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Mathematics education: The voice of African American and white adolescents

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Mathematics Education: The Voice of African American and White Adolescents

by

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Dedication

I dedicate this research project to my family, friends, and professors who supported me to the end. I am grateful for a loving mother and grandmother who never gave up on my dreams or me. I am thankful for my friends who prayed and cheered me on. I give a special dedication and thanks to one friend who is no longer with me, LaKira D. Porter. LaKira saw it not robbery to offer her help while battling breast cancer. Her offer was a constant reminder of God's power and that I can do all things through Christ who strengthens me (Philippians 4:13).

Table of Contents

List of Tables

Mathematics Education: The Voice of

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Sharondrea R. King

ABSTRACT

Several studies have provided evidence regarding factors that contribute to the mathematics achievement gap between African American and White students. Byrnes (2003) found that 45%-50% of the difference in White and African American students' performance in mathematics was associated with socioeconomic status, exposure to learning opportunities, and motivational aspects of math while 4.5% was explained by ethnicity. The goal in this mixed method study was to examine the mathematics attitude of African American (n = 22) and White (n = 10) high school students and to allow students to voice what practices and supports they perceived enabled them to learn mathematics. The students discussed practices and supports specific to their school, home, and community.

The Attitudes Toward Mathematics Inventory data were examined across race and performance levels. The performance levels, excelling and struggling, were based on each student's cumulative performance in mathematics. The attitude results yielded one positive significant differences between performance groups on the self-confidence construct. As for qualitative data, there were few differences across the racial groups. Unlike White excelling students (n=6), African-American excelling students (n=11)

reported that they received limited encouragement from teachers to take advanced mathematics courses or to participate in extracurricular activities related to mathematics.

In examining the students' responses, there were more similarities than differences across groups. Groups spoke of the need for teachers to be more patient and willing to provide additional support. Students reported that some teachers assumed something within them [students] was the reason that they had not grasped a concept (e.g., lack of attention during instruction).

The question of why African American students' mathematics performance lags behind their White counterparts remain pertinent. Many of the reasons for the achievement gap reported in the literature were not explicitly expressed by the students in this study. However, the intent to have students express their perspectives and needs related to mathematics was accomplished. Thus, this insight can only enhance our efforts to improve African American students' mathematical experiences and success.

Chapter I

Introduction

The No Child Left Behind (NCLB) Act of 2001 challenges schools to improve students' performance in reading, mathematics, and science. In addition, it focuses on improving educational outcomes for all students. Specifically, NCLB demands an end to the achievement gap between minority and non-minority students as well as disadvantaged and advantaged students. Unfortunately, gaps continue to exist between these groups in reading, mathematics, and science. This study focused on the mathematics performance of African American and White students. Due to the preferences of various authors, it is important to note that the terms African American students and Black students are used interchangeably throughout this manuscript.

Reading initiatives have overshadowed the importance of mathematics competency, as teachers adopt evidence-based reading strategies and districts focus on increasing reading test scores. Reading is a fundamental skill for all subjects; however, mathematics skills are also essential for academic success. This reminder is crucial because students in the United States have not been performing to their greatest mathematics potential, in comparison to other countries. Students' difficulties with mathematical concepts and computation skills have been identified in results of state, national, and international assessment (Lee, Griggs, & Dion, 2007; Loveless & Coughlan, 2004; NRC, 2001).

According to Loveless and Coughlan (2004), in 1999, only 56% of 17 year olds correctly answered problems involving fractions on National Assessment of Educational Progress (NAEP) items in comparison to the 76% in 1990. They further reported that students' computation skills are lacking with respect to addition, subtraction, multiplication, division, and fractions. The National Research Council (NRC) believes that students are exhibiting a great deficit in their ability to apply mathematics skills to problem solving and understanding of basic mathematical concepts (NRC, 2001).

Although the difference in achievement between Black and White students appeared to be decreasing during the 1980s to early 1990s, the 2003 NAEP scores indicated a continuous disparity in achievement between these two groups (Holloway, 2004). This disparity was also evident in the 2007 and 2009 NAEP results. Over the last 7 years, on average, there has been an approximately 30-point difference between the average mathematics scores of fourth grade White and Black students and an approximately 36 point difference between these groups in the eighth grade (Lee et al., 2007).

In 2007, only 39% of fourth graders and 32% of eighth graders performed in the *Proficient* achievement range on the National Assessment of Educational Progress (NAEP) (Lee et al., 2007). However, the average mathematics score for fourth and eighth graders has increased over the years. With the increase in average math scores, more students are earning scores at the *Basic* and *Proficient* achievement level (Lee et al., 2007).

In an examination of students' performance on the 2009 NAEP, there was a 26-

point gap between fourth grade Black students' average mathematics score and White students average mathematics score. For eighth graders, there was a 32-point gap between Black and White students' average mathematics scores. These gaps were not significantly different from the 2007 NAEP data. In addition, the average mathematics score for Black students on the 2009 NAEP was at the *Basic* achievement level for fourth and eighth graders. Although the White-Black gap in mathematics performance decreased between 1990 and 2007 for fourth graders and between 2005 and 2007 for eighth graders, Black students' achievement level is well behind their White peers who, on average, are performing at the *Proficiency* achievement level in fourth and eighth grade.

Existing research points to the substantial disparity between the mathematics achievement of African American students and White students (Butty, 2001; Byrnes, 2003; NRC 2001). In addition, this suggests that African American students, in general, are not mastering the mathematics skills necessary to compete in a society that is becoming more dependent on information technology and do not understand the need for mathematics proficiency on the job (Anderson, 1990; Batsche, 1993; NRC, 2001).

From history and research, we also know that African Americans have made gains in the educational system, despite adversity. For example, Lee and Slaughter-Defoe (2001) noted the increase in literacy among African Americans in the late 1800s, which was a time period most African Americans were fighting for equality. However, as a group, African Americans still have a road to travel in order for future generations to continue to be successful or, for some, to experience success. In our current educational

system, a disproportionate number of African Americans dropout of school, are suspended or expelled, and are placed in special education (Ladson-Billings, 1997; Lee & Slaughter-Defoe, 2001; NRC, 2002). These outcomes may be the result of the problems African American students face in schools and provide further support for paying attention to school-based outcomes for African Americans.

Schools will not experience the positive outcomes of effective pedagogy, curriculum, and structural changes until educators, parents, and students understand the importance of mathematics education for personal and social advancement. Consequently, students who do not obtain adequate mathematical skills in grade school will not gain access to advanced mathematics courses, such as algebra (the curriculum gatekeeper) and above, and will be limited in career choices related to the science, mathematics, and technology fields as well as nonprofessional jobs that require mathematics and reasoning skills (Anderson, 1990; Stiff & Harvey; 1988; Tate, 2002).

Mathematical literacy is considered a civil rights matter because mastery and access to higher-level mathematics is vital to "increased educational and economic opportunity for students" (Ladson-Billings, 1997). Successful experiences in mathematics allow individuals to have choices with regard to career and other personal endeavors as well as the mathematical knowledge to tackle, support, or modify efforts that do not support their community, family, and personal well-being (Anderson, 1990; Ladson-Billings, 1997). Slater (1997) states that when students graduate with sufficient mathematical skills, these skills also provide them with other skills necessary to "analyze critically [and advocate or fight against] the justice issues in their own environments" (p.

681).

