AN EXPLORATORY STUDY OF THE FACTORS ASSOCIATED WITH THE

MATHEMATICS ACHIEVEMENT OF SIX TENTH GRADE

AFRICAN AMERICAN STUDENTS

Except where reference is made to the work of others, the work described in this dissertation is my own or was done in collaboration with my advisory committee. This thesis does not include proprietary or classified information.

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AN EXPLORATORY STUDY OF THE FACTORS ASSOCIATED WITH THE MATHEMATICS ACHIEVEMENT OF SIX TENTH GRADE AFRICAN AMERICAN STUDENTS

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DISSERTATION ABSTRACT

AN EXPLORATORY STUDY OF THE FACTORS ASSOCIATED WITH THE MATHEMATICS ACHIEVEMENT OF SIX TENTH GRADE AFRICAN AMERICAN STUDENTS

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Using observations and interviews, six African American students were followed through their tenth grade year in mathematics class. All of the students were enrolled in regular, college preparatory geometry. An assessment of the factors affecting the mathematics achievement of these students also included interviews with teachers and parents. These students' success in mathematics was found to be linked to self-confidence, self-motivation, parental influence and educational level, school mathematics placement and assessment practices, teacher support and expectations, and classroom procedures and practices. Furthermore the issue of dysconscious racism at the school

level and its effects on students' mathematics achievement was addressed in this study. Recommendations which resulted from this study are focused on empowering, instead of filtering out African American students through mathematics instruction. With a goal of challenging the existing status quo of who is successful in mathematics and changing current practices which adversely affect African American students' success in mathematics, teacher and institutional practices must be addressed.

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I would like to thank my major professor and major supporter, Dr. Marilyn Strutchens, for her critiques, endless hours of editing, requests for rewrites, and thousands of sticky notes. I would also like to thank my other committee members: Dr. Kimberly King-Jupiter, Dr. Gary Martin, and Dr. Chris Rodger for their encouragement and feedback

The students and teachers in this study were most cooperative and accommodating and a heartfelt thanks goes to each of them. The students let me invade their business and their lives which I thoroughly enjoyed. The teachers accommodated my every request for information and classroom observation time. The school personnel and district superintendents were most helpful in locating students, providing interview space, and assisting me wherever possible.

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CHAPTER 1

STATEMENT OF THE PROBLEM

The cover story for the March 2004 issue of *U.S. News and World Report* was *Fifty Years After 'Brown V. Board Of Education' Unequal Education: Why So Many Kids Are Still Being Cheated ("50 years after Brown," 2004).* The 1954 Supreme Court ruling in *Brown v. the Board of Education of Topeka, Kansas* officially ended the practice of separate but equal public facilities for African American citizens. Apparently, unequal education remains for many African American students, even though more than fifty years have passed since the Supreme Court's ruling. The answer is not straight-forward nor is the solution imminent (Secada, 1995).

The National Assessment of Educational Progress (NAEP), dubbed the Nation's Report Card, is a congressionally-mandated testing assessment of a sample of United States students. The test is conducted in mathematics, reading, science, writing, history, and several other subjects (U.S. Department of Education, 2005). The 2004 NAEP results indicate a continuation of a pattern that has been apparent since NAEP achievement testing began in 1969 (U.S. Department of Education, 2005). White students consistently and significantly outscore African American students in mathematics. Results from other achievement tests such as the Scholastic Assessment Test (SAT), Advanced Placement exams, and the ACT (formerly American College Testing) show similar trends (ACT Inc., 2003; The College Board, 2003). Many well respected and well known researchers

have examined this pattern and established the fact that African American students as a racial group score lower than other racial groups on standardized and norm-referenced mathematics achievement tests used in the United States (Berry, 2003; D'Amato, 1992; Delgado & Stefancic, 2000; Delpit, 1988; Fordham, 1988; Hoffman, Llagas, & Snyder, 2003; Jacobson, Olsen, Rice, Sweetland, & Ralph, 2001; Ladson-Billings, 1997; Martin, 2000; Moses & Cobb Jr., 2001; Ogbu & Matute-Bianchi, 1986; Perry, 2003; Rech & Stevens, 1996; Schoenfeld, 2002; Shulman, 2002; Silver, Strutchens, & Zawojewski, 1997; Singham, 2003; Sleeter, 1997; Strutchens, Lubienski, McGraw, & Westbrook, 2004; Strutchens & Silver, 2000; Tate, 1997; Weissglass, 2002). Furthermore, even though improvements in test scores on many of the assessment instruments reviewed in the previously mentioned studies have occurred over the past years, striking differences between racial/ethnic groups remain. Finding and addressing the cause of this discrepancy is not as straight forward as confirming that achievement gaps exist.

Purpose of the Study

In answering the question as to why this achievement gap exists, researchers have posited several theories. These include teacher expectations and biases (Delpit, 1988; Rousseau & Tate, 2003; Sleeter, 1993), socioeconomic status (Roscigno, 1998; Tate, 1997), lack of parental or community support (Perry, 2003), social and historical factors resulting in cultural differences and resistance theories (Martin, 2000; Ogbu & Matute-Bianchi, 1986), inadequate teaching and lack of school resources (Oakes, 2002; Perry, 2003; Roscigno, 1998), negative peer pressure or regarding academic success as being White (Fordham, 1988; Kunjufu, 1988), and teaching methods and assessment measures which do not match the learning styles of the students (Banks, 1993; Berry, 2003; Delpit,

1988; Ladson-Billings, 1995a; Lee, Smith, & Croninger, 1997; Singham, 1998). This study sought to extend existing research by encouraging a few African American students to speak for themselves of their schooling experiences, their attitudes towards learning mathematics, and their interpretations of peer, parent, and teacher influences. While much of the research reviewed in this study focused on the broad picture of achievement pattern differences between African American students and other racial groups, this study sought to examine the mathematical learning experiences of a small number of African American students through their own, personal perspectives. Focusing on a small number of students allowed more in-depth information to be obtained, and learning experiences could be viewed through the student lens. The purpose of this study was to examine the mathematics experiences of several African American students through their eyes and their voices. More specifically, what did the students believe influenced their performance and achievement and how did they react to those influences? In addition to extending existing research on African American students' mathematics achievement, suggestions are offered to help eliminate barriers to educational attainment for African American students.

Significance of the Study

Ladson-Billings (1997) and Moses and Cobb (2001) argued that greater mathematics knowledge and skill attainment is tied to better life chances. Having mathematics and science skills allows students to succeed in advanced high school mathematics and science classes thereby allowing the opportunity for college enrollment (Moses, Kamii, Swap, & Howard, 1989). In the classroom, mathematics has been used as a sieve or gatekeeper to select a few top students to advance. This filtering approach has

tracked many African American students into the lower level mathematics classes, out of school, and into lower level jobs (Ladson-Billings, 1997; Oakes, 2002). Moreover, schooling tends to reproduce societal inequalities (Roscigno, 1998).

Furthermore, while math illiteracy is not unique to African Americans, it affects some African Americans and other minorities more than Whites (Moses & Cobb Jr., 2001). The amount of schooling that an individual has can affect his or her life chances and the choices available to them. African Americans have higher school drop-out, suspension, and incarceration rates than Whites (Ladson-Billings, 1997). If one accepts that life chances are improved by attaining higher levels of education, and that mathematics is one of the major hurdles in access to higher levels of education, then we must focus on African American students' mathematics education (Ladson-Billings, 1997).

Recently, a major educational reform project, Equity 2000, focused on increased mathematics experiences for students by ensuring exposure to algebra and geometry early in school and providing support for success in these classes (Green, 2001). The premise for Equity 2000 was that increased exposure to early higher level mathematics experiences would close the achievement gap between minority or disadvantaged students and their non-disadvantaged peers (Green, 2001). The basic premise of this paper was that African American children deserve to have the same life chances and opportunities as other children.

Framework and Research Questions

In this study, multiple-single individual case studies were conducted through extensive student interviews, classroom observations, and parent and teacher interviews. Six students were considered as individual case studies, even though the students, teachers, and parents were interviewed with the same initial set of questions, the result can be described as multi-single units. Students were interviewed concerning their beliefs about the importance of taking mathematics courses and the practical value of the mathematics they were learning in school. Questions for the students attempted to discern whether or not they felt that the education offered to them in mathematics was sufficient and equitable. Through interviews, observations, and clarifications, it was hoped that students voiced the positive and negative influences and hindrances which affected their mathematics experiences. Additionally, it was hoped that the students in this study would offer practical suggestions on addressing the issues which were barriers to their education, whether it was the teacher, the curriculum, peer pressure, or the students' interpretation of parental involvement levels.

Research Questions

1. How do African American students in this study view their mathematics experiences currently and in their past?
2. Do the African American students in this study consider mathematics important to learn? Do they see a relationship between mathematics acquisition and future job opportunities or education? Do they view mathematics as an empowering tool?
3. Are parents, guardians, community, and peers influential sources for the African American students in this study in achievement and specifically mathematics

achievement? For the students in this study, where or what is their primary source of influence?

4. How do the African American students in this study interact with their mathematics teacher? Do the students perceive their teacher as encouraging, and knowledgeable? Is there a relationship of mutual respect and admiration between the student and the teacher?
5. To be successful in mathematics, must one adopt the culture and behaviors of the White students? If this is the case, does it hold true for African American students whether they are the minority or majority in school? Are there other coping mechanisms for these students to employ when dealing with racial issues which confront them in situations at school so that access to mathematics education is not an issue?
6. Does gender affect the African American students' view of mathematics? If this is the case, in what ways does gender affect the student's relationship with school officials, parents and society at large, with respect to mathematics learning?

CHAPTER II

REVIEW OF RELATED LITERATURE

This literature review begins with an examination of African American students' mathematics achievements and trends of achievement over the past 30 years. Available data from the National Assessment of Educational Progress, the College Board testing programs, U.S. Census Bureau, Scholastic Assessment Test, and ACT assessments were examined to assess the status, and document the changes in the mathematics achievement of African American public school children. In addition to these test scores, college enrollment and high school drop-out rates were reviewed, and differences between racial groups were noted. The second part of the literature review was devoted to a discussion of the research and theories on why this discrepancy exists. The theories range from cultural influences and peer pressure to classroom practices, from school tracking policies to inadequate curriculum, and from the tendency of some teachers to stereotype to assessment practices. To assess the current situation in mathematics education, it is important to look at trends in achievement tests over the last several decades. As discussed below, in spite of the fact that improved test scores were found on many of the assessment instruments reviewed here, striking differences between racial/ethnic groups remain.

African American Student's Achievement in Mathematics

National Assessment of Educational Progress Results

To examine the question of how African American students are doing in mathematics, one could consider how African American students are doing in comparison to other racial/ethnic groups in the United States. Looking at national testing results is one method of examining the trends in mathematics achievement. The National Assessment of Educational Progress (NAEP) long-term trend assessment was designed to gauge levels of and trends in educational achievement for students across the nation (Jacobson et al., 2001). This long-term data set is used to indicate how well students are achieving computational skills in mathematics. NAEP scores range from 0 to 500 with level 150- the basic arithmetic facts, level 200- beginning skills and understanding, level 250- basic operations and beginning problem-solving, level 300- moderately complex procedures and reasoning, and level 350- multi-step problem solving and algebra (Tate, 1997). It should be noted that the problem-solving reflected here is different from that which the National Council of Mathematics (NCTM) has defined in the *Principles and Standards for School Mathematics* (National Council of Teachers of Mathematics, 2000), but rather was developed in 1973 as consistent with the terminology used at that time (Tate, 1997).

The National Assessment of Educational Progress (NAEP) provides long-term mathematics achievement data for ten of the years between 1973 and 2004 at randomly selected intervals ranging from two to five years. The test is administered nationwide to selected samples of students aged 9, 13, and 17 (U.S. Department of Education, 2005). The following figures, 1, 2, and 3, depict the reported scores by year for African

American, White, and Hispanic students, and indicate that the scores of African American students increased more than White or Hispanic students' scores from 1973 to 2004 for the three age groups with one exception. Hispanic 17 year-old students showed a greater increase than African American students.

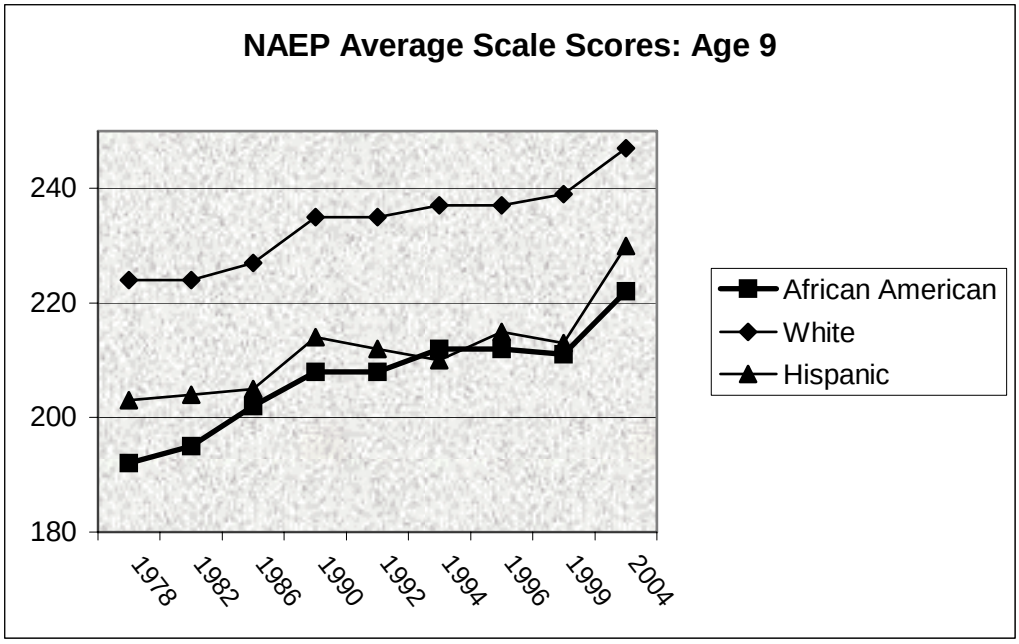

Figure 1. Average NAEP mathematics scores for 9 year old students by race (U.S. Department of Education, 2005).

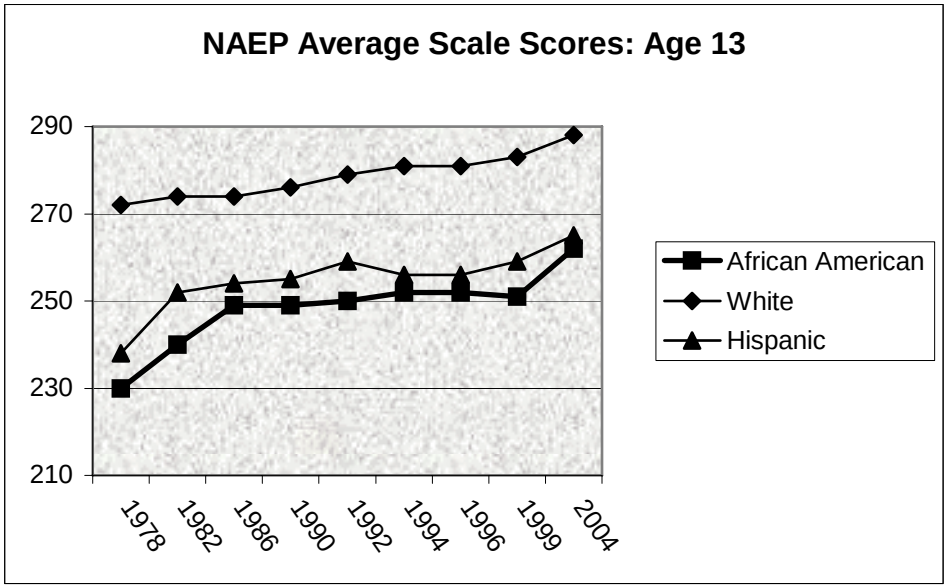

Figure 2. Average NAEP mathematics scores for 13 year old students by race (U.S. Department of Education, 2005).

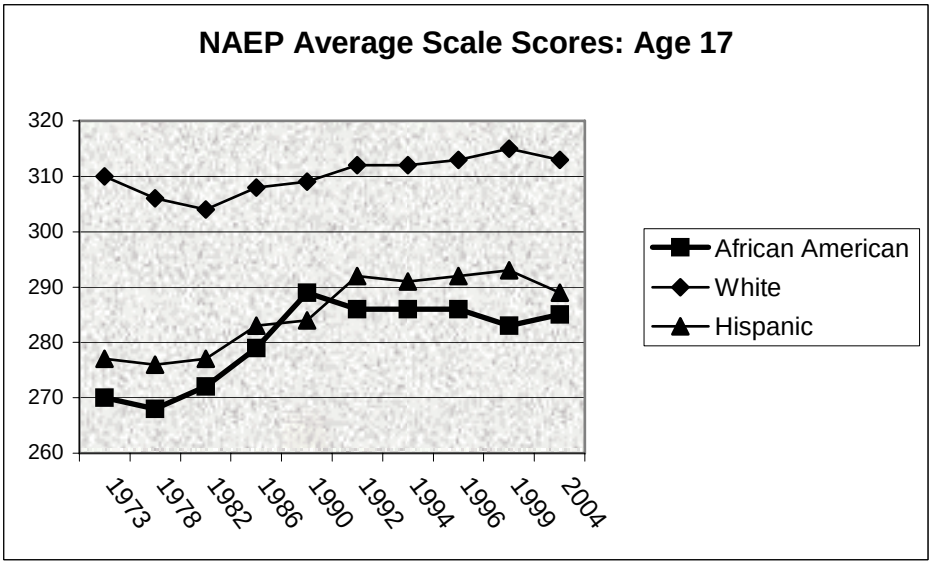

Figure 3. Average NAEP mathematics scores for 17 year old students by race (U.S. Department of Education, 2005).

How the gap between racial/ethnic groups changed has changed over the last 30 years: More important than studying the achievement gap is to examine how this gap has changed over the years. As measured by the NAEP long-term mathematics assessment, is the gap between racial/ethnic groups for mathematics achievement decreasing? The next three figures, 4, 5, and 6 depict the differences between African American and White students, between Hispanic and African American students, and between Hispanic and White students.

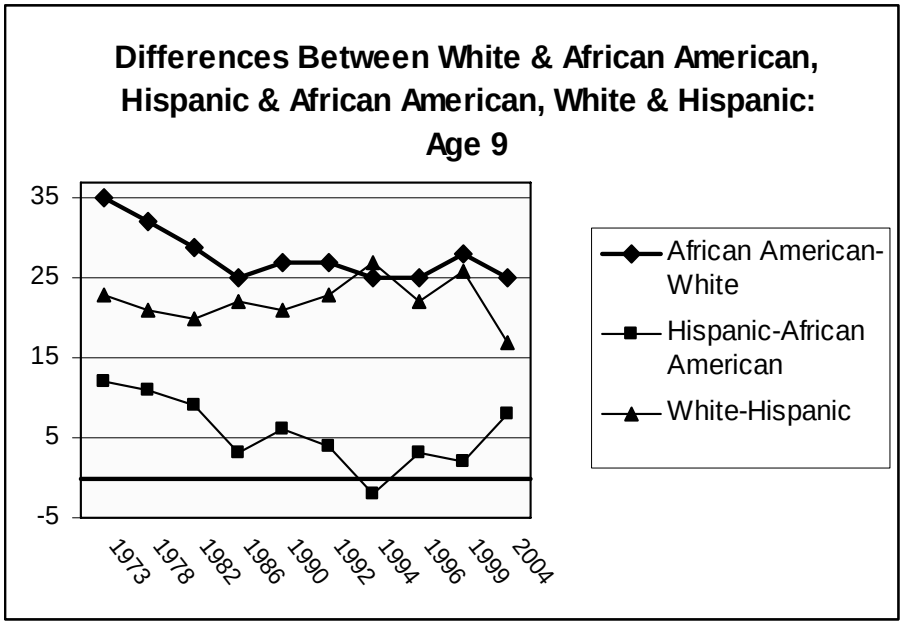

Figure 4. 1973-2004 average score differences on NAEP mathematics for 9 year old students (U.S. Department of Education, 2005).

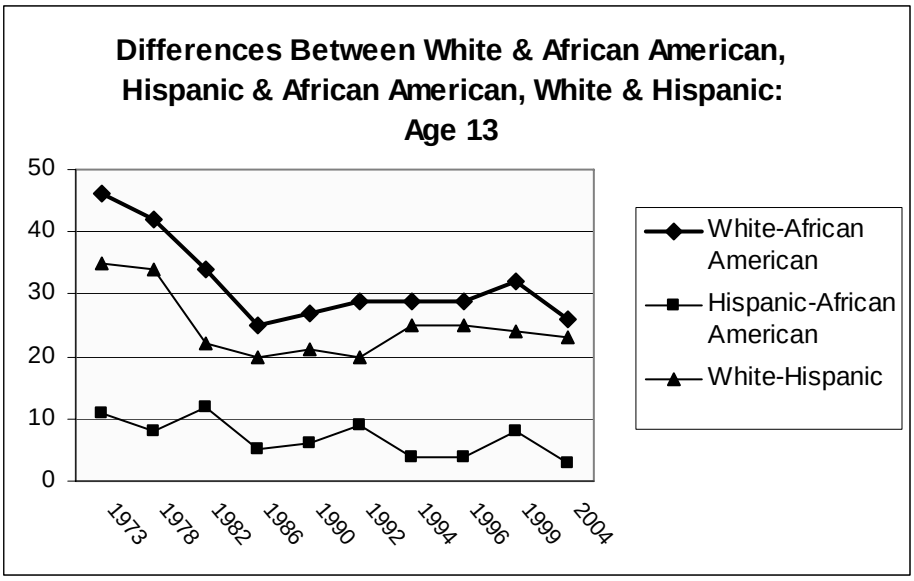

Figure 5. 1973-1999 average score differences on NAEP mathematics for 13 year old students (U.S. Department of Education, 2005).

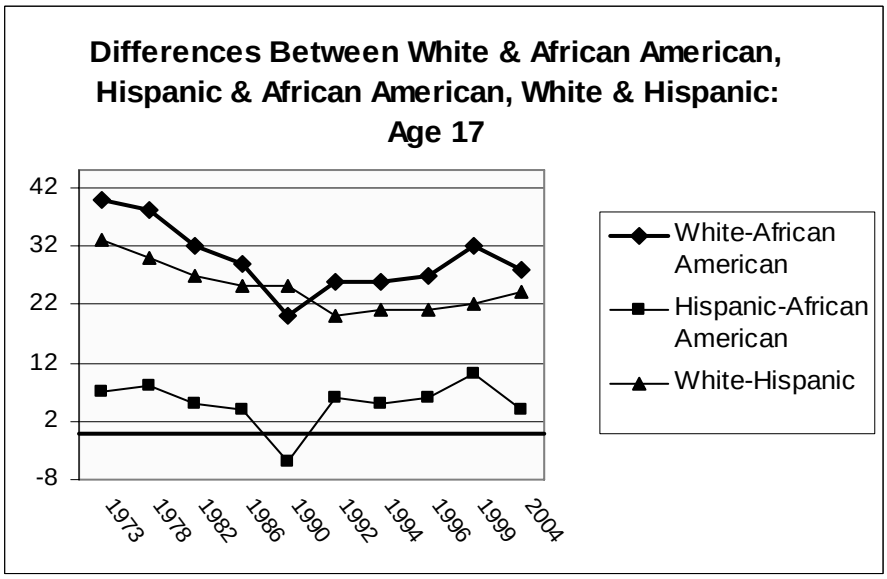

Figure 6. 1973-1999 average score differences on NAEP mathematics for 17 year old students (U.S. Department of Education, 2005).

In summary, it appeared that while the achievement scores for African Americans increased fairly consistently from 1973 until 2004, the achievement gap between African

American and White students did not decrease significantly during this same time period. The achievement gap decreased for the three age levels reported from 1973 until 1986, but this gap has not changed appreciably for 9 or 13 year olds since 1986, and for 17 year olds since 1990. In fact, the difference in achievement between African American and White students increased for 13 year olds from 1986 until 1999 and for 17 year olds from 1990 until 1999. The differences between the scores for White and Hispanic students were significant but were less than those for White and African American students. And the differences between African American and Hispanic might be increasing for 17 year old students but overall appeared to be small for all the ages tested.

Critical thinking skills. A second NAEP data set provides information on how well students are doing on problem-solving and application skills which is radically different from the basic skills on the trend assessment (Tate, 1997). The types of questions include some which require an extended response, not just multiple choice items. Strutchens et al.(2004) found that in 2000, just over 1 in 4 White 4th grade students scored at or above proficient while only 1 of 20 African American 4th grade students scored at this level. For 12th grade students, 1 in 5 White students and 1 in 25 African American students scored at or above the proficient level.

NAEP questions are either multiple choice, short constructed response, or extended constructed response (Silver et al., 1997; Strutchens et al., 2004; Strutchens & Silver, 2000). For the extended response questions which reflect more critical thinking skills, both the 8th and 12th grade students increased the percentage of correct responses across all racial groups 1992, 1996, and 2000. Examining only the data for 8th grade students by question type for the years 1992 and 2000, one can see some interesting

results depicted in Figure 7 (Silver et al., 1997; Strutchens et al., 2004). Overall, 8th grade students gained in the percentage correct on multiple choice and extended response items, with greater gains on the extended response questions. African American students made greater gains on multiple choice items, while White students made greater gains on extended response questions. All students lost percentage points from 1992 to 2000 on short constructed response test items with the White students having the largest drop, followed by the Hispanic students. African American students had the least drop in percent correct for the short constructed response questions from 1992 to 2000.

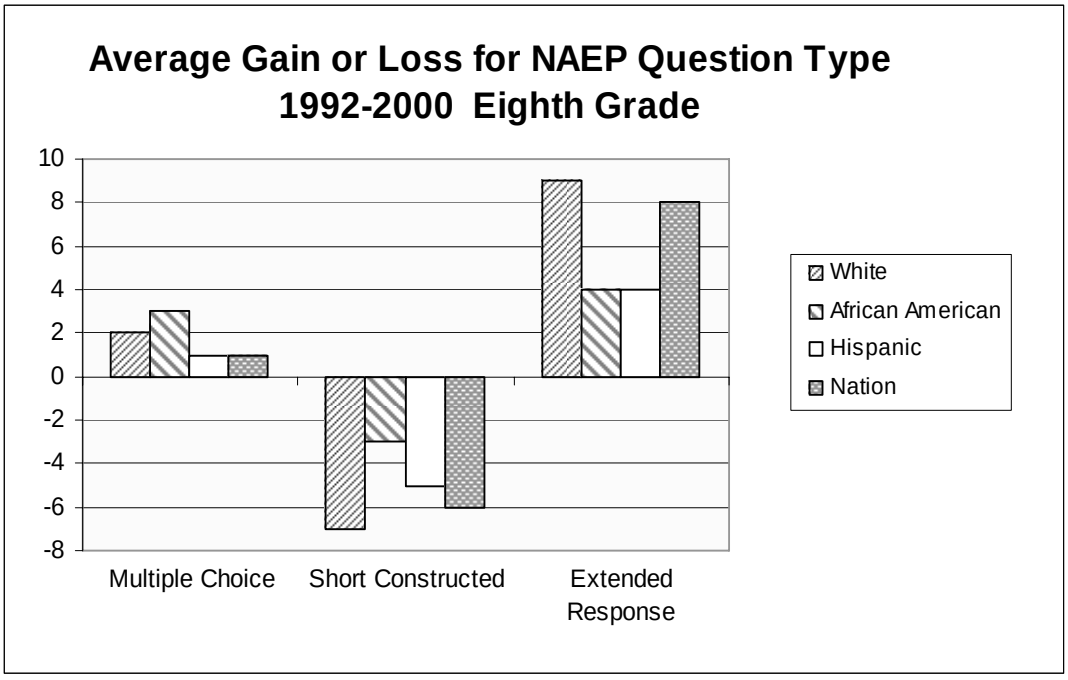

Figure 7. Gain or loss by NAEP question type for 1992 to 2000 (Silver et al., 1997; Strutchens & Silver, 2000).

