103). According to Creswell (2003), these aspects of an unfolding research model make it difficult to prefigure qualitative research tightly at the beginning of the research process. My data collection and data analysis processes evolved as I conducted my study.

Selecting the Research Site and Participants

City Middle School (pseudonym for the purposes of confidentiality) is one of the most diverse schools in Colorado. Students from 70 countries speaking 52 different languages are enrolled. Figure 3 details the student demographics at City Middle School

for the 2000-2001 School Year and the 2008-2009 School Year, as well as the percent of students qualified to receive free or reduced priced lunches.

Figure 3: City Middle School Demographics

	2000–2001 School Year	2008–2009 School Year
American Indian	0.7%	0.04%
Asian	6.5%	0.62%
Black	24.5%	33.7%
Latino	12.9%	30.5%
White	55.4%	29%
Free and Reduced Lunch	37.9%	72%

As Figure 3 shows, during the last eight years, the student population at City Middle School has changed from 24% to 34% African American students, 13% to 30% Latino students, and 55% to 30% White students. Despite these changing demographics, the number of students scoring at the proficient and advanced levels on the state mathematics achievement test has grown from 40% in the spring of 2006 to 59% in the spring of 2008. Using data from the same state assessment in comparing the 2007 and 2008 results, 59% of all students attained at least one year’s growth.

Contrasting these results with other schools in the same district, and schools with smaller percentages of students of color, and smaller numbers of students who are learning English as a second language contributes to a more complete picture of the noteworthy accomplishments of students and adults at City Middle School. The other 8 middle schools in the district produced 52%, 50%, 50%, 48%, 46%, 44%, 43%, and 34% growth rates during this same period of time (see Appendix for further explanation of these growth percentages). These shifts in demographics and achievement results contributed to my motivation to study the quality of mathematics learning that students

are receiving in this setting, and to record the teaching behaviors that are contributing to the students' success.

To select the individual teachers of middle school mathematics who participated in this study, I conferred with district and school leaders in City Middle School's district. I chose this neighboring district to the school district in which I work in order to benefit from an outsider's perspective. In our deliberations, I shared my research questions and the conceptual framework for my study. These leaders, based on their longevity in the district and their current levels of influence—Director of Schools, Executive Director of Student Success and Multicultural Services, and Middle School Administrators, were instrumental in selecting teachers who would be most qualified to be strong models of the teaching practices I wanted to study.

The two participating sixth grade teachers produced growth rates of 68% and 63% in their regular sixth grade mathematics classes, and 96% and 90% in their advanced sixth grade mathematics classes. These rates refer to the percent of students who score in the same range on the proficiency continuum from one year to the next. The eighth grade teacher produced growth rates of 59% with her pre-algebra students and 62% with her algebra students. Overall, 11% of the students at City Middle School have special learning needs, and 45% of the students speak a language other than English as their first language. Given these factors, the growth rates for the students in these three classrooms indicate that these teachers are influencing student learning at moderately high rates while they also support each of their students' social and emotional growth. Gaining entry to the research site and recruiting participating teachers was expedited because the findings

of my study are mutually beneficial to the district and school leaders within their strategic planning processes as well as to me.

City Middle School was added to the National Schools to Watch list in 2007.

“Schools to Watch” is an initiative which began in 1999 and is sponsored by the National Forum to Accelerate Middle-Grades Reform. The National Forum is an alliance of more than 60 educators, researchers, and officers of national associations and foundations dedicated to improving schools for young adolescents across the country. Through the Schools to Watch initiative, the National Forum identifies schools across the United States that are well on their way to meeting the Forum’s criteria for high performance. Forum members believe that three things are true of high-performing middle-grades schools:

1. They are academically excellent—these schools challenge all students to use their minds well.
2. They are developmentally responsive—these schools are sensitive to the unique developmental challenges of early adolescence.
3. They are socially equitable—these schools are democratic and fair, providing every student with high-quality teachers, resources, and supports.

Selected by state leaders for academic excellence, responsiveness to the needs and interests of young adolescents, and their commitment to helping all students achieve at high levels, City Middle School joins other middle schools across the nation in their quest to attain “equity and excellence” (School webpage/motto, December, 2008) for each and every student. To achieve this level of performance, high-performing schools establish norms, structures, and organizational arrangements to support and sustain their trajectory toward excellence. They have a sense of purpose that drives every facet of practice and decision-making. At City Middle School, their focus on strong leadership, teachers

working together to improve curriculum and instruction, and assessment and accountability to bring about continuous improvement creates an environment that was conducive to my study.

To respond to the diverse community and these changing demographics, City Middle School's principal facilitates four leadership groups, each with parent and student membership. Two of these groups, the Hispanic Opportunities in Public Education (HOPE) and the Building Leadership in the African American Community for Kids (BLAACK) meet regularly to create solid connections between the families and the school in an effort to build student confidence in the classroom and give students regular opportunities to interact with successful role models from their own ethnic group and from groups who are different from their own. Members of each of these groups work to help the entire community understand the uniqueness and needs of their culture, to close the achievement gaps that exist, and to speak out against cultural and ethnic stereotypes.

Roles and Perceptions of the Researcher

Throughout this study, I served in the role of observer, interviewer, narrator, and consultant (Stake, 1995, p. 91). I was a middle school and high school mathematics teacher for a total of 12 years in a small rural school district, a large urban school district, and a large suburban school district. Following these classroom teaching experiences, I served as a district mathematics coordinator and a district curriculum administrator for a total of 15 years in a large urban school district and a large suburban school district. These roles provided me with opportunities to plan and facilitate numerous workshops and seminars for classroom teachers, school-based instructional coaches, and school and district administrators focused on effective instruction that meets the needs of diverse

learners. Simultaneously, I taught mathematics content courses, mathematics teaching methods courses, and general teaching methods courses at the community college and university levels. During all of these experiences, I prioritized time to be in classrooms both as an observer and as a coach for the classroom teacher and school leaders.

All of my experiences have helped me to develop the interpersonal skills and sensitivities that I used in this research project to collect authentic details that assisted in answering my research questions with minimal interruption to the contexts in which I conducted my study. I established rapport and credibility with the teachers participating in my study, and I was very diligent about giving back to the participating teachers, the school leaders, and the district leaders associated with this study.

Due to my previous experiences, I do bring biases to this study. Specifically, I believe that it is critical that middle level learners make as much progress as possible in developing their mathematical understandings and their dispositions of equity and responsibility for self and others. Further, teachers play a significant role in supporting the development of such understandings and dispositions. These biases shaped the way I viewed and understood the data I collected, and I made every effort to be clear about my biases as I interpreted the data I collected. I believe that my understandings of the context in which study participants work, and the role that middle school mathematics teachers play, enhances my awareness about and knowledge of many of the challenges and decisions that were encountered by the participating teachers throughout this study.

In all cases, the names of all people and places included in this study are masked. Written permission to be included in this study was received from each of the participating teachers (see Appendix A), students (see Appendix B), and their

parents/guardians (see Appendix C), and all processes for securing permission for research from the Institutional Review Board were completed (see Appendix D).

Data Collection Procedures with Corresponding Limitations

In this study, I collected data during 50 hours of classroom observations and 10 hours of school activity observations; by conducting a student focus group and multiple teacher interviews; and, through the examination of school and classroom documents and artifacts. My data collection process was organized to address my research questions and to reveal unexpected clues that strengthen the theories that the research uncovers. During this process, I began with a flexible list of questions (see Appendix E) and progressively redefined issues. I took every opportunity to learn about unexpected realities (Stake, 1995). As new issues became apparent, I adjusted my interview questions and the focus of my observations to include the new details that my data collection process uncovered. Parlett and Hamilton (1996) call it “progressive focusing.” I worked to identify good moments of classroom work that revealed the unique complexity of these cases. The reader has an opportunity to “be there” through my use of specific descriptions and low inference story telling. The four phases of this data collection process are detailed in Figure 4.

Figure 4: Case Study Data Collection—Methods, Purposes, and Limitations

Phase I		
Method	Purpose	Limitations
Interview School Leaders	Define the context of the classrooms that will be included in this study.	The context for this study is complex and difficult to describe in a limited time frame.
Teacher Survey	Determine components of Culturally Responsive Teaching in Mathematics most likely to be observed during field study.	Survey responses may not accurately reflect actual teaching practices and instructional decisions. Survey questions and vocabulary may have multiple meanings.
Phase II		
Method	Purpose	Limitations
Classroom Observations	<p>Researcher can collect firsthand data and unusual aspects of culturally responsive teaching in mathematics.</p> <p>Observations focused on what the teacher is saying and doing (direct information).</p> <p>Observations can explore topics that the participant may be unaccustomed to thinking about/sharing.</p> <p>Allow researcher to create “thick descriptions” and low inference stories.</p>	Researcher may be intrusive and unable to describe things as they are when the researcher is not present.
Teacher Interviews	<p>Understand the participant’s reality and decision-making process.</p> <p>Accommodate need for “member checking.”</p>	Provides indirect information that is removed from the natural field setting. Participating teachers may be limited in their ability to reflect and describe their decision-making process.
Review of Teaching Artifacts	Define a more complete context for data collected within each classroom.	Documents may not be aligned to actual data from classroom observations.

Phase III		
Method	Purpose	Limitations
Classroom Observations	Observations focused on what students are saying and doing.	Researcher may be intrusive and unable to describe things as they are when the researcher is not present.
Student Focus Group	Understand students' reality and learning process.	Provides indirect information that is removed from the natural field setting.
Review of Artifacts and Student Work Samples	Include data about actual student achievement and accomplishments.	Documents may not be aligned to actual data from classroom observations.
Phase IV		
Method	Purpose	Limitations
Classroom Observations	Observations focused on collecting additional data to substantiate researcher's evolving theories.	Researcher may be intrusive and unable to describe things as they are when the researcher is not present.
Colorado State Assessment Program (CSAP) Results and Growth Trends in Mathematics	Establish achievement and growth outcomes of students for each participating teacher. Compare growth outcomes with other schools in district.	State assessment results are one measure of a complex construct—student understanding in mathematics.

Conducting School Leader and Teacher Interviews

Interviews with the participating teachers as well as their building leaders and colleagues resulted in uncovering multiple realities. Given their unique experiences, the interviewees had special stories to tell that contributed to my description of the cases. Interviewees contributed rich, personal information that assisted in developing deeper understandings about these cases.

I conducted interviews with the school leaders and classroom teachers using two types of questions: open-ended questions that are generated from the specific observations I made in their school and classrooms and common interview questions. The open-ended questions allowed me to collect more complete data because the leaders and

teachers had an opportunity to share their individual thinking processes and perspectives about specific situations that were observed in their school and classes. I took great care to understand each leader's and each teacher's lived and shared reality. Sample common interview questions were included in the interview protocol and served to guide my conversations with the leaders and teachers and give me an opportunity "to compare the data that I collected from one case to another" (Hancock & Algozzine, 2006, p. 43). While "it is so much better to observe the specifics of a case" (Stake, 1995, p. 67), all of the information obtained during these interviews contributed to a more complete description of this collective case study and guided future observations.

Classroom Observations

Results of an initial survey (see Appendix F) that the teachers who participated in the study completed revealed components of culturally responsive teaching that I had the greatest likelihood of observing in each of the classrooms of each participating teacher. The observation tool (see Appendix G) is aligned to the conceptual framework for this study and was used for each classroom observation. As noted in Figure 4 above, the first phase of my observations focused on what each teacher does and says, and the second phase was focused on what their students say and do. Notes for each observation session were written shortly following each visit so that important details could be recalled and low interference findings could be recorded. I focused my note-taking on capturing all details and the essence of each observation in order to assist in creating a complete and comprehensive narrative report.

Analysis and Examination of Standardized Assessment Results, Materials, and Artifacts

Analysis of standardized achievement data for the students of the participating teachers occurred following the two phases of classroom observations. Additionally, through the review and summary of information available in documents such as lesson plans, assessments, curriculum materials, student work samples, faculty meeting notes, community meeting agendas and school organizational documents, I collected additional data that assisted in the thorough description of each of the cases.

Student Focus Group

During the third phase of my data collection process, following classroom observations specifically focused on what the students are saying and doing, I conducted a focus group with representative students from each of the participating teacher's classrooms. The twelve participating students represented students with various achievement results and students from different cultural, ethnic, and language groups. Answers to the focus group questions assisted in my understanding of the students' perceptions of mathematics and the support that their teacher provides so that they have opportunities to develop understanding in mathematics and achieve at higher levels. While these students' perceptions cannot be generalized to all members of the City Middle School community, the focus group provided information to assist in interpreting unexpected findings, provided information in verifying data, and allowed for findings that may not have been obtainable using traditional qualitative methods (Vaughn, Schumm, Sinagub, 1996).