For instance, skills learned in mathematics courses can help students enhance problem solving and reasoning. These skills can be applied to other daily living activities and subject areas, if they are taught by connecting students' life experiences (or experience of those in their community) with course objectives as a way to promote generalization of skills across domains of life and schooling (D'Ambrosio, 2001). Unfortunately, as a society, we have accepted those who demonstrate inept mathematical abilities, while at the same time, we stigmatize those who are unable to read. The intent is not to suggest that individuals with limited mathematical skills be ridiculed, but we must be concerned about poor mathematics skill and encourage individuals to value reasoning and problem solving skills as much as we value other types of literacy (e.g., reading).

Therefore, it is crucial that we seek and determine why African American students are not performing well and conduct research to determine the factors that contribute to the success of African American students who are excelling in mathematics by taking into account what students perceive and experience. Thus far, we are aware of factors that may impede mathematics achievement such as lack of access to mathematical courses that prepare students for advanced mathematics, tracking, socioeconomic status (e.g., parent education), less rigorous curriculum, low expectations, and cultural capital (Byrnes, 2003; Holloway, 2004; Moody, 2004). Documenting the strengths of African American students and describing the environments that have fostered their success in mathematics are important because this information may serve as a mechanism to help

other African American students who are not achieving at appropriate levels. For instance, identifying the aspects of the learning environment, as well as home, school, and community environments that contribute to mathematics achievement will provide educators and parents information that could lead to psychosocial and academic interventions to help African American students who are not doing well in mathematics. However, examining the experiences of African American students in isolation of the experiences of White students would not help researchers understand the ways in which the experiences of these groups of students differ. A comparison of the mathematics experiences of White students and African American students will add insight into how such experiences may impact mathematics achievement.

By revealing factors that African American and White students acknowledge as having an impact on their experiences with mathematics, additional methods can be developed to encourage students' success in mathematics. This research may inform educators about the mathematical experiences of African American students, their beliefs and values about mathematics, their opportunities to learn and succeed in mathematics, and what motivates them to learn and do mathematics. Mathematical experiences include a student's engagement in mathematics exercises that include cooperative groups, direct instruction, supplemental instruction, tutorial supports, and enrichment/extracurricular activities. In essence, the knowledge of what experiences have enhanced or limited students' mathematics performance and significant aspects of schooling and home experiences that cause them to value mathematics, understand mathematics concepts, and define mathematics will help transform mathematics curriculum and pedagogy.

Statement of Intent

The intent of this study was to examine African American and White students' experiences in mathematics classrooms, focusing on factors that are perceived to influence their success or failure and seeking to understand the differential mathematics experiences of African American and White students. In addition to exploring factors that may support existing theories about racial differences in mathematics achievement, this study used the voice of the students to provide insight into what they perceived as differences that may exist in their mathematical experiences and possible methods to address the mathematics achievement gap. Specifically, this study was designed to gain an understanding of the mathematics experiences of African American and White students by allowing students to voice how school culture, family, and life experiences in and out of school have influenced their overall mathematics achievement.

Previous research has examined the mathematics experiences of students by analyzing quantitative data gathered by standardized assessments and surveys. Quantitative data provide valuable information such as the percentage of students not achieving at grade level, what mathematical concepts or skills students are not mastering, and information pertaining to score discrepancies by race, sex, gender, class, and schools (Loveless & Coughlan, 2004; Lubienski, 2002; NRC, 2001; Schmidt, Houang, & Cogan, 2002). Quantitative research on mathematics achievement also has been instrumental in determining factors that account for mathematics achievement such as exposure, motivation, and socioeconomic status (Byrnes, 2003). These findings have also stressed the need for reform (Holloway, 2004). Results from such quantitative studies allow

researchers to determine if a problem exists and approximate its severity.

However, qualitative data about students' experiences can provide researchers richer understanding of the experiences of students through students' words. Results obtained from qualitative studies could help educators understand how current curriculum, teaching practices, and ideology impact students' achievement. In addition, insights obtained from interviews and focus groups can assist educators in determining what outside factors contribute to students' mathematics experiences, what factors facilitate the understanding and acknowledgement of students' perceptions about mathematics teaching practices, and how the students' experiences are associated with mastery of mathematical skills. These findings could inform educators as they seek to develop interventions or teaching methods that work best for African American students as well as for other ethnic groups. For example, by using qualitative research approaches, Martin (2002) and Moody (2004) provided educators with insights into the experiences of African American students who excelled in mathematics. They explored students' experiences by taking into account the history of African Americans in the United States, society, family influences, and intrapersonal factors on mathematical achievement.

Martin (2002) explored the mathematical success of African American students through ethnographic interviews, case studies, and observations. Martin interviewed seventh through ninth grade students at Hillside Junior High School. The purpose of the study was to examine how sociohistorical, community, school, and intrapersonal factors shape one's mathematical socialization and identity. Student and teacher interviews as

well as case studies were used to gather information pertaining to the students' experiences with peer pressure, personal goals, motivation to learn mathematics and other subjects, beliefs about mathematics, and differential treatment from peers and teachers. Martin used interviews and case studies to collect data about the experiences of parents and community members. Moody (2004) used a phenomenological approach. Specifically, Moody used surveys, autobiographies, and interviews to collect data. The mathematical experiences of two African American female students were used to gather data related to the impact of social and cultural factors and to identify contributing factors to the students' success. The participants were adult women reflecting back on their elementary, secondary, and collegiate experiences. Similar to the Martin study, Moody's findings highlighted the mathematics classroom experiences as well as the social and cultural factors that impacted the mathematics experiences and successes of African American, college females.

The current study differs from the Martin (2002) and Moody (2004) studies in several ways. First, unlike Martin and Moody studies, the current study examined the experiences of both African American and White students. Students in both groups had an opportunity to express their beliefs about the importance of mathematics, their experiences in the classroom related to mathematical teaching practices that worked for them, and their input about individuals and experiences that motivate them to do well in the area of mathematics. Information from both groups allowed the researcher to investigate commonalities and differences that existed in the perceived experiences between and among the racial groups. Data about within and between groups

experiences help to address the "what, why, and how" questions.

Second, this study focused on high school students enrolled in any mathematics course. Adults participated in the Moody (2004) study in which information was gathered from elementary to college years. Martin's (2002) participants were middle school students. In both Moody's and Martin's study, data were gathered about participants' early mathematics experiences. However, a focus on the early mathematics environment such as the use of ability grouping and support from teachers and parents were not explored in enough detail to understand the impact of these early experiences on the students' mathematical performance. Although Moody addressed this area, her sample size was small and it is important to provide additional data in this area that might replicate previous findings. Recall of students' elementary, middle, and high school mathematics experiences is likely easier for high school student participants. These data could help the researcher explore how students' experiences from elementary to their present grade shaped their perspectives about mathematics and mathematics achievement. Martin's (2002) and Moody's (2004) studies are discussed in more detail in the literature review.

Third, in contrast to Martin and Moody, this study used both qualitative and quantitative data to explore the mathematical experiences of African American and White students. Survey data were gathered to examine the students' attitudes towards mathematics. Quantitative data have been useful in determining the existence of a problem and not as instrumental in explaining or developing reform efforts. However, qualitative information can inform educators regarding the following: (a) what do

African American and White students believe are contributing factors to their success (or failure) in mathematics; (b) what teaching methods were perceived by the students to help them grasp a mathematical concept or skill (e.g., small group work or independent seatwork); and (c) what motivated these students to do well in mathematics. Therefore, focus groups and interviews were used to gather this information. The following research questions provide the framework in this study for exploring the mathematical experiences of African American and White students:

- What are the attitudes of excelling and struggling African American and White high school students toward mathematics?
- To what extent do excelling African American, struggling African American, excelling White, and struggling White students differ in terms of home/community factors they believe influenced their experiences in mathematics?
- To what extent do excelling African American, struggling African American, excelling White, and struggling White students differ in terms of school and mathematics classroom factors they believe influenced their attitudes toward and their performance in mathematics?