Reporting on the 1996 NAEP data, Strutchens and Silver (2000) stated that 8th grade African American students performed about 70 percent as well as White students on multiple choice items, but only 20 percent as well on extended response questions.

From the 2000 NAEP data, they report that 8th grade African American students performed 72.5 percent as well as White students on the multiple choice and 31 percent as well as White students on extended response questions. Results from the 2000 NAEP data indicated that African American students are more often assessed with multiple choice tests than White students (Strutchens et al., 2004). One might hypothesize that African American students will score lower on constructed response test items because they have had less experience with this question type (Strutchens et al., 2004). In 2000 however, the percentage correct for African American students on extended response questions increased, and this increase held and was greater than increases for other reporting groups.

Advanced Placement Exams

Because calculus is the highest level of mathematics that is offered at the high school level in the United States, the Advanced Placement (AP) Calculus exam is a valid indicator of mathematics achievement (Tate, 1997). The College Board offers two levels of the Advanced Placement Calculus exam. Calculus AB is equivalent to the first semester of college calculus, and Calculus BC is equivalent to a full year of single variable integration and differentiation. Scoring on the AP exams is on a 5 point scale to determine whether or not the candidate should receive credit for the college equivalent course: 5 is extremely well qualified; 4 is well qualified; 3 qualified; 2 possibly qualified; and 1 no recommendation (The College Board, 2003). Using data from The College Board (2005) Table 1 was created comparing the average exam score for the reporting racial/ethnic groups in 2004. (The College Board uses the classification Chicano American in contrast to the NAEP classification of Hispanic).

Table 1

Average Scores for 2004 Calculus AB and BC Exams by Selected Racial/Ethnic Groups

	2004 AB	2004 BC
All students taking the exam	2.96	3.65
White	3.06	3.68
African American	2.00	2.79
Chicano American	2.06	2.82

(The College Board, 2005)

It is apparent from the table that African American and Chicano American students score significantly lower than the average of all students taking the exam and even lower than the White students taking the exam in 2004. Although African American students scored significantly lower than White students on both the AB and BC exams, African American students scored only slightly lower than Chicano American students. Of all the students who took the Calculus AB exam in 2004, only 62.3 percent of the White students, 31 percent of the Chicano American students, and 30 percent of the African American students scored at or above a 3 (The College Board, 2005). This means that approximately 70 percent of the African American students who took the calculus exam in 2004 did not score well enough to be considered qualified to have completed one semester of college calculus.

Another statistic apparent from an analysis for the work done by Tate (1997) and more recent data from The College Board (2005) showed the percentage of students who have taken the calculus exams by reported racial/ethnic group, see Table 2. From 1994 to 2004 the percentage of African American students taking the Calculus AB exam remained at 4 percent. The percentage of African American students taking the Calculus BC exam was 2 percent for 2004 (The College Board, 2005). So, while the number of African American students taking this exam has increased, as well as the percentage scoring a 3 or higher, the proportion of the students taking the exam who are African American has not increased over the last 10 years.

Table 2.

Percentage of Students by Racial/Ethnic Group for the 1994 and 2004 AB Calculus Exam.

Reported racial/ethnic group	1994 AB Exam	2004 AB Exam
White	67	68.5
African American	4	4
Chicano American	2	3.8

(The College Board, 2005)

Scholastic Assessment Tests and ACT exams

In addition to NAEP, the Scholastic Assessment Test (SAT) and the ACT, formerly the American College Testing assessment, are designed to measure academic

achievement. But in contrast to NAEP, the SAT and the ACT are designed to predict academic performance in colleges and are administered to a self-selected group of college bound high school students (Jacobson et al., 2001). Since neither the SAT nor the ACT are taken by all students, caution should be urged in interpreting the scores, although the trends might be of interest. From 1975 to 1995, the combined mathematics and verbal score on the SAT rose 8 percent for African American youth while remaining fairly constant for White youth (Jacobson et al., 2001). This trend led some to believe that the gap between the scores of the White and African American students was closing (Jacobson et al., 2001). But during this same time period, the number of African Americans taking the SAT dropped by 9 percent (Jacobson et al., 2001), and from 1992 to 2002, the mathematics portion of the SAT indicated an 8 point increase in the scores for African American youth and an 18 point increase for White youth (The College Board, 2003). Mexican American test takers had no increase in scores for the time period, while Puerto Rican students had a 13 point gain (The College Board, 2003). Apparently, the earlier trends closing the gap between White and African American students have not continued for students taking the SAT over the last ten years. Of the one and a half million students taking the SAT in 2004, 9 percent were African American; in 1992, 10 percent were African American (The College Board, 2003, 2005). While the actual number of African American students taking the SAT has increased, the percentage of students taking the SAT who are African American has not increased over the last 10 years.

The average composite score on the ACT was just less than 21 for all students taking this test in 2003 (ACT, 2004). For the high school graduating classes of 2003,

African American students' average score was 16.7, White students averaged 21.3, Mexican- Americans averaged 18.3, and other Hispanics averaged 18.9 in mathematics (ACT, 2004). Twelve percent of the slightly more than one million students who took the ACT in 2003 were African Americans, similar to the percentage taking the SAT in 2003.

The percentage of African American students taking advanced placement mathematics tests has not increased over the past decade nor the percentage of African Americans taking college entrance examinations. Furthermore, the difference between African American and White students' scores on advanced placement and college entrance exams is considerable. Advanced placement exam, SAT, and ACT scores are all indicators of college preparation and predictors of students' success in college level mathematics classes. Fewer African American students nationwide participate in advanced placement, SAT, and ACT testing than White students, and on average African American students score significantly lower on each of these measures. The results from these assessment tools indicate that African American students are not being prepared to compete with other students in college matriculation.

School Retention and Expulsion

For students to have access to higher level mathematics, they have to remain in school and progress to higher level classes. Students who are repeatedly retained on grade level, are suspended, faced with expulsion, or who have dropped-out altogether have little chance for success in higher level mathematics.

For seven of the years between 1990 and 2003, the National Household Education Surveys Program (NHES) was used by the National Center for Educational Statistics (NCES) to collect data on educational issues which were not addressed with the school

level data (National Center for Education Statistics, 2004). Through computer assisted telephone interviews, households spanning the United States are surveyed about issues such as adult education, early childhood program participation, parental involvement in education, and before or after-school programs (NCES, 2004). From the 1999 NHES, Hoffman et al. (2003) found that 18 percent of African American students in grades K-12 have repeated a grade compared to 9 percent of White and 13 percent of Hispanic students. In grades 7 through 12, 35 percent of the African American students report ever being suspended or expelled compared to 15 percent of the White students and 20 percent of the Hispanic students (Hoffman et al., 2003). It is shockingly clear that African American youth are being retained, expelled, and suspended more from school than other racial/ethnic groups. And certainly, being expelled or suspended must have a negative effect on mathematics achievement.

High School Dropout and Completion Rates

As stated earlier, for students to have access to higher level mathematics, they have to remain in school and progress to higher level classes. Hispanic students are much more likely to drop-out of school than African Americans, and African American students are slightly more likely to drop-out of high school than White students (Hoffman et al., 2003). In 1974, the high school drop-out rate for African Americans was twice the corresponding rate for Whites (Jacobson et al., 2001). By 1997 the dropout rate was 3.6 percent for African Americans and 5.0 percent for Whites, thus the dropout rates became more similar over the 23 year time span (Jacobson et al., 2001). Data from the Bureau of the Census reveal even higher rates for high school dropouts. The Bureau of the Census reports for the year 2000, that the percent of 16- to 24- year-olds who were high school

dropouts was approximately 28 percent for Hispanics, 12 percent for African Americans, and 7 percent for Whites (Hoffman et al., 2003). Data for all three racial/ethnic groups indicate a decrease from 1972 until 2000, with the African American and White decreases being fairly consistent in contrast to the reported Hispanic rate which shows great fluctuations over the same time period of nearly thirty years.

From the Bureau of the Census 1972 through 2000 data, high school completion rates are up for all racial/ethnic groups since 1972, but the changes since 1982 are not significant (Hoffman et al., 2003). The rates of high school completion for 2000 are 84 percent, 92 percent, and 64 percent for African American, White and Hispanic students respectively (Hoffman et al., 2003). Analysis of data from another source indicated similar trends. Used by the National Center for Education Statistics, the National Educational Longitudinal Study of 1988 (NELS:88) began with a baseline of 8th grade students in 1988 and conducted follow-up of these students in 1990, 1992, 1994, and 2000 (NCES, 2004). NELS:88 was designed to collect trend data about the transitions that students face and to supplement existing testing administered by schools and states (NCES, 2004). For the initial 1988 sampling, NELS:88 used student, teacher, school, and parent questionnaires along with four cognitive tests (NCES, 2004). An analysis of the NELS:88 data by Jacobson et al. (2001) revealed that the gap between African American and White completion rates had narrowed substantially between 1975 and 1998 from 16 to 6 percentage points (Jacobson et al., 2001). This data included both high school graduation and the high school completion equivalency exam the GED (General Educational Development) certificate. An analysis of this data indicates that high school

completion is not as large a problem for African American students as it currently is for Hispanic students.

College Enrollment and Completion

A higher percentage of African Americans attended college or a university in 2000 than in 1980. In 1980, 19 percent of all 18 to 24-year-old African Americans were enrolled as compared to the 31 percent enrolled in college in 2000 (Hoffman et al., 2003). Of all high school graduates, the proportion of African Americans enrolled in college increased from 28 to 39 percent from 1980 to 2000 (Hoffman et al., 2003). Of the total students enrolled in college, the percent of African Americans, during this same 24-year period, increased from 9 to 11 percent (Hoffman et al., 2003).

Interestingly the percent of White college and university students declined from 81 percent in 1980 to 68 percent in 2000 (Hoffman et al., 2003). And the percentage of Hispanic students rose from 4 to 10 percent over the same 20 years (Hoffman et al., 2003). Comparing the increases in percentage of Hispanic and African American students, it is apparent that the college enrollment increase for Hispanic students is much greater that the percent increase of African American students.

The top three declared majors for undergraduate African Americans in 1999-2000 were business management, health related, and other technical fields. For undergraduate White students, the top three declared majors were listed as arts and humanities, business management, and social and behavioral sciences (Horn, Peter, & Rooney, 2002). Less than one percent of the 1999-2000 college students either White or African American declared a mathematics undergraduate major. Of those who received degrees in 1999-2000, the top three majors for all students were business management, social and

behavioral sciences, and humanities (Bradburn, Berger, Li, Peter, & Rooney, 2003). Of the Bachelor degrees awarded in 1999-2000, only 1.1 percent and 0.2 percent were given in mathematics to White and African American students respectively. For those subjects which rely most heavily on mathematics, physical sciences and engineering, the percentage of all degrees awarded were low for all students, with African American students consistently lower in numbers and percent than White students.

The percentage of graduate students in 2000-2001 who listed African American as their race was similar to the percentage of undergraduate students, 11 percent. More interesting is the change in percent enrolled in graduate school from 1976 until 2000 as presented in Table 3 (Snyder & Hoffman, 2003). The proportion of Hispanic students increased the most during this period whereas the proportion of White students at the masters degree level declined.

Table 3.

Percentage of Graduate Students, Masters Level by Race/Ethnicity.

	1976	2000
African American	6.6	8.2
White	84	68.4
Hispanic	1.9	4.6

(Snyder & Hoffman, 2003)

At the doctoral level, there were 2,207 African American students in 2000 as compared to 27,454 White students (Snyder & Hoffman, 2003). The top two fields for all doctoral students in 2000 were education and psychology with less than 1 in 50 White students, and less than 1 in 100 African American students studying mathematics. In considering United States population demographics, it is clear that African Americans are not proportionally represented at the post secondary academic level, nor in mathematics-related fields of study, and considering the trends presented and discussed earlier on the data from elementary and secondary mathematics education, this pattern of African American student achievement in mathematics at the post secondary level is not surprising.

Summary of Achievement Trends

While there are positive trends in mathematics achievement for African Americans in the past 30 years of available statistics, many inequities remain. There is evidence to suggest that some of the reported gaps in achievement between White and African American students are not decreasing and in fact might be increasing over the last 10 years of analysis of NAEP testing results (Strutchens et al., 2004; U.S. Department of Education, 2005). On extended response type questions, 8th grade African American students performed about 31 percent as well as White students in 2000, which was an increase from 20 percent in 1992, and 18 percent and 1996 (Strutchens et al., 2004; Strutchens & Silver, 2000).

African American students continue to make up larger than expected proportions of all students who are retained in grades, suspended, or expelled (Hoffman et al., 2003; Jacobson et al., 2001). More African American students are taking advanced mathematics

exams each year. But examining the percentage of students taking these exams who are African American, the numbers remain constant (Tate, 1997; The College Board, 2005). Additionally, there had not been an increase in the percent of African American students scoring proficiently on these exams (Tate, 1997; The College Board, 2005). The proportion of African American students taking SAT and ACT tests has not changed appreciably in the last 10 years (ACT Inc., 2003; Tate, 1997; The College Board, 2003). Although the high school dropout rate for African American students is less than that of Hispanic students, it continues to surpass the rate for White students (Jacobson et al., 2001). Perhaps the most positive bit of data is the indication that a larger percentage of the 18 to 24- year old student population of African Americans was enrolled in college in 2002 compared to 20 years earlier (Hoffman et al., 2003). To summarize, if higher educational access and national assessment measures such as NAEP are valid measures of mathematics achievement, then African American students continue to be underserved by the educational system in the United States.

For the purposes of this study, the question remains: How does all of the above data relate to the actual classroom performance and mathematics achievement of African American students. National trends indicate performance differences but do not suggest how the students themselves are affected by these trends.

Barriers Suggested by Research Which Limit African American Students' Access to Mathematics Learning

The focus of research has too often been to compare African American students to White middle class students when measuring achievement (Singham, 1998). Even an

examination of the achievement gap between African American and White students assumes that the standard is what the White students are achieving (Ladson-Billings, 1999). It is clear that caution should be used in ascribing failure or setting standards for acceptance.

In an attempt to analyze the factors affecting student learning, and determine the category which has the most potential for change within the education community, several spheres of influence are offered for consideration. Borrowing from models used by Weissglass (2002) and Martin (2003), the following spheres of influences, as depicted in Figure 8, will be considered: community and culture, educational institution, classroom practices, and finally, student attitudes. Although these spheres of influence are depicted in Figure 8 as cleanly divided, and non-overlapping; in reality this would not be the case. The neat division of the spheres, with the exception of culture, are made purely for organizational reasons. Culture, as interpreted by the author, permeates the other spheres of influence for the student.

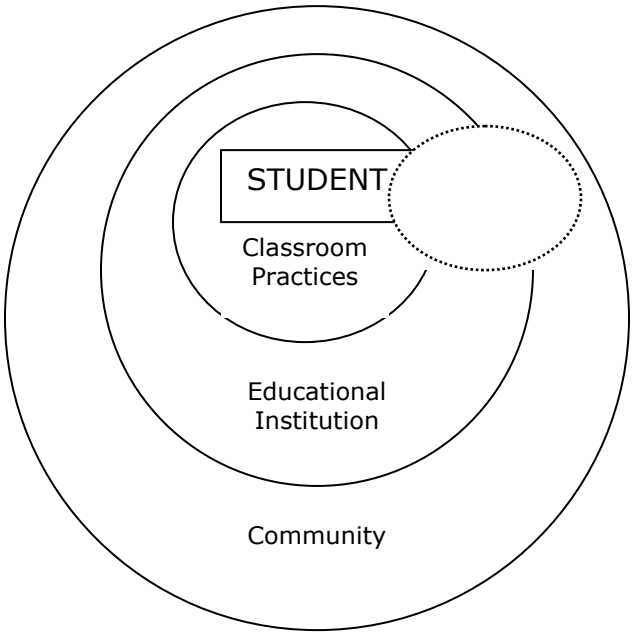

Figure 8. Spheres of Influence on Student Behaviors and Achievement.

First, the focus on the wider community of the student includes issues of parental influence, peer pressure, culture, and language. The term community is used here to mean the social, historical, and political influences on the student other than those from the educational system; therefore, culture will be addressed along with community issues. Narrowing the sphere of student influence to the institutional practices, the second set of issues such as course offerings, tracking, curriculum decisions, and funding will be discussed. Next, specific classroom strategies and resources such as teacher attitudes and behaviors, assessment practices, resources available, and curriculum implementation will be addressed.

Community and Cultural Influences

Caste-like minority theory and rejection of the dominant culture. Community and cultural influences received much attention from John Ogbu (1986) in his writings on how minorities react differently to oppression. Ogbu coined the term "Caste-like minority" to partially explain why African Americans are less likely to be successful academically than some other minorities in the United States educational system (Ogbu & Matute-Bianchi, 1986). Caste-like minorities are those minorities which are involuntarily and permanently incorporated into a society through slavery or colonization and then relegated to menial status (Ogbu & Matute-Bianchi, 1986). Immigrant minorities are those who come to the country voluntarily and respond differently than caste-like minorities to similar treatment (Ogbu & Matute-Bianchi, 1986). Voluntary immigrant minorities do not necessarily subscribe to the morays of the dominant culture and might not internalize the negative effects of discrimination (Ogbu & Matute-Bianchi, 1986). For immigrant minorities, self-advancement is strong enough to overcome the obstacles imposed on them by the host country (Ogbu & Matute-Bianchi, 1986). For caste-like minorities, such as Mexican Americans and African Americans, success in school is not linked to success in life (Ogbu & Matute-Bianchi, 1986). Thus some caste-like minorities do not respond to the educational system as do voluntary immigrant minorities (Ogbu & Matute-Bianchi, 1986). Having been historically denied access to equal education, some African Americans are not prepared to compete for the better jobs, and for those minorities who do enter the job force, some meet job ceilings, real or perceived, and because they are African American cannot advance to upper status jobs. Even for those African American parents who do value education, the reality of their life

experiences of being denied opportunities afforded Whites can dampen enthusiasm for the educational experience for their children, and consciously or unconsciously transmit these feelings of education being meaningless to their children (Martin, 2000). Children might interpret their parent's lack of involvement in school events as telling them that education and mathematics is unimportant. Community responses to school experiences can have a negative or a positive impact on student beliefs about school and mathematics. Martin (2000) argued that community forces have as much or more influence on student achievement as societal or school influences. Delgado (2000) stated that racial stigmatization can negatively impact parenting practices of minorities to the point that tradition of failure is perpetuated. Possible behavior responses range from feelings of isolation, humiliation, and self-hatred to psychological effects as severe as mental illness and physical illnesses such as high blood pressure (Delgado, 2000).

Negative peer pressure. According to Ogbu and Matute-Bianchi (1986), caste-like minorities seek to establish an identity separate from the dominant group, developing a collective distrust described as "cultural inversion." Cultural inversion refers to a set of practices for the minority which is oppositional to the dominant group and employed as a strategy for demonstrating this opposition (Ogbu & Matute-Bianchi, 1986). Cultural inversion also implies a rejection of some behaviors as not acceptable for their group because they are characteristic of Whites (Ogbu & Matute-Bianchi, 1986). As an example, being successful in school is synonymous with "acting White" for some African American students (Fordham, 1988; Kunjufu, 1988). By examining several successful African American students, Fordham (1988) found that these students had assumed a raceless persona in order to achieve academic success, that is being African American

while rejecting the ethos of the African American community. The students in Fordham's two year study, 1982-1984, responded in several different modes of racelessness. The female participants adopted an attitude of isolation, dropping their friends and dropping selected activities which were usually attributed to members of their community, whereas the male students generally chose to remain with their peers, keeping their academic successes hidden, and rejecting the upper academic tracts. Fordham (1988, p.80) maintained that to be academically successful, these students must internalize their oppression and appear to become raceless. While recognizing that the males and females in the study differed considerably in their reactions, Fordham (1988) labeled both as a form of raceless behavior adoption.

Steele (1995) used the term 'stereotype threat' to identify a behavior response for those students who value academics. Recall the study by Steele and Aronson (1995, 2004) where African American students responded with performance at a lower level than they were capable of when they internalized the stereotypes that permeated their culture. This self-condemnation contributes to students demoralization, and with continued threat over time, students might disidentify with school achievement (Ladson-Billings & Tate, 1995b; Steele & Aronson, 1995). Thus some forms of peer influence can be oppositional to academic achievement for African American children (Fordham, 1988; Kunjufu, 1988; Martin, 2003; Ogbu & Matute-Bianchi, 1986).

Cultural capital. While acknowledging that Ogbu's (1986) caste-like minority theory has merit for explaining some of the current academic status of African Americans, Perry (2003) argued that Ogbu's theory does not take into account the positive cultural traditions. Perry (2003) stated that African Americans have a strong and

powerful academic tradition of freedom for literacy, and literacy for freedom, racial uplift, citizenship and leadership. Those who follow Ogbu's caste-like minority theory completely might be tempted to place the blame for student failure on the African American parents and the community.

Instead of focusing on the failures of African American children in school, perhaps the real question should be: How have so many African Americans become successful facing so much opposition? For African American minorities, the task of academic achievement is distinctive (Perry, 2003). These distinctions include dealing with racism, cultural behaviors which cause misunderstanding, irrelevant curriculum, inappropriate pedagogy, tracking and other school issues which limit educational access. Citing cultural mechanisms of behavior and language patterns, Perry (2003) maintained that some African American students do not speak or act as Whites, and these cultural differences create misunderstandings.

Adapting to the dominant culture appears, in many instances, to be a precursor to skill acquisition in the American educational system (Perry, 2003). For example, Perry (2003) described the 1978 case of Martin Luther King Jr. v. Ann Arbor School Board. Two-thirds of the children from the local housing development and attending the Martin Luther King Jr. school were labeled learning disabled by the school (Perry, 2003). None of the fifteen plaintiffs, children up to age eleven, could read above the second grade level. It was determined that the barrier denying the children access to learning was language. Perry (2003) defined African American English as a distinct, rule-based language which is culturally based with different discourse rules than standard American English. The discourse rules can be problematic for children when they involve different

ways of asking questions, expressing emotions, and exercising control. Therefore, while non-standard English is not a barrier to education for African American children in itself, the problem results from teacher reaction and responses to the non-standard English (Perry, 2003).The children's home language in the case of Martin Luther King Jr. v. Ann Arbor School Board was African American English not standard English. Not only did the school not acknowledge African American English, but the teachers did not have the training to understand the language differences. The teachers equated African American English with being learning disabled. The point is that not only was there a mismatch between the minority and dominant cultures, but that students first had to adapt to the dominant culture before they could receive learning skills. Cultural capital is the term Perry (2003) used, borrowing from French social theorist Bourdieu, to mean the socially inherited cultural competence that facilitates learning in school. To Bourdieu, capital meant simply a resource that yields power (Calhoun, 1993).

In addition to language differences, cultural capital can include social behaviors that are inherited and learned through an individual's culture (Perry, 2003). For example there are some African American communication styles which can influence a teacher's judgment about the student's intellectual capacities when the teacher does not understand cultural differences (Perry, 2003). An African American student might sound loud and argumentative to the teacher by merely voicing his/her opinion. Perry (2003) hypothesized that the cultural capital offered by whiteness includes the ability to be reserved, suppress emotions, and present a disciplined exterior while for some, to be African American is to be lazy, criminal, emotional, rebellious, and disrespectful of authority. If one accepts that schools transmit knowledge in cultural and linguistic codes

then those who know the codes before attending school will out-perform those children who do not know the codes (Perry, 2003).

Summary of community and culture. In summary, community cultural influences conflict with goals for academic success for African American students according to Ogbu & Matute-Bianchi (1986), Martin (2000), and Fordham (1988). While for Perry (2003) and Singham (2003) the conflict arises from misunderstandings of cultural differences. Fordham (1988) maintained that for African American students to be academically successful, some feel they must assume a raceless persona, but Singham (2003, p. 587) argued that African American and White students share similar social costs and benefits of academic success. Therefore, Singham (2003) cast doubt on the negative peer pressure theory. One might hypothesize that whether you subscribe to Ogbu's (1986) caste-like minority theory, Perry's (2003) theories on cultural capital acquisition, or Fordham's (1988) raceless adaptation mechanisms, race plays a major role in all of United States society and especially in educational institutions (Ladson-Billings, 1999; Martin, 2003).

Racism

Ignatiev (1996), Lopez (2000), and others have asserted that Whiteness is a social construction and not a natural one. Greater genetic variation exists within populations labeled as African American or White than between these populations (Lopez, 2000). The racial spectrum in the United States is White on one end and African American on the other, with all other races in between (Ignatiev, 1996; Perry, 2003). Racism supports the notion that the traits and abilities of Whites is the admirable or correct end of the spectrum and as such, where does that leave all the "others"? W.E.B. Du Bois described

the difficulty of being African American in 1898 as a balancing act, a double consciousness (Perry, 2003). African Americans must perform this balancing act by trying to function as members of society and as outsiders: citizen without the rights and privileges of full citizenship (Perry, 2003).

Racism is the most prevalent theme that African Americans must face in educational access and is cited directly by Ladson-Billings (1999), Martin (2003), Perry (2003), Singham (1998), and Weissglass (2002). Whiteness as a social construction is not a natural one, and Whiteness is in opposition to Blackness (Ignatiev, 1996). Just as racism is pervasive in our society, so is the notion for some that being African American means inferior intelligence (Perry, 2003). A high school teacher told Malcolm X that being a "nigger," he could not expect to become a lawyer: rather he needed to be realistic in his life goals (Perry, 2003). Malcolm's response to this prejudicial behavior was to reject Whites and schooling altogether, possibly a cultural inversion tactic which he later regretted. Gwendolyn Parker met a similar response from an English teacher, but reacted differently from Malcolm X (Perry, 2003). When her family moved from the segregated south to the integrated north for better educational opportunities, they met school personnel who did not believe that a person of color could perform on the same level as a White person. Gwendolyn's English teacher accused her of plagiarizing a poem she wrote, stating that a "Negro" could not have possibly written something that good (Perry, 2003). Her response was the opposite of Malcolm's, Gwendolyn set out to prove that being African American was not being intellectually inferior. Perry (2003) asserted that African American students need to have support from their community to overcome the negative forces which they face in school and society. Malcolm X and Gwendolyn Parker

are only two examples of what many more African Americans have faced at some point in their lives. If being smart is oppositional to being African American, and African American children are faced with these attitudes and responses from others daily, weekly, and yearly, then how can we equip these children to handle this and persevere?

Educational Institution

To discuss this overview of research, the following are included under educational institution: school issues and reports such as dropout, suspension, retention rates; school population descriptions as pertaining to socioeconomic factors; course-taking patterns and tracking; and high stakes testing. Many of these issues are credited with affecting student learning. The school population can be described in terms of racial/ethnic and socio-economic status as measured by free or reduced lunch participation. Data from NAEP gives some insight into classroom experiences, as reported by the students, in instructional time, homework assigned, types of assessment, and type of courses taken. In surveys conducted by the U.S. Census Bureau, one can find data relating to grade retention and school suspension or expulsion as reported by racial groups.