Data Analysis Procedures Including Strategies for Validating Findings

My analysis of the data I collected will not serve to answer why things are as they are, but rather, to describe in depth how things were at a specific place at a particular time. Readers will have the opportunity to gain an experiential understanding of these cases. “Thick descriptions” (Geertz 1973) help to create experiential understandings for the reader. I offer a personal view of the case and, as with other qualitative researchers; I attempt to see what would happen in normal circumstances as though I had not been there.

Given the multitude of sources of data useful in answering my research question, I collected as much as possible in order to strengthen my confidence in my findings. “Because we can accumulate ever-increasing quantities of data—mountains of it—we have to be careful not to get buried by avalanches of our own making” (Wolcott, 1990, p. 35). The result of the analysis of the data collected with defined themes will assist readers in the formation of “naturalistic generalizations—conclusions arrived at through personal engagement in life’s affairs or by vicarious experience so well constructed that the person feels it happened to them” (Stake & Turnball, as cited in 1995, p. 85).

Descriptions of how teachers can provide regular and respectful opportunities for learning for every student; of how teachers can facilitate purposeful student interactions regarding student-generated solutions and solution methods focused on understanding mathematics; and, of how teachers share decision-making and leadership with all students resulted from the thorough analysis of all of the data collected. Synthesizing all of the information I collected was accomplished by answering the following questions for each of these components of culturally responsive teaching in mathematics:

1. Within each of the four data collection processes described above, for each of the three participating teachers, what information can be grouped?
2. Across the data collection processes, across the three participating teachers, what information can be grouped?
3. What interpretations contribute to grouping information together?
4. How do the results of my analysis connect to previous findings from other research projects?

General patterns of understanding emerged through the initial coding of the data I collected and the development of broad themes. As I identified specific potential themes within the three main components of culturally responsive teaching in middle school mathematics defined for this study, I assigned discrete pieces of data to the themes. I adjusted the themes as I found data points that expanded the theme, or narrowed it. My confidence in the identification of a theme as a priority finding grew by finding more and more data points that fit within a theme. Additionally, I validated my resulting themes and interpretations by triangulating data and using member checking.

My report includes carefully constructed findings—even in situations where there appear to be multiple, different, and even contradictory views. Taken together, the interview data, focus group data, classroom observation field notes, and survey data I collected assisted in understanding the complexity of using culturally responsive teaching strategies in middle school mathematics. “Two strategic ways that researchers reach new meanings about cases are through direct interpretation of the individual instance and through aggregation of instances until something can be said about them as a class” (Stake, 1995, p. 74). As other qualitative researchers do, I organized my data to define the

components of culturally responsive teaching as they were present during the time I spent at my research site. I was seeking to understand this complex phenomenon more than I attempted to see how it differs from other teaching strategies. Whenever I was able to confirm a data point from one source within another source or process, the evidence collected was more valid. For example, when the school's principal talked about the school's mission with a group of parents, and several days later, a sixth grade teacher was reviewing similar ideas about the mission in her mathematics classroom, I noted this as stronger evidence of a strong school culture that gives each learner greater opportunity to learn and supports higher student achievement.

Following each observation, and as I wrote portions of the narrative of my research findings, participating teachers were asked to review my work "to determine the accuracy of the qualitative findings" (Creswell, 2003, p. 196). This member-checking process contributed to my ability to provide the reader with information about the data collected through the participating teacher's reality as well as through my "disciplined eye" (Stake, 1995, p. 46).

Chapter Three

Findings

This study was designed to answer the question, how do effective middle school mathematics teachers employ culturally responsive teaching strategies? The three subsequent questions for my study are included in the narrative that I present in this chapter. Findings are reported for each of my research questions based on the data I collected. The results include themes and specific scenarios resulting from 50 hours of classroom observations in three different teachers' classrooms during the period of December 2008 through March 2009. My observations in each teacher's classroom resulted in enough trust to develop a substantial rapport so that teacher and student behaviors were unrehearsed much like they would be had I not been observing.

By the fifth observation in one of the classrooms, the teacher was very animated and secure, and I was confident that my presence was not interrupting the culture of the classroom so that I could collect authentic data. I conducted two interviews with each of the three participating teachers at regular intervals during this four-month period of time, and I interviewed three of the school leaders individually four different times to learn about their perspectives and decision making. Before beginning my classroom observations, I requested that each teacher complete a survey focused on the components of culturally responsive teaching. Their responses to the survey assisted me in focusing

my data collection process by indicating which components of culturally responsive teaching they were using their instruction.

In January and February 2009, I attended three different evening parent meetings to collect data about the work that school leaders were doing with these stakeholders groups. And, in February 2009, I conducted a focus group with twelve representative students from each of the three participating teachers' classrooms. Throughout my research, I reviewed lesson plans, student worksheets, student work samples, faculty meeting and professional development session agendas, and brochures for parents. At the end of this data collection process, one of the school's leaders shared the student achievement growth data for the students that each of the three participating teachers taught during the 2007–2008 school year.

The Role of a Strong School Culture

It is impossible to spend more than a few minutes at City Middle School on any given day and not be impacted by the strong and consistent school culture. There is substantial evidence of the enactment of the school's mission—Striving for Equity and Excellence—in every instance. The first time I parked at the school in November 2008 to meet with the school leaders and participating teachers, the sixth grade student leadership group left a note on my car. They washed the headlights of the cars in the parking lot in the middle of the afternoon on a Friday, and left the note, "*Have a safe and fun weekend!*

From the 6th grade leadership team."

Perhaps the morning of the inauguration of Barack Obama, our country's first African American president, is the best example of the uniqueness of this school's culture that you experience as an observer. It was a proud day for the whole student body at City

Middle School. A majority of the students wore Obama tee shirts and one student explained “Martin Luther King led us to freedom and President Obama is just as great!”

In an interview with one of the participating teachers in my study, she shared:

“Many of the kids and their families were very emotional about Barack Obama’s inauguration, and watching the inauguration on TV was such a great time to remind the students of the significance of the event and to let them know we all want you (the students) to be the best that you can be at our school. Taking time at school to watch this historic event helped us to make connections with the community because there was tremendous energy within many of our families about the significance of the day.”

In preparation for this significant event, students created their own news show, modeled after CNN. Selected students, in small groups and individually, teachers and leadership team members contributed small segments of news focused on Obama’s “*Yes we can!*” message. Students sang “*Yes! We can live together! Yes! We can be as one! Yes! We can overcome!*” As the student news show aired and individual students sang for the news program, everyone in the seventh grade audience I observed was respectful and serious. In addition to City Middle School personalities, the news program included video clips of Barack Obama and Martin Luther King speeches where both of these leaders spoke of the “*true meaning of our creed as Americans*” and the belief that “*anything is possible*” and “*We won’t stop until we realize the dream that we all share.*”

In the introduction to the student news program that morning, the school’s principal included information about the meeting scheduled for all eighth graders at the end of the day. The agenda for their meeting included time to discuss “what it takes to make City Middle School a great place” and the responsibilities the students have to make their school one of which they are proud to attend.

The assistant principal defined the culture at City Middle School as one that emphasizes taking risks and respecting diversity. “Because of our culture here, students can sing and recite poetry on the news without others jeering or laughing.” On another occasion, when the announcer on the student news introduced the time to recite the Pledge of Allegiance, she reminded students that those who want to refrain from reciting the pledge can do so, and “we will all respect your decision.”

In an interview with one of the teachers a few weeks later, she explained how taking time to watch the inauguration was one of the ways they build stronger relationships with all of their students. She said:

“The inauguration day was such a teachable moment. In a democracy, it is important to pay attention to such a significant moment in history. The whole ceremony gave the kids a chance to see so many role models. When I sit and watch moments in history with them, I can build stronger relationships with them. The kids see me differently and more completely. I feel more authentic as a teacher.”

On a monthly basis, City Middle School’s principal meets separately with a Hispanic Leadership group comprised of parents, teachers, and students, and a Black Leadership group. On one occasion, 45 parents including 23 who were monolingual Spanish, 20 students, and 12 teachers and staff gathered to plan an upcoming conference for the Hispanic community. In her introductory comments to the group, the principal reiterated the purpose of their leadership group and the purpose of the conference as follows:

“We are all committed to making sure teachers know how to help all of the Hispanic learners in their classes, making sure all of the parents know how to help their sons and daughters, and making sure that students develop confidence in the classrooms.”

The Spanish teacher and eighth grade students who were translating and co-facilitating the meeting with their principal added details to this goal.

As their planning progressed, they decided to invite two Hispanic people as speakers to their conference, one, a writer and motivational speaker, and the other, an assistant to the mayor of the city. As they were planning together, one gentleman who was a monolingual Spanish speaker addressed the group with overt humility. I recorded the English translation of his comments as follows:

“This is only my opinion. We parents need a lot of information to learn more ourselves so that we can help our kids—all of the kids in our community. We are so grateful that you (referring to the school’s principal) are focusing on the needs of our community. We know that we can count on you. Then, we feel so proud to be Hispanic.”

During the Black Leadership meeting the next week, the group of 35 adults and students discussed the plans to build a Science, Technology, Engineering, and Mathematics (STEM) campus on their school’s property as a result of the successful bond election. Taking full responsibility in his role as a parent, one father asked the school’s principal if she felt as though the parents of the African American students are involved enough so that the students will be accepted and then successful in the new STEM program. Similar to the Hispanic parents, these parents offered their full support to the school’s principal. These sentiments from the parents and community members are significant evidence of the principal’s strong relationship with a broad base of diverse community members. And, their comments are evidence of their strong allegiance to City Middle School’s mission.

In both groups, the principal and teacher leaders who were present invited parents to participate in the schools’ *‘Data in A Day’* process in which teachers and community

members participate in classroom walk-throughs to collect data about specific concerns or issues about which the school community wants to learn. On one occasion, the Black Leadership group members were asked to collect evidence about what it is like to be African American at City Middle School. Were all classrooms fair? Were students challenged in all classes? Were the rules fair for African American students? And, Hispanic Leadership group members were asked to collect similar evidence for the Hispanic students at City Middle School.

As a result of this process over the past several years, City Middle School groups second language learners together occasionally because of parent and community requests, and teachers monitor the behavioral referrals that they write for African American students because African American community members realized that the number of referrals for African American students was greater in number than those for students in other groups. One of the teachers in my study referenced her job interview when she was hired to teach at City Middle School. “From the very first conversation I ever had with our principal, when I was interviewed for this job, one of the questions was about my plans to work on the achievement gaps that exist between groups of students. As a school staff, we never let up on a kid.”

The clear alignment of expectations for students, messages to parents and community members, and topics for professional development for teachers contributes to the overall atmosphere at City Middle School. One eighth grade African American male referenced the work that he was doing as a part of the Black Leadership Group when he described the willingness of his friends and teachers to work on closing the achievement

gap. He said, “You know, Caucasians and Asians score higher on a test than African Americans and Hispanics. We’re trying to close that so we all score high on a test.”

Throughout the school, “*Different Individuals Valuing Each other Regardless of Skin Intellect Talents or Years*” (DIVERSITY) posters are prominently displayed.

Additionally, the sixth, seventh, and eighth grade leadership classes created a poster series titled “*A Walk Through African American History—Heroes of the Past and Present.*” Students researched personalities such as Al Green, Diana Ross, Denzel Washington, Ray Charles, Marvin Gaye, Tina Turner, James Meredith, Harriet Tubman, Michael Jordan, Chris Brown, Wilt Chamberlain, Darrent Williams, Will Smith, George Washington Carver, Daisy Bates, Barack Obama, Ruby Bridges, Colin Powell, and Kanye West and made an individual poster about each person. These posters were hung on the front wall of the school. During the month of February, each broadcast of the student news featured one or two of these African American people. The principal explained:

“It is so important to present different messages to all of our students. In one recent conversation with a group of African American and Hispanic students, I asked them to tell me about the stereotypes other people have about them. Their responses, without any hesitation included, single parent homes, poor, dumb, we steal things, and you can’t trust us. They continued saying that everyone knows that according to our test scores and how we do in school, we are at the bottom of the list.”

The principal described the ways in which she and the staff work to create a “counter narrative” (Perry, 2003, p. 92) so the students can imagine a different reality for themselves.

During one of my visits to the school, I entered the teachers’ lounge during lunch and planning time for approximately 15 teachers, and listened to the lively conversations.