Chapter II

Literature Review

To make a change that will impact the future, one must first have knowledge of the past. This statement is the premise of this literature review. With the current economic turmoil in our country, it is more apparent that taking into account what we know is paramount to not making the same mistakes.

This review includes an overview of students' current mathematics performance and discusses the impact of race, class, and poverty on academic achievement in general, as well as mathematics achievement specifically. These impact variables will provide a context for understanding the plight of African Americans from past to present as a means to facilitate discussions related to the importance for continued dialogue, change, and action toward efforts to close the achievement gap. In addition, literature pertinent to understanding the current status of students' mathematics achievement is examined as a way to provide knowledge about mathematics education and determine where educators need to make changes that improve mathematics achievement.

National Mathematics Curriculum Standards

The current National Council of Teachers of Mathematics document, *Principles and Standards* (NCTM, 2000) is used to inform teaching practices and is an attempt "to set comprehensive learning goals for school mathematics at the national level" (NRC, 2001). Although standards outlined by NCTM have not been adopted as the national curriculum, many programs use the document and previous versions of it to inform

teaching and the development of local and state standards (NRC, 2001). A national mathematics curriculum that is accessible to all students is based on a progressive scope and sequence for educators to follow regardless of geographic location and one that challenges students could help narrow the mathematics achievement gap, eliminate tracking, result in prepared and skilled teachers, and increase mathematics literacy among all students (Schmidt, 2004). Unfortunately, a preferred and accepted practice in the U.S. is for states to create their curriculum and for districts to modify adopted curriculum as needed. Such practices illustrate the lack of coherence and commonality across curricula used in the U.S. These practices have a negative impact on students because students are expected to learn different content in different settings. Such circumstances also may have a negative impact on students' exposure to the content necessary for advanced mathematics and lead to discrepancies in student expectations across grades (Schmidt, 2004).

The NCTM (2000) emphasizes equity, curriculum, teaching, learning, assessment, and technology as principles that influence and guide the decision-making process, curriculum development, instruction, and assessment in mathematics education. The principles cover issues from high expectations and equitable access to what and how students should be taught to be proficient in mathematics. This document also emphasizes the need for a coherent and common curriculum.

NCTM developed ten standards for curricular development. These standards were designed to assist in providing all students with a comprehensive foundation to gain mathematics understanding and competency (NCTM, 2000). Specifically, the standards

inform educators about what mathematics instruction should enable students to understand and apply mathematical skills. NCTM standards are divided into two overlapping parts, which include content and process standards. Content Standards "describe the content that students should learn" such as number and operations, algebra, geometry, measurement, and data analysis and probability (p. 29). Process Standards focus on the application of content knowledge through the use of problem solving, reasoning and proof, communication, connections, and representation skills. Although standards are intended for all grades, variation exists at each grade level regarding the amount of focus given to each of these areas during formal instruction.

The expectations set by the NCTM delineate principles educators at national and local levels should use as cornerstones when developing instructional materials and instructional practices. The following are examples that represent high standards to help meet the needs of all children, whether excelling or struggling in mathematics (NCTM, 2000):

- All students should be exposed to challenging mathematics curriculum, regardless of students' career goals.
- Students who are excelling in mathematics should be provided with opportunities for enrichment, which allows them to pursue their mathematical interests.
- Schools should provide differential mathematical learning experience such as a differential pacing to allow students to accelerate through expected curriculum to provide additional time in other mathematic content areas, curricula that emphasize a deeper understanding of targeted concepts to prepare students for future experiences,

provide supplementary mathematics opportunities, and instruction in heterogeneous groups which provide differentiated instructional support.

- Classroom teachers and special education staff should provide support for students with learning difficulties.
- Families and community members should be included in the development of curricular goals and content materials so that expectations are consistent in school, home, and community environments. Inclusion of family and community members should involve allocated time for helping participants understand, discuss, and decide upon goals.
- Elementary grade students "should study mathematics for at least an hour under the guidance of teachers who enjoy mathematics and are prepared to teach it well" (NTCM, 2000, p. 371).
- "Every middle-grades and high school student should be required to study the equivalent of a full year of mathematics in each grade" (NCTM, 2000, p. 371).

In essence, NCTM has provided a blueprint to guide educators. This blueprint delineates components necessary to develop accessible and challenging instruction. These guidelines also are necessary for improving students' mathematics achievement.

Current Status of Mathematics Achievements in the United States

Findings are mixed regarding mathematics achievement in the United States. Existing evidence supports the claim that achievement levels are below what is expected for a well-developed industrial society (Schmidt, Houang, & Cogan, 2002; NRC, 2001). Both NAEP and Trends International Mathematics and Science Study (TIMSS) results

reveal how well students are performing based on national and international comparisons. Researchers have used these results to hypothesize reasons for variations in mathematics achievement and to identify student performance disparity across areas and across states (Byrnes, 2003; Loveless & Coughlan, 2004; Lubienski, 2002).

NAEP data were collected using two types of assessment, the main NAEP and long-term trend NAEP. The main and trend NAEP samples consisted of fourth-, eighth-, and twelfth-graders. The main NAEP is sensitive to changes in instructional practices and was designed to measure standards developed by a national assessment board. However, the main NAEP was not designed to measure change over time (Loveless & Coughlan, 2004). Unlike the main NAEP, the long-term trend NAEP is a reliable tool used to measure change over time because the same testing instruments have been used since the first administration (Loveless & Coughlan, 2004). In comparison to the main NAEP, the trend NAEP focuses more on the assessment of computation skills (Loveless & Coughlan, 2004).

An analysis using trend NAEP data suggests that students are having difficulty with computation skills. Specifically, addition, subtraction, multiplication, division, fractions, decimals and percentage skills were deficient (Loveless & Coughlan, 2004). Loveless and Coughlan's (2004) analysis of trend NAEP results showed that gains observed in the 1980s "slowed, leveled off, and even reversed in the 1990s" (p. 56). For example, in 1999, 67% of 17 year olds correctly answered questions assessing fractions and by 1999, only 56% responded correctly. Of the fourth-, eighth-, and 12th graders who took the 1996 NAEP, 35% scored below the basic level of achievement and 45%

obtained mastery adequate for proficiency (NRC, 2001). As for the main NAEP, despite low levels of achievement, the results indicated a gain in achievement scores from 1990 to 2003. Overall, the results suggested a "generally low level of performance" among students in the United States (NRC, 2001, p. 55). The 2005 NAEP results revealed a decrease in the number of students whose performance indicated proficiency (Perie, Grigg, & Dion, 2005):

a) For fourth graders, 80% of the students performed at or above basic level and 36% performed at or above proficiency level.
b) For eighth graders, 69% of the students performed at or above basic level and 30% performed at or above proficiency level.
c) For twelfth graders, 80% of the students performed at or above basic level and 36% performed at or above proficiency level.