Socioeconomic factors. Low mathematics achievement patterns typically begin in the early school years and are often associated with poverty (Oakes, 2002). Children of poverty fail in disproportionate numbers (Singham, 1998). There is evidence supporting this, as well as evidence that African American children are disproportionately represented in the lower socioeconomic classes and schools (Strutchens et al., 2004). Because most states fund schools based on property tax, the better funded schools tend to be in the higher priced neighborhoods. Ladson-Billings (1999) maintained that this school level inequality is another form of institutional and structural racism. Evidence

from the 2000 National Assessment of Educational Progress indicated that 34 percent of African American versus 3 percent of White students attend schools in which over 75 percent of the students qualify for free or reduced lunches (Strutchens et al., 2004). Most African American students attended public schools where minorities represent the majority of the student population in 1999 (Hoffman et al., 2003). Of African American 4th grade students, 73 percent attended schools where more than half the students receive free or reduced lunch costs (Hoffman et al., 2003). Poorer schools provide fewer resources for the children, attract less qualified teachers, and serve a disproportionate number of African American students (Roscigno, 1998).

It is important to note that African American students score lower on standardized mathematics tests even when controlling for socioeconomic status (Singham, 2003; Strutchens et al., 2004). However instead of addressing racism, many educators ascribe educational success to socioeconomic factors, and in doing so, they are putting the blame on the students and their families (Rousseau & Tate, 2003). By blaming the students and their families, the social and economic injustices perpetuated by schools have been avoided instead of addressed.

High stakes testing. Attaching high stakes, such as graduation, grade retention or track placement, to achievement tests can disadvantage those who do not have the training to be good test-takers or a chance to learn the material ahead of time (Edley, 2002; National Research Council, 2000). In 1972, *Moses v. Washington Parish School Board*, the supreme court ruled that using standardized tests for track placement disadvantaged African Americans and denied these children their educational benefits, therefore established as unconstitutional (Tate & Rousseau, 2002). By placing African

American children disproportionately in the lower tracks, they were experiencing inferior education as compared to the academic tracks (Oakes, 1994a, 1994b). The National Council of Teachers of Mathematics issued a position statement on high stakes testing in 2002, making two critical arguments against testing which is tied to promotion, graduation, course credit, or placement in special groups. First, tying a single assessment to a crucial decision about a child's future is unfair, inaccurate, and not aligned with movement toward equity or equality (National Council of Teachers of Mathematics, 2002). Secondly, attaching inflated importance to any high stakes test can cause the curriculum and instructional methods to become narrowly defined to follow the objectives of that test (National Council of Teachers of Mathematics, 2002; Schoenfeld, 2002). Schoenfeld (2002) claimed that a large part of a test score reflects the preparation that the student has undergone, not what the student actually knows, or what the test purports to measure. The important decisions made with serious consequences for a child should encompass multiple means of assessment (National Council of Teachers of Mathematics, 2002).

Tracking. Tracking is a form of segregation (Tate & Rousseau, 2002). Because schools decide who takes what classes and what classes are offered, tracking is one of the principal barriers to academic access in American schools. Tate & Rousseau (2002) found tracking to be a primary barrier to academic access in American schools, yielding mixed results on the relationship between track placement and race in a number of studies. An explanation for these mixed results was offered by Oakes (1994a, 1994b) who claimed that the large scale assessment tools mask the subtleties found by examining the racial make-up of the school. Oakes (1994a, 1994b) and Useem (1992) argued that

the mixed results were the result of the differences in racial makeup of the school districts, for example, an African American student in the top track of a minority school would not necessarily be assigned to the top track in a predominantly White school. Wells and Oakes (1996) found in 1994 that the racial placement patterns varied dramatically by school. Through teacher interviews, Wells and Oakes (1996) learned that the teachers studied equated race with intellectual potential and made recommendations aligned with their beliefs. Additionally, parents with political and social power are the ones who can work the system for their children, insisting that their children receive something extra from the school (Wells & Oakes, 1996). Pushing the school to enroll his or her child in more advanced classes takes a self-confident person, and parents with higher levels of education have been linked to involvement with their child's placement (Useem, 1992). This means that the best educational assets will remain beyond the reach of all but the 'chosen few' who were placed by birth on the top of our stratified social system (Wells & Oakes, 1996).

Tracking is the post Civil Rights form of segregation (Tate & Rousseau, 2002). The supreme court of the United States decided in *Hobson v. Hansen* (1967) that African American children in the Washington D.C. school system were placed in the lower tracks in disproportionate numbers (Tate & Rousseau, 2002). While one would hope that better qualified teachers and higher quality instruction would join forces in the lower tracks where supposedly the students need more help, this is not what actually takes place. Oakes (1994a, 1994b) found in her studies that the higher mathematics tracks had the more qualified teachers, more resources and an overall better learning environment (O'Neill, 1992). Similar findings were reported in 1998 by Roscigno. In the lower tracks

the teachers were less qualified and held lower expectations of achievement for their students (Roscigno, 1998). Oakes (1994a, 1994b) claimed that the type of instruction typically found in the low level tracks can make knowledge less accessible to students. This instruction typically includes drill and practice, worksheets, as well as instructor-student interactions which are quiet and few; in other words, not the type of instruction recommended for students who are having difficulties in school (Oakes, 1994a, 1994b; O'Neill, 1992).

High school course taking. Tracking in the elementary grades determines what courses the student takes in high school. A child who is placed in a low level track early in her school career cannot hope to complete high school having taken the higher level college preparatory mathematics classes (Spade, Columba, & Vanfussen, 1997). Parents from higher socioeconomic classes are more involved in determining which classes students take, whereas in schools where mostly working class children attend, the decision is contained within the guidance department (Spade et al., 1997). Course-taking matters (Gutierrez, 2000; Strutchens et al., 2004; Tate & Rousseau, 2002). African American students are less likely than White students to take advanced mathematics courses in high school (Hoffman et al., 2003; Strutchens et al., 2004). White students are more likely to take algebra in the eighth grade and geometry in the ninth (Strutchens et al., 2004); therefore, White students are more likely than African American students to be on the college preparatory track to take calculus or other college preparatory mathematics courses in high school.

While African American students high school graduates completed more academic courses in 1982 than in 1992, the total credits for these African American

students lagged behind their White peers (Hoffman et al., 2003). The number of vocational credit totals for African American students was higher than the number of vocational credits for White students in 1998 for graduating students (Hoffman et al., 2003). African American students earned about the same number of academic credits as Hispanic students in 1982 as in 1998 (Hoffman et al., 2003).

Challenging and relevant curriculum. A challenging curriculum has been linked to the mathematics achievement of students (Gutierrez, 2000; Lee & Smith, 1993, 1995a, 1995b; Lee et al., 1997; Schoenfeld, 2002). Perry (2003) insisted that African American students who do not have a challenging curriculum will not only be shortchanged, but will believe that those who selected this curriculum think that they are not as capable as other students. Encouraging students by telling them they are smart and then offering them a watered down curriculum does not indicate to the students that you have faith that they are actually capable (Perry, 2003). One successful program offering students a challenging mathematics curriculum is the QUASAR project, an educational reform project aimed at economically disadvantaged middle school students (Silver & Stein, 1996; Tate & Rousseau, 2002). The project established partnerships between selected middle schools in various cities and local colleges and universities, and these partners worked together to address the needs of their students (Williams & Baxter, 1997). One of the purposes of QUASAR was to use challenging mathematical tasks to engage students and to help their understanding. The results for those students who participated in this project have been very promising with many of them taking and passing algebra in the ninth grade at higher rates than before the project (Tate & Rousseau, 2002).

On the high school level the Interactive Mathematics Program (IMP) provides students with a challenging and integrated mathematics curriculum. Comparative evidence from several studies indicated IMP students completed more years of high school mathematics, took more advanced mathematics classes in high school, and scored as well as or higher on the traditional standardized tests than did the students enrolled in traditional college preparatory mathematics classes (Merlino & Wolff, 2001; Webb, 2003). IMP content, which differs from the traditional college preparatory mathematics classes, includes an increased emphasis on statistics and probability, and helping students become more effective at problem solving. When IMP students are compared with other students on problem solving, probability or statistics, the IMP students outperform the students from the traditional mathematics classes (Webb, 2003).

In addition to being challenging, the content must be relevant to the students out-of-school life (Martin, 2003). For a student to learn new mathematical ideas, they must be able to relate it to previously learned material (Heibert & Carpenter, 1992). The degree of understanding that a student has is directly related to the number of connections the student can make with their own knowledge and personal experiences (Heibert & Carpenter, 1992). The culture of the student structures the learning environment so that relationships between in-school mathematics and out-of-school knowledge are strengthened. Students who do not see a connection between what they are learning in school and what skills are needed for their life goals will likely have little motivation for continuing to attend to their education (Carey, Fennema, Carpenter, & Franke, 1995).

Schools should help students develop the skills they need to analyze the social injustices that they encounter (Sleeter, 1997). Frankenstein (1995) argued that

empowering students mathematically requires teachers to include a component of investigating socioeconomic class issues in their curriculum. To challenge inequitable practices, one has to understand them. For example, suppose the working class person understood percentages and that the tax burden faced by them is much greater than that faced by the richest Americans (Frankenstein, 1995). Frankenstein (1995) found that most working class people do not have the time to reflect and analyze when they are just getting by and that it is the responsibility of educators to enable this analysis.

Supportive environment and addressing racism. Gutierrez (2000) analyzed several high schools which were effective in teaching minority students and found that common components were a rigorous curriculum, reform-oriented instructional practices, and a strong teacher collective believing in and committed to mathematics success for all students. These schools had administrative support, particularly department chairs, who were committed to and supportive of a teacher collective (Gutierrez, 2000). There was no evidence that these teachers helped their marginalized students address racism and become critical of social issues, rather the goal appeared to be assimilating the students into mainstream mathematics (Gutierrez, 2000). Furthermore, Gutierrez (2000) wondered what more these schools could have accomplished for their minority students beyond academic advancement if the collective goal had included critical thinking of social issues and inequalities.

Perry (2003) used the term “racial socialization” for the process of preparing children to deal with racism and other obstacles that they might face in school. The playing field is not always equal, and letting children know how to persevere is essential to empower them for society. To develop strong intellectual identity among African

American students, Perry (2003) suggested using a model such as one developed by the Association of Independent Schools, called the Multicultural Assessment Plan. Perry (2003) explained that the Multicultural Assessment Plan is an external review process in which schools are assessed on whether they reproduce the ideology of African American intellectual inferiority, and how schools can address this issue and move in another direction. Several schools in the Northeast have successfully used this plan to change the direction of their schools to a more supportive environment. African American students need affirmation that their racial heritage is synonymous with being intellectual and an achiever (Perry, 2003). Weissglass (2002) also argued that the racist practices in schools can be alleviated through a complex process of reflection and re-evaluation of existing practices and understanding. Furthermore, it is suggested that the new paradigm for our schools should be one of a healing community, and that it is our responsibility as educators to heal ourselves from the damage that racism has done (Weissglass, 2002). Reform efforts attempting to reduce the achievement gap which do not address racism/classism will be doomed to failure (Weissglass, 2002).

Banks (1993) argued that for education to be effective for marginalized populations, students should be taught that knowledge is culturally and situationally constructed. Students should be afforded the opportunity to explore these biases and cultural assumptions that influence knowledge construction, for example, consider how the Eurocentric paradigm reproduces the notion that Columbus discovered America ignoring the indigenous population and their claim to the land (Banks, 1993; Ladson-Billings, 2003).

Classroom Practices

While teacher-student interactions may be the most influential factor in student achievement for classroom practices, there are other factors in the classroom which can also exist as barriers to mathematics achievement for African American children (Singham, 2003). Some of these include irrelevant curriculum, lack of resource materials, types of assessment, teacher attitudes and beliefs, and instructional practices which do not match the learning style of the student (Tate & Rousseau, 2002).

Classroom resources. In resource materials, the argument might be made that the implementation of available resources is at least as important as the amount and type of materials available (Schoenfeld, 2002). If one accepts this, then the available data does not tell us much about whether or not resources might be a barrier to achievement for African American students. Results from NAEP 2000 indicated that even when accounting for socio-economic status, African American students are less likely to have teachers who report having all or most of the resources that they need (Strutchens et al., 2004). For instance, African American students are less likely to have access to calculators, and calculator access does correlate positively with mathematical proficiency (Strutchens et al., 2004). African American students are equally likely as White students to have access to and use of computers, although how the computers are used for instruction differs by the race of the student. More teachers of African American students reported using computers for drill and practice as opposed to simulations or demonstrations of concepts (Strutchens et al., 2004). Recall additionally that African American children are disproportionately assigned to lower tracks in mathematics and that students in the lower tracks have access to fewer resources and usually poorer quality

of instruction (Oakes, 2003). Again the author hypothesizes that implementation of the curriculum and resources may be more important for student achievement than the accessibility of the resources.

Curriculum implementation. While teachers do not often have the option of selecting the mathematics curriculum, teachers do have options in implementation of the selected curriculum. Ladson-Billings (1999, p. 21) described the curriculum in stark terms, with its distortions, omissions, and stereotypes, as a cultural artifact designed to maintain a White supremacist master script. For example, Rosa Parks is usually portrayed as a tired seamstress instead of a longtime participant in social justice endeavors, and Martin Luther King, Jr. is portrayed as a sanitized folk hero supported by all Americans instead of the disdained scholar and activist that he was (Ladson-Billings, 1999). One might argue that in mathematics class, this misrepresentation would not take place, as mathematics is supposedly culture-free. Weissglass (2002) disavowed this notion in his report of a popular 1998 eighth grade mathematics textbook. In an attempt to situate mathematics in history and give meaning to mathematics, the textbook misrepresents the indigenous people of California and the events surrounding the acquisition of California from Mexico (Weissglass, 2002). The societal, structural status quo is maintained by a curriculum which distorts the facts and encourages the acceptance of students' relative oppressed positions (Weissglass, 2002). Teachers mediate and interpret curriculum materials for students (Banks, 1993). Additionally, there is evidence that textbook publishers will avoid putting controversial issues, such as racism, classism, and poverty, in their books for fear of losing sales to school districts (Banks, 1993). So even if teachers do not have input in selecting the course objectives and textbooks, they can and should be

aware that repeating stereotypes and distortions disadvantages learning for many students; and the curriculum should be carefully examined for distortions.

Implementation of the curriculum might be as important as the curriculum itself (Schoenfeld, 2002). Assessing the results of a successful standards-based reform effort in Pittsburgh schools, Schoenfeld (2002) noted the differences between teachers who implemented the curriculum in the manner intended with those who had a weak implementation. For those students who were in classes with a strong implementation of this curriculum, achievement scores rose, and the gap between White and African American students decreased (Schoenfeld, 2002).

Another program, Cognitively Guided Instruction (CGI) was developed by researchers at the University of Wisconsin under the premise that if teachers increased their understanding of how students learned, then their teaching practices would become more effective (Carey et al., 1995; Tate & Rousseau, 2002). Research studying the effects of CGI summer training for teachers found that teachers who changed their implementation methods by focusing on more problem solving improved the mathematics achievement of their largely African American student population (Tate & Rousseau, 2002). Improved teaching practices coupled with higher level task requirements of their students result in better student performance (Schoenfeld, 2002).

Assessment strategies. Assessment strategies used for evaluation are another area of the mathematics classroom which can disadvantage the African American child. The type of assessment can favor a particular individual because of the cultural practices which it incorporates (Weissglass, 2002). For example, timed tests and multiple choice tests advantage those students who have learned particular test-taking strategies.

Strutchens et al. (2004) found that African American students are more likely than White or Hispanic students to take multiple choice tests. And the more often a student reported having been assessed with multiple choice tests, the lower their mathematical proficiency score (Strutchens et al., 2004).

The test taking environment can also work to the disadvantage of some students by causing different levels of anxiety (Weissglass, 2002). Steele and Aronson (1995) found that African American students scored much worse on a standardized test when informed that the test was evaluating their intellectual abilities. When the same test was presented as a non-evaluative problem-solving test, African American students performed about as well as White students who had equivalent performance records (Sackett, Hardison, & Cullen, 2004; Steele & Aronson, 1995, 2004). Steele and Aronson (1995) termed this phenomenon "stereotype threat," whereas Weissglass (2002) used the term "internalized oppression" for the phenomenon where people believe the messages that they receive about themselves from society.

Ladson-Billings (1999) argued that traditional assessment measures tell us what the child does not know but do not tell us what the child does know. She included an example of a 10-year-old African American girl labeled as a poor math student by her teacher. This child was responsible for all of the household budgeting and bill paying in an attempt to keep the welfare agent unaware of problems within the household. Apparently the girl's mother was incapable of maintaining the home due to a drug addiction problem. A girl who could not do fourth grade math was doing fine keeping the household going. The mathematics that the teacher was assessing was not the mathematics that the student could do, and some might argue, not the mathematics that

the student needed. Traditional assessment methods are a method of maintaining the inequitable power structure (Weissglass, 2002).

Teacher beliefs, differential treatment of students, and culturally relevant teaching. In education, the immediate point of contact and influence for students and their educational achievement is the teacher and what occurs within the classroom. Studies conducted in the 1990s indicated that teacher beliefs, expectations, and stereotypes play a role in maintaining the inequitable status of the classroom (Gutierrez, 2000; Levy, Plaks, Hong, Chiu, & Dweck, 2001). Teacher attitudes and beliefs influence how the teacher responds to the students (Levy et al., 2001). For many teachers, instructional practices presume that the African American child is deficient (Ladson-Billings, 1999). Historical narratives from several African Americans consistently include instances in which students are bluntly or subtly told that they are not capable because of their race (Perry, 2003). Differential treatment of students is one of the results of teachers connecting race, gender, or ethnic group to the intelligence of the individual. Students in the same room, using the same materials, with the same teacher, have very different learning experiences based on differential treatment from the teacher (Sadker & Sadker, 1986). Perry (2003) asserted that many people stereotype African Americans as having inferior intellect. If this belief is held by teachers, then teachers would automatically expect less of African American students, possibly interact less with these students, or recommend that African American students be place in lower tracks. Lower track placement can result in instructional methods and resources limiting mathematics skill acquisition (Oakes, 2002). Differential treatment patterns of students exist for

whatever reason and African American children seem to be shortchanged in teacher interactions.

Color-blindness on the part of the teacher is a form of dysconscious racism (Ladson-Billings, 1994). Probably unintentionally, this form of racism indicates that the teacher is unaware of the fact that she created an environment where some children are privileged while others are disadvantaged (Ladson-Billings, 1994; Rousseau & Tate, 2003). Teachers who claim not to notice the race of their students and purport to treat all students the same might be suffering from this form of racism. Color-blindness ignores students' important features and makes students wonder if they should be ashamed of their color (Rousseau & Tate, 2003). Teachers who do not address the issue of racism with their students, are not empowering their students to effectively confront racism in society (Martin, 2003; Rousseau & Tate, 2003). Marva Collins and Jaime Escalante are two teachers who practiced a method of addressing racism with their students (Ladson-Billings, 1995). They reminded their students that society expected them to fail, and as such, the students had to work even harder to overcome this oppression and be successful. Teachers can empower their students to confront racism in society through examples, discussions, and research.

Sleeter (1993) argued that the race of the teacher matters; not only are African American teachers generally more effective for African American students, but it is inadequate to address racism by educating White teachers on equity issues. The school population is increasingly diverse, while the teacher population continues to be predominately White. Sleeter (1993) argued that while multicultural education improves White teachers' attitudes immediately after receiving instruction, there are no lasting

changes. From 1987 through 1989, Sleeter (1997) studied the impact of professional development on 30 teachers from 18 schools. The study involved observing the training sessions, interviewing the teachers, and making three to five classroom observations over one and a half years. Other than increasing cooperative learning classroom time, Sleeter (1997) reported that the teachers studied did not sustain the benefits of their professional development as it was intended. Furthermore, Sleeter (1993) argued that teachers give one or two different explanations as to why students of color are not as successful as White students. Either teachers deny race altogether or they define students of color as "immigrants." Furthermore, by denying race, teachers are trying to suppress the negative images that they attach to those of other races (Sleeter, 1993).

In her book *Dreamkeepers*, Ladson-Billings (1994) contradicts Sleeter's (1993) assertion that African American teachers are the only teachers who can effectively teach African American students. Ladson-Billings (1994) described successful teachers of African American students who are not African American themselves. Ladson-Billings (1994) used the term "culturally relevant pedagogy" to describe the kind of teaching that is needed to ensure success for the disadvantaged child. The culturally relevant teacher has the following characteristics. First, the teacher sees knowledge as changing and must be viewed critically, not accepted at face value but examined for misrepresentations, stereotypes, and omissions (Ladson-Billings, 1994). Secondly, teachers help the student acquire prerequisite skills rather than expecting them to come to class equipped with them. Additionally, culturally relevant teachers are passionate about content and encourage students to learn collaboratively (Ladson-Billings, 1994). In the classroom the teacher develops a community of learners where students are respectful and responsible

for each other. The culturally relevant teacher believes that all students can succeed, and it is her job to help the student make connections to the community, the nation and the world (Ladson-Billings, 1994). Maintaining the status quo is not a goal for this teacher, but teaching goals do include achieving excellence and access. Sleeter (1997) used similar categories to describe a good multicultural teacher, one who is effective with minority students.

Ladson-Billings (1997) believed that the best chance for changing the success rates of African American students is through changing teacher practices. In her book, *Dreamkeepers*, Ladson-Billings (1994) observed and interviewed several successful teachers who model what Ladson Billings described as culturally relevant teaching. Margaret Rossi is one the teachers described in *Dreamkeepers* (Ladson-Billings, 1994, p.119*)*:

> From a pedagogical standpoint, I saw Margaret make a point of getting every student involved in the mathematics lesson. She continually assured students that they were capable of mastering the problems. They cheered each other on and celebrated when they were able to explain how they arrived at their solutions. Margaret's time and energy were devoted to mathematics.
>
> Margaret moved around the classroom as students posed questions and suggested solutions. She often asked, "How do you know?" to push students' thinking. When students asked questions, Margaret was quick to say, "Who knows? Who can help him out here?" Margaret helped her students understand that they were knowledgeable and capable of answering questions posed by themselves and others…
>
> All of Margaret's students participated in algebra, even though it was beyond what the district's curriculum required for sixth grade. Margaret scrounged an old set of algebra books from the district's book closet and exempted no one from the rigors of the class. One of Margaret's students was designated a special needs student. However, Margaret determined that with a few accommodations the student could remain in the classroom and benefit from her instruction. James performed well in the classroom. He participated in class discussions, posed problems as well as solved them, and accepted help from classmates when he struggled. By the end of the year, Margaret had convinced the principal that James had no need for services outside the classroom.

Contrast this description of Margaret's class with that found in a typical mathematics classroom where maintaining order and control is the teacher's focus. Effective teachers help students make mathematical connections in contexts that they know and understand. School mathematics cannot be divorced from what students experience everyday (Ladson-Billings, 1997). Furthermore, directive, controlling classrooms appeal to teachers who have low expectations for or who fear children of color or poverty (Ladson-Billings, 1997). A dysfunctional curriculum in combination with a lack of instructional innovation will result in poor performance for some minority students, especially African American children (Ladson-Billings, 1999).

Tate (1997), Rech and Stevens (1996), Sleeter (1993), Berry (2003), and Ladson-Billings (1994, 1997) addressed the learning styles of children and effective teaching practices. Tate argued that the traditional mathematics classroom emphasizes whole class lectures followed by students working alone on large problem sets or workbooks/sheets. This instructional practice is a cultural artifact, a default cultural policy which is designed to produce students who can correctly answer a set of narrowly defined problems (Tate, 1997). Similarly Rech and Stevens (1996) found a statistically significant correlation between learning styles, gender, and achievement of the African American eighth graders in their study. Interestingly, for fourth grade African American students the correlation was not as strong, but the variables which correlated were mathematics attitude, socioeconomic status, and achievement (Rech & Stevens, 1996). The learning style of the majority of the students tested was described as field dependent and oppositional to the manner used by most teachers. Field dependent learning styles include the use of manipulatives, verbalization, and a global perspective (Rech and Stevens, 1996). Berry

(2003) described the learning style of most African American students as a relational style of learning. A relational learning style is characterized by divergent thinking, freedom of movement, variation, creativity, and inductive reasoning with a focus on people (Berry, 2003). African American students prefer to use concrete imagery and base learning on making holistic connections between items and ideas (Berry, 2003). The learning style of the mathematics classroom is typically analytical, in which object relations are approached in a logical, diagnostic, impersonal fashion (Berry, 2003). While urging teachers to adopt culturally relevant teaching practices, Berry (2003) also warned of ethnic stereotyping: all African American students do not prefer or benefit from teaching practices recommended for relational or field dependent learners.

Empowering traditionally underserved students is a primary theme of Ladson-Billings (1994, 1995, 1997, 1999, 2003), Schoenfeld (2002), Perry (2003) and others. Empowering students goes beyond matching teaching practices to learning styles. The teacher is the primary contact person for children in school and can impact positively a child's self confidence and desire for learning. There are many examples of teachers who empower their students with relevant mathematics. Assigning his students a project on housing costs, mathematics teacher Gutstein (Martin, 2003) required students to use mathematics to examine housing costs to determine whether or not there was evidence of racism.

Gutierrez (2000) found some encouraging results from her study of several successful high schools. Selecting several high school mathematics departments which were chosen based on their success with their working class and ethnically diverse students, Gutierrez (2000) correlated the organizational structure of the mathematics

department with student achievement over a six year period. School site visits were conducted in 1994 where observations and interviews were conducted, questionnaires were administered, and school documents were examined (Gutierrez, 2000). While not all teachers within the departments were on board with the reform practices being used in the schools, Gutierrz (2000) noted several interesting phenomena. Teachers who did not believe that students would respond to reform-oriented classroom practices were surprised by how much their students achieved (Gutierrez, 2000). These teachers adopted the teacher practices that were implemented collectively in their school before buying into the practices, but the results were so impressive that the teachers became believers in the practices. None of the teachers adopted practices aimed at confronting social inequalities and injustices, but because they did adopt reform-oriented practices such as rigorous curriculum, cooperative learning, and use of manipulatives their students experienced success (Gutierrez, 2000). The conclusion is that teachers can be taught how to be more effective in the classroom without their buying into the ideal, and with more successful students, the teachers will become believers.

Ladson-Billings (1994, 1997), Berry (2003), Sleeter (1997), Tate (1997), and Schoenfeld, (2002), Lee and Smith (1993, 1995a, 1995b,1997), and Gutierrez (2000) gave convincing arguments that effective teaching styles and standards-based curriculum can make a difference in mathematics learning. Results from several standards-based reform curriculum implementations in Pittsburgh, Michigan, Philadelphia, Massachusetts, and other locations indicate that a well-designed standards-based approach appears to work (Berry, 2003; Schoenfeld, 2002). Not only did more students do well, but the racial performance gap, although not eliminated, was reduced.