One small group of teachers was talking about the results of a recent assessment that they used. They were trying to figure out how to help the kids understand one of the questions about determining all of the numbers or values that are between 0.7 and 0.8 because the students didn't understand this idea. Instead of talking about how hard this idea is for students to learn or lamenting the fact that students aren't completing their homework regularly, this group of three teachers wanted to know how each other approached the problem during instruction to see if they could combine strategies to determine a stronger approach to supporting their students' learning—all while they ate their lunch and visited about personal details.

Comments from one of the teachers during our interview confirm the strong collaborative spirit among teachers. She said:

“Our team is so strong that we learn a lot about an individual kid's situation from each other. I collaborate with my teammate who teaches social studies because she regularly has our students do projects where they learn about their own culture and the culture of the classmates. In math, we do projects where the students collect and share data about their family (birth order—oldest, middle, youngest children) that give us an opportunity to learn about each other.”

Posters that seventh grade students made about themselves and their cultures in their social studies class included details like, “I'm from Nigeria, and I am proud of our accent—which I wish I had,” and “I'm proud of the Navajo clan that I come from because of our strong beliefs.”

Each of the teachers and school leaders that I interviewed referred to their school-wide expectation that all students will achieve and learn. One teacher said:

“All of the adults in our school consistently talk with the kids about going to college and holding high expectations for learning. The kids know that we are not going to let up on them. I constantly use informal assessments techniques so I know where my kids are in terms of their understanding and they know that

together we will learn the ideas they need to know.”

Another teacher explained:

“We all talk to the kids about college regularly. We want them to take their job as student seriously. For our kids without fathers, we get people from the community who can talk to them and be role models for them. Through these experiences, kids can develop more confidence.”

And from another teacher’s perspective:

“When we had a guest teacher in my classroom because I was out one day, the students were rowdier and off task. I told the kids when I was back that they hurt my feelings when they act like that to guests in our school. My point was that I wanted them to be serious about learning, and I wanted to hold them accountable for treating every single person in our school with respect and compassion.”

All of these data contributes to a clear picture of the defined school culture at City Middle School. I observed that such a well-defined and consistent culture supports high student engagement and achievement in each of the classrooms that were a part of my study. The unwavering focus on respect and compassion for all and the strong belief in the capacity of all staff and each student permeates the learning environments and influences the work ethic of each person in the overall learning community.

One significant piece of evidence is a concrete example of the school-wide efforts to support all students. The staff and leadership team members’ commitment to supporting high achievement in mathematics led them to reallocate resources so that all 6th graders participate in 90 minutes of mathematics each day. Without this careful planning, the students would just have 45 minutes of mathematics each day. All staff agreed that larger classes in eighth grade and other sacrifices were worth the benefit of the sixth grade students receiving more time in mathematics.

Following is the data I collected that answers each of the specific research questions for my study. Each question pertains to one of three main components of culturally responsive teaching in middle school mathematics, including the opportunity to learn; reasoning and sense-making; and sharing leadership and decision-making. To organize all of the data I collected, I hand-coded my field notes, the responses teachers provided to the questions that I included in their interviews, and the responses students provided to the questions I included in the focus group. For each research question, I defined subcategories as I coded data and searched for patterns and themes. These categories are defined in each of the following sections of this chapter.

Unlike any other content area, at City Middle School, the staff groups learners for mathematics using the results students receive on state and school level mathematics achievement tests. The two sixth grade teachers in this study teach a regular sixth grade section of mathematics and an advanced sixth grade section. The eighth grade teacher teaches a pre-Algebra and an Algebra class. In the specific instances that I describe in the remainder of this chapter, I report my findings with specific mention of the group of students that is involved in the situation.

Opportunity to Learn

As I reviewed and organized the data collected from all of the sources, four clear categories emerged within this portion of culturally responsive teaching in middle school mathematics. These categories provide answers to the first question that my study was organized to answer, specifically, how do the teachers in my study provide every student with a regular and respectful opportunity to learn challenging content at a deep level?

The first classification includes the ways in which students help each other and the behaviors teachers engage in to organize the classroom so that students act on the opportunities that occur to help each other. In my data, there were several ways that teachers worked with students to develop their expertise so they were better prepared to help each other. Opportunities for students to work in small groups before large group discussions provided them with time and support to organize their thoughts and develop confidence in their own problem-solving strategies and solutions. The second category that emerged related to the times that teachers adjusted their instruction and lessons based on students' needs as a large group or based on an individual student's needs.

The third category included the work teachers did to establish a strong community of learners so that all students feel comfortable and all students are supported in taking risks without the threat of jeers from their peers. The fourth category within the 'Opportunity to Learn' component of my study includes the teacher establishing challenging learning goals for all students predicated on the belief that all students need access to grade level curriculum. This category includes the ways in which teachers hold each student accountable for attaining the learning goals that they establish based on their strong beliefs about the learning potential and capacity of each student.

Students Helping Each Other

Two of the participating teachers in my study teach sixth graders. Both of them used very similar strategies for supporting each student's confidence in their ability to solve challenging problems and encouraging students to help one another, based on their collaborative planning and their participation in weekly professional development for the

mathematics teachers at City Middle School. One of the teachers explained her underlying value that influences her actions in her classroom. She said:

“I don’t force any of the kids to ask questions. I want them to ask questions when they feel safe. I want their questions to be genuine. I also encourage the kids to be the teacher for their friends. When I help one of the students, and I feel pretty sure they are comfortable enough, I ask them to go and help another student.”

In an observation in her sixth grade advanced mathematics classroom prior to our interview, one of her students asked a question about a specific homework problem. She said, “I’m glad that you asked about this one” indicating her respect for the student’s thinking and her expectation that students ask questions that will help them learn important ideas more completely. She continued, “It is so helpful when students ask questions that really help all of us think about these problems more carefully.” The second sixth grade teacher explained that he talks with his students all of the time about the give and take nature of helping one another. “When the kids help each other, they develop more confidence. They say to themselves, I just helped him. He can help me.” On several occasions in both the regular and advanced mathematics groups, I observed both of these teachers encouraging students to help others. For example, one teacher asked one student who was working in a small group with others, “If she (referring to another student in the group) doesn’t know how to do this problem because she wasn’t here, will you help her?”

Each of these teachers has developed skills to monitor group dynamics within their classrooms along with their teaching and assessing behaviors. They effortlessly coach students to care for others. In his regular sixth grade mathematics class, when one teacher approached two students who were working together to solve a problem at the

board, he paused to listen in on their conversation and could sense some moderate tension. The first student spoke and said, “I was just trying to help him.” The teacher added, “But it seems like he doesn’t want your help. I think he wants to figure it out on his own.” And just then, the second student said, “When I figure this out on my own, I will understand it better.”

Each teacher uses specific strategies to promote quality problem solving within small groups. One such strategy that I observed in their classrooms involves asking each small group to select one of their members who travels to another group to share and to learn. When the traveling group member works with their new group, the questions are *What was your answer? And, how did you get it?*

In both of these teachers’ classrooms, students get regular support to be sure that their behaviors in small groups are helpful to others and supportive of their own learning. One of the teachers shared:

“I regularly take time to analyze group behaviors with students. Which behaviors were helpful to you? What things did people in your group do that really didn’t help you understand? I like to emphasize and model supportive behaviors. I model making mistakes with the kids and we talk a lot about how much you can learn from getting the right answer or from getting the wrong answer.”

The most notable evidence of the quality of the small group interactions present in these classrooms is the honesty among students—even when they aren’t sure about how to solve a problem and the respect students have for each other. In one case, in an advanced sixth grade mathematics group, when a student estimated an answer, he made an error and he realized it himself. He said, “Wait! Hold up! I can get this!” None of the other students laughed or made unsupportive comments. Instead, they waited patiently. And, within the same classroom, in another group, a student told his classmates, “You

guys are going too fast! I'm lost!" just as a fellow group member was saying to him, "You don't get it do you?" Several times, I observed students repeating their comments to their fellow group members because they could tell that what they had shared was not clear to others.

Adjusting Instruction Based on Students' Needs

The third teacher who participated in my study teaches eighth graders. She was very articulate about the students in her classroom, and on several occasions, shared stories about certain individuals. In her interview, she provided a rationale for her keen interest in the lives of her students. She said:

"It turns out that the kids that I know who have a particular story influence my teaching a lot. I know that one student has been in 6 middle schools this year, and she is very quiet. She is absolutely capable of doing what we are doing, I just know that I need to help fill in the gaps in her learning about the topics that she has missed or had little experience with so far. I really try hard to understand kids like this. I learn their stories from them, from my teaching teammates, from our dean, and from watching them in class."

One of the African American male students in her pre-Algebra class shared his experience in her class. "My teacher helps me...like she taught me about fractions. I didn't think I could do it. I used to have a hard time adding and subtracting fractions and she helped me do that." When I learned more about this particular student's performance, his teacher told me that given the interruptions he experiences because of his family's situation, he has definitely missed opportunities to learn certain ideas. She continued, "When I give him extra help, he is absolutely capable."

I observed one of the sixth grade teachers as she introduced a new unit in her regular sixth grade mathematics class. In order to understand what her students already knew, she asked them to create a poster about angles. They could use drawings, words or

phrases to list everything they already knew. In 10 minutes, their posters included *straight angles, angles that add up to 180 degrees, angles that add up to 90 degrees, parallel lines, perpendicular lines, vertical angles, and right, obtuse, and acute angles.* Each small group produced a lot of information in a short amount of time. Then, she provided time for the students to do a gallery walk—“like you do in an art museum”—to look at each others’ work and to get ideas to add to their own poster. This was a quick way for her to see what her students knew and for the students to remind themselves about their own knowledge. As a result, her lesson plans for the students were better matched to the needs of the students. And, she would sometimes delay giving the students tests by several days because she wanted to give the students more time to learn the content. Based on her observations of their work in small groups, she knew that they needed more time. This same teacher helped me to understand how she developed these skills. She explained:

“I learned how to teach the way I do by focusing on what really makes a difference with the kids. Do the things I am doing help them to understand? Are they genuinely participating? I have learned to mentally flip things and focus on the good things that are happening, mathematically and behaviorally. I regularly talk to kids about their weekends, and about myself. I speak Spanish, so that is one way that I can connect with them on another level.”

All three of the teachers were very careful in their facilitation of large group discussions with their students. One day in debriefing the warm-up problems with her students in sixth grade advanced mathematics, one teacher said, “Do you want to *show* your method or do you want to *verbalize* your method?” in order to support the student’s contribution to the large group in the best way possible. On another day, a sixth grade

student, when asked a similar question, eagerly replied, “Can I do both?” As this teacher and I were visiting informally while we walked to lunch, she said:

“When I am facilitating a whole class discussion, I pay very close attention to the kids so that I know which ones need extra support. This varies from day to day, so I am constantly paying very close attention to kids while they are listening to their classmates talk about solutions and solution methods.”

In each of the three classrooms, it was a common routine for the teacher to pause in the middle of a large group discussion with students in their advanced and regular mathematics groups and ask students to work in their small groups again because there was confusion or disequilibrium among them. Following additional work time in small groups, the teacher continued the large group discussion with students who had more to contribute and more confidence. An eighth grade African male Algebra student told me later:

“When I am helping one of my friends, what I do is try to make them remember what we learned before. We don’t tell them the answer but help them remember what we did before because if they can remember that then they can do it. Then they can experience it on their own without you. If you tell them all the answers, they are just copying and they don’t know it. And if you *know it*, you can explain it to the class.”

To add emphasis to the contribution of one of her students during a large group conversation in Algebra, the eighth grade teacher asked, “Can you guys see what Jamila is saying? She wanted to ensure that each student was engaged and thinking. Her question communicated clear expectations for all students. When redirecting a student in pre-Algebra, she said, “You are missing some very good information” and kept the focus on learning.

One morning, I worked with two sixth grade students in the regular mathematics class because I wanted to determine if they understood the problems for the day. Both

students were not working as I sat down with them at their table. One of the boys was from a fourth generation American Hispanic family and the other boy's family immigrated to the United States from Ethiopia six months earlier. They were both very quiet as I joined them, and they were not helping each other. The problem they were trying to figure out included the ratio of 1 green marble to eight blue marbles, and they needed to know how many blue marbles you would have if you were given six green marbles.

As I sat with them and asked, "What are you trying to figure out"? one of the boys was engaged and attentive. We wrote out a simple chart to organize our thinking, and he caught on very quickly. We just added eight each time. When their teacher moved the students from their small group work to the large group, he wrote the problem on the overhead. Quickly, the student with whom I had been working said, "Oh! We could have just multiplied!" and he was visibly proud of himself. His partner, who was less fluent as an English speaker, didn't add anything to our conversation, but he was engaged as a keen observer. As the teacher talked about the problem with the whole class, he coached, "The more effort you put in—the more you will understand our conversation about the problem when we talk about it as a whole group."