NAEP data from 2007 revealed that low performing students across all races made greater gains than high performing students, that students across all races, on average, obtained higher mathematics scores, and that the gap between fourth grade Black and White students narrowed in 1990 and 2007 (Lee, Grigg, & Dion, 2007). Currently, the gap between fourth grade Black and White students is 26 points. A 32-point gap exists between eighth grade Black and White students. Lee, Griggs, and Dion's (2007) report also found the following:

a) For fourth graders, Black students made a 35 point gain in comparison to their White and Hispanic peers who made gains of 28 points and 27 points, respectively.

b) For fourth graders, 82% performed at or above the basic level and 39% of those tested performed at or above the proficiency level.

c) For fourth graders, when comparing 1990 data with 2007 data, the gap between Black and White students narrowed. In 1990, Black students' average mathematics score was 188 in comparison to their White peers' average mathematics score of 220. In 2007, the average mathematics score for Black students was 222 and 248 for White students.

d) For eighth graders, 71% performed at or above the basic level and 32% of these tested performed at or above the proficiency level.

e) For eighth graders, a comparison of 2005 and 2007 data revealed that the gap narrowed between Black and White students. In examining students' performance since 1990, the gap did not decrease.

While the NAEP data provide information about mathematics achievement in the United States, TIMSS is a cross-national study in which the performance of fourth, eighth, and 12th graders in the U.S. was compared to students in other countries (Schmidt, Houang, & Cogan, 2002). In addition to assessing mathematics achievement levels, the TIMSS researchers collected data pertaining to students' studies and their beliefs; teachers and school administrators' beliefs, practices, and policies related to mathematics and science; and textbooks and curricula used to instruct students (NRC, 2001). Information about students' performance data as well as information about their beliefs and learning environments is valuable.

Of the 40 countries that participated in the 1995 TIMSS study, each country varied

with regard to educational, social, economic, historical, and cultural factors (NRC, 2001). Therefore, it is important to note that the variance in achievement scores is linked to differences in the classes in which students were enrolled and to differences among schools. Differences among schools or classes explained 64% of the variance in U.S. eighth-grade mathematics achievement scores and only 7% of the variance in Japan (NRC, 2001). These differences between the U.S. and Japan were a result of one or more of the following factors: parents, teachers, and students beliefs about hard work and importance of mathematics; grouping of students for mathematics instruction; and availability of special schools or tutors to provide additional assistance for mathematics tests (NRC, 2001, p. 31).

U.S. students' performance varied across content domains on the 1995 TIMSS assessment. Geometry, measurement, and proportionality skills were below the international average (NRC, 2001). As for data representation, analysis, and probability, students performed at about the international average. Differences among U.S. students and students in other countries were not observed on tests measuring fractions, number sense, and algebra (NRC, 2001).

The 2007 TIMSS's data for fourth graders revealed that the average mathematics score in the United States of 529 was above the TIMSS's average mathematics of 500 (Gonzales et al., 2008). The United State's average mathematics score of 529 for fourth graders (average for Black students was 482 and 550 for White students) and 508 for eighth graders (average for Black students was 457 and 533 for White students) was also above the TIMSS's average mathematics score of 500. The United States fourth graders

were outperformed by eight other countries. The eighth graders were outperformed by five other countries.

With 95% of fourth and 92% eighth graders performing at or above the low benchmark, the current status of mathematics achievement in the U.S. suggests that students need more support in mathematics (Gonzales et al., 2008). The fact that students in the U.S. are also performing below students in other countries suggests that students' preparedness to compete globally might be limited. In addition, with the mathematics gap between African American and White students not changing significantly and African American students lagging persistently behind other ethnic groups, the question of what should be done to help improve the mathematics performance of African American students remains.

Mathematics Performance of African American and White Students

Although African American students have consistently scored below their White peers on mathematic assessments, NAEP data indicated that these students rate mathematics as a favorite subject or have a positive attitude toward mathematics (Martin, 2002; Matthews, 1984). Unfortunately, this positivism is not reflected in outcome data for many African American students in mathematics. Performance on the 2000 NAEP revealed that there is approximately 3.4 years difference between the achievement of fourth-grade African American students and their White peers, approximately 4.3 years difference for eighth grade African American and White students, and approximately 3.7 years difference between 12^{th} grade African American and White students (Lubienski, 2002). These approximations were derived using Lubienski's assumption that the

difference of 9 points could equate to a one year difference.

Current NAEP results continue to reflect a disparity between African American and White students' performance as well (Lee et al., 2007; NCES, 2009). Although the fourth grade score gap between African American and White students has decreased from 32 in 1990 to 26 in 2007, these data imply that a gap continues to exist and it occurs early in the education process. For African American and White eighth graders, the score gap in 1990 of 33 was not significantly different from the 2007 and 2009 score gap of 32. In addition, the factors that contribute to the gap also impact students' preparation for advanced mathematics (Holloway, 2004). These factors include ethnicity, socioeconomic status, instructional practices, attitude towards mathematics, perspective about education and achievement, and self-concept.

Impact of Ethnicity and Socioeconomic Status

Studies attempt to examine barriers and factors associated with mathematics achievement by way of survey data or other forms of quantitative analyses (e.g., standardized test scores). Byrnes (2003) used NAEP data to examine ethnic differences in mathematics achievement. His study provided insight into what affects African American students' mathematics achievement as well as suggested possible interventions based on the analyses of data.

Byrnes (2003) focused on the mathematics performance among 12th grade White, African American, and Hispanic students. He used the 1992 NAEP test, demographic, and survey data. Equal access to schools, tracking, course selection, cultural incongruity (i.e., within classroom cultural clash between teacher and student, unconscious racial

bias), differential experiences of students in the same classroom, and differences in home environment were factors Byrnes discussed as those that may help explain ethnic differences in mathematics achievement. He argued that these factors alone cannot explain or account for every situation or outcome that is related to ethnic differences. It should be expected that outcomes are a "result of multiple antecedent factors that work in concert" (Byrnes, 2003, p.316). Therefore, integrating these factors to explain ethnic differences was Byrnes' way of identifying characteristics of students and schools that were predictive of performance levels.

Byrnes used various stages of sampling to examine the 1992 NAEP mathematics data. His sample consisted of 6, 410 elementary and secondary students from White, Black, and Hispanic ethnic groups. His regression analyses found that parent education, ability and liking of mathematics, coursework, and beliefs about the nature of mathematics were more predictive of mathematics performance than ethnicity. Approximately, 45%-50% of the variance among 12^{th} grade students' proficiency scores could be accounted for by parent education, number of parents in the home, exposure to learning, and motivation. As for ethnicity, when added to the regression analyses, the variable explained 4.5% of the proficiency scores when parent education, number of parents in the home, exposure to learning, and motivation were controlled. Byrnes also reported that ethnicity accounted for 11.9% of the variance in proficiency scores when other parent education, number of parents in the home, exposure to learning, and motivation were not included in the analysis. These findings suggest that educators should attend to factors within the schools that they can directly impact or change to meet

students' needs such as curriculum and learning opportunities.

Using 1990, 1996, and 2000 NAEP fourth, eighth, and twelfth grade data, Lubienski (2002) examined the Black-White mathematics achievement gap by analyzing achievement means at each grade and SES (socio-economic status) level and investigating differences in instructional practices. In addition to NAEP data, NAEP teacher and student survey data were used. These data pertained to demographics (i.e., socioeconomic status, performance level, number of math courses), instruction delivered to students, students' attitude toward mathematics, teachers' educational background, and teacher report of mathematical content strands emphasized with specific ethnic groups.