Student Attitudes

Kim (1998) found that the attitudes of the students towards learning mathematics appeared to be a major factor in determining achievement for African Americans as well as Whites although this study used data collected in 1981-1982 for the Second International Mathematics Study (Kim, 1998). Similarly and more recently, Rech and Stevens (1996) found that the strongest predictor of mathematics achievement for fourth grade students in their study was their attitude about mathematics. Rech and Stevens (1996) administered standardized tests to 251 fourth and eighth grade students from city schools with largely African American student populations. The standardized instruments used were the California Achievement Test to measure mathematics achievement, the Mathematics Attitude Inventory to measure attitudes towards mathematics, the Group Embedded Figures Test to measure learning style in terms of field dependence; and the Piers-Hams Children's Self Concept Scale to measure the self-concepts of students (Rech & Stevens, 1996). Rech and Stevens (1996) then correlated the results from the four tests using multivariate analysis of variance and established that the strongest correlation factor was between mathematics achievement and student's attitude towards mathematics.

A student who fears mathematics or thinks that only certain people can understand the subject might be inclined to have a negative attitude towards the subject. Often mathematics is feared and revered as a subject only understood through innate ability (Ladson-Billings, 1997). Confirmation of this belief in how and who can learn mathematics is found in studies by Levy, Plaks, Hung, Chiu, and Dweck (2001), and by Signer, Beasley and Bauer (1997) which supported the evidence that less successful

students viewed intelligence as fixed and innate. Less successful students in the study believed that if a person is good at something, then they do not have to work hard at it; therefore, if effort is involved then low ability is implied (Signer, Beasley, & Bauer, 1997). The more successful students indicated the belief that intelligence could be obtained through hard work and persistence. In contrast, low achieving students often believed that their ability level is fixed and the cause of failure (Signer et al., 1997). Signer, Beasley and Bauer (1997, p. 387-389) found some interaction between ethnicity and beliefs about ability, and advised teachers to examine classroom practices that lead to "learned helplessness."

From the 1996 NAEP data, the largest difference in attitudes towards mathematics found between African American and White students was in the belief that mathematics is merely a matter of memorization (Strutchens & Silver, 2000). Many more African American than White students maintain that mathematics is a matter of memorization. The authors suggested that this might be a reflection of course taking, since more White students reported taking the college preparatory mathematics classes (Strutchens & Silver, 2000). In a NAEP mathematics achievement study by Strutchens et al. (2004), the percent of all students who liked math had decreased; and while more African American students have reported liking mathematics at a higher percentage than others, by 2000 for twelfth grade students the difference between the reporting racial/ethnic groups was almost non-existent. In response to the statement that learning mathematics is mostly memorizing facts, more African American students consistently agreed with this statement from 1990 through 2000 (Strutchens et al., 2004). While the overall numbers of students agreeing that mathematics is mostly memorization has decreased, the difference

in percentages between the number of African American and White students who agree with the statement has increased (Strutchens et al., 2004).

D'Amato (1992) contended that schools themselves are responsible for student resistance due to three factors: First, school is compulsory and the element of compulsion and resulting unequal power struggle is a source of contention between the teacher and student (D'Amato, 1992). Secondly, instruction involves assessment with the teacher as the evaluator; meaning students must vie with each other for teacher awards (D'Amato, 1992). And lastly, by teaching children as a group, the resistance developed by peer relationships is a natural consequence from teacher expectations of group norms and group duty (D'Amato, 1992). When schooling has a primarily negative meaning for a child, and the child does not have an acceptably cultural or self-developed rationale for attending, then resistance occurs and very little learning takes place. One might argue that the caste-like minority theory as discussed by Ogbu and Matute-Bianchi (1986) explains why some individuals develop a rationale of striving for school success and others do not.

Summary of Barriers to Mathematics Achievement

The issue of racism and its devastating effects is in all of the spheres of influence for students. From teacher attitudes, beliefs, and stereotypes, through curriculum distortions, tracking, language, and behavior traits of the student's culture; racism seems to be the major obstacle for African American children to overcome in attaining educational access. Martin (2003) insisted that if one accepts that mathematics is the gatekeeper for higher education and higher status jobs, then equity for education implies correcting the unequal power structure which currently exists and prevents some minorities from attaining the same educational access as the White, middle class male.

Teachers who are committed to learning for all students can make a difference in their classrooms by addressing issues of equity. Educational institution policy makers have to make conscious choices to address issues of equity for teacher action to have a sustained effect. Ideally the teacher, school personnel, parents, and community should work together to reach goals of equal educational access and empowerment. Cohen (National Research Council, 2000) argued that children are delegates from the outside world and, as such, one must consider their social environment and their community. Additionally for mathematics achievement, one cannot address any of the components listed above separately as the students community and social environment can be linked to student perception of classroom activities and success (National Research Council, 2000). Research concerning barriers to educational access for African American children mandates a challenging curriculum, supportive school environment, and teacher professional development to learn innovative instructional methods, methods of addressing racism, and culturally relevant pedagogical techniques. To summarize and borrow a quote from Christopher Edley, Jr., research tells us that "to improve student achievement, pick better students; failing that, do better and more teaching of the students you are stuck with" (Edley, 2002).

Theoretical Basis for Study

A critical social theory concerns issues of power and justice and the ways in which race, class, gender, education, religion and other social and cultural dynamics interact to construct a social system (Kincheloe & McLaren, 2003). Critical emancipation is an attempt to gain control by those who seek to control their own lives and critical research

attempts to expose those forces that prevent individuals from making their own decisions (Kincheloe & McLaren, 2003).

Traditional educational theory takes the existing society as a given, even desirable, and not changeable in any major way (Weiler, 1988). On the other hand, critical educational theorists argued that the exploitative and oppressive society is capable of being changed (Weiler, 1988). In critical education theory there are production theorists who are concerned with the processes that allow social structures to maintain and reproduce, and reproduction theorists who are concerned with how individuals interpret their experience and resist the forces imposed on them (Weiler, 1988). For many production and reproduction theorists, schools are the primary means of transmitting the culture (Weiler, 1988). According to French social theorist, Bourdieu, children of the dominant classes are successful in school, not because of their natural intelligence, but because they already know what is valued in society (Weiler, 1988). Additionally, school language and knowledge is middle-class language and as such has restricted access for working-class children (Banks, 1993). Production theorist Gramsci's central concern was the ways that the dominant classes impose their reality on all subordinate classes, and the possible ways that the oppressed create understanding of this oppression (Weiler, 1988). As discussed earlier, different minorities respond to their oppression in different manners, some of these methods seem to be more beneficial to individual achievement than others.

Racism and Critical Race Theory

For theory and research, the natural response to racism is critical race theory. Critical race theory evolved from critical legal studies, a movement that challenged the traditional legal scholarship focusing on doctrine and policy analysis in favor of law

which focuses on individuals in social and cultural contexts (Ladson-Billings, 2003; Ladson-Billings & Tate, 1995b). Earlier work from the production theorist Gramsci questions the continued legitimacy of the oppressive American societal structures and contributes to the ideology of critical legal studies (Ladson-Billings, 2003; Ladson-Billings & Tate, 1995b). In that critical legal studies were not concerned with racism as a primary issue, something more was needed. Derrick Bell's and Alan Freeman's frustration with the slow pace of racial reform in the 1970's fueled the emergence of critical race theory (Delgado & Stefancic, 2000; Ladson-Billings, 2003; Ladson-Billings & Tate, 1995b).

Critical race theory scholars maintain that our nation was founded not on individual rights, but on property rights (Bell, 2000; Delgado & Stefancic, 2000; Ladson-Billings, 2003). This property rights notion is from England, where only those who owned the land could make decisions about the country. Our founding fathers did not conceive of individual rights apart from property, therefore belief in liberty and justice could coexist with oppression of African Americans, indigenous peoples, and women (Bell, 2000). Additionally, this notion of property ownership and the rights of ownership has developed into thinking that what Whites own is valuable (Ladson-Billings, 1999). Many African Americans are naturally less enthusiastic about U.S. citizenship than Whites because their experiences of citizenship are not the same as the White experience. And with differential treatment in school and job ceilings, African American students will be less convinced that success in academics is related to higher status job access (Ladson-Billings, 1999).

Features of critical race theory include acknowledging that, in our society, racism is accepted as normal and not aberrant (Delgado, 2000). A former Congresswoman, Shirley Chisholm, stated in 1970 that racism is so widespread and deep-seated that it is invisible in this country (Weissglass, 2002). Critical race theory is concerned with understanding how a regime of white supremacy and subordination of people of color developed and is being maintained (Kincheloe & McLaren, 2003; Ladson-Billings, 1999, 2003). Without this understanding, one cannot hope to make the sweeping changes needed to combat racism.

Other important concerns of critical race theory are challenging the bonds between racial power and law (Kincheloe & McLaren, 2003; Ladson-Billings, 1999, 2003), acknowledging that the civil rights legislation has benefited Whites primarily (Bell, 2000), and giving voice to people of color (Delpit, 1988). With regards to education, beyond exposing racism and proposing radical solutions for addressing it, critical race theory makes several claims addressing issues of curriculum, assessment, instruction, funding, and desegregation. These areas are identified as sources of inequity for many minority children and, as such, need to be examined for contributing to the problem of addressing educational access for African American children which, in turn, affects mathematics achievement.

Storytelling is an often-used feature of critical race theory which can help heal the wounds of racial oppression (Ladson-Billings & Tate, 1995b). Stories can help the storyteller put order to experiences, understand how the oppression came to exist, and stop internalizing the stereotypic images created by society to maintain the power structure (Ladson-Billings & Tate, 1995b). The oppressor will also be affected by the

stories and will have cause to reexamine their rationalization of their contribution to the injustices inflected on the marginalized groups (Ladson-Billings & Tate, 1995b). To analyze the educational system, voices from African Americans are needed (Delpit, 1988; Ladson-Billings & Tate, 1995b). Secada (1995) warned that implicit in the idea of giving voice is that an individual can speak for himself, but not necessarily for the group. Not only can one person not capture the complex behaviors or response of the group, but within the group are many different ways of interpreting and responding (Secada, 1995).

In summary, critical race theory seeks to uncover color-blindness and the presumably race-neutral practices of public education which maintain and perpetuate the power structure (Kincheloe & McLaren, 2003). With an emancipatory agenda, critical race theory uses methods such as story-telling to give voice to people of color (Denzin, 2003). Seeing the world through the eyes of the person of color, one will reject the Eurocentric paradigm and the postpositivist view (Denzin, 2003). The Eurocentric paradigm developed from the colonization of other countries by European countries and postulates that everything progressive has developed from European male thinking. The Eurocentric paradigm brings into being the notion of the White European male as the self-proclaimed dominant species, and the sole owner of rational thinking, learning, and mathematics (Denzin, 2003). A tenet of postpositivistism states that we can never understand or describe reality only approximate it (Denzin, 2003). Whereas through story-telling offered by critical race theory, reality is true for the story-teller (Denzin, 2003). In Martin's (2003) sociohistorical forces, Ogbu's (1986) caste-like minorities, and Perry's (2003) historical narratives, reality exists as interpreted by the individual, and this is the reality that the individual acts upon. Buying into the Eurocentric paradigm

reinforces the belief that European descendents have innate intellectual abilities that other races do not have (Sleeter, 1997).

CHAPTER III

DESIGN OF THE STUDY

Overall Approach and Rationale

The author believes as do Moses and Cobb Jr. (2001), that equitable schooling is a civil rights issue and as Ladson-Billings (1997, 1994) wrote, that more African American than White children are limited in their life choices because of current schooling practices in the United States. Furthermore, the author believes that the same issues which prevent many African American children from being successful in mathematics and taking more higher level mathematics courses are the issues that cause many children to be unsuccessful in mathematics. Even if you believe our society to be racially equitable in job accessibility, students who are not successful in mathematics are severely limited in their life choices and chances for attaining the more technical, higher-salaried jobs (Ladson-Billings, 1997; Moses & Cobb Jr., 2001).

While it appears that critical race theory, with its emphasis on the devastating effects of racism, is the most appropriate theory for this study, certainly elements from the other theories reviewed are important. For example according to reproduction theory, one acknowledges that schooling reproduces our society, and with production theory, one has hope for helping empower students to deal with oppression. Cultural reproduction theory adds an important dimension in examining the student's cultural reference. Additionally, Martin's (2003) sociohistorical and community forces, as well as Ogbu's (1986) minority classifications and Perry's (2003) insistence on strong academic

traditions, expand this discussion. Certainly critical race theory can not just explain the existing conditions but also encompasses all of these as it seeks to make significant changes in the educational system.

Methodology

This study consisted of six multi-individual case studies. Creswell (1998) described the focus of a case study to be an in-depth analysis of a single or multiple cases, bounded by time and place. For this study, the cases are six African American high school geometry students studied within a time frame of six months, which is the length of the semester of tenth grade mathematics. Data collection for case studies consists of multiple sources to include documents, interviews, observations, archival records, and physical artifacts (Creswell, 1998). The data sources included in this study consisted of interviews with students, three per student; classroom observations, a minimum of four per student; interviews with mathematics teachers, a minimum of three times during the semester; interviews with former mathematics teachers for five of the six students; and a minimum of one parent interview for five of the six students. Artifacts examined included each student's notebook which they maintained for geometry class, and the student's cumulative record for test scores and previous mathematics grades. Additionally, the context of the school and community setting are described and discussed. The purpose of this study was to examine the mathematics experiences of several African American students through their eyes and through their voices, and to address the research questions which examined potential barriers to mathematical success for African American students.

Participant Selection

Six students were selected for this study from the population of tenth grade African American mathematics students at two public schools, Central City and Jackson High School, located in a southeastern state. At both of the schools, geometry is taught in a single course with the label “regular geometry”, or divided into two parts to be taught as two courses, geometry part A and geometry part B. By splitting geometry into two courses, the class can be taught at a slower pace. A tenth grade student who is enrolled in regular geometry class is on the college preparatory track culminating in an advanced diploma. Only students enrolled in regular geometry as tenth graders were considered as prospective participants for this study. A ninth grade student enrolled in geometry is on an accelerated track because he or she took algebra in the eighth grade. Very few geometry students at Central City and none of the geometry students at Jackson had the opportunity to be at this accelerated level, and therefore, ninth grade geometry students were not considered as candidates for this study.

Using data from the National Longitudinal Survey of Youth, 1980, the National Education Longitudinal Survey, 1988, population surveys of 1970, 1975 and 1990, and the National Assessment of Educational Progress, researchers from the RAND institute found the highest correlation between student achievement and family demographics in the following four areas: parental education level, household income, family size, and age of mother at birth of child (Grissmer, Kirby, Berends, & Williamson, 1994). Therefore, for this study, students from middle to upper household income levels were sought, as well as students from lower income levels. Lower income levels were determined by whether or not the student participated in a government subsidized lunch program.

Within these two income groupings, lower and middle, students who have been successful in mathematics as well as students who have not been successful were recruited. Successful students were defined as those who were taking college preparatory mathematics classes, were on track for college, passed the State High School Exit Exam, scored at or above the average Stanford Achievement Test-version 10 percentile in eighth grade, and had done well in previous mathematics classes. Students who are not successful were those whose eighth grade standardized test scores (Stanford Achievement Test-version 10) indicated that the student might not be successful in mathematics class, those who had not passed the State High School Exit Exam, or those who were generally not performing at expected levels in mathematics.

Stanford Achievement Test-version 10 (SAT-10) scores, and the State High School Graduation Exam (SHSGE) mathematics pass rate were used in this study as a general comparison of mathematics proficiency. The SAT-10 was administered to all students in this state in grades three through eight in the school year 2002-2003, and the results for the two schools are recorded in Table 6. A second means of assessing mathematics proficiency was the mathematics portion of the State High School Graduation Exam (SHSGE). The SHSGE is administered to all students in the eleventh grade and to selected students in the tenth grade, dependent upon the school district policy and student class selection. Students must retake the SHSGE or portions thereof which they did not pass. Table 6 contains the SHSGE pass rate data from the schools, and Table 4 contains the individual test results of the six participants in this study.

In an effort to measure the effects of gender, it was necessary to include both males and females. Participants were selected to include male and female, weak and strong past performance in mathematics as measured by their SAT-10 eighth grade mathematics score, and students who received government subsidized lunch, as well as those who did not. Students were selected from both single and two parent homes and included three females: Danielle, Amber, and Jasmine, and three males: Tony, Jonathan, and Josh. Only one of the six students, Jasmine, had not passed the high school exit exam in mathematics. The students' SAT-10 eighth grade mathematics scores ranged from Jasmine's 14 to Josh's 90 percentile. Four of the six students, Danielle, Amber, Tony, and Jonathan, participated in government subsidized lunch. A summary of demographics, school, and testing performance for the six participants is included in Table 4. Pseudonyms have been used for all students, teachers, and schools included in this study.

Table 4

Summary of Student Demographics and Testing Performance

	Previous math grades	8th grade SAT-10 math score	SHSGE math portion	Other school grades	2005 Lunch status: Free indicates government subsidized	Type of household
Josh	A	90	Pass	A-B	Paid	Single: Recently widowed
Danielle	A	29	Pass	A-B	Free	Single parent
Amber	A-B	56	Pass	A	Free	Single parent
Tony	B	86	Pass	C-D	Free	Two parent
Jonathan	B-C	61	Pass	B-D	Free	Single parent
Jasmine	C	14	Fail	C	Paid	Two parent

School and Community Setting

The six students selected for this study attended two different schools in two different school districts. The first school, Central High, was located in a small town with a population of approximately 15,000 and the second school, Jackson High, was located in a rural community with a population of approximately 3,000 (U.S. Census Bureau, 2004). In both locations, the median family income was below that of the rest of the state, and was significantly lower than the median family income in the United States. While more than 80 percent of the people in the United States in 2003 had completed high school, this number dropped to 70 percent for Central City and 60 percent for Jackson

(U.S. Census Bureau, 2004). For 2003, the percent of the population which was African American was 28 percent for Central City and 45 percent for Jackson (U.S. Census Bureau, 2004).

Table 5

2003 Demographics of Central City and Jackson

	2003 Population Estimate	2003 Median household income	Percent of Population who are White	Percent of Population who are African American	Education: percent of population completing high school
Central City	14,832	$29,309	70	28	70
Jackson	3,212	$25,266	53	45	60
State	4,385,446	$35,158	71	26	79
United States		$43,564	75	12	84

(United States Census Bureau, 2003)

The demographics of the two schools shared some characteristics and were strikingly different in other characteristics. The median household income for the cities in which the two schools were located was comparable, with both being well below the national median household income. Both districts had lower than national average percent of population who had completed high school. The most notable difference between the two schools was the classrooms themselves. The rooms in Jackson High were small, dirty, not well-lit, and with poor heating and air conditioning. Central City

High had many of its class rooms renovated, so that they were spacious, well-lit, with good heating, and air-conditioning.

More striking differences between Central City and Jackson High student populations were found in student mathematics achievement as measured by SAT-10 mathematics scores, and the State High School Graduation Exam (SHSGE) mathematics pass rate. Central City students averaged higher than the state average on SAT-10 scores and on pass rates for the mathematics portion of the exit exam. Jackson High students scored significantly lower than state averages on SAT-10 and mathematics pass rate for the exit exam. Table 6 summarizes this data.

Table 6

SAT-10 and AHSGE Pass Rate for State, Central City, and Jackson High

	2004 SAT-10 8th grade average percentile	2004 SHSGE 11th grade mathematics portion pass rate
State average	50	78
White	59	85
African Amer.	34	65
Central City	57	88
White	69	92
African Amer.	40	78
Jackson High	25	59
White	27	69
African Amer.	21	45

(* State Department of Education, 2004a)

Teachers

There were four regular geometry sections at Central City, three of which had the same instructor. There was only one regular geometry class at Jackson High. Four of the students in this study were from Central City, with Mrs. Smith as their teacher; and two students attended Jackson High, with Mrs. Basswood as their instructor. A brief description of each teacher and their typical geometry class follows.

Mrs. Smith

A twelve-year veteran of high school mathematics teaching, Mrs. Smith lived all of her life in the same region of the state and has spent all of her career at Central City. Mrs. Smith majored in mathematics for her undergraduate studies and completed a Masters in Applied Mathematics from a nearby state university. Although she has taught geometry from another text, Mrs. Smith stated that this was only her second year teaching geometry from the textbook used at that school.

Mrs. Smith's classroom had been recently renovated, and it was clean and well-organized. The walls of her classroom were covered with inspirational posters, such as "Strive to do your best" and "You can be successful." Along one wall were all of the geometry terms covered in class. As the chapters from the geometry book were covered and new terms were introduced, Mrs. Smith printed the geometry vocabulary on brightly colored paper and pasted them onto the geometry wall of terms. The classroom was meticulously organized with all of the transparencies, worksheets, homework checks, tests, and assignments placed where Mrs. Smith could readily place her hands on them. Students had access to two bookshelves in the back of the classroom where Mrs. Smith kept a classroom set of textbooks and workbooks, so that the students would not be required to bring their own mathematics book to class.

When asked to describe herself as a teacher, Mrs. Smith, who is White, stated that most important for her is to break down mathematics so that her students can understand the material. Mrs. Smith described a college mathematics professor who lectured so that no one in the class could understand; Mrs. Smith was determined to do just the opposite and make mathematics easy for her students.

A typical geometry class in Mrs. Smith's room. (Tony and Jonathan were in one of Mrs. Smith's classes, and Amber and Josh were in another.) When the bell rang, students went to their assigned seats. Mrs. Smith put prepared transparencies with answers to the even problems from the homework of the previous night on the overhead projector. She set a timer for ten minutes and allowed the students to ask questions on those problems that they did not understand. Mrs. Smith explained to me that the timer helped keep her on track so that there was time for her to cover the new material. If a student had a question at the end of the ten minutes, Mrs. Smith would reset the timer for a few more minutes. Amber is the only one of Mrs. Smith's students in this study who asked questions about homework. Tony and Josh never asked questions about the homework, and only on one occasion did Jonathan ask about a problem.

At the end of the question period, Mrs. Smith passed out a half sheet of paper with a homework quiz on it. The questions on the short quiz were similar to the homework that the students had been assigned to do the previous evening. Jonathan was the last student or one of the last students to complete his homework quiz at every observation. According to Mrs. Smith, she explained her assumption that Jonathan was trying to figure out how to do the quiz problems, because he had not done his homework.

After the quiz, Mrs. Smith passed out a double-sided sheet of main ideas for the next section or two of the book. This paper was to be used as a guide for the students to take notes and organize the lecture and book material. During the first observation, which took place the second week of the semester, most of the students appeared to be taking notes on this paper. On subsequent visits, fewer and fewer students were taking notes as Mrs. Smith lectured, but most of the students were quiet and mannerly. Of the four

students from this study in Mrs. Smith's geometry classes, only Amber continued to take notes throughout the semester. Josh was busy doing geometry but not taking notes or paying much attention to Mrs. Smith. Tony did not take any notes during observations, and Jonathan took notes occasionally. Jonathan would often quietly talk to another student in front of him when Mrs. Smith was not facing his direction. Of the four students in this study in Mrs. Smith's class, Jonathan had the most trouble sitting still, paying attention, not talking, and taking notes for 90 minutes.

Other than when the students were taking a quiz or a test, Mrs. Smith lectured for most of the 90 minute block. A student occasionally asked a question or volunteered an answer when a question was presented to the class. Amber was one of the few students in the class who was not shy about volunteering an answer or asking questions. Mrs. Smith called upon students who volunteered and only rarely called on a student who did not volunteer. When this occurred, it was frequently to correct or interrupt a student's behavior.

During my visits to Mrs. Smith classes, I observed no deviations from the routine described except on two occasions. Near the end of the second observation with less than ten minutes remaining in the class period, Mrs. Smith directed groups of four students whose desks were the closest together to work on a problem or two and to compare their solutions. At another time, after Mrs. Smith changed the seating arrangement, students had different groups that they worked with. During this period, Josh sat with his assigned group, but he did not share his solutions unless someone in his group asked him directly what answer he had gotten. Amber appeared to be the group leader in her groups and used the time to work on the problem assigned. Jonathan used the group time to do some

chatting with whomever was in his group and did not appear to be discussing geometry, as he watched Mrs. Smith closely and stopped talking when she came near his group. Tony politely sat with his group, but it appeared as if he had nothing to offer and did not work on the assigned problem. The group-work on these two occasions lasted no more than 5-10 minutes, and the groups did not share with the class the results of their group-work.

Mrs. Basswood

Mrs. Basswood was a thirteen-year veteran of high school teaching who had graduated from a state university with a degree in mathematics education and history, and who later returned to the same university to complete a Masters in Mathematics. Mrs. Basswood was White and had grown up in a small town less than 50 miles from where she currently taught and resided. All of her family lived in this same area for years, and she did not expect to live anywhere else.

Mrs. Basswood's classroom was typical of those at Jackson High, which was an old building in need of repair. The classrooms were heated with radiators and cooled by window units which did not always work. Other repairs were needed in the classroom. There were missing tiles in the floor, desks which were covered with scratches and nicks, and bent metal support on the desk chair backs resulted in very uncomfortable seating. Mrs. Basswood's room was decorated with very old trophies, prom paraphernalia from previous years, and old student-created posters and drawings. Everything in the room was covered with dust. Mrs. Basswood stated that any cleaning done in the room usually had to be done by her since the janitorial staff was understaffed. Adding to the clutter in Mrs.

Basswood's room were club fundraiser items, such as boxes of candy or pencils for sale, since Mrs. Basswood was the sponsor of several school clubs.

When asked to describe herself as a teacher, Mrs. Basswood stated that it is most important to understand the people that you teach. "That is the first thing I learned when I went, when I started teaching, was that if they break up with their boyfriend, that they really don't care what's going on in algebra and geometry." Since Jackson is a very small town, Mrs. Basswood was very knowledgeable of each student and his or her family. Mrs. Basswood taught both Jasmine and Danielle. The previous year, Mrs. Basswood was Danielle's algebra teacher. This was Mrs. Basswood's second year to teach geometry, and she stated that she was much more comfortable with the material this year.

A typical geometry class in Mrs. Basswood's room. Even though the atmosphere in Mrs. Basswood's room was more relaxed than in Mrs. Smith's, the teaching method was still predominantly traditional. After the students were seated in their assigned seats, Mrs. Basswood began by reviewing the homework or the answers to a quiz or test. Mrs. Basswood used the overhead projector to draw a copy of the sketches from the book, and explained how the solution was obtained. After this review time, Mrs. Basswood began the next section of the book and explained the new material. After an explanation, students worked out some of the problems either individually or in pairs. At the beginning of the semester even if Mrs. Basswood had not explicitly asked the students to share their work, many would ask each other about their answers. By the end of the semester, the majority of the students were still doing the required tasks, but the level of cooperation from the students to complete the assigned tasks was diminished. Danielle

was very attentive and cooperative at the beginning of the semester, but by mid-semester, she no longer eagerly participated. Jasmine did not participate, ask questions, or share work with other students except on one occasion discussed later.

Mrs. Basswood occasionally gave the class a notebook quiz. Students found specific problems in their notebooks and then copied the problems and solutions directly from their notebooks onto the quiz. Additionally, Mrs. Basswood used worksheets created by the textbook publisher, which Mrs. Basswood felt were a more "fun" version of the problems in the text. Danielle usually worked on whatever was assigned in class and completed the quizzes; whereas on many occasions Jasmine appeared to be doing nothing and would turn in partially completed work.

When students were assigned to work in groups, the typical assignment consisted of problems from the text or workbook. Students were instructed to solve the problems and compare solutions with their group members. Students did not share their groups' work with the class, nor were they required to justify their solutions. Groups were not assigned open-ended problems or projects. Danielle appeared to enjoy group-work, particularly when the group contained some of her basketball teammates. Jasmine did not seem to enjoy group-work any more than any other activity that occurred in geometry class.