Nurturing a Strong Community of Learners

Many different pieces of the data I collected give evidence of the work each of the three participating teachers did to establish a strong community of learners so that all of their students feel comfortable and all of their students can take risks as they solve challenging problems. Establishing such a learning community depends on the teacher getting to know students as individuals, and providing them with multiple opportunities

to learn about the other members of the community so that they can develop trust and respect for each other as people and as learners. Ultimately, a strong learning community supports greater learning for each person.

In her advanced mathematics class, one of the sixth grade teachers connected an individual student's behavior to the learning of the whole group and said, "I want to be able to call on you (to a student who was off task) and know that you will be able to help all of us with the problem we are working on." The second sixth grade teacher shared her strategy of regularly talking with students in both of her sixth grade classes about "their job as a student" so that they are serious about their own learning so that they feel a part of the learning community. At the middle school level, it is often necessary for teachers to remind students about the importance of not distracting other students from their learning. In addition, these teachers hope to help their students understand how important it is to contribute to the learning of others.

Two comments from eighth grade female students indicate that they understand the purpose of their teacher's efforts to facilitate trusting relationships among all of the students in their class. One student in pre-Algebra told me:

"When we go over a question as a class and each student can give their ideas about the problem, I think it is good. I sometimes learn more. But I don't want to talk out loud if kids are going to think that I don't know what I am talking about."

And, the second student who is also in pre-Algebra said, "It is good to get another perspective on a problem. If we have different ideas and we're not on the same page then our brain really gets to start thinking when we talk about it."

In addition to working to help students understand the important contributions they can make to their classmates learning, one of the sixth grade teachers talked about

another strategy she uses to strengthen the relationships among the students in her classes. She said:

“I use examples from various cultures whenever I can. One day (in the regular mathematics class), a student accused me of using a ‘ghetto’ name when I was reading a problem out loud for the kids and I inserted a name into the narrative. I immediately asked all of the kids, what makes ‘Trevion’ a ‘ghetto’ name? The students and I had a very lively conversation. Through these experiences, I think we all get smarter about living in a diverse community. I know I do. And I think the kids are more respectful to each other because of these kinds of experiences.” A few days later, she shared a specific example, “There are some units or

assignments in our curriculum that lend themselves to giving students time to think more about their own culture and the cultures of their classmates, but not always. One lesson asks the kids to determine the value of their own name—with each letter having a different value.” So, within a lesson like this one, for some students, it may be the first time they ask their parent or guardian why they have the name they do. She continued, “Some students’ names are very long, so as a class, we talked about the meaning of some student’s names. Why are some names so much longer than other names? Are all names in the Sudan that lengthy?”

The eighth grade teacher shared her strategy to build a strong community, and connect with her students. She said:

“I regularly talk to students about their weekends, and the church that they go to, because in many cultures, religious practices are an important component of their culture. After the Martin Luther King march during a weekend in January, some of the African American kids in Algebra were surprised to hear that their friends who are Hispanic participated with their families in the march. It was a good opportunity for all of us to talk about interracial relationships and the value of cross racial alliances.”

The assistant principal relayed to me that during her visits to these classrooms, she witnesses the kids genuinely helping and learning from each other. “It seems like

they all know that it is ok to make approximations and give answers that might not be right and no one will snicker or laugh. All of the teachers in this school work very hard on this.” I observed the third teacher in my study ask one of her pre-Algebra students, “What else do we need to do? She waited while the student was obviously rereading the problem to figure out what to do. The teacher’s willingness to slow down and genuinely listen to the student’s response was encouraging to the student. This eighth grade student persevered and gave another answer to the problem to see if he was on the right track.

In all of the classrooms, it was common to observe the teachers acting on their belief that each student has the ability to understand and to make sense of the mathematics they were studying. As one of the sixth grade teachers was leading a large group discussion with her students in advanced mathematics, she asked, “What do you need to do?” to a student who was not engaged. Without anymore coaching, the student said to his classmate who had just spoken, “What did you say?” asking his classmate to repeat his comment. Each of these teaching behaviors was used comfortably and as a matter of routine, and the students knew that their participation was expected and necessary. Throughout the school, classroom bulletin board messages including, “*Always listen and learn!*” “*Be Kind and Helpful to Others*” “*Be Quiet and Listen to the Person Talking*” support the staffs’ value of all students learning from one another.

It was very common to observe the participating teachers asking students to help one another. On one occasion in her regular sixth grade mathematics class, when the teacher noticed that in one group a third member of the group was unengaged, she said, “You guys need to pull him along.” And the teachers all monitored the ways in which their students offered help to others. When one student in the advanced sixth grade

mathematics class said “That is *not* going to work!” regarding a fellow student’s contribution, his teacher was quick and kind in his response “That’s not a very constructive comment. Your comment doesn’t help anyone to get smarter about math or this particular problem.”

During a lesson focused on preparing students to take the state-wide achievement test, one of the sixth grade teachers encouraged the students in the advanced mathematics class to be confident and write complete responses. “Show them how smart you are! To get advanced, tell them what you know!” Such coaching gives the students concrete evidence of their teacher’s genuine belief in each one of them and their capacity and potential. She modeled for the students what she would say if she were one of them. “I picked *mode* because it was the best measure of central tendency for this question. I told them what I picked and why I picked it.”

Within this category, I also want to present the data I collected related to the strategies teachers used to redirect student behaviors that hindered the establishment of strong relationships among students. In one instance, one student in the advanced mathematics class was being impatient and unkind to a student with asperger’s syndrome. One of the sixth grade teachers said:

“I jump on that kind of behavior right away. We were in the library, and I asked the student to look up asperger’s syndrome and learn about the situations that her classmate faces. I asked her privately to learn more and hopefully develop greater sensitivities about differences. I correct kids for stepping on each others’ toes and I believe that they know that nothing like this kind of thing slides. Emotional safety for all of the kids is very important if they are going to have the opportunity to feel comfortable, and to feel an equal part of our learning community.”

Establishing Challenging Learning Goals

This category focuses on the teachers' work to give each student access to grade level curriculum and to hold each student accountable for these high expectations. Within a skills-based mathematics curriculum, it is common for teachers to determine a specific skill that students do not know and dwell on that skill at the expense of students having experiences with the concepts that their peers are learning. For each of the teachers in this study, my data reveal three strategies that teachers used to strengthen learning outcomes for all of the students. First, the teachers designed classroom routines to support their students in organizing their learning strategies and goals. Second, they coached students about the benefits of working hard, completing homework and using classroom learning time wisely. Finally, they were focused on regularly assisting students with tracking what they were accomplishing, so that new learning experiences could be connected to past learnings.

In both sixth grade classrooms, the daily and weekly routines included time for the students to organize learning logs that included vocabulary words, class notes, and class assignments. I regularly witnessed students referring to their notebooks for answers to questions during small group problem solving times. On one occasion in the regular sixth grade mathematics class, the teacher asked her students to add the word *area* to their logs. Students used a standard graphic organizer including the definition of area, other key words associated with area, and examples and non-examples of area, including pictures and diagrams. The teacher asked the students to consider the area of an "L" shaped figure to support them in thinking more completely about the concept of area.

Later that week, this teacher referred students to their logs and this particular graphic organizer when she asked, “If you are stuck, what do you need to do?”

In an interview a few days later, she said:

“Because of the diversity of the students in my classroom, I pay special attention to all of the language and vocabulary that we use. In one instance, some of the kids (referring to her regular sixth grade mathematics students) didn’t know the word campsite or campground. We didn’t say, “REALLY!” We looked up some pictures of campsites on the internet and filled in the knowledge that these students needed. Then, we continued with the problem.”

Down the hall, her colleague was explaining to his students in advanced sixth grade mathematics, “The most important thing is that I want you to figure it out on your own—and not have me tell you how to do it, because then you will remember it longer.”

He was being clear that he expects each student to work at figuring the problem out in the way that makes sense for them. During each observation in his classroom, I saw students engaged and motivated to complete the tasks they were working on. He said:

“They (referring to his students in the regular and advanced sixth grade mathematics class) really don’t have the option to not pay attention. I alternate between small group time and large group time so that the kids know that we will keep on making progress with each idea. I notice that the kids really do learn more when there are divergent ideas from different perspectives on the table.”

The eighth grade teacher in my study explained, “The technology that I use—the wireless tablet and smart notebook—allow me to roam around the room and stay in closer proximity to all of the students.” Her students know that she expects all of them to work and to learn the ideas in their curriculum. Comments from her students indicate that her efforts impact her students’ beliefs about mathematics. One female Algebra student told me, “Everyone can be good at math but it depends on how focused they are.” And one of her male Algebra students said, “That is the only way to not know math is that the student just doesn’t care.” In private conversations with students, I heard this teacher say to a pre-

Algebra student, “I have to see you trying. Then I can help you.” Her steady and specific encouragement influenced her students’ work ethic, engagement, and performance.

I observed these teachers encouraging students individually and collectively. When five student’s hands were raised in response to one of the teacher’s question, she said quietly, “I’m not letting five people do the work for the class” indicating her commitment to each student and her expectation of participation and work from each student. Through this process, she regularly communicates her belief in each student’s capacity for learning. In another regular sixth grade mathematics classroom, the teacher asked, “Who can tell me my next step, and why? There are only three hands now. Now four. Now five. We need more people who are willing to help. Don’t you think?”

Each time I scheduled time to do classroom observations or interview the teachers, they were generous with their time. Through this process, I was very careful, because each of the three teachers was always engaged in the unending task of caring for each and every student. They used every extra moment of time to connect with and support their students. One day, in the hallway, in a side conversation with a student, one teacher was privately and kindly talking with a student. He said:

“You didn’t get your homework done? You have to budget your time. From the end of school yesterday to this morning, and subtracting off the time for sleeping and eating, you probably could figure out some time to do some school work.”

And several days later in class I observed this same teacher talking just as kindly to another student in sixth grade advanced mathematics. “You are not getting your work done a lot. I want you to come in at lunch so we can work together.” This indicates the teacher’s expectation that every student completes his or her work. Students know that their teacher believes that they have the capacity to learn the material. One of his students

in advanced mathematics said, “I try to figure out problems by myself. My teacher knows that I can, so I do.”

All of the teachers regularly talked with their students about taking responsibility for their own learning. One teacher, while discussing the answers to the warm-up problems for the day, talked to the whole advanced mathematics class, and said:

“As we look across the scores that you get on these warm up problems from day to day, I’ll find some time to work with you individually at lunch or something, if you are not making progress. We have to pay attention to this. If you get the right answers, good. But if not, we just need to work more on these kinds of problems.”

All three teachers were efficacious about the influence that they could have on each of their students. One explained:

“As teachers, we know that we can’t control what happens in the students’ lives outside of school, but we can control what we do for them to support their learning in school. We don’t give up on a kid—*ever!* If a student does not complete their homework at home, we know that we can provide other opportunities for them to show that they have learned the ideas.”

All of the teachers at City Middle School use the Connected Mathematics Program which was created with support from the National Science Foundation and is aligned to the National Council of Teachers of Mathematics curriculum standards. As evidence of the curriculum expectations that each of the teachers had for their students, the classroom walls were covered with key words that were sometimes organized by the curriculum units. Each word was accompanied by definitions that the students wrote. For example, words hanging in one classroom associated with the *Prime Time* unit included factor, prime number, GCF, composite number, square number; and, words associated with the *Data About Us* unit included x-axis, bar graph, histogram, line plot, frequency table. Teachers referred to these vocabulary words and definitions in their conversations

with their students, and the word walls contributed to a print-rich and purposeful classroom environment. Additionally, there was a regular focus on vocabulary words associated with problem solving processes for students to experience. In one classroom, the teacher had the words *revise*, *support*, *compose*, *predict*, *consider*, *synthesize*, *solve*, *investigate*, *omit*, *reflect*, and *analyze* hanging from the ceiling.

To support student success with grade level curriculum topics, it is important for teachers to help students understand the rationale for problem solutions instead of relying solely on the students' abilities to memorize answers to questions. In one case, the teacher said to the students in pre-Algebra, " $B^2 = 225$. The whole square is 225 units. So what is the length of the side? That's what taking the square root means." In this case, the teacher helped an individual student privately and gave the student a reason for what he was being asked to do, even though finding square roots was not the focus of this particular lesson.