Lubenski (2002) found, in 1996, 23% of African American students from high SES backgrounds took pre-calculus in comparison to 35% of their White counterparts. However, the number of African American students (14%) from low SES backgrounds taking pre-calculus was greater than their White counterparts (11%). Thus, a possible confounding factor when examining exposure is accessibility. Lubienski (2002) used data from the 1990, 1996, and 2000 NAEP to study the issue of accessibility and how it contributed to learning. She examined data reported for fourth-, eighth-, and 12^{th} graders.

She found that the number and type of courses taken are primary determinants to students' accessibility to mathematics instruction. African American students were found to take fewer advanced classes than White students. For instance, 84% of White students took geometry while only 74% of African American students took geometry. The impact of SES was linked to the gap in course enrollment because the gap was more pronounced and steady between the SES groups (i.e., lowest and highest) than between the racial

groups (i.e., Black and White).

Algebra and geometry are considered entry-level mathematics courses that are viewed as a "credential" that leads to advanced courses and success (Tate, 2002). Having such credentials at the beginning of high school produces "higher expectations about how much mathematics a student will take, greater longevity in the college prep track, and higher achievement results" (Tate, 2002, p. 148). Pelavin and Kane's (1990) research findings indicated that 80% of African American students who completed algebra and geometry attended college. Matthews's (1984) meta-analysis indicated that the number and type of mathematics courses taken in high school are associated with later achievement. Unfortunately, many African American students were found to be enrolled in lower level mathematics courses (Ladson-Billings, 1997; Matthews, 1984; Tate, 2002). Schools that offered more advanced classes had fewer African American students and schools populated with a large percentage of African American students offered lower level mathematics classes (Matthew, 1984; Tate, 2002).

Instructional Practices

One might think that a negative attitude toward mathematics would be a pervasive problem among those with substandard mathematics ability. However, this is not the root of the issue for African Americans. Numerous researchers (e.g., Martin, 2000; Matthews, 1984; Stiff & Harvey, 1988; Yong, 1992) have reported that the attitude of African Americans toward mathematics and mathematics educators is positive. This finding suggests that the consistent low mathematics scores and disproportionate number of African American students in remedial or low-level courses is much more than a student-

centered problem, and is not likely a problem of attitude (Martin, 2002; Stiff & Harvey, 1988). In fact, the following practices related to instruction were found to contribute to differences in performance: (a) White students were allowed more access to calculators for daily use and on tests; (b) African American students were more likely to be assessed with multiple-choice tests, especially at the fourth-grade level; and (c) White students were more likely than African American students to have a teacher give heavy emphasis to reasoning skills (Lubienski, 2002).

Manswell-Butty (2001) found that 12th grade students who received reformed mathematics instruction obtained higher mathematics achievement scores. Reformed mathematics instruction consisted of activities that helped students connect mathematics to their daily lives by engaging them in exploration, peer instruction, and small group work that included problem-solving and active student inquiry. With reformed mathematics instruction, students learn critical thinking skills, how to explain or show steps taken to solve a math problem, and the teacher acts as a facilitator. Manswell-Butty's sample was derived from the National Educational Longitudinal Study of 1988, in which she examined the data of African American and Hispanic students. In Evertson et al.'s study (1980) the results also indicated that students' mathematics achievement is associated with teaching methods such as lecture-demonstration, effective teachers who asked more process and product questions, and class discussion. In addition, Evertson et al.'s (1980) results revealed "a positive relationship between the proportion of process questions asked (calling for explanations from the students) and student achievement in mathematics."

In our schools, students are expected to learn mathematics through drill and practice, repetition, convergent thinking, right-answer thinking, and predictability (Ladson-Billings, 1997). However, these practices do not take into account the diversity that exists amongst individual learners. Such practices also are not designed to support the learning styles of minority students. The learning style and academic behavior of minority students are shaped by their home experiences and may differ from the experience of middle class European American students, to which the curriculum, textbooks, and assessments typically are tailored (Ladson-Billings, 1997). In mathematics, conventional methods have been practiced and are expected as a means for doing and learning mathematics. These conventional methods include a curriculum disconnected from African American students' experiences, including such practices as individual seatwork, and recitation (D'Ambrosio, 2001; Sleeter, 1997).

A major misconception is that mathematics is culture free, that is, issues related to culturally responsive teaching, diversity, discrimination, and biased assessment practices are absent in mathematics instruction or curriculum. Aspects of culture are intertwined in every discipline, behavior, and thought. The impact of culture is profound and "cannot be suspended" (Ladson-Billings, 1997, p.700). As it should be expected of all educators, Sleeter (1997) stresses that all mathematics teachers should be able to do the following:

> (a) help students from historically low-achieving sociocultural groups achieve well in mathematics by using their cultural backgrounds as a pedagogical resource, (b) challenge the lower levels of mathematics that are open to such students and work to institutionalize much higher mathematics, (c) recognize

> mathematics as a cultural construct in which all people around the world engage…help all students see mathematics as a creation of people like themselves, and (d) connect mathematical concepts with students' lives…to think through social issues of concern to them (p.682).

Attitude Towards Mathematics

Lubienski (2002) emphasized the importance of understanding how students' mathematical beliefs and attitudes impact their mathematical achievement and their response to instruction. This sentiment is understood when examining African American students' performance in comparison to White students' performance. For example, as stated previously, Lubienski (2002) found gaps ranging from 3.4 years to 4.3 year between African American and White students based on 2000 NAEP data. Using 2000 NAEP data, the above statistics revealed the severity of the gap among African American and White students (Lubienski, 2002). The limited gains in mathematics as well as the difference in gains between African American and White students demand an understanding of students' experiences from each racial group.

In Manswell-Butty's (2001) study, tenth grade students with a "better attitude towards mathematics had significantly higher achievement scores than those students with poor attitudes towards mathematics" (p. 31) and their attitudes also affected their 12^{th} grade mathematics performance. Although one's attitude towards mathematics is not a predictor of mathematics achievement, Manswell-Butty's findings suggest that attitude is a factor that has relevance, in which educators need to be cognizant of and understand that some students' mathematics performance will be impacted by their attitude towards

mathematics. Consequently, efforts in improving the mathematics attitude of those students with negative attitudes should not be forgotten.

Research indicates that instructional practice, as well as students' attitudes toward mathematics, influence students' mathematics achievement. Specifically, we know that students who receive instruction that involves teaching methods such as lecture-demonstrations, active inquiry, problem-solving, and small group instruction achieve higher mathematics scores (Evertson et al.'s, 1980; Manswell-Butty, 2001). We also know that African American and Hispanic students benefit from these teaching methods (Manswell-Butty, 2001). Therefore, schools should be supported and encouraged to integrate "unconventional or reformed mathematics instruction" including the methods listed above to increase African American students' mathematic performance.

The review of literature on the impact of ethnicity and SES suggested that there was more to the mathematics gap than student-centered variables. The authors emphasized the need to examine accessibility, instructional practices, and students' attitudes as data to understand the disparity in African American and White students' mathematic test scores and as an avenue to find ways to close this achievement gap. This research study was designed to assist with this endeavor by looking beyond test scores. Instead, students' experiences were examined as a vehicle to understand the differences in African American and White students' performance in mathematics.