Instrumentation

Interviews

At the initial interview of each student, parent, and teacher, a predetermined list of questions was used to ensure that those interviewed were asked the same questions and that all of the planned topics were covered. The interview questions are included in

Appendix A. Subsequent interviews consisted of clarifications of earlier statements made at the initial interviews, discussions of classroom observation notes, and updates on the semester's progress.

The student interview questions were designed to determine how they rated their efficacy as mathematics students, and their perceptions of teacher, parent, and peer support and expectations. Questions were used to determine if the students thought mathematics was useful, important, and necessary to be successful in life. Student participants were asked to analyze the reasons for their current mathematics grade and whether they were performing as well as they could. Students were asked if they liked mathematics and their mathematics teacher. Additionally, students were asked if they thought that their mathematics teacher expected them to do well, if their teacher encouraged them, and what manner of encouragement the teacher used. Students were questioned about whether or not they had homework and whether or not they completed their homework. Information obtained from students which could be confirmed by observations included asking students to describe their typical classroom performance, specifically whether they took notes, paid attention in class, interacted with the teacher or others, and whether or not the students asked questions.

Teachers were asked to analyze the students' performance in geometry class, their typical classroom behavior, typical homework assignments turned in by the students, and the types of interactions that they, as teachers, had with students. Questions were asked to determine what the teachers perceived as the students' attitudes towards mathematics, if the students appeared to be interested in class, and if the students volunteered or asked questions. Teachers were asked if they believed that the students were working up to their

potential in mathematics and what the students might do to improve performance in math class. In subsequent interviews classroom observation notes were discussed with the teachers with regards to the behavior of the students in class, and the students' responses to their respective teachers and the assigned tasks.

Parents were asked to analyze their child's performance in school and specifically in mathematics. Parents were questioned about their child's attitude towards mathematics, why the child had this attitude, and where the child might have obtained his or her attitude. Specifically, parents were asked what motivated their child to do well in mathematics and whether the parents thought their child was doing the best that he or she could. Parents were questioned about their interactions with their child's mathematics homework, interactions with their child's mathematics teacher, and what expectations the parents had for the child's success in mathematics. Additionally, for students who had siblings, parents were asked if they had the same expectation for success in mathematics for all of their children as for the child in this study.

Observation Protocol

Observations of the mathematics classrooms were conducted to determine the type and level of interactions that the students had with their respective teachers and their peers. All of the classes observed were approximately ninety minutes in length unless interrupted by planned events such as school assemblies or fire drills. During the observation, notes were taken documenting each student's behavior, note-taking patterns, response to teacher questions, group participation, and perceived level of interest. Additionally, notes were taken on the arrangement of the classroom, the classroom procedure, the lesson discussed, the pacing of the lesson, the seating patterns of the

students, the demeanor and actions of the teacher, and the interactions of the students even if they were not related to the lesson. The level and types of student participation in the mathematics classroom were noted and discussed with each student at subsequent individual student interviews.

Procedure

During the semester prior to the 2005 spring semester, school superintendents and principals were contacted and meetings were arranged in which the purpose and direction of this study were discussed. Permission to proceed was obtained from these principals and superintendent; see Appendix B for copies of the consent forms used as well as an introductory letter given to the principals. The second task completed before the semester began was to locate the regular geometry classes and the potential tenth grade African American students for the study. Students were approached at each of the schools in the study, the planned procedure of the study was discussed with possible student participants, and permission from the students was obtained to contact parents for approval to proceed. Next, the parents of each of the selected students were contacted, the study explained, and permission obtained to conduct student interviews and classroom observations. Permission to conduct classroom observations and teacher interviews was obtained from each classroom teacher and their respective school principals; examples of the consent forms given to the teachers and parents are included in Appendix B.

After permission was obtained from the parents or guardians of the students, each student was interviewed individually on at least three separate occasions during the spring 2005 semester. All interviews were audio-taped and later transcribed. Classroom observations were conducted of the students' mathematics classrooms at least four times

during the semester. Interviews with parents followed initial student interviews and classroom observations. Teacher interviews were conducted before and after classroom observations, and teachers were contacted via email almost weekly throughout the semester.

Data Analysis

Interviews of students, parents, and teachers, as well as classroom observations, were employed in this study as a method of triangulation of the data sources. Triangulation can be described as a method of adding layers to the data source, using multiple items to measure the same construct (Fine, Weis, Weseen, & Wong, 2003). In an attempt to triangulate the data sources, some identical questions were asked of the student, teacher, and parent for each case. For example, one question asked of the students, teachers and parents, was to rate the student on a numerical scale of one to ten with one being the worst mathematics student and ten being the best mathematics student.

Other data sources for this study included accessing cumulative records of the six students and examining the students' current geometry mathematics notebooks. Data was obtained from the students' cumulative records which included past grades for mathematics courses and overall performance, eighth grade SAT-10 mathematics score, and whether or not the student had passed the mathematics portion of the SHSGE. From students' geometry notebooks, observations were made as to the students' organization, and absence or presence of classroom notes, quizzes, tests, and homework assignments. Geometry notebooks were examined with the students present in order for students to be able to explain what was in the notebook, what was missing, how the notebook was organized, and whether or not the student used the notebook to study.

All interviews, which were audio-taped, and observation notes were transcribed into word processing documents and subsequently loaded into a software package, ATLAS-ti. This qualitative data analysis software was used to code data so that similar responses could be noted and discussed. The major categories and codes obtained from the analysis using ATLAS-ti are discussed in detail in the results and analysis chapter of this document.

CHAPTER IV

RESULTS OF THE STUDY

Jasmine

Past Performance in Mathematics

Based on past performance in mathematics classes and previous test results, Jasmine was the lowest performing student in this study. One of 25 regular geometry students at Jackson High, Jasmine was the only student in the class who did not pass the State High School Graduation Exit Exam. With a SAT-10 mathematics score of 14th percentile, Jasmine fell below the average SAT-10 score at Jackson High of 25 percentile, and well below the state average of 50 percentile (* State Department of Education, 2004a). Jasmine's previous mathematics grades were consistently in the average range, and even though Jasmine stated that mathematics was her worse subject, her past mathematics grades were fairly consistent with her other school grades. Taking into account Jasmine's SHSGE failure, her SAT-10 score, and past performance in mathematics classes, one might predict that Jasmine would not be successful in Geometry, or at least not as successful as other students in the study.

Family Structure and Influence

Jasmine did not participate in the government subsidized lunch program, and lived with her two parents in a modest brick home in Jackson. Jasmine was a much younger sibling of two others who quit school before graduating. Jasmine's mother

believed that Jasmine was more capable academically than her other two children. According to Jasmine's mother, "I expect more from her (than the other two children), as my other two kids were born in the 70's and had changed a lot. I want more for her (Jasmine)." Jasmine stated that both of her parents expected her to do well in school, not just in mathematics, and that they planned for her to go to college. Jasmine's mother seemed to be very influential in instilling in Jasmine the importance of doing well in school and made an appointment to talk with Jasmine's teacher when Jasmine brought home a low grade on a progress report. Stating that she herself was not good in mathematics, Jasmine's mother said that she helped Jasmine when she could. On a scale of one to ten with ten being the best mathematics student, Jasmine's mother rated her as an eight because Jasmine usually got all of her work done and finished her assignments.

Jasmine volunteered information about her father when asked about her shyness. Jasmine stated,

> I think it (shyness) is genetic. Because other people in my family are shy, not all of them. I guess I get it from my Dad. He is really shy, but it depends on who he is around. My mom is not shy at all. People in my Dad's family are not really shy, but he is.

Neither of Jasmine's parents had attended college, but they expected Jasmine to attend college.

School Level Factors

Jasmine belonged to both the girl's basketball team and the track team at Jackson High. While Jasmine's mother related that Jasmine was often discouraged during basketball season because Jasmine sat on the bench most of the time instead of getting to play, Jasmine stated that she preferred basketball to track. When asked if she might

qualify for an athletic scholarship, Jasmine stated, “I might. I don’t really know. In basketball, I’m not the best. . .maybe in track. Well, I like basketball better than track. It is something I really enjoy.”

Classroom Dynamics

Jasmine was a very quiet, cooperative young person, who would only speak when she was asked a question directly. I never witnessed Jasmine volunteer a comment in class, during our interviews, or when I met with her in small groups or in her home. When asked what Jasmine could do to improve her work, her teacher, Mrs. Basswood specifically mentioned wanting Jasmine to speak up in class, find someone with whom to work, and ask questions. Although Jasmine stated that she would seek help by phone from one of her friends or maybe from Mrs. Basswood if she needed it, I never witnessed her asking for help except on one occasion at the end of the semester. At this point Jasmine had received a D on her progress report for the second nine-week period, and her mother had been to the school to speak with Mrs. Basswood.

During this class, each student was assigned to a group of three. Jasmine was placed in a group which included another African American female and a White male. The other female student proceeded to work on her own and not speak to Jasmine or the third group member. This third group member was a very bright boy, not very popular among the class members, but insightful and talented. He had written only the answers to the problems assigned and passed those over to Jasmine, then got out a paperback book to read. Jasmine looked at the answers to the assigned problems, interrupted his reading, and asked him to explain how to do several of the problems.

As a mathematics student, Mrs. Basswood rated Jasmine as a three out of ten and stated that Jasmine was a very weak math student. During the year, Mrs. Basswood asked for a parent conference several times but did not get a response from Jasmine's mother until Jasmine brought home a D on her progress report. Mrs. Basswood expressed surprise and pleasure when Jasmine had a grade of a high C at mid-semester and believed that was a good grade for Jasmine in view of her weak foundation in earlier mathematics courses.

On one occasion, when the geometry class was learning about angle bisectors, altitudes, medians, centroids, incenters, orthocenters, and perpendicular bisectors, Mrs. Basswood had the students use patty paper and fold the different triangle attributes. Jasmine was very confused about what to do and spent much of the time just sitting and watching other students fold their triangles. Other students asked me to help them as Mrs. Basswood could not help all of the students individually, so I asked Jasmine if she wanted me to help her, and she said that she did not. At the end of class, I interviewed Jasmine and talked to her about what was going on in the class. She reluctantly got out the patty paper, and we folded each of the triangle bisectors, median, and altitudes. Many of the basic geometric terms covered earlier in the term seemed to be meaningless to Jasmine. For example, she could not respond to directions of folding a 90 degree angle, or questions such as "if an angle is bisected and one of the resulting angles is 40 degrees, what is the measure of the other angle?"

Personal Beliefs about Mathematics

Jasmine expressed her dislike of mathematics because she "did not get it" a lot of the time. Jasmine stated that she is frustrated when she does not understand and will quit,

but then try to force herself to start to work again. On a scale of 1 to 10, Jasmine rated herself as a 5, because she considered herself to be "in the low range of the smart people." Jasmine believed that she could change the 5 to a higher number if she made herself understand it. Questioning Jasmine about her reluctance to seek help, the conversation was as follows.

Interviewer: Is it hard for you to ask, to talk in front of other people, the class?

Jasmine: mmm, hmmm

Interviewer: Why do you suppose it is hard?

Jasmine: Because you are afraid of what people will think- of your answer and maybe laugh if it is wrong.

Interviewer: That would be embarrassing.

Jasmine: Yeah.

Interviewer: Is there a time when you could ask for help outside of class?

Jasmine: Yes, but I wouldn't. I would ask my friends.

Interviewer: Do you see other people in the class asking for help when they don't know what is going on?

Jasmine: Yes.

Interviewer: Plenty of people do, don't they?

Jasmine: Yep.

Interviewer: But you wouldn't do that?

Jasmine: Yep.

Interviewer: Explain that.

Jasmine: I don't know, I am a shy person.

Interviewer: Are you that way in every class?

Jasmine: Yes, well not in Biology. It depends on the class and the teacher.

Interviewer: What is different about Biology?

Jasmine: I got a good grade in that class- and so I know what is going on.

Throughout the semester, Jasmine maintained that mathematics is important, that she needed to take mathematics. She wanted to be a part of this college track class, but was having trouble passing tests and understanding the material. Even at the end of the semester, with her low grade average, Jasmine maintained that geometry was important to learn for many fields of study and that she planned to attend a state university and possibly become a lawyer.

Jasmine's geometry notebook was disorganized and incomplete, consisting of the work done in class that day and partially completed homework assignments. Jasmine stated that she never used her notebook to study or to understand how to do a problem from her notes. In reviewing the problems in her notes, it seemed that Jasmine did not recognize when she was close to a solution or when she was completely on the wrong track. For example, she correctly set up a triangle proportionality problem which involved algebraic equations. Jasmine solved the algebraic equations correctly until the final step of the solution when she divided by four instead of two. In her notes, she made another complete copy of the problem, starting over because she got it wrong. Jasmine did not realize that she made a small calculation error which could have been easily corrected instead of starting at the beginning to repeat many of the steps which she had done correctly.

Summary of Performance in Geometry

Jasmine appeared to have little success with geometry and struggled to maintain a passing grade throughout the semester. In class, Jasmine never volunteered solutions, comments, or questions. As a general rule, Jasmine did not seek help from her teacher, Mrs. Basswood, nor from others in the class. Jasmine did not enjoy geometry and seemed to have very little understanding of mathematical terms. Jasmine completed geometry with a D average. Jasmine is scheduled to take Algebra II in her 11th grade year.

Danielle

Past Performance in Mathematics

Danielle was an honor roll student from the time she entered school until the time of this study, consistently maintaining high grades in all of her subjects. At the beginning of the semester her geometry teacher, Mrs. Basswood, described Danielle as a sponge, the perfect math student, and on a scale of one to ten: a ten plus. Mrs. Basswood taught Danielle the previous year and so felt that she knew her fairly well. Mrs. Basswood stated that she would love to have a class full of Danielles; that Danielle is just that good.

Danielle passed the SHSGE mathematics portion, but only scored in the 29th percentile on the SAT-10. The average SAT-10 for Danielle's high school was 25th percentile, so Danielle scored just above the average for her school, but well below the state average of 50 percentile.

When Danielle was asked to rate herself as a mathematics students, she stated "I'd say probably a five. I'm not saying that I'm the lowest, I'm not saying I'm the best." When asked if maybe she was underrating herself, Danielle responded, "I try not to, you

know, I try not to have a big head about myself." Clarifying her statement later, Danielle added,

> …that just makes other people think like, oh she's just thinking more of herself, she don't care about anybody else, you know. Care about if we know how to do it or if I know how to do it. It's, I just don't do that. I try to put myself in a position where I don't try to brag on myself. If I know how to do it, then , yeah I know how to do it, but if I see someone else struggling then I'm gonna try to pick them up.

Danielle took two semesters of algebra during her ninth grade year so that she could be in regular geometry in her tenth grade. Danielle stated "Well, mainly because if I like took Algebra A the first semester then I may need to take it again. I wouldn't have remembered some of the stuff that I took." When asked if someone encouraged her to double up on her mathematics, Danielle stated that she figured it out for herself.

Family Structure and Influence

Even though Danielle lived in the housing project, she came to school dressed nicely and similar to most of the other students at Jackson High. More than half of the student population at Jackson High, including Danielle, received free or reduced lunch. Danielle lived with her mother in Jackson's only housing project and although Danielle's mother signed the permission form allowing me to interview her daughter, she never responded to my requests for an interview. According to Mrs. Basswood, Danielle's family never attended any of the basketball games in which Danielle played, nor any other school function. Mrs. Basswood stated that Danielle would not allow Mrs. Basswood to give her a ride home following school activities. Rather Danielle rode home with other friends of hers from the school. Mrs. Basswood believed that Danielle did not

want Mrs. Basswood to see where she lived or to meet her mother. The only information that I obtained about Danielle's family was from Danielle herself.

It is interesting to note that when asked who influenced her the most, Danielle noted her most influential source was a certain friend whom she has known for many years. When Danielle began experiencing problems in geometry and her grade dropped, she told me that her friend encouraged her and told her not to give up.

> When I did want to give up, because I couldn't take it all. But they encouraged me to keep on. If you want to really reach your goals, then it will settle down some day. I have to keep on.

School Level Factors

Danielle was a member of the Jackson High girls basketball, volleyball, and track teams. Midway through the semester, Danielle took a job working at the local grocery store and dropped off of the track team. At the end of the semester, Danielle stated that she was back on the track team for the final week of school. When asked how this happened, Danielle responded, "My coach needed, she was like, needed someone for the relay." Apparently Danielle was a good athlete and needed by her coach for a final track meet so that she was allowed to compete even though she had not been to practice.

Classroom Dynamics

At the beginning of the semester, Danielle was attentive, responsive, cooperative, prepared, and helpful to other students. By mid-semester, this was not the case, Danielle remained cooperative, but she was not as responsive in class, did not have all of her work, and seemed tired and distracted. During this time, Danielle took the job at the local grocery store and worked several days a week. Mrs. Basswood was concerned that Danielle had a boyfriend and her driver's license, and was no longer as interested in her

studies. Danielle denied both of these things when asked. While Danielle was very polite and answered every question that I asked, I did not feel that Danielle shared her thoughts and feelings with me or Mrs. Basswood. For example, a conversation about her drop in grades follows.

> Interviewer: You have had a lot of changes this year. I see a difference from the time I first started talking to you until now. What do you think? Do you see a difference?
>
> Danielle: Yes.
>
> Interviewer: What do you see as a difference?
>
> Danielle: About how I am always on the go?
>
> Interviewer: That and geometry, I see a difference. What do you think?
>
> Danielle: I don't know.
>
> Interviewer: What do you see as different?
>
> Danielle: (silent)
>
> Interviewer: Do you want me to tell you what I see as different?
>
> Danielle: Yes
>
> Interviewer: I see that you are a really top-notch student and back in January, I noticed that you smiled a lot and really paid attention. Now you are tired and you don't smile as much and you seem distracted. I think some things have happened this year to make a change. Something is different.
>
> Danielle: Well, I'm not trying to let work get in the way. . .not sleeping well, with all the work to do.. . .I don't know, I be paying attention, but it just doesn't click with me.

Personal Beliefs about Mathematics

Danielle stated that mathematics was important: "I think more jobs today, you know, require more math. Cuz, you know, technology and stuff, you need good math.. .

You need math to get through life." Additionally, Danielle stated that mathematics is something that could be used every day. For example, Danielle stated that geometry is important because …

> when you are playing sports, you have to draw out the plays. You have to be at a certain angle to the goal to make it. Or when you are running track and you have to know the circumference of the track.

As Danielle experienced the changes in her grades through the semester, she continued to tell me that she was fine, everything was fine, and that the geometry was just getting a little harder. Danielle continued to state that she might get a scholarship to college by way of her athletic abilities and her good grades.

Danielle's ambition was to be a cosmetologist, but she was not sure what she would have to study to become a cosmetologist. While she indicated that there were many people who depended on her to do well in school and in sports for a college scholarship, she was frightened about going off to college and not at all sure that this was what she wanted to do with her life.

Summary of Performance in Geometry

Danielle clearly had circumstances in her life which affected her normal classroom behavior. Danielle was an honor roll student making excellent grades in mathematics up until this year. Danielle did not have a parent or sibling who went to college, and no one from her family attended school functions. Instead, Danielle seemed to receive her encouragement and support from her friends and her teachers. In addition to being an excellent student before this semester, Danielle was also a strong athlete on the basketball, volleyball and track teams. It seemed as if working at the local grocery store was replacing some of her involvement in school activities and her homework time.

Danielle seemed to have lost her focus to be one of the top students at Jackson High and to remain on the scholarship track. Danielle finished the year with a D average in geometry.

Jonathan

Past Performance in Mathematics

Jonathan's grades in mathematics prior to geometry were in the average range. Jonathan passed the SHSGE in the ninth grade and scored in the 61 percentile on the SAT-10 in the eighth grade. The SAT-10 average for Jonathan's school, Central City, was 57 overall with African American students averaging 40 and White students averaging 69. Jonathan's ninth grade teacher described him as very bright but moody, that he responded inappropriately in class either by showing off or putting other students down. According to his ninth grade algebra teacher, Jonathan was suspended during his freshmen year in high school for fighting, and she believed that he had gotten in trouble again earlier in his tenth grade year. Other teachers labeled Jonathan as disruptive in class and disrespectful to the teacher.

Jonathan indicated to me that he thought math was his favorite subject, important to learn, and that he was a good math student, 8 out of 10. When asked why he rated himself an 8, he responded:

> Cuz I can't rate myself a ten, cuz I'm not really, really good at it like people making 98's and all. I ain't that good at it, and I wouldn't rate myself a one, cuz I know, I know how to do math better than that, give myself a one…I just connected with math so good. I just catch on real fast, or at least know what the teacher say and then I know how to do it once I heard it.

Jonathan said that he could be a ten if he put his mind to it "if I put more and more effort into it, I probably could."

Family Structure and Influence

Jonathan participated in the government subsidized lunch program and lived with his mother and brother in a well kept trailer on the edge of Central City. The community where Jonathan and his mother lived consisted of modest homes and trailers and would probably be considered as lower middle class.

Jonathan's mother rated Jonathan a 10 as a math student and believed that he is very smart, motivated to do well, and that school is easy for him. Jonathan's mother believed that Jonathan did the best that he could and that he liked mathematics. Jonathan's mother stated that Jonathan finished his homework at school, and so she did not usually see him do homework and did not get involved with his homework. When Jonathan was asked what his mother would do if he brought home a D or an F in mathematics, Jonathan responded:

> Mom would just get mad. She'd be like, I know you can do better than this. What you doing with this grade? She'd be asking me questions, are you getting it, is the teacher teaching you right? Get to asking me, so I try to make good so she won't have to ask me if the teacher teaches right.

School Level Factors

Jonathan did not participate in any official extracurricular activities at Central City. Jonathan's behavior of fighting with other students continued into his tenth grade year and caused him to be on suspension on at least one occasion during his semester of geometry.

Classroom Dynamics

Early in the semester, Jonathan usually had his head down on the desk, did not appear to be listening to the geometry lecture, and could not have been taking notes.

Jonathan's geometry teacher, Mrs. Smith rated Jonathan a three or four out of ten and indicated that he often scored a C on the chapter tests, but on the homework checks and mastery tests, he made lower grades. Mrs. Smith stated that Jonathan rarely brought items which he needed for class and usually did not pay attention. But there were periods of time during the semester when his behavior changed, and during observations late in the semester, Jonathan paid closer attention and took notes. Mrs. Smith believed that the progress reports spurred Jonathan into facing reality and that he tried harder for a short period of time.

Jonathan had behavior issues in class and at school. According to Mrs. Smith, Jonathan lost his privilege of going to the bathroom during class, because he disappeared for long periods of time instead of returning to class in an appropriate amount of time. During the second nine weeks, Jonathan was suspended from school for three days. According to school regulations, when a student was suspended, they were not allowed to make up the missed work.

Jonathan chose to prepare his notebook before he shared its contents with me. Jonathan removed all traces of any graded work or progress reports and rearranged the order of his notebook before he would let me examine it. Surprisingly, Jonathan's geometry notebook revealed handwriting that was extremely neat and meticulous, and consisted of quite a few days of class lecture notes. Not surprisingly, there were no homework assignments in his notebook. Jonathan was quite pleased with what he shared.

Personal Beliefs about Mathematics

Jonathan believed that mathematics was important to learn and useful in dealing with prices and knowing what to charge people:

> …know how to count money. Like say you be working at a restaurant or something, don't have a calculator and you count back their change in your head… Cuz, like somebody might ask you what's this and you'd be able to tell them. Or like they ask you something, multiply by something and you'd know how to tell them the answer.

Jonathan thought it was important to do well in mathematics so that it would look good on his diploma. Although Jonathan did not know exactly what he wanted to do upon graduation, he mentioned that he and his brother might move to another state to work with his cousin painting automobiles. Jonathan stated that he tried for good grades, "so that it looks like I know math real good. That's why I try to get A's and B's in math, so it will look like I know how to do math real good." When asked who this would look good for, Jonathan responded, "Hm? For a college or something like that."

Summary of Performance in Geometry

Jonathan appeared to be quite capable of doing well in mathematics, as recognized by his mother, his algebra and geometry teachers, and himself. Jonathan was not truthful about the work he did, what grades he was making, or what was happening to him in geometry. Additionally, Jonathan had behavior problems which caused him to miss class from time to time. It seemed as if Jonathan believed that he could catch onto the mathematics without actually having to do any work outside of class. Jonathan completed the term with a D in geometry. At Central City High, this meant that he passed geometry, but he would not be recommended to take Algebra II; Jonathan would be assigned to Algebraic Connections, a lower class level than Algebra II and no longer on the advanced diploma track.

Tony

Past Performance in Mathematics

Tony made a B in his ninth grade algebra class, passed the SHSGE, and scored in the 86th percentile on the SAT-10, well above both his school and state average scores. Tony's ninth grade mathematics teacher described him as a good student, whose attendance problems hampered his performance in mathematics. In ninth grade Tony was described by his former teacher as a cooperative student who tried to do his work. Tony's ninth grade mathematics teacher stated:

> he participates…if something's bothering him or if something's upsetting him um, he might not participate as much but he would (participate). He was typically one of those that wanted to go to the board, you know, kind of like to show out. Cuz, he knew what we were talking about.

Tony stated that he took Algebra I twice:

> I took it in the eighth grade and I took it again in the ninth grade. I don't know why, I think they just placed me in it. My teacher advised me before that year was over to take it again, because algebra was to be so much of future math. Whatever you do you are gonna use Algebra I. So that is why I took it over again.

Family Structure and Influence

Tony lived with two parents, several siblings, and occasionally cousins in government-subsidized housing in Central City, and he received free lunches through the government school lunch program. Tony seemed to be very close to his family and spoke of his mother and father several times. In discussions of the importance of mathematics, Tony mentioned his father and other family members.

> Well, my daddy, he used to say it was always important, you know, and um, my auntie was like my auntie goes, was in college, and my cousin's in college now for accounting, and he always does math, and he says how important it is.

Tony was planning on attending college with a scholarship to study computer science and possibly play basketball or softball.

Tony's mother apparently had serious health issues resulting in open heart surgery during Tony's tenth grade year, the semester of this study. Immediately preceding the first interview, Tony missed a week of school while his mother was in the hospital in a city about 80 miles from their home.

School Level Factors

In addition to days missed from school due to family and personal illness, Tony missed school because he participated on the football, basketball and baseball teams. Discussing how many days he missed from school, Tony stated that he might not be able to take Algebra II the following year. "They probably won't let me take it (Algebra II) since I been so lazy this year…That is I want to take it, I need to focus. I have been all out of focus this year." Tony broken his wrist playing basketball earlier in the year so that " somebody else had to write for me since I am left handed and that's the one I broke. And then my mom had open heart surgery." Tony again acknowledged in a later conversation, "I always have an attendance problem, I get sick all the time."

Classroom Dynamics

Mrs. Smith rated Tony as a potential seven or eight out of ten as a mathematics student. Mrs. Smith believed that Tony could be a better student if he did not miss so many assignments. Tony indicated that he liked his current mathematics class because the class did not contain any students who were disruptive or rude; "we have no clowns or nothing so that's why she has a good class. No one's talking out loud or nothing like that. Everyone's listening to what she's saying." Tony liked his math teacher, liked all the

math teachers that he has ever had, and believed that Mrs. Smith was "real good." Tony stated that you do not have to do the homework in Mrs. Smith's class, because she goes over how to do it before you take the homework quiz.

Tony was a handsome young man with a charming smile and agreeable disposition, who appeared to get along very well with other class members. If there was a chance to interact with other students in the class, Tony appeared very comfortable talking with whomever was in his group.