Similarly, when solving a problem with students in Algebra that referred to a two-dimensional map of a cylinder, the teacher held a cylinder map in her hands that they had made in an earlier unit and reminded the students why the length of the rectangle was the circumference of the circle by wrapping it around the circle. A few days later, as one of their warm-up problems, the eighth grade students in Algebra worked to determine the line of best fit for various data sets. She reminded a couple of the students about the work they did with a piece of spaghetti as their anchor for thinking about this idea. I regularly saw students referring to information that was displayed on the commercial or student created wall charts in their classroom to solve problems. One sixth grade teacher explained:

“I definitely rely on the fact that our curriculum spirals, so that students can keep going with their classmates and I know that we will have more opportunities to help them with the ideas that they don’t understand right now. I always ask, “Is there another way to do it?” because I know that these kinds of conversations help the students to see the problems more completely. And then, I make a mental note that this particular student or this particular group of students will need more help with this idea as we go along.”

Each time during my data collection process that I had time to talk with any of these teachers individually, I was struck by their ability to balance appropriate mathematics learning goals and taking care of each student personally so automatically.

On one occasion, one of teachers said:

“I just noticed the other day that two of my students are more out of their shell (referring to two students in the regular sixth grade mathematics class). I’ve been giving both of them extra attention and help so that they understand the math that we are working on and they realize that they can accomplish what I ask them to get done. In fact, one of them said, ‘This isn’t so hard’, for the very first time.”

Reasoning and Sense-Making

In this section, I will share the data I collected to answer another major question for my study. How do the participating teachers facilitate purposeful student interactions regarding student generated solutions and solution methods focused on understanding mathematics? The consistent behaviors of these teachers assisted their students in developing a much more comprehensive understanding of the purpose and nature of mathematics. Additionally, students learned that they each had the capacity to do and value doing mathematics.

The *Connected Mathematics Program* provides these teachers with daily problems that are engaging for middle school students and focused on important mathematical ideas to learn. Within each unit of this program, the key questions helped to organize each teachers’ instruction in important ways. For example, within the sixth

grade *Bits and Pieces* unit the main focus is on comprehensively answering the question, *How are fractions, decimals and percents related?* As each teacher at City Middle School engages students in these kinds of investigations throughout each year and across the years, students have opportunities to develop conceptual understandings over time and to develop a healthy disposition about their own potential as a mathematical thinker.

Each of the three teachers in my study had specific classroom routines in place that included giving their students warm-up problems at the beginning of each class session. At times, students had their own worksheets for the warm-up problems, and at other times, the written directions for the warm-up problems were on the board. In one of the sixth grade regular mathematics classrooms, the directions on the board were, *Do these three problems. Explain your answer. Even if you are not sure, write down what you do know about the problem.* This sort of constant focus on solving problems, explaining your thinking, and trying or keeping track of what you do know about a given problem was evident on a regular basis in each of the three classrooms.

In many cases, the middle school mathematics curriculum is organized into separate chapters dealing with computation using fractions, decimals, whole numbers, or percents. At City Middle School, it was more typical to see the use of problems like, $5/7$: *Write the equivalent decimal and percent*, given during these practice sessions. Often, the teachers would facilitate *number talks* after the warm-up activity in which the students would consider the relationship between numbers within an oral discussion with their peers. For example, one day, the eighth grade pre-Algebra students were discussing these three relationships, first to find the values of the variables, and then to compare their solutions between the three problems: $\frac{3}{4} = f/16$; $\frac{3}{4} < d/16$; and, $\frac{3}{4} > x/16$ The teacher

first asked the students to think about the problems individually, then groups talked at their tables and finally, the teacher facilitated a conversation between the small groups. In giving the directions to her students, she said, “As I am walking around, I want to hear reasons, not just answers. Consider asking in your group, did anyone figure it out a different way?”

This constant focus on the students’ sense-making about solutions resulted in learners who were articulate about their thinking, even if it was not always complete. One seventh grade male told me that he’s glad his teacher wants him to think, so that “when I go shopping, and they give me change, I don’t get ripped off! But really, math involves a lot more than money. So I’m glad to be learning so much.” During one number talk session, one of the sixth grade teachers said to a student in advanced sixth grade mathematics, “Your method is risky. We haven’t tried that before. It shows good number awareness.” This student’s reaction was to use a louder voice with more confidence as he continued to tell his classmates about his idea. And, his classmates listened with greater intensity.

During one introduction to this warm-up time in her class, the eighth grade Algebra teacher coached her students, “How do we remember volume? What did we do in class so that we have a picture in our heads every time we hear the word volume?” One of her students responded without hesitation, “We poured water into a vase and it filled up the bottom first, and then the water rose to the top of the vase.” When I talked to this teacher later, she was particularly happy with this response from a student who she didn’t realize had such a solid understanding. Number talk sessions regularly concluded with

comments from the teacher such as, “It doesn’t matter which method you use as long as we come up with the same answer.”

One of the sixth grade teachers used a graphic organizer each day in her advanced mathematics class to present the warm-up problems. The graphic organizer had separate sections on the page for *Algebra, Computation, Probability and Statistics, Number Sense, and Geometry and Measurement* so that her students could see and develop a more complete understanding of the alignment between the work they were doing and the learning expectations for their grade. On some days, students are asked to do problems involving geometry and computation, and on other days, they completed algebra and number sense problems. She regularly gave her students time to work on the warm-up problems, and then she wrote some of the answers on the white board. She asked her students, “Who would like to go to the board and change anything that I just did?” As a matter of routine, several students took turns without a lot of verbal explanation.

If the problem seemed more confusing to her students, the teacher spent more time leading a discussion about her students thinking. One day, she asked the students to determine the equivalent percent for the decimal 1.12 in the computation section of the graphic organizer. After several students went to the board to talk about their thinking, the teacher asked all of the students to tell someone in their group why the answer is 112%. When she thought they had spent enough time, and most of the students were understanding the explanations from their classmates, a student persisted. She asked, “If % means *out of 100*, how can the answer be 112%? Doesn’t the answer have to be less than 100?” Without any comment from their teacher, another student said, “Have you ever gotten 112% on a test? What does that mean?” At this point, the teacher asked each

small group to think about this question that came from one of their peers. After about ten minutes, two other students volunteered to share with the whole class how their group was thinking about this problem.

This kind of exchange between students and this kind of flexibility in lesson planning and enactment was typical during my observations in each of these three classrooms. Probably most noteworthy related to a thorough description of culturally responsive teaching is the fact that I always tracked the percent of students engaged in these kinds of interactions. And I was always struck by the fact that the majority of students in each of the learning communities were genuinely participating and asking questions so that they could understand the problems that were the focus for the day.

With a healthy emphasis on covering the ideas that were the focus for a given day, I regularly witnessed these three teachers taking extra time for certain problems if the students needed more conversation or additional experiences to understand the ideas. For example, in one sixth grade advanced mathematics class, the students were working to reduce $65/100$. One student gave the answer $13/20$, and their teacher was ready to proceed to another problem. In the middle of the teachers next set of directions for the students, one student said “So it is still 13 out of 100, isn’t it? Thirteen is prime but 20 isn’t, is it?” In this case, the teacher took time for students to ask questions and seek more understanding. Given the comfortable reaction of her students to her obvious pause in the flow of the lesson, I could sense that this focus on developing understandings was a usual way of doing their work together.

Each of the teachers spent the majority of every class time focused on the main ideas for the day within their curriculum materials. They were persistent in their support

of their students thinking within each lesson. For example, one sixth grade teacher said to the students in advanced mathematics:

“Can you use your background knowledge and your vocabulary to help us solve this problem? There is a \$50 one time fee to tow your car, and then you have to pay \$4 per mile to have your car towed however far you would need to go. Can you determine the formula and determine how much it would cost to tow your car 24 miles?”

When one student said, $50 + 4 + \# \text{ of miles}$, another student corrected him. “The 50 and the 4 are not the same kinds of numbers in this problem.” Throughout this session, all of the approximating by the students was genuine and they persevered without any of their classmates becoming impatient. This kind of exchange between students related to appropriately challenging mathematical ideas was common during the times that I spent in the classrooms at City Middle School.

The teachers constant use of questions like “Why would that answer make less sense than the answer we were talking about before?” encouraged a dual focus on mathematical knowledge and reasoning or sense-making. In sixth grade regular mathematics class one day, the teacher said, “So think of the story and see what makes sense to divide. You can’t always say divide the bigger number by the smaller number. We have the miles and we want to see how many miles each swimmer swam. And in another case, a student exclaimed: “12 buses! That’s a lot of buses!” in response to another student who was offering an answer. Without reminding the student about voice tone or taking turns, their teacher instead supported this impulsive and energetic problem solving and said, “Well. For our field trips with our team, our buses hold more than 30 students, so that would make a difference, right? In this problem, the buses just hold 30 students. Our buses hold 60 students, so we only needed three buses.” Effortlessly, the

teacher helped connect the ideas under consideration to examples from the students own experiences.

When I walked into a sixth grade advanced mathematics class one morning, I was glad to witness students working on the problem, *what are all of the ways to solve $1\frac{1}{2}$ divided by $\frac{3}{4}$?* As the students were sharing their different approaches in a whole class discussion, one student was recording the contributions from each of the small groups:

1) $\frac{3}{4}$ plus $\frac{3}{4}$

2) $\frac{3}{2}$ divided by $\frac{3}{4}$ so you try to figure out how many $\frac{3}{4}$'s are in $\frac{3}{2}$

3) 1 divided by $\frac{1}{2}$ and $\frac{1}{2}$ divided by $\frac{1}{2}$

In the middle of this process, a student shouted, "I don't get (understand) that answer, and I don't believe it either!" In a typical middle school mathematics classroom, this student might be admonished for such behavior. In this case, her teacher said, "What don't you believe about the answer we are discussing?" When I talked later to the teacher about this exchange, he said:

"I wanted to support the thinking she was doing. This particular student (a new student to their school just 4 months earlier) isn't participating as regularly as I would like, so I want to support her as she adjusts to our school and a whole new culture. And I want all of my students to form opinions and defend them using mathematics if they can!"

Sharing Leadership and Decision-Making

The final question for my study was the most interesting to investigate. *How do these teachers share decision-making and leadership with all students?* I did not often observe students leading large group discussions of problem solving strategies and solutions or students making decisions about topics to study. However, I did record numerous situations that give evidence of student ownership of their accomplishments

and success and students' drive to work hard and persevere that their teachers fostered through their shared leadership disposition in the classroom. "The trick of culturally responsive teaching is to get students to 'choose' academic excellence" (Ladson-Billings, 1995, p. 160). Indeed, the data I collected shows how the three participating teachers in this study were capable of organizing lively and productive learning environments for their students. And notably, these environments were supportive for *all* of the students.

Just before their holiday break in December, I witnessed a large group of sixth graders in an advanced mathematics class eagerly listening to their teacher as she explained their next project. The classroom was joyful and noisy. The teacher wanted the students to collect data about questions in which they were interested, and she was introducing how to use the *Google Docs* website so that they could jointly create a display of their findings. When students were about to access the website and enter data that would be available to people participating in a larger social network, the teacher wanted the students to remember their responsibilities. She said:

"You are representing yourself, your math class, your school, your school district." The students helped her complete this list. "We are proud of our school and our school district and we don't want to do anything that would ruin people's ideas about our great school!"

The teacher was communicating her desire for the students to work with her to create the image people have of their school and classroom. Examples such as these were common and important. Through these experiences, the students I observed were encouraged to see themselves as leaders, to recognize their individual strengths, and to take pride in their accomplishments. I believe these examples demonstrate how these skills are the

foundation of developing efficacious attitudes that support ongoing productivity and success.

In several instances, teachers gave students direct decision-making power regarding in which small group they work and which assignments they complete to show that they have accomplished the expected outcomes. In other cases, teachers collected feedback from their students so that they could organize future instruction and activities that were helpful to the students. The eighth grade teacher said, “I talk with the students a lot about how things are going. I ask the kids, *Is the homework too hard? Is it too long?* Their answers to questions like these help me to be a better teacher.”

Each teacher used the information they had about individual students to organize their instruction and their classroom. Knowing that a student’s “primary language, developed in the context of social interaction, is fundamental to the thinking, learning, and identity of every individual (Miramontes et al, 1997, p. 15)” I observed teachers allowing students to move freely between use of their first language and their second language as they were comfortable. School staff, parents and community members, and students operated from the belief that bilingualism or multilingualism is a cognitive, social, and economic asset (Miramontes et al, 1997; Perry et al, 2003; Reyes et al, 1999) and people’s use of multiple languages was a regular part of the school culture. At City Middle School, leaders take seriously their responsibility to plan programs for their linguistically diverse students and reflect regularly about the ways in which their overall instructional program builds on students’ linguistic strengths (Miramontes et al, 1997).