Other Factors that Influence the Academic Achievement of African American Students

In addition to the aforementioned factors that impact mathematics achievement, intertwined into how African American students perform in mathematics is their attitude

towards education and academic self-concept. A dichotomous view of attitude and academic self-concept was defined and examined in this section. The importance of these two constructs is briefly expounded upon.

African Americans' attitudes about education and academic behavior have been shaped by their experiences with achieving the "American Dream" or observance of others striving to achieve the dream (Ford, 1993; Mickelson, 1990; Ogbu, 1986). Unfortunately, some African American children witness the death of the American dream in their communities by observing the continued struggle of those who have completed some form of education. An awareness or observances of inequities in employment such as practices that inhibit qualified minorities in the job market affect students' motivation and achievement (Ford, 1993; Mickelson, 1990).

As a result, African American youth are cognizant that their educational gains may not guarantee them the same success or rewards as their White counterparts. The circumstances resulting in this death occur as African American youth observe members of their racial-ethnic group outside of school. In addition, African American youth experiences leading up to this aforementioned death are also manifested as a result of their negative experiences in the school system, which is a microcosm of the rejecting and discriminating environment many might face as adults. Researchers associate social structures that perpetuate discriminatory practices that imply one must assimilate and accept European standards of behavior and values with the low academic achievement of many African American students (Ford, 1983; Gay, 2002). These discriminatory practices limit access, opportunities, and demand conformity (Ladson-Billings, 1997;

Ogbu, 1986; Sleeter, 1997).

Therefore, when examining the achievement of African American students, researchers must probe beyond descriptive, demographic variables such as parents' education and socioeconomic status. In addition to parents' education and whether or not a child is living in poverty, assessing and understanding the attitudes, beliefs, and experiences of the child and his/her family are also essential in unraveling why a child is not achieving well in school. Demographic data are important to provide necessary support to families. For instance, these data could lead to referrals for (a) parent education programs to help parents assist their children at home with academic or behavior difficulties, (b) respite or support programs for health care issues, and (c) financial assistance (i.e., agency to help find job or attain job skills). However, this information may not help educators develop strategies in which they can directly intervene to address the gap in achievement among African American students (Ford, 2005). For example, one cannot use demographic data in isolation to explain why two African American children from the same neighborhood, a single parent home, and living in poverty are having different experiences at the same school.

In developing reform methods to help African American students, researchers should consider data about students' perceptions related to the utility of an educational degree along with the data many educators typically examine such as family demographic variables (i.e., socioeconomic status, parents' level of education, and family composition). Although these demographic variables help educators pinpoint barriers that are associated with less favorable family and student outcomes, they alone cannot

"explain achievement and underachievement among Blacks" (Ford, 1993, p. 48). In fact, Ford found that the impact of parents' level of education, occupation, employment status, and primary caregiver on African American students' perception of an education was minimal. Family achievement orientation was found to have a greater impact on African American students' achievement orientation (Ford, 1993).

Attitude and Achievement

Students' attitudes and the effect of family, school, and community variables have been studied in an effort to understand achievement among African American students. Mickelson (1990), Ford (1993), and Sanders (1998) expounded on how the experiences, attitudes, and perception of significant others affect academic achievement among African American students. Mickelson (1990) investigated the impact of abstract and concrete attitudes on academic outcomes. This study examined the significance and relevancy of abstract and concrete attitudes when predicting achievement, in which cumulative high school grade point average was used as a dependent variable. Mickelson's primary purpose was to use the data to explore the attitude-achievement paradox among African American adolescents.

According to Mickelson, an individual has two belief systems, abstract and concrete. Mickelson defined abstract attitudes toward education as beliefs shared by the general population, which reflect the American Dream. Abstract attitudes are "based on the dominant American ideology that holds that education is the solution to most social problems" (1990, p. 46). As for concrete attitudes, they are formed by the realities of life an individual experiences in regards to what education has provided for people in his/her

community and/or family. Simply stated, concrete attitudes are a reflection of "students' perceptions of their probable returns on education from the opportunity structure" (Mickelson, p. 46).

Mickelson defines the attitude-achievement paradox as a discrepancy in one's attitude or belief about education in comparison to one's performance. The African American community has embraced education as a valuable vehicle for achieving success as far back as slavery (Mickelson, 1990; Morgan, 1995; Perry, 2003). Sanders (1997) also supports this claim stating that, "historically many African Americans have possessed a strong belief in and desire for learning that has been exhibited in an ongoing, collective struggle for educational opportunity and equality" (p. 84) and to also stress how African Americans desire and understand the significance of having an education despite achievement levels. Yet, African American students are performing below other racial groups despite this collective belief that education leads to success and a better life. Therefore to answer the question, why is it that African American students are lagging behind their White counterparts in academics and are frequently identified for poor reading and mathematics performance, students' experiences and the experience and attitudes of significant others must be considered.

In relation to achievement, Mickelson posited that concrete attitudes significantly affect students' performance in school. This hypothesis is supported by data, which revealed that the difference between abstract attitude and performance is high among African American students. African American students believe that one can achieve the fruits of the American dream by excelling in their education, but their academic

performance is more reflective of their concrete attitudes about education. Consequently, the experiences and observations of African American students, specifically those that do not result in desirable returns, shape their beliefs and have a negative impact on their attitude toward schooling and grades (Mickelson, 1990). A significant difference between class groups was not observed (i.e., middle-class, working-class).

Mickelson found that, in comparison to White students, African American students' concrete attitudes about the utility of education were less hopeful. For instance, African American students understood that doing well in school could improve their chances of being successful. However, their experiences overshadow their ability to believe that an education will provide greater opportunities. This finding illustrates Neisser's (1986) point that despite African Americans desire to achieve, "Blacks feel they have to work twice as hard for the same rewards [afforded to their White counterparts]…perhaps partly for this reason they have reduced their academic efforts, even though they still believe in the overall value of education" (Neisser, 1986, p. 46). When examining class difference across gender and racial groups, middle-class students "are more positive about education than their working-class peers" (Mickelson, 1990, p. 53).

Various factors contribute to why some students succeed and others do not. These factors include resiliency and family support. Sanders (1998) found that church involvement and parental and teacher support had a significant and positive impact on the attitude and behavior of African American eighth graders. She concluded that academic self-concept and school behavior influenced the academic achievement of these eighth-

grade students. In addition, Ogbu's (1986) findings suggested that African American children are more likely to respond positively to the schooling experience when "older people in their community usually obtain jobs, wages, and other societal benefits commensurate with their level of schooling" (Ogbu, 1986, p. 40). In conjunction, African American students who are reared in strong families enter schools with social and cultural capital that fosters school success (Sanders, 1998). However, many African American students enter schools with cultural and linguistic capital that differs from the capital schools embrace resulting in fewer positive experiences and less opportunities for success.

Generalizability of Mickelson's (1990) study is limited because the sample consisted of high school seniors enrolled in social studies. However, it reflects how an individual can be discouraged when observing others, who did what society says you should do to be successful, continue to struggle twice as hard for a quality of life many presume as guaranteed. In addition, it illustrates how witnessing family and friends encounter mobility barriers due to social structures can affect African American students' persistency and will to achieve (Ogbu, 1986; Mickleson, 1990; Sanders, 1997). This study also provides data to support hypotheses and other findings that attempt to explain the achievement discrepancy between minority and nonminority students based on the effects of a caste system (Neisser, 1986; Ogbu, 1986). In essence, "to be born into a lower caste or castelike minority…is to grow up with the conviction that one's life will eventually be restricted to a small and poorly rewarded set of social roles" (Neisser, 1986, p.4). This notion speaks to the experiences and negative reality African Americans face,

even today in the new millennium. These experiences exist because some individuals continue to believe that African Americans are not capable, are culturally deprived, and/or disadvantaged due to their genetic makeup (Smedley, 1999).