By mid-semester, Tony had missed quite a number of days and appeared to be confused about what was being presented in class as well as behind in his homework. During a classroom observation near mid-semester, Tony placed his head in his hands during the note-taking time of the lecture and when he did look up, he kept his hands in his lap. There was no evidence that Tony participated by taking notes or asking questions. Several times, he appeared to have fallen asleep during the class period.

At the end of the semester, Tony had much the same classroom behavior: he did not appear to be taking notes nor did he appear to know what was going on in the class. Tony was behind in much of his work. Interestingly, he was very optimistic about his grades; he stated that he was going to make it up and make a good grade on the final. With a D the first nine weeks and a D on his progress report, he stated that he hoped to make a C in the class. He was confident in his ability in math and continued to state that his poor attendance caused his low grades. Tony explained:

> See when I miss school, I always get behind, and I never really catch up. I never make up all of my work. I get a lot of zeros out of 10 and can never get it all made up, and they always bring my grade down.

After being gone from class, Tony explained what it was like coming back and trying to catch up with the geometry.

> You have to figure it out yourself… It is kind of hard. She (teacher) gives you the notes, but it's just a whole lot different without her explaining it… And then you have that night's homework.

Tony described his normal schedule, "during season, you practice, get home late, eat, do homework," and consequently he is too tired to get everything done. Tony went on to state that:

> if you know the work in Mrs. Smith's class, you don't have to do the homework…She goes over it right before you take the homework check…And I always manage to figure it out before a chapter test.

Personal Beliefs about Mathematics

Tony believed that mathematics was important to learn, primarily so that you would get into college and possibly get a scholarship. Tony planned to do both, and was taking advice from his cousin who was attending college and involved with sports.

Summary of Performance in Geometry

Tony had the ability to do quite well in geometry, based on his past performance, his standardized test scores, and teacher assessments of his ability. Tony had a history of missing many days of schools. Even when Tony was in the first grade, he missed more than 25 days of school. His official attendance for geometry class listed only 8 days absent due to the nature of the reporting system. Any excused absences would not be recorded as absent, so when he missed for basketball games, had doctor's notes or checked out of school early, these did not count as absences. Of approximately a dozen visits to Central City, Tony was absent on three occasions and checked out early by his mother on two other occasions. As a consequence, Tony stayed behind in his work and

barely managed to pass geometry. Tony planned to take Algebra II in his junior year in high school, but he will be placed in Algebraic Connections, because he completed geometry with a D average.

Josh

Past Performance in Mathematics

Josh was at the 90th percentile on the SAT-10 mathematics, the highest score of those included in this study. Josh passed the SHSGE and made an A in algebra the previous year. Josh's ninth grade teacher described him as very quiet, very conscientious, attentive, and a student who completed all of his homework. Therefore, Josh's former mathematics teacher rated him a 9 out of 10 as a mathematics students. Additionally, Josh's former teacher stated that she would have rated Josh as a 10, but he had a habit of working ahead on future homework assignments during the class instead of being on task. Her concern was that Josh might be missing important information because he liked to do the homework for the next section during class while she was covering earlier material.

Josh stated that he did not like mathematics, although his mother stated that mathematics and science were his favorite subjects. Josh claimed that he never studied because it was not necessary for him to do so, and that he was good in mathematics. Rating himself an 8 out of 10, Josh stated that he could be a 10, but that he did not have a passion for doing mathematics. Josh explained that he would have taken geometry in the ninth grade but he had a really bad eighth grade mathematics teacher, whom he did not like, and consequently he made a 79 in her class. He explained that to not repeat Algebra I in ninth grade, he needed to make an 80 in eighth grade.

Family Structure and Influence

Josh did not receive free or reduced lunch and lived with his recently-widowed mother in a brick home in Central City. When I first interviewed Josh in his home, I noticed the respect that Josh and his mother had for each other and the way that Josh's mother listened intently to what Josh was saying. Josh's father was an engineer by profession, who died during Josh's ninth grade year in school. When interviewing Josh alone or with his mother, he was not reluctant to speak about his experiences and feelings about mathematics and mathematics class.

Josh's mother was very concerned with his progress in school and seemed to make every effort to be available to the school and to his teachers. His ninth grade algebra teacher remarked that Josh's parents consistently responded to progress reports and were the only parents from his mathematics class to attend open house at the school during Josh's ninth grade year.

Josh stated that his mother wanted him to be an engineer, and he planned on attending a college or university. According to Josh: "I really wanted to be a race car driver," even though his mother does not like it. To clarify, Josh said that this would have to be his side job, and that he would do something else to earn his money so that he could race. Josh stated:

> You have to have something to fall back on if that does not work. . .engineering will help, but I don't want to be an engineer.. . I would rather do something outside.. . I think of an engineer as being stuck inside.

Josh did not know where he got this interest in racing cars, because he did not drive, never saw car races first hand, and had no relatives who raced, but he had seen some races on television.

School Level Factors

Josh did not participate in official extracurricular activities at the school. Josh did not indicate that he was interested in participating in school activities, nor did he indicate that he was adverse to the idea.

Classroom Dynamics

Josh was a neatly-dressed young man who was very small for his age and had a high-pitched, soft voice. According to Josh's ninth grade teacher, she tried to protect him when other students picked on him because he was so small and vulnerable. Josh's algebra teacher described his classroom behavior as "quiet, he didn't say a word. He didn't like to call attention to himself but he would…put stuff on the board. He was one of those that he just didn't like to be the center of attention." In his geometry class, Josh did not volunteer or speak to others in the class.

While describing Josh as an introvert, Mrs. Smith rated him a 9 or a 10 on a scale of 10, because he always completed his homework, and always did the required assignments. Josh stated, "I do my homework while Mrs. Smith is talking unless she is looking directly at me." Apparently Mrs. Smith gave her students the list of homework assignments before she covered each chapter, and so Josh worked on the assignments while Mrs. Smith was talking; the result was he did not have to do any homework at home. When Josh did homework at home, he might work ahead. "Last night I did my homework for, well it was for today and I started, um, for tomorrow." Questioning Josh about what might happen if he misses something important by working on homework instead of listening, he stated, "I might have to stop and listen. Or figure out how to do the problem by myself…There are examples in the book."

Josh stated “I do not study for anything. I probably should, but I don’t like to study.” As an explanation of why he had good grades, Josh stated “I do my homework, and I understand everything.” Although, Josh was not as sure of himself when he took algebra the first time, “now that I’ve gotten into it more, I understand it…well, I felt like I understood it before, but the test did not show it. And now I am doing better on the tests.”

Josh’s geometry notebook was completely disorganized, containing all of his other school work in with his geometry work. Josh thought that it was amusing that he was disorganized and that he could not find old papers. Josh laughed about the state of his notebook and shared that his notebook was missing a zipper on it and caused him to lose some of his papers from time to time, as the papers would fall out.

Personal Beliefs about Mathematics

Josh stated that mathematics was not his favorite subject and that he did not like mathematics, but it was apparent that he was probably not exactly truthful when he made that statement. Josh’s mother stated that Josh did enjoy mathematics. Josh was very playful in his comments during the interview process. For example, he told me that he was stating exactly whatever he thought I wanted him to say. Josh was clever and challenging in his short concise comments.

While acknowledging that mathematics was important, Josh did not see the connection between geometry and what he expected to do with his life. Josh seemed to trust that the school knew what he needed to take to be successful. As Josh expected to do well in mathematics, both he and his mother were quite surprised when he did not earn an A for the semester.

Summary of Performance in Geometry

Josh had the potential to make excellent grades in mathematics and he did the work that he thought was necessary to make a good grade in geometry. While admitting that he did not study for tests and did not pay attention in class, he did not see a conflict because he understood the material. Josh made a B for his final average because of his final exam on which he earned a D. In a telephone conversation with Josh and his mother, after school had ended, Josh stated that he did not understand how the final exam average was calculated, as there was not a particular test given in his class which was called a final exam. I explained to Josh and his mother that Josh was correct, and that the final exam for his geometry class consisted of an accumulation of quizzes given throughout the semester. It is hard to imagine that Josh would have made such a low grade on the accumulation of these quizzes, when his other grades were very good.

Amber

Past Performance in Mathematics

Amber passed the SHSGE and scored in the 56th percentile on the SAT-10, which was close to the average mathematics SAT-10 for Amber's school, Central City. Amber consistently made As and Bs in mathematics other than her 6th grade year. In the 6th grade, Amber indicated that she had a D average in mathematics and that her mother had subsequently gotten her a tutor. As a result, in the seventh grade, Amber stated that she had the highest mathematics average in the class. Amber cited the following reasons for her success:

> …it was the tutoring and it was me, cuz I studied a lot. When I got to middle school everything changed cuz I think I started studying more… And I was getting older. Maybe I'm make (take) some more responsibilities. A little more.

Amber's ninth grade teacher said that Amber started the year thinking that she was not a good mathematics student, and enrolled in Algebra A, the first semester of Algebra I. By the end of her semester of Algebra A, Amber had become quite proud of what she could do. Amber then enrolled in Algebra B for the first semester of her tenth grade, doubling up on her mathematics to be able to take regular geometry for the second semester of tenth grade. Amber's algebra teacher believed that Amber was a very good student, an 8 out of 10, who understood the connections in mathematics and did not just memorize the algorithms. According to her algebra teacher, Amber always sought to understand the mathematics, often came early to class to ask questions, listened in class, and generally did all that she could do as a mathematics student.

Family Structure and Influence

Amber participated in the government subsidized lunch program at school and lived with her mother in Central City. Amber spoke often of her mother, "…well my mama, she's in college right now, and I help her with her math." Amber was a vivacious, competent student who credited her academic success to her family and her personal goals for her success. She stated that other students might not be successful because "they didn't push theirself (themselves) to their goals," or have family support: "maybe their family can't put them through college." Amber seemed very close to her mother and stated that "if your mama don't care about what you do, why should you?"

Amber's mother saw the need for a strong mathematics background and wanted Amber to do better than she had done herself in school. Amber's mother believed that

Amber was at least an 8 out of 10 as a mathematics student. Amber's mother believed that the only reason Amber was not a 10 was that Amber did not have the confidence herself that she was a great mathematics student.

School Level Factors

Amber played on the girls basketball team, was a member of the flag team during football season, was a part of the concert band, and was nominated to be a class officer at Central High. Amber was conscientious about putting her school work first and did not allow her extracurricular activities to interfere with her academics. Furthermore, Amber stated that she planned on taking her next mathematics course during football season rather than during basketball season so that she would not miss so many classes. According to Amber, "I ain't takin it (during basketball season). I'm sure about that. It's gonna always be on Friday with football. It ain't as bad as basketball 'cuz you have every Monday, Wednesday, (and) Thursday (for games or practice)."

Classroom Dynamics

When I first contacted Amber's mother, she said that she was glad that I was talking to Amber because Amber complained about her geometry teacher, stating that Mrs. Smith did not explain things well. Amber stated:

> I still don't like the way Mrs. Smith teach. But I'm not the only one.. . There is something about her I'm not used to, but maybe that help me out in the long run since she don't break thing down like I think she could.

Amber indicated to me that she really loved algebra and her algebra teacher, but she did not think that Mrs. Smith was a good geometry teacher. However, Amber believed that Mrs. Smith wanted all of her students to do well, because she had posters all over her room which told you to be excellent and to try your best. Amber said that she checked

with her friends and believed that Mrs. Smith was the best geometry teacher at Central City ". . and basically I think that's (she's) the best teacher it (there) is from what they say."

Amber was observed to always do exactly what was being required in her geometry class; she took notes, and paid attention. When the class was invited to ask questions, Amber was one of only three or four in the class to ask questions, and Amber asked as many questions as she could. Amber sought help from her teacher and from friends when she did not understand a concept. Mrs. Smith rated Amber an 8 out of 10 as a mathematics student and could not think of ways for Amber to improve.

Personal Beliefs about Mathematics

Amber believed that mathematics was important and that she needed to do well in mathematics class. Amber stated:

> Without math skills, you probably can't get too far. Cuz if you like, want to make a lot of money. McDonald's, you don't need math. . .if you're at the cash register it tell you how much money to give them back when it pop up…The way the world is today, you need it (math).

Amber planned on getting scholarships and becoming "a physical therapist, an x-ray technician, or a pharmacist," any of which, according to Amber, would probably require mathematics. Amber stated, "I want to be something in the medical field and you got to know math for that."

On a scale of 1 to 10, Amber initially rated herself a 5, "cuz, I ain't gonna say I'm the best math student, but I know I'm not the worst. But if I had another choice, maybe a 7. I can help out my friends." Then Amber upped that to an 8 in the next sentence and rated herself, not in comparison to others as a 10. Overall Amber concluded with rating

herself an 8, based on the fact that she paid attention in class and did what the teacher said. Amber stated that other students fell asleep or just talked during class, while she did what she was suppose to do.

Summary of Performance in Geometry

Amber did the work that was required of her in geometry and class and if she was absent from school for any reason, she made sure that she made up the missed work. Amber finished the semester with a B average. Amber stated that her grade was:

> …89, I think…I been doing my homework, so-so. I been making good on my homework checks and we took a chapter test today and yesterday we took a formula test and I know I made 100 on that 'cuz I knew all them formulas. I think I did good on the test.

Amber still believed that it was important to make good grades in mathematics and that she wanted to remain on the advanced diploma track, but she was no longer sure of the usefulness of geometry. Amber stated that "It might be, but I don't think it got nothing to do with what I want to be. I want to be, um, an x-ray technician, and I don't think it got nothing to do with that." Amber had advice to give future teachers of mathematics.

> Don't go as fast as Ms. Smith, go at a slow pace. The homework check…is a good thing, but if you don't get it, then there go your grade. Do like Mrs. Johnson (another math teacher) and give a grade if you try it, and then learn how to do it…Go over it slowly…We only get in groups on certain days and you don't get to pick your group. If I could, I would get in a group with Coot (a friend), and…Don't do homework checks and do as many worksheets as you can to get lots of practice.

CHAPTER V

ANALYSIS AND INTERPRETATION

Interpretation and analysis of interviews, observations, interactions with the six students, their parents and teachers in this study was done with the aid of Atlas-ti (Muhr, 1991), a qualitative computer software program . After all taped interviews and observation notes were transcribed, they were loaded as separate path documents into the software. That is, each document was linked to the software and accessed through the link, therefore the document could not be altered by the software. Atlas-ti allows the user to code text in any size segments into hermeneutic units, which is simply a means of naming a unit of text documents. A single word or a paragraph from several documents could be coded or labeled with a phrase which referred to the meaning attributed to the words. For example, each student, parent, and teacher discussed the students' study habits and these words or phrases were all coded with the words "study habit". Identical phrases or parts of phases might be coded with more than one code; as study habits might include "homework" or "peer influence". Subsequently, a selected code will yield all text associated with that code, and to which document the code belongs.

After reading each of the documents, response pattern emerged and similarities were noted which led to the development of code lists. In that all initial interviews with students, parents, and teachers followed a defined script, it was not difficult to find similar response categories even if the responses were different. For example, five of the

students gave responses which revealed elements of confidence in their ability to do mathematics. These five students contrasted with the one student who was very unsure of her ability in mathematics and her frustration in not “getting it”. As each document was reread, any response which referred to self-confidence or lack of self confidence was coded with the term “self confidence”. Other codes were developed as the documents were read. These included codes such as personal goal, family education, reference to peers, and understanding (as in the importance of understanding mathematics).

In that the review of current research was presented in categories labeled as spheres of influence for the student and the interview protocols were developed from these spheres, it seemed important to attempt to locate evidence of these categories within the student, teacher, and parent responses. The spheres of influence included the community and culture of the students, their educational institutions, and their mathematics classrooms. For example, in the review of research there were theories discussed which offer a rejection of the dominant culture by African American students and the associated negative peer pressure (Kunjufu, 1988; Ogbu & Matute-Bianchi, 1986). In response to this research, a code of peer influence was developed and a student response such as “I call up my friends” or “they think it is hard, was coded with the words “peer influence”. There were a total of 52 responses from the students which were coded with “peer influence”. Interestingly, none of these resulted in what would have been classified as negative peer influence.

Teachers and parent interviews and classroom observations were used to triangulate the data obtained from the students. There were no new codes developed from the analysis of the teacher, parent interviews and the observations. The list of codes

follows in Table 7 with the number of times each code was used after all the documents were coded.

Table 7

Codes Words Used and Frequency

Codes	*Frequency*
Advanced diploma	9
Agree with interviewer	2
Attendance	11
Behavior issues	15
Classroom dynamics	33
Confidence	98
Cooperative	25
Family education	13
Group work	16
Homework	38
Importance of math	45
Like or dislike	30
Parental pressure	6
Pay attention in class	29
Peer influence	52
Personal goal	50
Prepare for college	16

Table 7 continued

Codes Words Used and Frequency

Codes	*Frequency*
Scholarship	7
Seeks help	40
Study habits	43
Takes notes	24
Teacher support	29
Understanding	67
Want better for child	4

With 98 responses resulting in ‘confidence in ability”, it was apparent that confidence was a major category for all of the six students. Furthermore, as an example of the triangulation of data, students, parents and teachers were asked the same question. Students, parents, and teachers were asked: “On a scale of 1 to 10 with 1 being the worst math student and 10 being the best math student, how would you rate ____?” The results obtained from this question are summarized in table 8 and will be discussed further in the analysis of results.

Table 8

Answers to the question: "On a scale of one to ten, with one being the worst math student and ten being the best math student, how would you rate ____?"

	Jasmine	Tony	Jonathan	Amber	Josh	Danielle
Student	5	8	8	7	8	6
Mother	7-8	8-9	10	8	9	-
Geometry teacher	3	7-8	5-6	8	8	10
Algebra teacher	-	7-8,10	5-6	8	9-10	10

One can see from the table that most of students were fairly confident in their ability and that the ratings given by student, teacher, and parent are generally not too far apart.

Using Atlas-ti allowed for an efficient and accurate count of selected codes so that in the analysis it could be easily determined which issues were the most often mentioned by the students, their teachers and parents. For example, interview text from the six students resulted in "understanding mathematics" being coded 67 times while "parental pressure" was only mentioned six times.

Community and Cultural Influences

Whereas, the verbal evidence from students and parents indicated strong support for Perry's (2003) argument that African Americans have a strong and powerful academic tradition, the actions of some of the parents tended to support the rejection of education ascribed to caste-like minorities by Ogbu and Matute-Bianchi (1986) or Martin (2000). According to every student and parent in this study, success in school and in

mathematics was important and linked to success in life by way of attending college and possibly receiving scholarships to support college attendance. Amber and Josh were the only students in the study with parents who attended or graduated from college, but all of the interviewed parents stated that they were confident that their children could be successful in mathematics, would attend college, and would exceed what they as parents had accomplished in school.

Martin (2000) maintained that even for those African American parents who value education, the reality of their lived experiences of being denied opportunities afforded Whites can dampen enthusiasm for the educational experience for their children. Furthermore, these adults might consciously or unconsciously transmit these feelings of meaningless education to their children (Martin, 2000). It is conceivable that Danielle and Jonathan might have sensed this from their families, as their families did not participate in school activities, nor did they respond to poor progress reports from geometry class. Danielle, in particular, appeared to receive the least support from her mother and expressed this family conflict by avoiding talk of her mother, hindering contact attempts with her mother, and stating that her main support was from her good friends and from members of the basketball team. Jonathan's mother might not have been aware of how poorly Jonathan was doing in geometry until late in the semester, as Jonathan might have implied otherwise to his mother as he did in his interviews. On several occasions during our interviews, Jonathan was not honest when he reported his grades or classroom behavior to me. Danielle and Jonathan continued to state that education, mathematics, and geometry in particular were important for them to learn. They felt it was important to make good grades, even when their grades were not good. Thus, if Jonathan, Jonathan's

mother, or Danielle, consciously or unconsciously believed that education was meaningless, they did not verbally confirm this.

Tony's family was directly responsible, at least partially, for his lack of success in geometry. Based on the number of days Tony stayed home or was checked out of school early, attending school was not a high priority for Tony's parents. Interestingly, Tony's absences from school, which were consistent and chronic through all of his school years, did not seem to interfere with his grades in his early grades compared to what occurred during his tenth grade in geometry. Tony's parents had been able to keep Tony at home many times prior to his high school years without causing him to make poor grades. It is probable that the combination of days missed due to family and days missed due to playing sports was finally taking toll on Tony's academics.

The mothers of these six students were the most vocal, the most visible, and the most often mentioned by the students. Josh talked about his father occasionally when questioned, whereas Jonathan and Danielle never mentioned their fathers. Jasmine's mother was vocal in her support of Jasmine's education, and her actions reinforced this support when she met with Mrs. Basswood after Jasmine brought home her progress report. Jasmine's mother was confident that Jasmine was going to college and that she was a good student who could earn a scholarship. Amber's mother provided tutors for Amber when she needed help and was always aware of Amber's struggles in school and how she was doing in mathematics.

Several of the students mentioned other family or community members who were supportive of their educational efforts. Tony discussed his father, cousin, and "auntie," who talked to him about going to college. Although, as noted earlier, his family's

behavior obstructed his academic success. Amber stated that while her mother supported and influenced her, her biggest supporter was her grandmother. Amber's grandmother had not been to college herself, but encouraged and taught Amber that it was important to go to college to be successful and to do what she wanted with her life.

Useem (1992) interviewed 86 parents of middle school students to study the correlation between parent educational levels and ability level placements of students in mathematics class. The results of the study indicated that parents pass their educational advantage on to their children (Useem, 1992). The more educated the parent, the more the parent understands the placement process of the school, and the more involved the parent is in school activities. Therefore the more educated the parent the more likely the parent is to intervene in the placement process (Useem, 1992). The results also indicated that the more educated parent encouraged the higher level placement of their children in mathematics class (Useem, 1992). The two most successful students, Josh and Amber, had parents who had either had been or were currently enrolled in college. Furthermore while all of the parents verbally supported their children in school and encouraged them to do their best, the evidence supported Useem's finding that the higher educated parents were more knowledgeable about their child's mathematics placement. In particular Josh and Amber seemed to have inherited an educational advantage, whereas Tony, Jonathan, Jasmine, and Danielle did not. Specifically, Tony's success in mathematics was undermined by his family's actions as they caused him to miss many days of school. There was no evidence that family members of Jonathan or Danielle contacted the school, participated in school activities, or questioned their child's placement in mathematics class.

Negative Peer Pressure

It should be noted that the students in this study were selected from a pool of students who were already on the advanced diploma, or college track in their mathematics coursework. These six students had been fairly successful in their mathematics career thus far, and therefore the conclusions on negative peer pressure might not be applicable to a wider population of students.

There was no evidence of pressure from these six students' peers to not be successful academically, and there was no evidence that being successful was not synonymous with acting White as described by Fordham (1988). All six students stated that their friends thought mathematics was important to learn, and being successful in school and specifically in mathematics was important. Amber mentioned older friends who had passed geometry, but did not like it, as well as friends who had to repeat algebra in summer school, and did not like it. All of her friends thought mathematics was important, but did not like it because they did not understand it. Amber seemed to be proud of the fact that she could help her friends with their mathematics and would arrange study sessions for them. Danielle stated that she competed with her friends for the highest grades on mathematics tests and if she needed help, she would call up her friends. Danielle relied on her friends for support, and she indicated that they expected her to be successful in mathematics and overall in school. Jasmine agreed with others that her friends who understood math, liked it; and those who did not understand it and therefore did not do well, did not like math. Jasmine stated that even her friends who did not like math, thought it was important to learn. Tony stated that his cousin liked math like he did, and his cousin was also his friend because they hung around together. Tony

stated that he competed with another friend in his geometry class for the better grades. Josh stated that he did not talk to his friends about mathematics, but that he knew that his friends thought it was important to learn.

Jonathan had the least positive relationship with his peers, as evidenced by his school suspensions which resulted from fighting in school. In ninth grade, Jonathan acted inappropriately in his algebra class by teasing or putting other students down. Jonathan's algebra teacher believed that Jonathan possibly did this to make himself look better in front of his peers. In geometry class, he did not mind asking questions which might have sounded foolish or giving answers that might not be correct. Jonathan did not indicate that he was bothered by appearing to his friends as if he understood mathematics, and his peers did not influence him to hide his talent.

In summary, the evidence from interviews of the students, their parents, and classroom observations supported Perry's (2003) viewpoint, in that these African American students appeared to have a strong cultural academic tradition. Furthermore, the task for academic achievement is distinctive for African American students. The distinctions listed by Perry (2003), many of which will be discussed later, include: dealing with racism and cultural behaviors which cause misunderstanding, irrelevant curriculum, inappropriate pedagogy, tracking, and other institutional and school practices which limit educational access. While the evidence indicated a strong academic tradition for these students, some of the actions or inactions by some of the parents did not support student success.

Educational Institution

Socioeconomic Factors

With children of poverty the pattern of low mathematics achievement often begins in the early years, and these children continue to fail in disproportionate numbers (Oakes, 2002; Singham, 1998). Whereas four of the six students in this study qualified for the government-subsidized lunch program, it was unclear how their poverty level affected their success in mathematics. It was evident that the total number of African American students in each of the geometry classes observed was not proportional to the number of African American students in the school. Moreover, most of the students eligible for this study were eligible for government subsidized lunch. Tony and Danielle resided in different housing projects, but both were well liked and respected by their classmates and did not appear to have trouble relating to other students. Additionally, both Jackson and Central City had median household income levels below the state average and well below the national average, but it was not clear that this affected the success of these students in geometry.

It was apparent that school resources were more abundant in Central City than in Jackson, but all of the students had access to qualified and experienced teachers, new textbooks and workbooks, and the supplies that they needed for school. Neither of the geometry teachers in this study utilized their schools computer labs, but both teachers had calculators available for their students to use in class. Both Central City and Jackson High offered mathematics classes designed to prepare the students for college.

High Stakes Testing, Tracking, And Course Taking

Track placement based on a single assessment measure often disadvantages African American children (Edley, 2002; National Research Council, 2000; Oakes, 1994a, 1994b; Tate & Rousseau, 2002). While it was not clear to me that a single assessment placed the students in the college preparatory track, four students in this study mentioned how they came to be on the college track with their mathematics courses. These four students stated that it was a result of taking pre-algebra in seventh or eighth grade, and what their final grade was in each of those classes. Josh stated that he made a 79 when 80 was the cut off to be allowed to take algebra in the eighth grade. Jonathan and Tony acknowledged that they were good in math in junior high, and therefore they were allowed to take geometry in the tenth grade. According to Amber, she was not encouraged to take pre-algebra in the seventh grade and later learned that not taking pre-algebra early was a mistake. Amber stated that she doubled up in mathematics, taking two mathematics classes her tenth grade year so that she could get an advanced diploma. Amber commented that students should be required to take pre-algebra in the seventh grade, and algebra in the eighth grade, so that when they got to high school they would not be behind. Without her mother and grandmother pushing her, Amber stated that she would not have known to take the mathematics that she did. Course-taking matters (Gutierrez, 2000; Strutchens et al., 2004; Tate & Rousseau, 2002), as Amber stated very ably.

According to Mrs. Smith, passing geometry did not qualify a student to take Algebra II. Students from Central City High were recommended for Algebra II if they earned a 70 percentage average in geometry calculated by taking their two 9-week

averages as 50 percent and their final exam as 50 percent. Mrs. Smith stated that this was a departmental decision and applied to all of the mathematics classes offered at Central City High. This meant that a student who did poorly on the final exam would be assigned to take Algebraic Connections instead of Algebra II. None of the students in Mrs. Smith's class understood or acknowledged knowing this policy. Additionally, Tony, Jonathan, Amber, and Josh did not understand that the mastery quizzes which they took throughout the semester would accumulate to become the final exam grade.