One of the sixth grade teachers explained:

“When they request it, I sometimes group students by race so that there is increased comfort in the conversations that they have. Sometimes, I group kids by language so that kids who speak Spanish as their first language can speak Spanish while solving the problems they face. Sometimes the kids work with their friends so that they can be as comfortable as possible. I really think that in certain situations, grouping structures and arrangements are better if they are set up depending on what the kids want. When students know that they can influence how our classroom works we all can be more successful at building a strong classroom community. And a strong community helps to reduce achievement gaps between students and it supports the development of deeper understanding for all of the students. The students know that I want them to help each other out, and everyone has the opportunity to learn more.”

Her teaching colleague said:

“One of my classes is much more verbal than the others. They call out answers more, and they talk to others across groups so much more. But, the whole time, I know they are engaged and working on the math problems, so I let them continue with behaviors that are productive for them.”

In one of the sixth grade advanced mathematics classrooms, one of the students chooses to sit at a table by himself against the back wall. During our interview, I asked his teacher about this arrangement. The teacher said, “I just don’t get into power struggles with him. He might join small groups on some days, and other days, he doesn’t. He chooses. I just pay close attention to be sure that he is learning and understanding what we are discussing.” From my observations, this type of decision making on the part of these teachers contributed to high student engagement and respectful relationships between all of the members of the learning community, students and teachers alike. These relationships support trust and risk-taking, and ultimately greater confidence for each of the students. This teacher continued:

“Students know that in our classroom community, they have to be responsible. They have to make an effort. They know that if they do, they will learn more, and they will be able to help their friends more because of their understandings. As

this school year has progressed, I see more and more of the students taking leadership roles in their small groups and feeling secure enough to make sure their voice gets heard.”

In each of the three classrooms, students refer to their journal or log as each curriculum unit progresses. At the end of a large group conversation one day, one eighth grade student in Algebra said, “If you look in your journals on January 9th, we all wrote down the formula for the circumference of a circle.” Her contribution not only helped others with the specific problem they were working on, but she also helped her classmates understand the value of their individual logs as tools for collecting evidence of the progress they are making and the knowledge that they’ve gained. In one sixth grade advanced mathematics classroom, the teacher regularly records a student’s (or group of students) method for solving a problem and names it their method to give students credit. Each of the students records the method in their journal as their classmates’ method. Then, as a class, or in small group problem solving settings, students refer to that method as that student’s method. The teacher explained, “This is one way that I give kids positive attention.”

The participating teachers regularly encouraged students to be willing to help others after they developed their own understanding of the topics they were studying. One of the sixth grade teachers asked her students in the regular mathematics class, “Who knows how to do these problems? You can serve as a master for others.” And to the rest of the class, she said, “Use these four people to get help if you need it.”

To support his students in the advanced mathematics class, one sixth grade teacher responded, “Maybe I just didn’t say the question right...and, maybe you are not seeing how I am thinking of the problem” when students gave the wrong answer to his

question. Later, he said to the class, “I mess up like that too sometimes” which allows him to support student thinking and acknowledge their solution methods and ideas. This action on the part of the teacher encourages participation and thinking from all of the students. And he is sincere about sharing the teaching role in the classroom with his students. On another day, he said to his class, “I used this method. That is just me. There are other ways.”

Throughout my data collection process, at various times, each of the three teachers shared their reflections about the dilemmas they face as they work hard to meet the academic and social needs of all of their students. One sixth grade teacher said:

“I’m always wondering what to do with quieter kids, because I want them to participate publicly but I wonder if sometimes that is too emotionally stressful. I visit with them individually whenever I can. I try to figure out a good balance. I use popsicle sticks with the students’ names on them as a way of selecting students randomly, so they all know that I’ll call on them at any given point. I don’t use the popsicle sticks when we are exploring a new concept so that there is more safety in the classroom. Students can try out their thinking without worrying about sharing with a large group.

On another day he also shared:

“As a male, I think I face different dynamics in building relationships with the students. I know they can perceive me as more cutting or curt. Lots of kids without dads can be crushed so easily. I try to let kids be engaged in learning in their own way and I am always encouraging if they are not engaged. Some kids need more praise and support, and I try to make sure they get it. It has taken me 10 years to figure out how my style can be used to support each learner. I’ve listened to many many parents and families talk to me about how I am helpful or not helpful to their child because I want to support each student’s success.”

The eighth grade teacher in my study talked about her work to support her students and the uncertainty that she faces. She said:

“Students know that if I do get upset about their classroom behavior, or their lack of completed assignments, it is because I care about them. I work to be sure that kids take responsibility for their own assignments and learning. But I never know

for sure if my comments to some of my students make the situation more stressful for them, or if they understand that I care about them.”

The teacher explained that she tries to have them become self-initiated. She wants students to do their assignments and actively participate in class because they know how important their own growth and development is for their futures.

I was regularly struck by the knowledge these teachers had about their students' activities beyond their classroom time together. One student came into his sixth grade regular mathematics class 20 minutes late, and his teacher used a very quiet tone to say, “Were you causing trouble on the bus?” After the student responded, the teacher continued very genuinely, “Why did you do that? You are such a good leader. You need to be the good leader that you are.” This teacher's expectations for his students extended beyond the 90 minutes that he spent with them in class. And, he used every possible opportunity he could to support his students' visions of themselves as productive respectful members of their school's community.

Chapter Four

Discussion

In this final chapter, I define three themes that frame the discussion of what I learned from my research study that focused on how middle school mathematics teachers employ culturally responsive teaching strategies. These three themes include the importance of a strong school culture; the impact of teachers' using an additive view of diversity (Garcia et al, 2004); and, the value of expanding students' understanding of what it means to be successful in mathematics. The data that I collected to define these themes are evidence of strength for City Middle School.

The work that the faculty in general and the math department specifically accomplishes contributes to the attainment of the goals of *culturally responsive teaching* including, high academic achievement for all students; supporting students in affirming their cultural identities and maintaining individual self worth; and, nurturing the development of an ethic of care in each member of their learning community—students and adults. At City Middle School, student's academic achievement is coupled with opportunities for each student to acknowledge, learn more about, and be proud of their own culture and family values. Equally important, students learn about their peers' cultures and family values as well. This chapter will conclude with a brief discussion of the practice of ability grouping students at City Middle School, and its impact on the staff's ability to fully attain their school's mission of *Excellence and Equity*.

The Importance of a Strong School Culture

As reported in Chapter 2, during the last eight years, the student population at City Middle School has changed from 24% to 34% African American students, 13% to 30% Latino students, and 55% to 30% White students. These shifts in demographics contributed to my motivation to study the quality of mathematics learning that students are receiving in this setting, and to record the teaching behaviors that are contributing to the students' success. Despite these changing demographics at City Middle School, the number of students scoring at the proficient and advanced levels on the state mathematics achievement test has grown from 40% in the spring of 2006 to 59% in the spring of 2008. Findings from my study describe the school-wide and classroom specific variables that contribute to these results given the complex context.

Research studies in recent years have pointed to the importance of school and district contexts in the support of teaching reforms (McLaughlin and Talbert, 2001). From my observations, I believe that City Middle School's strong and consistent school culture supports widespread lively student engagement, multiple opportunities for teacher reflection and professional growth, and strong examples of culturally responsive teaching in mathematics. Janet Schofield (1995) suggests that one strategy for supporting trust amid differences in the classroom is to work to be responsive to the learning community's diversity in planning curriculum, in making staffing choices, and in thinking about how best to serve students (p. 640). At City Middle School, the school's mission is actualized through each of these components and others. Importantly, this school's mission is aligned to the goals that researchers define for public schools that provide students with opportunities to acquire the skills needed to become wise

participating democratic citizens (Glickman, 1993; Goodlad, 1984, 2004; Greene, 1988; Holzman, 2007; Kozol, 2005).

In a democracy, leaders want schools to foster a commitment to free inquiry, questioning, and participation; to maintain a focus on access and equity; to implement a curriculum that encourages free thought and independent judgment; to act on a standard of full recognition of the humanity of each individual and to support the development of a social justice disposition within each student (Manzo, 2008). My data suggest that the students at City Middle School have regular opportunities within their mathematics classes to attain their full potential as democratic citizens because of the strategies their teachers use consistently and inclusively. One of the sixth grade teachers said,

“In the big scheme of things, I think as a faculty, we have moved from *tolerant to appreciative and interested* when we think about our approach to multicultural education. And our revised thinking influences everything we do. We are a very strong group and very focused on helping the kids—*all of the kids*—in every subject!”

The eighth grade teacher in my study admitted, “I knew that our school’s mission is being lived when one of my students said to me, ‘I know I am disappointing you because I’m not handing in my assignments. I know I am not learning as much as I could.’”

Using an Additive View of Diversity

An additive view of diversity on the part of school leaders produces different results than deficit thinking. Here, teachers and systems develop a strong sense of their own influence over student learning because they dedicate time and resources to learning about the strengths and knowledge that students and families bring to each learning opportunity. Survey results from 16,500 middle school and high school students of color involved in the Minority Student Achievement Network indicate that their teachers are

important to their overall motivation and success when they honor and acknowledge their backgrounds and prior experiences within their classroom environments.

In my study, I found that at City Middle School, each student matters to their teacher. Teachers regularly “raised the status of students” (Cohen, 1994) by praising what they said that had intellectual value; bringing productive comments to other group members’ attention; asking a student to present their thinking to a larger group; or, praising a student’s work in a whole class setting. Praise is a strong influence of student learning and achievement if it is specific and relevant to the learning task (Cohen, 1994).

My data reveal that students at City Middle School are learning to treat each other in more respectful ways than is typically seen in schools based on the day-to-day experiences in their mathematics classes. Cliques (based on ethnicity or other factors) were not evident in the mathematics classrooms. And the participating teachers were endlessly dedicated to caring for each and every student in their classroom. Equitable relations among students can be better supported through more equitable classroom conditions such as these.

Unless teachers work to expand the dimensions along which students regard each other, students readily classify themselves and others into categories, such as ‘smart’ and ‘dumb’ (Boaler, 2006, p. 183). But at City Middle School, the students were learning a great deal about the strengths and needs of others. According to one of the sixth grade students:

“When I am helping someone who needs help, I just start them on the right path. I let them finish with the rest of the problem so that they know that they can do the problem. They just needed a little help. You know. Not everyone is smart at the same problems. We are all smart sometimes.”

It was a common occurrence in my classroom observations to watch students operate with confidence whether they understood the problems they were solving or not. Students had very subtle ways to let their teachers or their peers know that they had a question. The teachers picked up on their students' gestures for extra support seemingly automatically. In one instance, the teacher responded to a female student "I do that too sometimes. I multiply by 2 instead of squaring a certain quantity", after the student let him know very quietly that she didn't understand how he got the answer that he did. In this case, and in many others that I observed, the teacher shared the learners' role with the students and held to strong beliefs about this individual learner's potential.

On another day, the other sixth grade teacher said, "I got letter C as well (referring to a multiple choice question) which means nothing. I am not the authority, here. How many of you got C? We need to justify this choice." And the eighth grade teacher said:

"In my classroom, students know that learning is a social event, and that as a class, we can create stronger rationale for our problem solving methods and the answers that we get. The students know that I am not the only one with the answer and the ideas about how to solve a problem. I want each student to have a good sense of their own accomplishments, and to know about the things they still need to learn."

Repeatedly, I witnessed instances where these teachers shared their thinking with their students. One sixth grade teacher said to his class, "I get confused too when I see 10^5 . I always think, does that mean 5 more zeros or 5 zeros all together? So I do 10^2 . I know that is 100. Oh! 2 zeros! So 10^5 has 5 zeros." His students responded to his humility with respect and curiosity. In each of these classrooms, teachers acted on the

knowledge they had about each individual student and were encouraging and overtly optimistic about the learning potential of each of their students.

Defining Success in Mathematics

During the student focus group, I asked each student, what does it take to be successful in your mathematics class? The participating students offered a range of answers without hesitation. They said:

“asking questions; make sure you ask for help if you need it; try to put the problem in your own words; be careful; don’t give up; think about how you got your answer to a different problem that is kind of like the one you are working on; be logical—you *have to make sense*; justifying your work; considering the answers and ideas from other students.”

These responses were different from traditional answers like, “you need to concentrate and you need to pay careful attention to the steps that your teacher shows you” (Cushman, 2008). Through constant and deliberate uses of specific teaching behaviors, the three teachers in my study were able to produce students who have expanded ideas about mathematics and healthy notions about their own ability to be successful as mathematical thinkers.