Self-concept and Achievement

As noted previously, family and community variables have been associated with academic achievement as well as psychological variables such as self-concept, motivation, and attitude/beliefs. Failure and success are products of the following factors: "aptitude and acquired skills; a motivation factor such as immediate or long-term effort; the difficulty of the task; luck; mood; and help or hindrance from others" (Graham, 1988, p. 6). When examining the impact of psychological variables on academic achievement, it is imperative to consider one's need for academic competence (Jordan, 1981). To decipher why students from similar or disparate backgrounds achieve and some have limited success with academic experiences, researchers must consider if academic achievement is a desirable goal before equating data gathered as indicative of reasons for academic success or failure. For instance, assessing academic self-concept will provide knowledge pertaining to an "individual's perception of their ability to learn and succeed in school" (Sanders, 1998, p.392). However, assessing an individual's global self-concept will result in data that speaks to "the totality of one's self-knowledge emanating from a history of interactions with others and evaluations of how one has coped with life" (Jordan, p. 509). In essence, a correlation between global self-concept and achievement might lead to inconclusive or misleading data because one has not accounted for the unique contribution for "academic self-concept" and the need for

academic competence (i.e., competence is needed or sought by individual) (Jordan, 1981).

Jordan assessed eighth graders from an urban school setting and found low positive correlations of global self-concept with academic achievement. However, he reported moderate correlations between academic self-concept and academic achievement as well as with the need for academic competence. These data were collected using self-concept scales, questionnaires, and using composite grade point average in four subject areas, scores on standardized assessments, teacher constructed tests, and teacher evaluation of student learning characteristics. The unique proportion of variance accounted for by academic self-concept was statistically significant for male and female participants, which supports academic self-concept as a predictor of academic achievement. Such findings suggest that a student's belief in one's ability to succeed at academic tasks as well as understanding that related academic tasks are important must be addressed when tackling the issue of underachievement and developing interventions.

Academic self-concept is a construct that adds valuable information to the study of achievement. Self-concept is an all-encompassing construct that influences aspects of learning and behavior and is shaped by interactions with family, friends, and institutions (Campbell-Whately, 2000). As home and primary social networks significantly play a role in shaping one's self-concept, school environments reinforce or have an adverse effect on self-image, self-esteem, and attitude. Because many African American students are nurtured in home environments that embrace cultural, behavioral, or social perspectives and ways of doing that differ from the dominant culture, educators must be

mindful of school factors that lead to negative self-concept among African American students.

Summary

Children in the United States are having problems with fundamental mathematics skills necessary for success in mathematics (Lubienski, 2002; NRC, 2001). For instance, data gathered from the trend NAEP suggest that students are having significant problems with computational skills. Computational skills are essential and without them students' mathematical experiences are limited, impacting future choices (i.e., course selections and career) (Pelavin & Kane, 1990; Tate, 2002). On the whole, students are performing below the expectations of teachers and the public. Only 5% of U.S. students obtained "partial mastery of knowledge and skills that are fundamental for proficient work" (NRC, 2001, p. 55).

Although the mathematic gains observed during the 1980s have not been evident in recent years, a gap between African American students and their White counterparts has been persistent throughout the years. African American students are performing at least 4 years behind their White counterparts (Lubienski, 2002). Thus, students' experiences must be taken into account when examining the gap.

Various researchers have examined the gap in mathematics achievement and factors associated with overall achievement by means of quantitative and qualitative methods (Byrnes, 2003; Ford, 1993; Martin, 2002; Matthew, 1984; Mickelson, 1990; Moody, 2004). Exposure, motivation, and parent education were found to be more predictive of mathematic success (Byrnes, 2003). However, these factors were impacted by the

attitude and experiences related to mathematics of parents' and other significant individuals in the students' life, students' attitudes toward mathematics and determination to overcome obstacles, and instructional practices (Lubienski, 2002; Matthews, 1984; Martin, 2002).

Although researchers have examined issues related to the mathematics gap, an investigation of students' overall schooling experiences in mathematics has not been conducted to understand why some students are succeeding while others fail. Researchers have used quantitative data to examine reasons for and contributing factors to the mathematics gap and have used quantitative methods to assess the students' present experiences or adults' recollection of past experiences. However, it is important to connect the quantitative data with students' experiences.

Therefore, a goal of this study was to connect students' achievement and personal experiences to explain factors that may contribute to understanding and closing the mathematics gap. Factors such as motivation, self-concept, attitude, and family and school influences were explored as the basis for understanding and communicating the differential mathematics experiences, perceptions and beliefs related to mathematics, and mathematical behaviors of African-American students. In addition, studies have not probed the experiences of White students as a part of the puzzle in understanding the mathematics gap. This study was designed to investigate the mathematical experiences of African-American and White students as a means to understand the gap in mathematics achievement.

Chapter III

Method

This study used a mixed-method design to determine if African American (AA) and White students have differential mathematics experiences and what factors these students perceived influenced their attitude toward mathematics and mathematics performance. The use of triangulation procedures increased reliability and validity of the data. Triangulation aids in corroborating findings and reducing biases that might occur from reliance on one method (Gall, Borg, & Gall, 1996). Therefore, both qualitative and quantitative data were collected.

The use of a mixed-methods approach allowed the voice of African American and White students to be heard as they shared their experiences related to mathematics. The mixed-methods approach was aimed at understanding participants' experiences from their perspectives. In previous research, the mathematics experiences of students have been analyzed using numbers derived from standardized assessments and surveys. Although quantitative data provide meaningful information, the practical significance and utility for informing practice may be limited. Therefore, focus groups, interviews, and an attitude inventory were used to address this study's research questions:

1. What are the attitudes of excelling and struggling African American and White high school students toward mathematics?
2. To what extent do excelling African American, struggling African American, excelling White, and struggling White students differ in terms of

home/community factors they believe influenced their experiences in mathematics?

3. To what extent do excelling African American, struggling African American, excelling White, and struggling White students differ in terms of school and mathematics classroom factors they believe influenced their attitudes toward and their performance in mathematics?

Recruitment and Selection of Participants

Participating Schools

Before entering the schools, the researcher obtained approval from the University of South Florida's Institutional Review Board and the school district located on the Gulf Coast of Florida to conduct the study. After obtaining district approval, the researcher contacted schools in the district, but was unsuccessful in obtaining approval from school principals to conduct the research in their schools. Due to initiatives required by schools not meeting adequate yearly progress, principals believed their schools were inundated with school improvement efforts and chose not to participate. The selected school district had a limited number of schools with diverse populations and those schools with diverse populations were overwhelmed by Federal initiatives to address student achievement, thus limiting the number of schools in which the study could be conducted. Consequently, the researcher identified another school district in which to conduct the study. This change allowed for a larger pool of schools from which to select participants and an increase in the chances of finding a school to gather the number of African American and White students needed for the participant groups.

Four school principals agreed to allow their schools to participate in the study. Due to one school's schedule and space constraints, limited teacher participation or consistency, and students not returning parental consent forms, three of the four schools were retained in the study and served in different capacities. Two urban schools and one suburban school participated in the study.