Challenging and Relevant Curriculum

The degree of understanding that a student has is directly related to the number of connections that the student can make with personal knowledge and experience (Heibert & Carpenter, 1992). In addition to being challenging, the content must be relevant to the students' out-of-school life (Martin, 2003). All of the students in this study acknowledged the importance of geometry, but rarely could any of the students state any connection to out-of- school experience. Danielle stated that geometry was needed in sports, "You have to draw out the plays. You have to be at a certain angle to the goal to make it. Or when you are running track, and you have to know the circumference of the track." So Danielle made connections from the geometry vocabulary to sports, but she did not need geometry for any future work other than to make a good grade in class. Jasmine stated that you needed geometry only if you were to become an architect or some similar profession. All of the students determined that the mathematics of the class itself was not important other than for counting out or adding money, but it was important in that they could receive an advanced diploma and thus go to college.

In all of the classroom observations, it was apparent that those students who were most successful- Josh by focusing on his future homework and Amber by taking notes- could remain focused on the material being presented by the teacher even though the curriculum did not appear to be relevant or connected to life outside of the classroom. Danielle was focused on the teacher lecture early in the semester, but not later as her grades began to drop. Jasmine, Tony, and Jonathan often had trouble remaining focused for the ninety-minute block of geometry theorems, postulates and proofs.

Supportive Environment and Addressing Racism

Gutierrez (2000) analyzed several high schools which were effective in teaching minority students and found that common components were a rigorous curriculum, reform-oriented instructional practices, and a strong teacher collective believing in and committed to mathematics success for all students. These schools had administrative support, particularly department chairs, who were committed to and supportive of a teacher collective (Gutierrez, 2000). There was no evidence in the two schools involved that either administration was committed to a teacher collective or to ensuring success for students who had traditionally not been successful in school. When asked if I might work individually with one of the students who was struggling in geometry, the principal of Central City responded that there was plenty of after-school help offered at the school in which the student should participate and that offering special services to that student was not necessary.

The four year projected dropout rate is the percent of students in grade nine for the academic year 2002-2003 who would be projected to leave school prior to graduation in 2006 (* State Department of Education, 2004b). The projected dropout rate, not

reported by racial/ethnicity groups, for Central City was just over 20 percent, and for Jackson High, 33.5 percent (* State Department of Education, 2004b). Both of these dropout rates are extremely high as evidenced by the overall state dropout rate of 13 percent, which earned this state the rank of 47 of the 50 United States in the percent of people who complete high school (* State Department of Education, 2004b; U.S. Census Bureau, 2004). So while the projected dropout rate is not reported by race, it is apparent from examining the racial makeup of the freshmen and senior classes at each of the two schools in this study that more African American students dropout than White students from both Jackson and Central City High Schools. None of the six students in this study appeared to be considering dropping out of school, but as stated above the administrations at the school was not committed to addressing this issue for their African American students.

The geometry curriculum at Jackson High and Central City High was identical in content, both teachers using and following the same textbook, chapter by chapter. Instructional practices were traditional and non reform-oriented for both Mrs. Smith and Mrs. Basswood, and both appeared to operate independently of their respective departments. The teachers seemed to be committed to treating all students equally, but did not appear to be committed to ensuring that their minority students would be empowered mathematically to overcome any injustices that these minority students might experience because of their race. Mathematics was viewed as a stepping stone on the college path, but not as a tool to empower students as described by Sleeter (1997), Ladson-Billings (1995), Frankenstein (1995), and Guiterrez (2000). The students in this study were not challenged to investigate the connection between mathematics and

society, and therefore did not have the opportunity to learn to deal with obstacles which can limit their success.

Classroom Practices

Classroom practices which can serve as barriers to mathematics achievement for African American students include irrelevant curriculum, lack of resource materials, and types of assessment which do not match the learning style of the student (Singham, 2003; Tate & Rousseau, 2002).

Classroom Instructional Practices

The classroom practices of Mrs. Smith and Mrs. Basswood were not aligned with the best practices recommended by the National Council of Teachers of Mathematics and described in their documents, the Professional (1991) and Assessment Standards (1995) and the *Principles and Standards for School Mathematics* (2000). Effective teaching practices can make a difference in mathematics learning, therefore it is informative to examine the methods used by Mrs. Basswood and Mrs. Smith.

Analysis of Classroom Strategies

Ladson-Billings (1994, 1997), Berry (2003), Sleeter (1997), Tate (1997), and Schoenfeld, (2002), Lee and Smith (1993, 1995a, 1995b,1997), and Gutierrez (2000) gave convincing arguments that effective teaching styles and standards-based curriculum can make a difference in mathematics learning. Not only do more students do well, but the racial performance gap, although not eliminated, could be reduced (Berry, 2003; Schoenfeld, 2002). As stated earlier, neither Mrs. Smith nor Mrs. Basswood used a standards-based curriculum but relied heavily on their textbook, incorporating very little group work, no student discourse, no student investigations, and no justifications of

student work. The vision for the mathematics classroom as described by the *Principles and Standards for School Mathematics* (National Council of Teachers of Mathematics, 2000) had not been realized in these two classrooms. Four of the six students in this study completed geometry with a D average. If success in mathematics is measured by grades, then these four were not successful. But if success in mathematics is seen as empowerment, relevance, and training for future work and society situations, then one might hypothesize that none of the students were successful. The two students who made grades above D did not view geometry acquisition as having importance beyond going to the next level of mathematics and on to college.

Assessment Strategies

There was no evidence in either Mrs. Basswood or Mrs. Smith's room that assessment consisted of measuring the students' critical thinking skills. Ladson-Billings (1999) argued that traditional assessment measures tell us what the child does not know but do not tell us what the child does know. Furthermore, traditional assessment methods are ways of maintaining the inequitable power structure (Weissglass, 2002).

In Mrs. Smith's class, student assessment consisted of homework checks, which mimicked the problems of the textbook; mastery check quizzes, given over the semester and totaling to become the final exam score; and graded homework assignments when a student or Mrs. Smith was absent. There was no evidence of investigative work, projects, or group-work which was graded.

Mastery quizzes in Mrs. Smith's classes were one-fifth of the students final grade. These quizzes were scheduled to be taken over the course of the semester and as much as several weeks after the material had been covered. For example, the class might be

working in chapter seven, section three, and take a short mastery quiz on section one, chapter six, on the same day. A student could arrange to retake a mastery quiz, but the two quizzes, the original and the make-up, would be averaged for the final mastery quiz grade. None of the four students in Mrs. Smith's class: Tony, Jonathan, Amber, or Josh understood how these mastery quizzes were scored or that they would sum to become the final exam grade.

Another grade component of Mrs. Smith's class was the homework check, or in case of absences, graded homework. The students took a homework grade or quiz on the material to which they had been introduced the previous day. Amber stated concisely, "The homework check is a good thing, but if you don't get it, there go your grade." Amber continued with the recommendation, " do like Ms. Johnson (another mathematics teacher) and give a grade if you try it, and then learn how to do it…go over it slowly." Amber's recommendation was to give a homework grade for effort instead of correctness and then review the new concept a second time.

Student assessment in Mrs. Basswood's class consisted of notebook quizzes, where the students used their notebooks to find and copy a previously assigned problem onto the quiz; chapter tests taken from textbook material; and points given for effort on class or group work. Again there was no evidence in Mrs. Basswood's room of investigative work or projects. Jasmine, with her disorganized and incomplete notebook, had a particularly difficult time with notebook quizzes.

Therefore the only means of determining success in mathematics for the six students were more traditional forms of assessment, the final class averages, and whether or not they would be allowed or encouraged to move to the next level in mathematics. As

a result of the assessment practices used in their respective schools, Jasmine, Amber, Josh, and Danielle are eligible to take Algebra II in their junior year in high school, and Tony and Jonathan are only eligible to take Algebraic Connections, a lower level of mathematics. Amber and Josh would be the only two students in this study to be deemed successful by their final grade averages.

Teacher Beliefs and Differential Treatment of Students

Perry (2003) asserted that if teachers stereotype African Americans as having inferior intellect then these teachers would automatically expect less of African American students, possibly interact less with these students, or recommend that African American students be place in lower tracks. There was no evidence from classroom observations or statements made by students that either of the two teachers involved in this study expected less from these students as African American than they did for their students of other races. But on the other hand, there was no evidence to suggest that either Mrs. Basswood or Mrs. Smith was committed to ensuring the success of their minority students.

Danielle and Jasmine were students in Mrs. Basswood class, and both of them stated that they liked their teacher and felt supported by her. Mrs. Basswood did not expect Jasmine to make a good grade in geometry because Jasmine failed the SHSGE mathematics portion. Mrs. Basswood saw Jasmine as a weak geometry student and ranked her as a 3 out of 10. When Danielle made unexpectedly low grades, Mrs. Basswood's response was to write notes on Danielle's tests encouraging her to do better. Danielle seemed to respect Mrs. Basswood, but she did not communicate to Mrs. Basswood any reason why her grade was dropping. Neither Danielle nor Jasmine would

seek extra help from Mrs. Basswood, and Mrs. Basswood clearly had different expectations for Jasmine and Danielle.

The two students who made the highest grades, and the two students who made the lowest grades in geometry were in Mrs. Smith's class. Mrs. Smith seemed to have no particular expectations for most of her students. She did not know anything about their home situations, or study habits, or friends. She was unable to identify any reasons which may have caused them to behave as they did. For example, Mrs. Smith did not know why Tony missed so much school, and she did not know that Josh had recently lost his father. Mrs. Smith did not expect Jonathan to do well, and commented on Jonathan's behavior both in her class when he lost bathroom privileges, and when he got suspended and could not make up the work. Mrs. Smith was not enthusiastic about any of the students' work when I interviewed her. She usually did not know how the students were doing in her class until she got out her grade sheets. Mrs. Smith's response to low grades was to send home the school-mandated progress report and expect her students to improve their performance.

Neither Mrs. Basswood nor Mrs. Smith made a practice of calling the homes of their students. Direct parental contact by both teachers was maintained through the progress reports or was initiated by the parent. Any information about the student's home circumstances either was told to the teacher by others at the school or by the students themselves.

Color-blindness on the part of the teacher is a form of dysconscious racism (Ladson-Billings, 1994). The teacher who claims that she does not see children as African American, White, or Hispanic, but sees them only as children, is unaware of the

fact that she created an environment where some children are privileged while others are disadvantaged (Ladson-Billings, 1994; Rousseau & Tate, 2003). Both Mrs. Smith and Mrs. Basswood, who were White, appeared to treat all of their students equally and most probably would fall into the category of acting color-blind. There was nothing done proactively by either teacher to ensure success by their African American students nor to empower these students in or through mathematics.

Student Attitude

Students' attitudes towards learning mathematics appears to be a major factor in determining achievement (Kim, 1998; Rech & Stevens, 1996). Mathematics is feared and revered as a subject only some can understand through innate ability (Ladson-Billings, 1997). Tony, Jonathan, Amber, and Josh believed strongly in their self-efficacy as mathematics students. Jasmine struggled with the notion that she was not particularly good in math, but believed that if she pushed herself then she could possibly understand more. Danielle seemed fairly confident of her ability at the beginning of the semester, but unsure of her ability by the end of the semester as her grade dropped. Danielle did not acknowledge that she was not attentive in class, in contrast to her behavior earlier in the year.

According to a study by Signer, Beasley, and Bauer (1997), many students believe that if a person is good at something than they should not have to work hard at it. Therefore, if effort is involved, then low ability is implied. On the other hand, more successful students indicated that intelligence could be obtained through hard work and persistence (Signer et al., 1997). Tony and Jonathan continued to believe that they could finish the year with C averages because they were good in math and could do well on the

tests. Both Jonathan and Tony did do remarkably well on the chapter tests and homework quizzes, despite having done none of the homework and being absent on numerous occasions. There were several chapter tests on which either or both Jonathan and Tony made as high as a B. In contrast, Jasmine seemed to be experiencing what Signer, Beasley, and Bauer (1997) termed as "learned helplessness", where students believe that their ability level is fixed and the cause of their failure. Observing Jasmine in class, it was apparent on many occasions she gave up, would not ask questions, and accepted that she was not going to understand.

Student Reactions to Marginality

Forham (1988) described how some African American students assume a raceless persona when faced with confrontation from peers and teachers. Grant and Reese (1997) offered several more categories for describing response behaviors, some being detrimental to learning, such as withdrawn or affected; and some being beneficial to learning, such as emulative, emissarial, and balanced. As all six of the students in this study were chosen based on the fact that they were in regular college-track geometry, and none of the six were found to have adapted behavior detrimental to their mathematics learning as a response to racism. None of the students appeared to reject their race nor their African American friends; they were not defiant or withdrawn, two of the categories found by Grant and Reese (1997). It is possible that Josh rejected his friends, but he did not seem to want to be friendly with any of the other students in the class, choosing to work by himself. Amber stated that it would be helpful to her if she were allowed to select her own group in geometry so that she could work with some of her friends whom she believed were doing well. Furthermore, on several occasions Amber mentioned

working with her friends on their mathematics, even those who were not taking geometry. All six students commented that their friends and family believed being successful in mathematics and in school was important.

CHAPTER VI

SUMMARY AND RECOMMENDATIONS

The purpose of this study was to use a student lens to assess the mathematical experiences, attitudes towards mathematics, expectations of peers, parents and teachers, and to assess how these perceptions affected the mathematics performance of six tenth grade African American students as expressed by the students, each student's classroom behavior and performance, and the students' parents and teachers. The general research questions were:

1. How do African American students in this study view their mathematics experiences currently and in their past?
2. Do the African American students in this study consider mathematics important to learn? Do they see a relationship between mathematics acquisition and future job opportunities or education? Do they view mathematics as an empowering tool?
3. Are parents, guardians, community, and peers influential sources for the African American students in this study in achievement and specifically mathematics achievement? For the students in this study, where or what is their primary source of influence?
4. How do the African American students in this study interact with their mathematics teacher? Do the students perceive their teacher as encouraging, and

knowledgeable? Is there a relationship of mutual respect and admiration between the student and the teacher?

5. To be successful in mathematics, must one adopt the culture and behaviors of the White students? If this is the case, does it hold true for African American students whether they are the minority or majority in school? Are there other coping mechanisms for these students to employ when dealing with racial issues which confront them in situations at school so that access to mathematics education is not an issue?
6. Does gender affect the African American students' view of mathematics? If this is the case, in what ways does gender affect the student's relationship with school officials, parents and society at large, with respect to mathematics learning?

Specifically the purpose of this study was to examine the mathematics experiences of six African American tenth grade students through their eyes, their actions, and their voices. What did the students believe influenced their performance and achievement and how did they react to these influences? This study supplemented existing research on African American students' mathematics achievement, and echoed the appeals made by many researchers for changes in curriculum and instructional practices so that barriers to mathematics attainment for African American students could be reduced. Additionally, this study reinforced the idea that parental support and cooperation must be maintained to maximize student learning and achievement.

Limitations

Although a multi-single unit case study was selected as the most appropriate method for this study, there are several limitations. A major limitation of this study is in

assuming applications to a wider population than these six high school students. Using a few case studies allows in-depth information to be obtained on these few students at the sacrifice of breadth. A second limitation of this study is in generalizing characteristics of populations along racial/ethnic lines. Not only do different assessment tools use different classifications for race/ethnic groups, but there exist subgroups within racial groups adding the need for further caution in applying generalizations about racial groups (Tate, 1997). Tate (1997) warned of the difficulty in classifying racial/ethnic groups, recognizing that the literature reviewed is limited by not defining the subgroups within the classifications used. Additionally, it is important to recognize that individuals are not just African American or White, Hispanic or Asian, but gendered, and gender differences do exist. Acknowledging these differences and maintaining that overall the gender differences were outweighed by racial/ethnic differences, this paper does not further address gender issues.

A further limitation with this study was in determining whether or not these six students were successful in mathematics. To the students, their parents, and teachers, success was passing geometry and making a good grade. According to *Principles and Standards of School Mathematics* (2000), geometry should enable students to analyze and understand structures in the world. Students should be able to problem solve, make conjectures, justify their position mathematically, and apply their learning to new situations (National Council of Teachers of Mathematics, 2000). For these six students, the kind of mathematics learning recommended by the National Council of Teachers of Mathematics was not assessed. Schoenfeld (2002) warned that often the kind of knowledge being tested is not aligned with the kind of mathematics that we want our

students to be learning. The type of assessment that would more closely measure mathematics which reflected problem solving skills beyond basic computation have been expensive for school systems as well as hard for the public to understand (Schoenfeld, 2002). Therefore these tests, which actually measured useful and relevant mathematical skills, were not likely to be used by school systems in general and specifically were not used for these six students.

Finally, and possibly most importantly among the limitations, was the subjectivity of the researcher in being a participant as well as an observer in these case studies. While a script was used for all initial observations, and the analysis resulted from the use of available software to code common themes, there was an interpretive component to this qualitative research in which a degree of subjectivity was involved. The researcher was occasionally involved in the classroom dynamics during observations, and always a participant in the interviews. Interpretive research requires the researcher to continually reflect critically on self and the components of self which the researcher brings to the research setting (Lincoln & Guba, 2003). One necessary component of the required critical reflection was the fact that the students were African American and the researcher was White. Some would argue that a researcher who is not African American can not interpret research results of African Americans critically or effectively (Bergerson, 2003). It is possible that a White researcher would have the opportunity to analyze this research in a manner differently than an African American, but there is arguably validity in both. Therefore, recognizing that some of the student interviews might have revealed more to a researcher who shared the student's race, there was considerable self reflection done while analyzing the results of this study.

Implications of the Study

Amber and Josh took responsibility for their mathematics learning. Amber asked questions in class, completed her homework assignments, engaged a tutor when needed, and enrolled in two mathematics classes during her sophomore year. Josh completed most of the homework assigned, read and understood the textbook, and usually paid attention in class. While Danielle, Tony, Jonathan, and Jasmine did not take the essential steps to ensure successful completion of geometry, student inactions should not excuse parents, counselors, coaches, and teachers from allowing these students to fail. Educators can and should affect change in the classroom to enable students, and specifically students who have been underserved, to become successful and empowered by mathematics. Therefore the greater part of the implications discussed in this chapter are school level issues.

Implications for Parents

Three of the students in this study, who were not successful in geometry, had families whose actions or non-actions interfered with their children's success in mathematics. Tony's family was mostly responsible for his chronic absentee problem. Jonathan's mother stated that she did not get involved with the school because Jonathan was smart and could do his work. Danielle's mother did not attend school functions, would not respond to requests for conferences, and might have been responsible for Danielle dropping off the basketball and track team to take a job at the local grocery store.

The two most successful students in the study had parents or other family members who were directly involved with their school work, and were aware of what

mathematics courses their child was taking, and who their child's mathematics teacher was. Josh's mother was present at the school's open house and met his mathematics teacher. Amber's mother was aware of what Amber thought about mathematics and her mathematics class and teacher. Additionally, Amber's mother furnished a tutor for Amber when it was indicated that she needed additional help.

Josh and Amber were the only two students whose parents had or were attending college. Parents with higher levels of education or those from higher socioeconomic levels often have higher levels of involvement in their child's education (Spade et al., 1997; Useem, 1992; Wells & Oakes, 1996). The parents in this study support previous research results, as evidenced by the parents of Josh and Amber who appeared to be the most positively involved in their children's schooling.

In summary, parents need to be aware that they have the power to hinder or support the schools efforts on behalf of their children. A student whose family places school attendance as a low priority will negatively effect the students ability to be successful in mathematics. Parents who detach themselves from their child's school or academics send a message to the child that schooling has to be handled without the parental support. For some children, being successful in mathematics is not supported by parents' actions.

Implications for Schools

Parents as partners. It is the responsibility of the school to ensure that parents are involved in their child's schooling at an early age so that major educational decisions are not left solely to the schools guidance department or worse not made at all. It should not be assumed that all parents are equipped with the tools necessary to effectively support

the educational endeavors of their children. If that assumption is made then school personnel through inaction allow the failure of some disadvantaged children.

Teacher collective. While Mrs. Smith's mathematics department worked together to decide what standards they would collectively use to recommend students for placement the following year in mathematics class, they did not work together to ensure the success of their students. At Mrs. Basswood's school, the math teachers usually worked individually in their respective classrooms. Neither Mrs. Smith nor Mrs. Basswood had time scheduled for their respective mathematics departments to work collaboratively.

As stated previously, the effective components for schools to ensure success for minority students include a rigorous curriculum, reform-oriented instructional practices, and a strong teacher collective believing in and committed to mathematics success for all students (Gutierrez, 2000). Teachers working individually might be successful with students for the term or year, but to support long term results, schools must ensure collaborative efforts of all the teachers and administrators. Ladson-Billings (1994) described a situation when a student of a culturally relevant teacher faced a setback the following year when confronted with a teacher who did not acknowledge the students' mathematical abilities (Ladson-Billings, 1994). When the administration and teachers work together in a committed collaborative effort, situations such as those faced by this student would be avoided.

Ideally, the coaches and counselors from the school would be a part of the teacher collective focused on academic success for all students. Four of the six students in this study participated in school sports and three of those students experienced less than

desirable success in their mathematics courses. There was no evidence that the athletic staff from the students' teams were involved with the students' academic endeavors. Similarly, there was no evidence that the schools' counselors were involved with student academic achievement or with student course selection and placement.

There are several approaches which school counselors can use to increase the number of African American students who are successful in mathematics. Recommendations from the United States Department of Education include holding high expectations for all students and recognizing that taking advanced mathematics courses in school is essential to increase opportunities for students in career selection and higher education (U.S. Department of Education, 1996). Counselors should have a system to communicate the necessity of mathematics course-taking to parents and to tap professional organizations to provide role models for students (Shoffner & Vacc, 1999; U.S. Department of Education, 1996). Further recommendations for counselors include working with teachers and administrators to address perceptions and the relationship between attitudes and achievement (Shoffner & Vacc, 1999).

Cohesive challenging curriculum. The students in this study were not exposed to a challenging relevant geometry curriculum. A challenging curriculum has been linked to students' mathematics achievement (Gutierrez, 2000; Lee & Smith, 1993, 1995a, 1995b; Lee et al., 1997; Schoenfeld, 2002). Perry (2003) insisted that African American students who do not have a challenging curriculum will not only be shortchanged, but will believe that those who selected this curriculum think that they are not as capable as other students. Successful programs such as the QUASAR project and the Interactive Mathematics Program (Merlino & Wolff, 2001), serve as models for how to offer

challenging mathematics curriculum to students who are primarily African American and economically disadvantaged (Silver & Stein, 1996; Tate & Rousseau, 2002).

Tracking and course-taking. Central City High had a method of placing students into advanced mathematics classes that was not easily understood by the students in this study. Furthermore, Amber would not have been on college track in mathematics if she had not taken the initiative herself to double the mathematics courses she took during the school year. Neither Tony nor Jonathan understood how they were placed in geometry in the tenth grade. At Jackson High, Danielle was encouraged by her teachers to take college track mathematics as she had been an excellent student through the years. On the other hand Jasmine's mother was the one who pushed her to take the college preparatory classes and maintain a decent grade.

Schools must be mindful of their open or subtle tracking procedures, and who or what influences the students in selecting which courses to take. Tracking can start as early as elementary grades and can determine what courses the student takes in high school (Spade et al., 1997). Additionally, the parents with political and social power are the ones who make the system work for their children, insisting that their children receive something extra from the school (Wells & Oakes, 1996). Pushing the school to enroll their child in more-advanced classes takes a self-confident person, and parents with higher levels of education have been linked to increased involvement with their child's placement (Useem, 1992). Parents from higher socioeconomic classes are more involved in determining which classes students take, whereas in schools where mostly working class children attend, the decision is contained within the guidance department (Spade et al., 1997). Course-taking matters and African American students have been less likely

than White students to take advance mathematics courses in high school (Gutierrez, 2000; Hoffman et al., 2003; Strutchens et al., 2004; Tate & Rousseau, 2002). Schools must carefully evaluate how they encourage or discourage students from taking specific mathematics courses.

Preparing students to address racism and social inequities. While some might argue that the mathematics classroom is not the place to address issues of social injustices, others would argue that there is no better place than in mathematics. Both Ladson-Billings (1997) and Moses and Cobb (2001) argued that more mathematics knowledge and skill attainment is tied to better life chances. Furthermore, educational reform efforts which attempt to reduce the achievement gap but do not address racism/classism will be doomed to failure (Weissglass, 2002). Perry (2003) used the term racial socialization, for the process of preparing children to deal with racism and other obstacles that they might face in school. The playing field is not always equal and helping children learn how to cope and persevere is essential to empowering them to function as citizens. Perry (2003) suggested using a model such as one developed by the Association of Independent Schools, called the Multicultural Assessment Plan. Perry (2003) explained that the Multicultural Assessment Plan is an external review process in which schools are assessed for how they reproduce the ideology of African American intellectual inferiority and how schools can address this issue and move in another direction. Several schools in the Northeast have successfully used this plan to change the direction of their schools to a more supportive environment. African American students need affirmation that their racial heritage is synonymous with being intellectual and an achiever (Perry, 2003). Weissglass (2002) argued that the racist practices in schools can

be alleviated through a complex process of reflection and re-evaluation of existing practices and understanding. Furthermore, it was suggested that the new paradigm for our schools should be one of a healing community and that it is our responsibility as educators to heal ourselves from the damage that racism has done (Weissglass, 2002).

Implications for the Classroom

Relevant standards-based curriculum. Culturally relevant teaching as described by Ladson-Billings (1994, 1995a) was not available to these six students in geometry class. If these six students, who seemed to have the potential to do fairly well in mathematics, had been exposed to mathematics which was culturally relevant and empowering for them, what would have been the outcome? Research indicated that effective teaching coupled with a standards based curriculum could make a difference (Berry, 2003; Gutierrez, 2000; Ladson-Billings, 1995a, 1997; Lee & Smith, 1993, 1995a, 1995b; Lee et al., 1997; Rousseau & Powell, 2005; Schoenfeld, 2002; Sleeter, 1997; Tate, 1997).

Using the same textbooks and supplemental workbooks, Mrs. Basswood and Mrs. Smith employed very traditional teaching styles. Lesson plans for both Mrs. Smith and Mrs. Basswood consisted of textbook chapter numbers, and test and quiz dates. Lessons in these two classrooms did not flow from student conjectures and student discussions. Therefore, the students were often bored and not paying attention. These students were not participants in their learning.

For a student to learn new mathematical ideas, they must be able to relate it to previously learned material (Heibert & Carpenter, 1992). Moreover, the students' culture affects the students' perception and interpretation of the learning environment.

Additionally, the degree of understanding that a student has is directly related to the number of connections the student can make with their knowledge and personal experiences (Heibert & Carpenter, 1992). Students who do not see a connection between what they are learning in school and what skills are needed for their life goals will have no motivation for continuing to attend to their education (Carey et al., 1995). The curriculum used in the classrooms in this study did not allow for connections to the students experiences or personal knowledge. The opportunity to learn of students' culture, experiences, or personal knowledge was not possible in these two classrooms as little or no student discourse took place.