These teaching behaviors include creating time for individual, small group, and large group problem solving, supporting students in their effort to explain their mathematical ideas and thinking strategies, and using problems that are engaging and focused on important mathematical ideas. At City Middle School, I observed students who are regularly provided with guiding questions from their teacher or their peers that assist in promoting understanding and making sense of the mathematics content, a component of the high quality mathematics instruction described in the *Looking inside the Classroom* report (Weiss et al, 2004).

In all three of the classrooms associated with my study, the teachers processed effective group behaviors with the students. The roles assigned to the students during small group work contributed to the overall classroom system in which everyone had something important to do and all students learned to rely on each other. Whenever the students worked in small groups or during whole class problem solving time, these teachers expected students to ask one another questions about their work. They encouraged the interactions between the students to be focused on “why?” questions that required justification from the person who is answering. And, students were encouraged to stick with a question until they are satisfied that they had a complete explanation to their question.

In many of the classroom scenarios that I witnessed, these teachers followed along closely to their student descriptions of their thinking, and encouraged students to make their explanations more complete. They asked probing questions when necessary in order for students to think more carefully and more deeply about their explanations. Based on these experiences over time, students expected their peers to defend and justify their answers, and they became better at talking about their own thinking. These teachers regularly used students’ ideas and methods as the basis for lessons or extensions to the lessons. When sharing the teaching role with the students, these teachers expected students to be responsible for co-evaluation of the work and thinking in the classroom. I witnessed students listening to understand and expecting to be heard. Through all of these experiences, the students developed confidence in their own problem solving abilities knowing that their ideas are valued by their teacher and their peers.

Ability Grouping

Grouping students according to test scores or ability as measured in other ways is a very common practice in middle schools and high schools across the country (Goodlad, 1984, 2004; Oakes, 1985; Sapon-Shevin, 1994). A consistent finding across studies on ability grouping is that students in lower ability groups are offered curriculum and instructional programs that limit or severely limit their opportunities to learn (Boaler, 1997; Oakes, 1985). Lower track classes, disproportionately populated by students of lower socioeconomic status and ethnic minority students, maintain or produce inequities in schools because they are often taught by less well qualified teachers and teachers who often have low expectations for their students (Boaler, 2006; Oakes, 1985).

At City Middle School, each mathematics teacher groups their students by results they receive on beginning-of-the-year classroom assessments and results on the state level mathematics test that students take each spring. The two sixth grade teachers in my study worked with a general mathematics group of students and an advanced mathematics group of students. The eighth grade teacher taught a group of students pre-algebra and another group Algebra. For each of my classroom observations data points, I noted which group of students the teacher was teaching.

While I observed times when each teacher was less patient with their *lower ability group* of students, I did not emphasize these results in my report. Instead I focused on the examples I saw that support a strong definition of *culturally responsive teaching*. However, there were enough instances in which the three teachers in this study behaved differently with their *lower ability group* of students that I wondered about the implications based on the research results regarding such grouping decisions. I noticed

times in which these teachers were less energetic and used more questions with one word or right answers when they were working with their lower ability groups of students than I observed when they were working with their higher ability groups of students.

Because mixed ability approaches have consistently demonstrated more equitable outcomes (Boaler, 1997; Cohen and Lotan, 1997), it would be interesting to observe the effects of mixed ability grouping structures at City Middle School. Given all of the components of effective mathematics instruction used in this setting, undoing this ability grouping tradition would no doubt further the staff's interest in supporting growth for all learners. Not only would students learn more mathematics, but in mixed ability group classrooms, learners can better see the value of differences in thought. This opportunity would have a significant impact on the staff's desire to support the development of more equitable dispositions in each of their students.

Summary

In this chapter, I defined three themes that emerged from the data I collected while completing my case study research at City Middle School. All of the data that I collected to define these themes allow the staff at City Middle School to actualize the goals that they set for themselves and their students as they strengthen their use of culturally responsive teaching strategies. Perhaps the most comprehensive definition of culturally responsive teaching is given in Geneva Gay's (2000) book, *Culturally Responsive Teaching—Theory, Research, and Practice*. These descriptive characteristics are as follows:

1. It is validating—because it acknowledges the legitimacy of the cultural heritages of different ethnic groups as legacies that affect students' dispositions and approaches to learning, and as worthy content to be taught in the formal

curriculum; it builds bridges of meaningfulness between home and school experiences; and, it teaches students to know and praise their own and each others' cultural heritages.

2. It is comprehensive—because it focuses on teaching the “whole” child including acquiring academic skills and concepts, cross-cultural competencies, critical social consciousness, and responsible community membership.
3. It is multidimensional—because it includes curriculum content, learning context, classroom climate, student-teacher relationships, instructional techniques, and performance assessments.
4. It is empowering—because it enables students to be better human beings and more successful learners.
5. It is transformative—because academic success and cultural consciousness are developed simultaneously so that students are prepared to identify inequities and plan strategies to attain goals that further the realization of a common good.
6. It is emancipatory—because it encourages students to find their own voices, to contextualize issues in multiple cultural perspectives, to engage in varied ways of knowing and thinking, and to become more active participants in shaping their own learning and planning for productive citizenship (pp. 29–36).

These characteristics are aligned to the goals that the staff at City Middle School wants to attain.

In addition to providing a description of culturally responsive teaching in middle school mathematics, another important outcome of this study is to uncover and justify the quality and quantity of teacher development necessary to build teacher capacity to establish learning experiences and environments that support deep learning for all students—including those who have been traditionally marginalized. Teachers need opportunities to develop deeper understandings of mathematics (NCTM 2008) and they need opportunities to learn and to think through teaching strategies that are culturally responsive and effective for all students (Gay, 2000; Howard, 1999; Shade et al, 1997). At City Middle School, both the school-wide and department specific professional development plans support the mathematics teachers in their desire to improve their

instruction. Carefully supporting effective teacher behaviors is necessary because teachers play a crucial role in student learning.

Because of the staff's collective interest in motivating all students to work hard and achieve at high levels, the focus of the school-wide professional development at City Middle School during the past several years has been to reflect on answers to questions like each of the following:

“How does the learning experience contribute to the development of participants as a community of learners who feel respected by and connected to one another and to the teacher (respect and connectedness)?
How does the learning experience offer meaningful choices and promote personal relevance to contribute to participants' positive attitude (choice and relevance)?
How does the learning experience engage participants in challenging learning that has social merit (challenge and engagement)?
How does the learning experience create participants' understanding that they are becoming more effective in authentic learning that they value (authenticity and effectiveness)?” (Ginsberg et al, 2000).

The mathematics teachers extend these discussions within their weekly department meetings, and apply the strategies for attaining their school goals to their mathematics classrooms. They work together to create and revise assessments based on student results, and their ongoing collaboration contributes to their growth and deep satisfaction with their accomplishments. Understanding the depth and quality of professional development necessary to enhance all teachers' expertise and giving attention to the needs of specific groups of students in mathematics are important areas of focus for future research studies.

Additionally, future research studies could be organized to gather data about the leadership work that has supported the creation of the strong school culture that is in place and the use of culturally responsive teaching in mathematics.

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APPENDIX A
District CSAP Growth Expectations

- Students scoring in Below Proficient levels must gain more than students in Proficient and above levels in order to “catch up”
- Students scoring in levels Proficient and above must basically gain enough to stay in their relative performance levels over time
- Target for students scoring Below Proficient: One “step” or more
- Target for students scoring Proficient and above: Gain enough to maintain relative performance position
- Students in “A” range may score in “A” or “A–” the following year.

	US	US+	PP–	PP	PP+	P–	P	P+	A	A–
US										
US+										
PP–										
PP										
PP+										
P–										
P										
P+										
A										
A–										

APPENDIX B
Permission to Participate in Research—
Culturally Responsive Secondary Mathematics Teaching:
A Case Study to Describe How Teachers Use These Teaching Strategies

An Invitation: We are inviting selected teachers in the Cherry Creek School District to participate in a study that will help to describe how secondary mathematics teachers use their skills to deliver culturally responsive instruction. We are asking you to participate in the study. The research is being conducted by Rosanne Fulton for partial fulfillment of a doctoral degree from the University of Denver under the supervision of Dr. Kent Seidel. The study has been approved by the Cherry Creek School District.

Purpose: The purpose of this study is to answer the question, how do effective secondary mathematics teachers employ culturally responsive teaching strategies? The most important contribution of this study is to justify the quality and quantity of teacher preparation and development necessary to build capacity to establish mathematics learning experiences and environments that support deep learning for all students—including those who have been traditionally marginalized. Additionally, this study will assist in the refinement of questions that can motivate future research projects.

Description of the Study: The researcher will conduct eight to ten classroom observations lasting 2 to 3 hours in each of three or four selected mathematics teacher's classrooms, and all notes will be confidential so as to not publicly identify any teacher's personal information. The focus of the observations will be determined by the responses the participating teachers give on the researcher's initial survey that identifies a broad range of characteristics of culturally responsive teaching in mathematics. Additionally, the researcher will interview these teachers and their specific administrators and academic coaches and all interview data will be confidential. Each interview will not last longer than one hour. Further, the researcher will conduct a focus group with representative students from each of the participating teacher's classrooms to secure student perspectives about their mathematics learning experiences. Confidentiality cannot be guaranteed in a focus group setting, though the researcher will not report any data specific to a particular student. Two final data collection processes will include a review of specific students' mathematics Colorado State Assessment (CSAP) scores for the past three years (using anonymous student identifiers), and a review of other related classroom and school documents that contribute to an understanding of the work of the participating teachers and the decisions that they make. Classroom observations, interviews, the focus group, and the review of artifacts and student achievement data will occur from October 2008–February 2009.

Potential Risks: Potential risk to the participants include the possibility that some individuals may feel uncomfortable being interviewed and having lesson plans and other documents reviewed by the researcher. In addition, participants may feel anxiety, concerns around class records being exposed, and feel uncomfortable sharing their personal rationale for the decisions they make in their classrooms. Some participants might be uncomfortable providing answers to the interview questions. Participating teachers will have the right to drop out of the study at any time for any reason without consequence.

Potential Benefits: This study may potentially inform: 1) School and district-level goals, policies and instructional practices with regard to culturally responsive instruction in mathematics; 2) Preservice and inservice professional development plans for mathematics teachers in order to help them attend to the cultural well-being of their students; and, 3) Research questions for future studies.

When the study is completed, participating teachers will be sent a report of the overall findings. Because all answers are private and confidential, there will not be results for each individual.

Confidentiality: The answers that participants provide to the interview questions and other demographic information and information gathered from school and classroom documents will be kept private and confidential. All records including student achievement data will be kept confidential. Participant names will not be included on classroom observation forms or interview question worksheets. Only group results and general trends will be reported so that individual participants can not be identified. There are two exceptions to the promise of confidentiality. If information is revealed concerning suicide, homicide, or child abuse or neglect, it is required by law that this be reported to the proper authorities. In addition, should any information contained in this study be the subject of a court order or lawful subpoena, the University of Denver might not be able to avoid compliance with the order or subpoena.

Voluntary Participation and Right to Withdraw: Your participation is voluntary. You have the right to withdraw from the study at any time and this will not affect you in any way.

Future Questions and Concerns: If you have any questions about the study or your rights as a participant you may call Dr. Kent Seidel at 303-871-2496. If you have any concerns or complaints about how you were treated during the study, please contact Dr. Susan Sadler, Chair, Institutional Review Board for the Protection of Human Subjects at 303-871-3454, or Sylk Sotto-Santiago, Office of Research and Sponsored Programs at 303-871-4052, or write to either at the University of Denver, Office of Research and Sponsored Programs, 2199 S. University Blvd., Denver, CO 80208-2121.

Authorization: I have read and I understand the description of the study, “Culturally Responsive Mathematics Teaching: A case study to describe how secondary mathematics teachers gain and use these types of teaching dispositions and strategies”. I have asked for and received a satisfactory explanation of any language that I do not fully understand. I agree to participate in the study, and I understand that I may withdraw my consent at any time. I have a copy of this permission and consent form and have returned a signed copy to the researcher.

Teacher/Parent Signature: _____ Date: _____

Printed Name: _____ Telephone: _____

Email Address: _____

APPENDIX C
ASSENT FORM for STUDENTS
ATTACHMENT

CLASSROOM RESEARCH—Culturally Responsive Teaching in Mathematics

You are invited to participate in a study that will assist in the improvement of teaching in middle school mathematics. The study is conducted by Ms. Rosanne Fulton from the University of Denver. Your teacher knows how to contact Ms. Fulton if you would like to ask any questions. This project is supervised by Dr. Kent Seidel at the University of Denver.