Standards based curriculum is focused on student's conceptual understanding and reasoning rather than rote learning and memorization (National Council of Teachers of Mathematics, 1989, 2000). Features of a standards based curriculum include meaningful mathematics which is accessible to all students, empowering them to become mathematically literate for the workplace or for college, and to function as informed citizens in a democratic society (National Council of Teachers of Mathematics, 1989). Standards based curriculum emphasizes problem solving, higher-order thinking, and student inquiry through investigations, conjectures, and justifications. While both geometry teachers expressed wanting all of their students to be successful in mathematics, there was a conspicuous absence in either classroom of higher order thinking through problem solving and no student investigations, conjectures, or justifications. Of the six students only Josh and Amber stayed on track with homework through the semester. There was not an opportunity for any of the six students in this

study to experience standards based curriculum or teaching practices aligned with the recommended standards.

Effective pedagogy. Standards based teaching includes selecting worthwhile mathematical tasks, knowing and understanding mathematics, understanding students as learners, knowing what the students bring to class from their culture and past mathematics learning, providing a challenging and supportive environment, knowing how to orchestrate student discourse, and being reflective about instructional practices (National Council of Teachers of Mathematics, 1991, 2000). To both Mrs. Smith and Mrs. Basswood teaching meant that they should explain all of the material very carefully to the students. Both Mrs. Smith and Mrs. Basswood wanted to make mathematics as understandable and simple as possible, going over an example of each kind of problem which their students would encounter in the chapter being studied. The students depended on their teachers to translate the mathematics textbook for them. Mathematics being similar to a foreign language. Indeed, very few students could read the examples in the textbook, nor were they able to proceed unaided with an assignment when either Mrs. Basswood or Mrs. Smith was absent. Danielle depended on Mrs. Basswood to explain or translate the material for her, and Jasmine stated that she did not understand most of what was explained but could understand more with help from Mrs. Basswood than when left to her own devices with her textbook. Amber believed that she needed a teacher to explain math to her, but Josh would teach himself from examples in the text. The type of instruction which took place in the two geometry classrooms in this study included drill and practice, worksheets, as well as instructor-student interactions which were few and

required only short responses; in other words, not the type of instruction recommended for students who are having difficulties in school (Oakes, 1994a, 1994b; O'Neill, 1992).

Not all African American students can be categorized as a particular type of learner, although research indicated that many African American children are relational or field dependent learners (Berry, 2003; Rech & Stevens, 1996). Effective teaching for field dependent learning styles includes the use of manipulatives, verbalization, and a global perspective (Rech and Stevens, 1996). A relational learning style is characterized by divergent thinking, freedom of movement, variation, creativity, and inductive reasoning with a focus on people using concrete imagery (Berry, 2003). Traditional teaching styles are not effective for relational, field dependent learners and were described by Tate (1997) as a cultural artifact designed to produce students who can answer a narrowly defined problem set. Furthermore, by allowing some students to fail, traditional methods of instruction served to maintain the status quo, reinforcing white privilege (Rousseau & Tate, 2003).

Rousseau and Tate (2003) identified two barriers to teachers reflection about their teaching and changing teaching practices, and these were the teachers' view of equity and the teachers disposition toward color blindness. Color blindness, while probably unintentional, is described as a form of dysconscious racism (Ladson-Billings, 1994). The teacher is unaware of the fact that she created an environment where some children are privileged while others are disadvantaged (Ladson-Billings, 1994; Rousseau & Tate, 2003). Teachers who do not address the issue of racism with their students, are not empowering their students to effectively confront racism in society (Martin, 2003; Rousseau & Tate, 2003). Culturally relevant teaching which respects and utilizes the

culture of the student and empowers the student to face societal injustices does not allow for color blindness. Culturally relevant teaching ensures the success of the disadvantaged child (Ladson-Billings, 1994). While both Mrs. Smith and Mrs. Basswood believed that they were doing the best job that they could to teach geometry to their students and to treat all of their students fairly and equally, neither recognized the need to use unequal means to ensure equitable outcomes for their unique students.

On one occasion in Mrs. Basswood class, two students, both White males, returned graded quizzes to their peers. These two students commented on whatever grade was on the paper as they returned the paper to its owner. Jasmine, along with several other students, was distinctly uncomfortable with having her grades analyzed by another student. Mrs. Basswood did not seem to notice that these two boys were humiliating other students. Parsons (2005) had several suggestions for helping teachers to become culturally relevant caring teachers. The first step for the teacher is to disrupt the dominance of any students which might prevent access to learning for other students (Parsons, 2005). The second step is for the teacher to recognize the abilities of the students, and provide assistance to students not as remediation but in the spirit of pride and supportive accomplishment (Parsons, 2005). The third step requires teachers to seek opportunities to reinforce African American students competencies and encourage them to support their peers (Parsons, 2005). Parsons (2005) insisted that teachers, and particularly white teachers, can and must disrupt the existing order of white privilege by empowering their African American students in the classroom.

A classroom which incorporates cooperative learning, another aspect of standards based teaching, can have a positive effect on African American students (Ladson-

Billings, 1994). Controlled, directed classrooms appeal to teachers who have low expectations for poor or minority students (Ladson-Billings, 1997). Gutierrz (2000) found common threads present at schools which had been successful in teaching minority students. Teachers who adopted reform-oriented practices such as rigorous curriculum, cooperative learning, and use of manipulatives, found that their students experienced success (Gutierrez, 2000). Gutierrez (2000) concluded that teachers can be taught how to be more effective in the classroom without them buying into the ideal, and with more successful students as a result, the teachers will become believers. In this study, Amber recognized the benefit of working with other students, and stated that she wished Mrs. Smith would let her pick her own group to work with in class. Amber wanted to work with three other African American students who she believed understood geometry. Amber stated that they could communicate with each other better than listening to the teacher lecture. A standards vision for teaching changes the focus of instruction from teacher centered with lecture and demonstration, to student centered with active participation and managed student discourse (National Council of Teachers of Mathematics, 1991). The teacher's role should be one of facilitator, making sure that all students participate in classroom discourse surrounding mathematically appropriate tasks designed to further student learning.

Assessment practices. Traditional assessment measures are another means to maintain the inequitable power structure (Weissglass, 2002). Amber was correct when she acknowledge that Mrs. Smith's assessment plan penalized those students who do not understand the homework the first time they are exposed to it. Amber stated that some

students needed to be taught in a different manner and not tested on material until they had the opportunity to learn the material.

Assessment practices in the mathematics classroom must reflect what is valued for mathematics learning. Assessments should address the students' full mathematical power not isolated skills (National Council of Teachers of Mathematics, 1995). The kind of assessment practices which are fundamental in a standards based classroom include the use of multiple sources, allow for open-ended tasks, and are seamless with instruction (National Council of Teachers of Mathematics, 1989, 1995, 2000). Assessment practices should allow students to fully express themselves, their thinking, and their problem-solving processes using varied forms of communication (National Council of Teachers of Mathematics, 1989, 1995, 2000). Assessment should not be used as a filter to select certain students away from learning opportunities, but should enhance the learning process (National Council of Teachers of Mathematics, 1995).

Summary of Recommendations

Explicitly, schools must evaluate their output: who is being successful, who is being empowered by the system, and who is not making acceptable grades; who is not enrolled in the college-track classes, and who is not graduating and heading off to higher education. It is not sufficient for schools to offer mathematics courses to students and assume the position that ensuring the success of the students is the student's or parent's job. There are effective models in place, such as the QUASAR project and the Interactive Mathematics Program, but school administration must be committed to disrupting the failure patterns of African American and other minority students. The collective goal of

the school must be to empower all students through a rigorous, challenging, and relevant curriculum.

To effectively transform traditional classroom teaching practices to standards based practices as recommended by the National Council of Teachers of Mathematics, teachers must make substantial changes. Recommended teaching practices which include higher order thinking, cooperative learning, problem solving, conjectures and justifications, effective student discourse, assessment which does not focus on isolated skills, are necessary but not sufficient changes. Teachers need to critically reflect on their practices with regards to color-blindness, and equality versus equity. Additionally, teachers must actively disrupt the existing power structure and failure patterns which are experienced by many African American students in the mathematics classroom.

Final Remarks

Recommendations which could eliminate barriers to mathematical success for African American students could have a positive effect on mathematics learning for all students. Whereas this study was situated in a southeastern state, the achievement gaps for African American students reflect the national picture with the exception of the statistics for Hispanic students. In addition to the achievement gaps between African American and White students, NAEP data obtained from the National Center for Educational Statistics (2004) indicated that in comparison to national scores, the overall mathematics achievement was quite low for most students in this southeastern state. Therefore while the study was situated in a southeastern state, the implications and recommendations described in this study are not limited to this state.

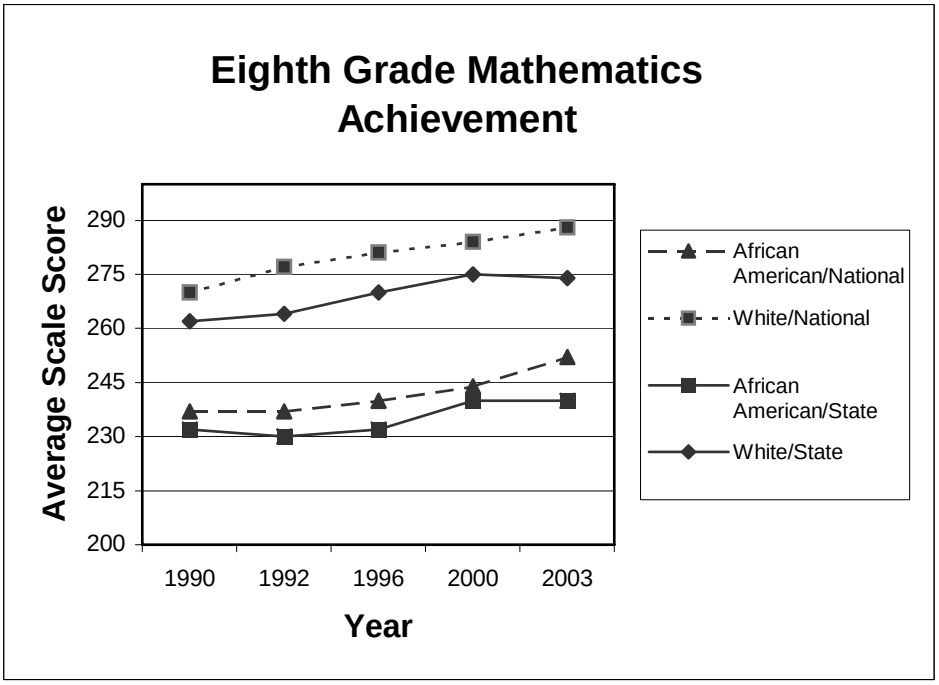

Figure 9. Comparison of National average eighth mathematics scores with State eighth grade average scores. (U.S. Department of Education, 2005).

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APPENDIX A

Interview Guides

Parent

1. What subjects are easiest for your son/daughter? What subjects are the most difficult? What subjects does he/she like the most?
2. Does your son/daughter like mathematics? Why do you think this?
3. Do you think that your son/daughter does well in school, in math?
4. Do you have the same expectations for this child in school and in mathematics as you did your other children? Do you think that your child knows what you expect?
5. On a scale of one to ten with ten being the very best mathematics student, and one being the worse, how would you rate your son/daughter? Why do you think this?
6. Does your son/daughter have math homework?
7. How do you get involved with your son/daughter's math homework?
8. What grades does your son/daughter make in math? Are you okay with those grades?
9. Do you think your son/daughter is motivated to do well in mathematics?
10. What do you think influences your child the most in how he/she does in math?
11. What do you think is your child's attitude about mathematics? Where did he/she get this attitude?
12. Do you think that your son/daughter does the best that he/she can in math class?

Teacher

1. First tell me about yourself. Where did you go to school? How long have you been teaching and where? Do you live in the area?
2. Describe yourself as a teacher, your approach to teaching.
3. Describe __student name_ as a mathematics student.
4. How does he/she typically behave in class?
5. What kind of class and homework does he/she do?
6. On a scale of one to ten, with ten being the very best mathematics student, and one being the worse, how would you rate __student name_? Why do you think this?
7. How often do you interact with this __student name____? Describe the typical interaction.
8. Does __student name__ volunteer in class?
9. How often do you call upon __student name____ ? (When he/she volunteers or other times?)
10. Does __student name__ seem interested in math?
11. Does __student name__ ask for help?
12. What do you think is __student name__'s attitude towards math? Why do you think this?
13. Do you believe that __student name__ is working to his/her full potential in math? Why do you think this?
14. What could __student name__ do to improve his/her performance in math class?

Student

1. How would you define mathematics?
2. Who could become a mathematician? Could you?
3. What do you want to do when you finish school? Does it involve math?
4. Is mathematics useful in the real world?
5. Do you need math to be successful in life?
6. Is it important to do well in math in school?
7. Do your parents talk about the importance of math?
8. How do your friends feel about math? Do they like math? Do they think it is important to learn?
9. Would you take math if you did not have to?
10. Do you like mathematics? Your math teacher?
11. How did you decide what math course to take? What were your choices?
12. On a scale of one to ten with one being the worse math student and ten being the best math student, how do you rate yourself? Why do you think this?
13. How do you compare to other students in your math class?
14. Describe a typical math class. What would I see happen? What would I see you do?
15. Do you think that your teacher expects you to do well in math?
16. Do you think that your teacher encourages you? How?
17. When the teacher asks a question do you raise your hand?
18. Does your teacher call on you even if you don't raise your hand?
19. What grades do you try for in your classes and in math class?
20. What is the reason for your current math grade?
21. What would happen if you brought home a D or F in math?
22. Do you have math homework? Do you do it? Why or why not?
23. If you need help in math, what do you do?
24. Are you doing as well as you can in math? Why do you think this?

APPENDIX B

Permission Forms

Information letter for Principal

One of the goals of TEAM-Math is to address the mathematics achievement of students who have not been performing on the same levels as other students. As a graduate student, I am interested in learning why some African American students have been successful in mathematics and some have not. Standardized test results for the United States indicate that overall African American children do not perform as well as White students in mathematics achievement. Additionally, fewer African American students are enrolled in college track mathematics courses than are White students. Research has suggested several theories for this discrepancy, including- income level, parental involvement, negative peer pressure, low expectations of teachers, and low motivational levels on the part of students.

The research that I intend to conduct focuses on the mathematics achievement of six African American high school students. My methodology will be to closely follow several successful students as well as students who have not been successful. By focusing on only a few students, no more than six, more in-depth information can be obtained. Following recommendations from your school personnel, several students from the tenth grade will be approached about participating in this study. Permission will be sought from both the students and guardians to conduct interviews and observations. Initially, the students and parents/guardians will be interviewed individually to talk about their expectations for mathematics learning. Next, the mathematics teachers of the students will be interviewed to obtain information on the student's level of performance in class. In assessing whether or not the student is performing at expected levels, previous standardized tests scores for the individual students will be examined. The students will be observed in their mathematics class at least three times during the next semester with minimal intrusion into the class. Following the observations and interviews, it is expected that students and possibly teachers will be interviewed again to verify the information collected and clarify any misunderstanding or misinterpretations on my part.

Enclosed are copies of the permission forms and interview questions which will be used with the teachers, parents, and students. Thank you and your teachers for allowing me to conduct this research, and I will be happy to share the results with you.

S. Kathy Westbrook

Transforming East Alabama Mathematics

The East Alabama Partnership for the Improvement of Mathematics Education

INFORMED CONSENT BY ADMINISTRATORS
East Alabama Partnership for the Improvement of Mathematics Education

You are invited to participate in a research study related to a project aimed at improving mathematics education in East Alabama. The study is being conducted by W. Gary Martin, associate professor in the Department of Curriculum and Teaching at Auburn University and the director of the project, along with faculty members at Auburn University and Tuskegee University. This project is being conducted by a partnership of Auburn University, Tuskegee University, and twelve school districts in the area. The project's goal is to improve students' mathematics achievement and learning through changes in educational policies and practices over a five-year period. You were selected as a possible participant because you are an administrator responsible for overseeing mathematics instruction in one of the participating school districts.

If you decide to participate, we will ask you to complete a questionnaire about your beliefs and practices related to the teaching and learning of mathematics. Completion of the questionnaire should take approximately 30 minutes. You may also be asked to participate in an interview providing additional information about your beliefs about effective administration practices relative to mathematics teaching and learning. Participation in the interview will take approximately 30 minutes. This data collection will be repeated on an annual basis for the next five years. As such, if you agree to participate we will be recontacting you each of the following years.

Any information obtained in connection with this study and that can be identified with you will remain confidential. No information will be shared with anyone who has supervisory responsibilities over your nor will it be shared with any of your colleagues. To minimize the potential risk that any information gathered will be inadvertently divulged, we will use a unique code to identify you, and any identifying information will be removed as the information is transcribed. The original documents containing identifying information will be stored in a secure location, and the key linking codes with identifying information will be stored in a separate, secure location. Information collected through your participation may be used to meet dissertation requirements of graduate students associated with the project, published in a professional journal, and/or presented at a professional meeting. If so, none of your identifiable information will be included. All data that might identify you, including the list of codes, will be destroyed one year after the conclusion of the study.

HUMAN SUBJECTS
OFFICE OF RESEARCH
PROJECT # 03-143 EP 0307
APPROVED 7-23-03 TO 7-22-05

Participant's Initials

Your decision whether or not to participate will not jeopardize your future relations with Auburn University or its Department of Curriculum and Teaching, or with Tuskegee University. Note that you may withdraw from participation at any time, without penalty, and that any data which has been collected may be withdrawn, as long as that data is identifiable.

As a result of your participation in this project, you may experience increased effectiveness in carrying out your duties related to supporting mathematics teaching and learning, resulting in increases in your teachers' mathematics instruction. Moreover, if the model developed in this project is successful, it may also benefit teachers and students in other parts of the state. I cannot, however, promise that you will receive any or all of the benefits described. No compensation will be offered for participating in the research study.

By agreeing to participate in this study, you will be provided professional development designed to improve your effectiveness as an administrator. However, this professional development may occur at different times, depending on your school's assignment to one of four cohorts that will begin participation in the project in the following four years. All administrators who agree to participate in the study will have an opportunity to participate in the project's activities at some time in the following four years.

If you have any questions nor or at a later point in time, you can contact me at (334) 844-6878 or by e-mail at martiwg@auburn.edu. You will be provided a copy of this form to keep. For more information regarding your rights as a research participant you may contact the Office of Human Subjects Research by phone or e-mail. The people to contact there are Executive Director E.N. "Chip" Burson (334) 844-5966 (bursoen@auburn.edu) or IRB Chair Dr. Peter Grandjean at (334) 844-1462 (grandpw@auburn.edu).

HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE WHETHER OR NOT YOU WISH TO PARTICIPATE IN THIS RESEARCH STUDY. YOUR SIGNATURE INDICATES YOUR WILLINGNESS TO PARTICIPATE.

Participant's signature Date	Principal investigator's signature 11/11/04 Date
Print Name	Print Name W Gary Martin

Interviews and classroom observations may be audio or videotaped. The tapes will only be used for research purposes, allowing qualified researchers to review the event after the fact, or for educational purposes, such as professional development. In no case will a tape be used for any commercial enterprise, disseminated beyond the TEAM-Math project, or used in anyway designed to cause a negative perception. Please sign below if you agree to allow audio and videotaping.

Participant's signature

HUMAN SUBJECTS
OFFICE OF RESEARCH
PROJECT # 03-143 EP 0307
APPROVED 7-23-03 TO 7-22-05

Transforming East Alabama Mathematics

The East Alabama Partnership for the Improvement of Mathematics Education

INFORMED CONSENT BY TEACHERS
East Alabama Partnership for the Improvement of Mathematics Education

You are being invited to participate in a research study related to a project whose goal is to improve mathematics education in East Alabama. The study is being conducted by W. Gary Martin, associate professor in the Department of Curriculum and Teaching at Auburn University and director of the project, along with faculty members at Auburn University and Tuskegee University. The project is being conducted by a partnership of Auburn University, Tuskegee University, and twelve school districts in the area, including the district in which you are currently teaching. The project's goal is to improve students' mathematics achievement and learning through changes in educational policies and practices over a five-year period. You were selected as a possible participant because you are a teacher in a school which has agreed to participate in initial data collection.

If you decide to participate, we will ask you to complete a questionnaire about your beliefs, knowledge, and attitudes related to the teaching and learning of mathematics. Completion of the questionnaire should take approximately 45 minutes. You may also be chosen to participate in an interview providing additional information about your knowledge of mathematics. Participation in the interview will take approximately 30 minutes. A trained investigator may also observe you teaching a mathematics classroom in order to assess the pedagogical methods used. This, however, should not require that you take any additional time. This data collection will be repeated on an annual basis for the next five years. As such, if you agree to participate we will be recontacting you each of the following years.

Any information obtained in connection with this study that can be identified with you will remain confidential. No information will be shared with anyone who has supervisory responsibilities over your nor will it be shared with any of your colleagues. To minimize the potential risk that any information gathered will be inadvertently divulged, we will use a unique code to identify you, and any identifying information will be removed as the information is transcribed. The original documents containing identifying information will be stored in a secure location, and the key linking codes with identifying information will be stored in a separate, secure location. Information collected through your participation may be used to meet dissertation requirements of graduate students associated with the project, published in a professional journal, and/or presented at a professional meeting. If so, none of your identifiable information will be included. All data that might identify you, including the list of codes, will be destroyed one year after the conclusion of the study.

HUMAN SUBJECTS
OFFICE OF RESEARCH
PROJECT #03-143 EP 0301
APPROVED 1-23-03 TO 7-22-05

_____
Participant's Initials

Your decision whether or not to participate will not jeopardize your future relations with Auburn University or its Department of Curriculum and Teaching, or with Tuskegee University. Note that you may withdraw from participation at any time, without penalty, and that any data which has been collected may be withdrawn, as long as that data is identifiable.

As a result of your participation in this project, you may experience increased effectiveness in carrying out your duties related to mathematics teaching and learning, resulting in increased mathematics achievement and learning by your students. Moreover, if the model developed in this project is successful, it may also benefit teachers and students in other parts of the state. I cannot, however, promise that you will receive any or all of the benefits described. No additional compensation will be offered for participating in the research study, although stipends may be offered for participation in other selected activities of the project.

By agreeing to participate in this study, you will be provided professional development designed to improve your effectiveness as a teacher. However, this professional development may occur at different times, depending on your school's assignment to one of four cohorts that will begin participation in the project in the following four years. All teachers who agree to participate in the study will have an opportunity to participate in the project's activities at some time in the following four years.

If you have any questions nor or at a later point in time, you can contact me at (334) 844-6878 or by e-mail at martiwg@auburn.edu. You will be provided a copy of this form to keep. For more information regarding your rights as a research participant you may contact the Office of Human Subjects Research by phone or e-mail. The people to contact there are Executive Director E.N. "Chip" Burson (334) 844-5966 (bursoen@auburn.edu) or IRB Chair Dr. Peter Grandjean at (334) 844-1462 (grandpw@auburn.edu).

HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE WHETHER OR NOT YOU WISH TO PARTICIPATE IN THIS RESEARCH STUDY. YOUR SIGNATURE INDICATES YOUR WILLINGNESS TO PARTICIPATE.

Participant's signature Date	Principal investigator's signature 11/16/04 Date
Print Name	Print Name WGary Martin

Interviews and classroom observations may be audio or videotaped. The tapes will only be used for research purposes, allowing qualified researchers to review the event after the fact, or for educational purposes, such as professional development. In no case will a tape be used for any commercial enterprise, disseminated beyond the TEAM-Math project, or used in anyway designed to cause a negative perception. Please sign below if you agree to allow audio and videotaping.

Participant's signature

HUMAN SUBJECTS
OFFICE OF RESEARCH
PROJECT # 03-143 EP 0309
APPROVED 1-23-03 TO 7-28-05

Transforming East Alabama Mathematics

The East Alabama Partnership for the Improvement of Mathematics Education

INFORMED CONSENT BY PARENTS/GUARDIANS OF STUDENTS
East Alabama Partnership for the Improvement of Mathematics Education

Your child has been invited to participate in a research study related to a project whose goal is to improve mathematics education in East Alabama. The study is being conducted by W. Gary Martin, associate professor in the Department of Curriculum and Teaching at Auburn University and director of the project, along with faculty members at Auburn University and Tuskegee University. The project is being conducted by a partnership of Auburn University, Tuskegee University, and twelve school districts in the area, including the district in which your child is enrolled. The project's goal is to improve students' mathematics achievement and learning through changes in educational policies and practices over a five-year period. Your child was selected as a possible participant because she or he is a student of a teacher who is participating in the project.

If you decide to allow your child to participate, we will ask your child to complete a questionnaire about his or her beliefs and attitudes related to the teaching and learning of mathematics. Completion of the questionnaire will take 30-45 minutes and will be conducted as a part of the regular school day. In addition, she or he may be asked to participate in an interview providing additional information about her or his knowledge of mathematics. Participation in the interview will take approximately 30 minutes and will be scheduled with your child's teacher as a part of the regular school day. We may also gather additional information (such as transcripts) about your child from school records. This data collection will be repeated on an annual basis for the next five years. As such, if you agree to let your child to participate we will be re-contacting you each of the following years.

Any information obtained in connection with this study that can be identified with your child will remain confidential. No information will be shared with your child's teacher. To minimize the potential risk that any information gathered will be inadvertently divulged, we will use a unique code to identify your child, and any identifying information will be removed as the information is transcribed. The original documents containing identifying information will be stored in a secure location, and the linking codes with identifying information will be stored in a separate, secure location. Information collected through your child's participation may be used to meet dissertation requirements of graduate students associated with the project, published in a professional journal, and/or presented at a professional meeting. If so, none of your child's identifiable information will be included. All data that might identify your child, including the list of codes, will be destroyed one year after the conclusion of the study.

HUMAN SUBJECTS
OFFICE OF RESEARCH
PROJECT # 03-143 EP 0309
APPROVED 1-23-03 TO 1-22-05

_____
Participant's Initials

Your decision whether or not to participate will not jeopardize your future relations, or your child's future relations, with Auburn University or its Department of Curriculum and Teaching, or with Tuskegee University. Note that your child may withdraw from participation at any time, without penalty, and that any data which has been collected may be withdrawn, as long as that data is identifiable.

As a result of your child's participation in this project, his or her teachers may become more effective in teaching mathematics instruction, resulting in improved achievement for your child and other children. Moreover, if the model developed in this project is successful, it may also benefit teachers and students in other parts of the state and nation. I cannot, however, promise that your child will receive any or all of the benefits described. No compensation will be offered for participating in the research study.

If you have any questions now or at a later point in time, I will be happy to answer them. You can contact me at (334) 844-6878 or by e-mail at martiwg@auburn.edu. You will be provided a copy of this form to keep. For more information regarding your child's rights as a research participant you may contact the Office of Human Subjects Research by phone or e-mail. The people to contact there are Executive Director E.N. "Chip" Burson (334) 844-5966 (bursoen@auburn.edu) or IRB Chair Dr. Peter Grandjean at (334) 844-1462 (grandpw@auburn.edu) .

HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE WHETHER OR NOT YOU WISH TO ALLOW YOUR CHILD TO PARTICIPATE IN THIS RESEARCH STUDY. YOUR SIGNATURE INDICATES YOUR WILLINGNESS TO ALLOW YOUR CHILD TO PARTICIPATE.

Parent's signature Date	W Gary Martin 11/11/04 Principal investigator's signature Date
Print Name	W Gary Martin Print Name

Interviews and classroom observations may be audio or videotaped. The tapes will only be used for research purposes, allowing qualified researchers to review the event after the fact, or for educational purposes, such as professional development. In no case will a tape be used for any commercial enterprise, disseminated beyond the TEAM-Math project, or used in anyway designed to cause a negative perception. Please sign below if you agree to allow audio and videotaping.

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