Participation in this study should take you about 45 minutes. You will be participating in a small focus group with other students, and responding to questions about your experiences in mathematics class, and the ways in which your teacher helps you to learn. Participation in this project is strictly voluntary. Ms. Fulton will respect your right to choose not to answer any questions that may make you feel uncomfortable. The researcher cannot guarantee confidentiality but all participants in the focus group will be encouraged to keep the discussion confidential. Additionally, the researcher will not report any specific data attached to your name.

There will not be any negative consequences if you decide not to participate in this study, and you will not experience any adverse treatment in your classroom for not participating. You can discuss any questions you have with Ms. Fulton, or your teacher. Please sign below if you choose to participate in the focus group described above. Also, please take the attached letter home so that your parents can sign it. You can return the letter that your parents sign and this letter that you sign to your mathematics teacher.

Signature: _____ Date: _____

APPENDIX D
INFORMED CONSENT FORM for PARENTS
CLASSROOM RESEARCH—Culturally Responsive Teaching in Mathematics

Your student is invited to participate in a study that will assist in the improvement of teaching in middle school mathematics. For this study, your child will be participating in a small focus group with other students, and responding to questions about their experiences in mathematics class, and the ways in which their teacher helps them to learn. Participation in this study is strictly voluntary and will take your student about 45 minutes. The risks associated with this project are minimal. If, however, your child experiences discomfort he/she may discontinue their involvement in the focus group at any time. The focus group leader will respect his/her right to choose not to answer any questions that may make him/her feel uncomfortable.

All of the responses from the students will be identified by code number only and will be kept separate from information that could identify them. Only the researcher will have access to individual data and any reports generated as a result of this study will use only paraphrased wording or unidentifiable quotes. The study is conducted by Ms. Rosanne Fulton from the University of Denver to fulfill the requirements of a doctoral degree.

Your child's teacher knows how to contact Ms. Fulton if you would like to ask any questions. This project is supervised by Dr. Kent Seidel at the University of Denver. We are required by law to tell you that if information is revealed concerning suicide, homicide, or child abuse and neglect, it is required by law that this be reported to the proper authorities.

If your child has any concerns or complaints about how they were treated during the interview, please contact Dr. Susan Sadler, Chair, Institutional Review Board for the Protection of Human Subjects, at 303-871-3454, or Sylk Sotto-Santiago, Office of Sponsored Programs at 303-871-4052 or write to either at the University of Denver, Office of Sponsored Programs, 2199 S. University Blvd., Denver, CO 80208-2121.

You may keep this page for your records. Please sign the next page if you understand and agree to the above. Your child can bring your signed page back to his/her mathematics teacher.

INFORMED CONSENT FORM for PARENTS
CLASSROOM RESEARCH—Culturally Responsive Teaching in Mathematics

I have read and understood the foregoing descriptions of the study called Culturally Responsive Teaching in Mathematics. I have asked for and received a satisfactory explanation of any language that I did not fully understand. I give my permission for my student to participate in this study, and I understand that I or my child may withdraw my consent at any time. I have received a copy of this consent form.

Signature: _____ Date: _____

Signature: _____ Date: _____

_____ I would like a summary of the results of this study to be mailed to me at the following postal or email address:

APPENDIX E

The following human subjects protocol application has been approved by the IRB, effective 11/11/2008.

Protocol Director: Rosanne Fulton

Protocol Title: A Case Study - Culturally Responsive Teaching in Middle School Mathematics

Protocol Number: 2008-0893

Submission include Interview Questions for Teachers, Observation Tool, Survey for Teachers

The Institutional Review Board for the Protection of Human Subjects has reviewed the above named project. The project has been approved for the procedures and subjects described in the protocol for a period of 12 months.

This information must be updated on a yearly basis, upon continuation of your IRB approval for as long as the research continues. Please submit any changes, revisions and unanticipated events reports in a prompt manner. We will be sending you a continuation/renewal email reminder as this expiration date approaches.

The Institutional Review Board appreciates your cooperation in protecting subjects and ensuring that each subject gives a meaningful consent to participate in research projects. If you have any questions regarding your obligations under the Assurance, please do not hesitate to contact Syk Sotto-Santiago.

Approval Letters:

You may find your approval letter on eprotocol as well. Your IRB application will now be listed under protocols approved. Select the protocol ID of interest and open in view mode. On the left menu, please select "Event History", the approval letter link should be available.

APPENDIX F
Student Focus Group Questions

- 1) How are you a leader in your mathematics class?
- 2) What contributions do you make toward the learning of other students in your mathematics class?
- 3) What kinds of experiences are typical in your mathematics class?
- 4) What do you and your friends enjoy about your mathematics class?
- 5) What helps you to learn mathematics?
- 6) Why do you have to learn mathematics? What is the nature of mathematics?
- 7) What is the value of the group work that you do in your mathematics class?
- 8) What do you do when you get stuck on a problem in mathematics?
- 9) What do you do when you notice other students who are stuck on a problem in mathematics class?
- 10) Can anyone (all students) be good at mathematics if they try? Explain your thinking.

Interview Questions for Teachers

How do you build a strong learning community in your classroom?
How does the lesson I just observed fit into your overall goals for the year?
What do you think went well in the lesson that I just observed?
In what ways is your teaching making a difference in closing the achievement gaps between students?
How do your students view themselves as learners?
How do you help your students to see themselves as good in mathematics?
Who are the students that you serve the best?
Are there students who have special learning needs in the class that I just observed?
Can you describe how you could expand the circle of students that you serve the best?

APPENDIX G
Teacher Survey Questions

This survey is designed to gather information about culturally responsive teaching strategies. It is divided into two sections and each section is organized into the following four categories:

- Opportunity to Learn
- Student Interaction and Student Generated Solution Methods
- Teachers and Students Share Decision-Making and Leadership in the Classroom
- Focus on Sense-making and Developing Understandings

SECTION 1

For each statement, please indicate the frequency with which you use the following strategies with your students in the classroom (place a check in the appropriate box).

Opportunity To Learn				
	Never	Some of the time	Most of the time	Always
All students have access to grade level curriculum.				
Students who have “holes” in their knowledge and skills have extra time to learn them while they continue learning with their peers at their grade level.				
Students evaluate and improve their own performance and thinking.				
Students review and identify quality student work samples.				
Informal and formal feedback to and among students is focused on learning and growth.				
Student Interaction and Student Generated Solution Methods				
	Never	Some of the time	Most of the time	Always
Students find their own solutions to multiple-step problems and share and compare their solution methods and answers with others.				
I ask students to work in small groups initially and then facilitate student-led whole class discussions where key mathematical ideas and solution methods are brought to the surface.				
I provide students with private think time.				

Teachers and Students Share Decision-Making and Leadership in the Classroom				
	Never	Some of the time	Most of the time	Always
Students co-develop scoring guides that concretely define the learning targets and a continuum of performance levels.				
Students are involved in the construction of their own knowledge and establish plans for meeting their educational and social goals.				
I adjust my teaching based on the ideas I hear from students.				
I help students recognize their individual strengths and minimize the influence of negative behaviors and unhealthy peer influences.				
Students understand how they learn best, and demonstrate their skills and understanding through projects, written work and/or classroom discussions.				
Focus On Sense-Making and Developing Understandings				
	Never	Some of the time	Most of the time	Always
Students can answer questions (orally and in writing) such as: <ul style="list-style-type: none"> • Why is ___ the answer to this problem? • Why does the strategy you used to solve this problem work? 				
I ask “why” questions and use non-routine problems that do not have expected solutions.				
Students use concrete materials to construct meaning of the mathematical ideas they need to understand.				
Students work flexibly with numbers in order to make sound decisions and reasonable judgments. Mental computation, calculators, and estimation are integrated into their solution strategies.				

SECTION 2

For each statement, please rate the level of importance of the following practices in supporting student learning (place a check in the appropriate box).

Opportunity To Learn				
	Not important at all	Somewhat important	Important	Very important
Students are flexibly grouped. Students with fewer understandings are not permanently grouped together.				
Teachers establish and maintain caring communities: <ul style="list-style-type: none"> • They demonstrate caring in their own interactions with all students. • They engage students in dialogue about caring to improve upon the practice of it. 				
Assessments are used to inform students about their own goals and growth, instead of comparing students to each other.				
Student Interaction and Student Generated Solution Methods				
	Not important at all	Somewhat important	Important	Very important
Opportunities for collaborative dialogue and resolution of conflicting points of view are provided.				
Teachers and students honor each person's right to solve problems in unique ways and make approximations.				
Students learn to act equitably. Students approach problems and ideas in a variety of ways, and they consider different viewpoints fairly.				
Teachers and Students Share Decision-Making and Leadership in the Classroom				
	Not important at all	Somewhat important	Important	Very important
Teachers involve students in decision-making at all levels in the classroom.				
Students have opportunities to express their ideas and beliefs and to be heard.				
Students see themselves as leaders and take responsibility for each other's learning.				

Focus On Sense-Making and Developing Understandings				
	Not important at all	Somewhat important	Important	Very important
Student explanations emphasize the meanings of ideas and how and why the students' methods do or don't work.				
Classroom activities are thinking-centered and engaging for students. Students' solutions involve complex thinking.				
Students spend a majority of class time engaged in sense-making and problem-solving and a lesser amount of time practicing routine procedures.				

Thank you for taking the time to take this survey!!

APPENDIX H
Promising Practices in Mathematics—An Observation Tool

I. Opportunity to Learn		
Look Fors:	What is the teacher saying and doing?	What are the students saying and doing?
All students have access to grade level curriculum every day.		
Students who have "holes" in their knowledge and skills have extra time to learn them while they continue learning with their peers at their grade level.		
Students are flexibly grouped. Students with fewer understandings are not permanently grouped together.		
Teachers establish and maintain caring communities: *They demonstrate caring in their own interactions with all students. *They engage students in dialogue about caring to improve upon the practice of it.		
Teachers regularly provide students with private think time.		
Students spend a majority of class time engaged in sense-making and problem-solving and a lesser amount of time practicing routing procedures.		
Students are involved in the construction of their own knowledge and establish plans for meeting their educational and social goals.		
Students understand how they learn best, and demonstrate their skills and understanding through projects, written work and/or classroom discussions.		
Students have opportunities to express their ideas and beliefs and to be heard.		
The teacher adjusts her teaching based on the ideas she hears from students.		

II. Focus On Sense-Making and Developing Understandings		
Look Fors:	What is the teacher saying and doing?	What are the students saying and doing?
Students find their own solutions to multi-step problems and share and compare their solution methods and answers with others.		
Regular opportunities for collaborative dialogue and resolution of conflicting points of view are provided.		
Teachers ask students to work in small groups initially and then facilitate student-led whole class discussions where key mathematical ideas and solution methods are brought to the surface.		
Teachers and students honor each person's right to solve problems in unique ways and make approximations.		
Students learn to act equitably. Students approach problems and ideas in a variety of ways, and they consider different viewpoints fairly.		
Students can answer questions (orally and in writing) such as: * Why is ___ the answer to this problem? * Why does the strategy you used to solve this problem work?		
Teachers ask "why" questions and regularly use non-routine problems that do not have expected solutions.		
Student explanations emphasize the meanings of ideas and how and why the students' methods do or don't work.		
Classroom activities are thinking-centered and engaging for students. Students' solutions involve complex thinking.		
Students regularly use concrete materials to construct meaning of the mathematical ideas they need to understand.		
Students work flexibly with numbers in order to make sound decision and reasonable judgments. Mental computation calculators, and estimation are used regularly.		
Students co-develop scoring guides that concretely define the learning targets, and define a continuum of performance levels.		

III. Teachers and Students Share Decision-Making and Leadership in the Classroom		
Look Fors:	What is the teacher saying and doing?	What are the students saying and doing?
Teachers involve students in decision-making at all levels in the classroom.		
Students see themselves as leaders and take responsibility for each other's learning.		
Teachers help students recognize their individual strengths and minimize the influence of negative behaviors and unhealthy peer influences.		
Assessments are used to inform students about their own goals and growth, instead of comparing students to each others.		
Students regularly evaluate and improve their own performance and thinking.		
Students review and identify quality student work samples.		
Informal and formal feedback to and among students is regular and focused on learning and growth.		

Adapted from:

- 1) *Improving Student Achievement in Mathematics (1999)*—International Academy of Education and International Bureau of Education.
- 2) *Teachers Development Group Observation Tools (2004)*
- 3) *Inside the Classroom Study Indicators (2003)*—Horizon Research, Chapel Hill, North Carolina
- 4) National Council of Teachers of Mathematics *Process Standards (2000, NCTM)*