Demographic characteristics of the participating schools are reported in Table 1. All participating schools were identified as Title I schools and included magnet programs. Each school's population was comprised of 50% or more students who were eligible for free or reduced lunch (i.e., economically disadvantaged). In addition, there were a higher percentage of African American students than any other racial group enrolled in each school.

Table 1

Percentage of Students at Participating Schools

	School A	School B	School C
Demographics			
White	26	14	24
Black	34	72	41
Multiracial	4	2	5
Hispanic	28	11	24
Asian Pacific Islander	7	2	6
American Indian/ Alaskan Native	.26	.30	.30
Economically Disadvantaged	50	78	54

According to NCES data, School A had a student teacher ratio of about 17

students per teacher during 2007-2008, while Schools B and C had reported about 13 students per teacher and approximately 19 students per teacher, respectively (NCES, 2008). In 2009, 83% of the School A's White students scored at or above grade level in mathematics on the Florida Comprehensive Achievement Test (FCAT). It is important to note that ninth and tenth grade students' achievement scores are used for high school FCAT reporting. As for African American students in School A, only 43% scored at or about grade level in mathematics on the FCAT. When reviewing these data for School B, we see that a similar percentage of the African American student population scored at or above grade level in mathematics on the FCAT (43%). Since School B's number of White student represented less than 15% of the school's population, their scores were reported by grade level. For example, 93% of ninth grade and 94% of tenth grade White students scored at or above grade level in mathematics on the FCAT. Finally, in School C, 71% of African American and 82% of White students scored at or above grade level in mathematics on the FCAT.

Selection Process

A purposeful sampling technique was used to select participants and to accomplish the goal of understanding the mathematical experiences of African American and White high school students (Gall, Borg, & Gall, 1996). Specifically, the type of purposeful sampling used was criterion sampling, in which criteria were established for selecting participants. Initially, the criteria targeted high school students enrolled in Algebra I and those identified as excelling or struggling in mathematics. However, the criterion related to Algebra I course enrollment was broadened to include students

enrolled in any mathematics high school course. The following definitions detail the criteria used to identify students as excelling and struggling:

- Excelling students: These were students whose cumulative records indicated that they received all A or B mathematics course grades since eighth grades. For the most part, students in this group were enrolled in advanced mathematics courses or courses on target for their grade level. However, this group also included one student enrolled in a remedial mathematics course and one student enrolled in a mathematics course below the targeted course for grade level.
- Struggling students: These were students whose cumulative records indicated that they received all D or F mathematics course grades since eighth grade. Students in this group primarily were enrolled in courses on target for their grade level or in remedial mathematics course. This group also included one student enrolled in an advanced mathematics course and four students enrolled in a remedial mathematics course.
- Targeted course for grade level: The school district's course sequence chart illustrates students' progression through mathematics over a five-year period. The map is designed for students in the eighth grade through twelfth grade. The first course on target for eighth and ninth graders is Algebra I and Algebra I Honors for those ninth graders on the Honors track.

During the first phase of participant recruitment, the mathematics department head at each school was contacted. The department head was asked to provide names of Algebra I teachers to participate in the nomination process. Algebra I was selected

because it is considered the gatekeeper to advanced mathematics courses (Tate, 2002). Once teachers were identified, teachers were informed of the study and the procedures for selection, and asked to assist by nominating students. Although teachers nominated a list of students for the study, participation was on a voluntary basis contingent upon return of parent consent forms. Participating students were required to submit a signed parental consent form and a signed assent to participate. Teachers nominated possible student participants based on current grades and cumulative mathematics performance. Cumulative mathematics school performance was based on grades earned from eighth grade up to the student's current grade level. Teachers used cumulative mathematics performance (i.e., student transcript) in conjunction with students' current grades to determine if a student should be placed in an excelling or struggling group. Using these criteria, students were alphabetized on a roster by race and gender as either excelling or struggling. The department chairs emailed these lists to the researcher. The groups were organized as follows:

- African American students excelling in mathematics
- African American students struggling in mathematics
- White students excelling in mathematics
- White students struggling in mathematics

The process of gaining parent consent was complex. When the researcher met with the students to explain the study and disseminate consent forms, they appeared to be interested in participating. The researcher visited each participating school a minimum of three times after explaining the study to the students to check if teachers had received

parent consent forms. During each visit, additional consent forms were distributed to students who indicated that they had lost the form, left the signed form at home, gave the signed form to a teacher, or simply forgot.

As recruitment continued throughout the duration of the study, the researcher addressed the problem with students forgetting or misplacing the form or teachers misplacing forms by mailing consent forms to interested participants. However, this change yielded few additional participants. Of approximately 60 parent consent forms mailed, two signed consent forms were received. The following year, the researcher implemented the original plan of disseminating consent forms to the interested students and increased the amount of compensation for participation.

To increase the return of consent forms, all students were informed that if signed or unsigned forms were returned, they were eligible for a random drawing of one fifty dollar gift card. Each participant received a ten dollar gift card to a local store. The gift card was given immediately after each of the final focus group sessions. Students were informed that the payment included their time for completing the inventory and participating in the focus groups or interviews.

Early in the study, the decision to sample students from Algebra I was changed due to the inability to obtain a sufficient number of White students. The researcher subsequently learned that many White students completed Algebra I prior to 9^{th} grade. As a result, only a few White students enrolled in Algebra I were available for possible participation. However, these few were either not interested in participating or did not return forms. Therefore, the sample was comprised of students enrolled in a high school

mathematics course without the Algebra I only restriction.

Participants

School A was used to gather pilot data, School B was used to gather the study data, and School C was used to gather interview data. The capacity in which each school served was predetermined and originally involved primary study data being collected at each school. However, the capacity was changed as an outcome of the number of students available to participate. The number of each school's participants was based on the number of students who returned consent forms.

The composition of participants included students from a pilot study and the primary study. The final participant sample included 32 students enrolled in mathematics courses in three high schools. Demographic characteristics of the sample are reported in Tables 2 and 3. The sample was comprised of 22 African American students and 10 White students. As shown in Table 2, there were more African American participants and students enrolled in grades 9 and 10 than grades 11 and 12. Amongst the African American group, there was an equal number of excelling and struggling students. Although fewer White students participated, the majority of participants from this group were excelling students and those enrolled in grades 9 and 10.

Table 2

Participants' Academic Information

	African American[a]	White[b]
Gender		
Female	12	5
Male	10	5
Grade		
9^{th} - 10^{th}	18	7
11^{th} - 12^{th}	4	2
Performance		
Excelling	11	6
Struggling	11	4
Math Courses		
1-2	17	5
3-4	3	2
5-6	2	2

Note. The table represents data reported by participants on Demographic Questionnaire

[b]One student did not report grade level or number of math courses taken.

The participants included students receiving services in the exceptional student education program and illustrated in Table 3. Four African American students were identified as having specific learning disabilities and/or speech and language difficulties. Two White students qualified for services in the gifted program. Data about exceptional student educational services were not collected for pilot study students.

Table 3

Participants' Background Information (excluding pilot groups)

	African American	White
Grade Point Average		
A/B	4	6
C	2	0
D/F	7	0
Exceptional Student Education Services[a]	4	2
Retained	2	0

Note. These data were gathered from the participants' cumulative files. Students from the pilot study are not represented.

[a]The services include gifted services.

The extracurricular activities of the participants were included to understand the students' interests outside of mathematics. These data are reported in Appendix A. When examining the types of activities in which students were involved, the African American struggling students were less involved in clubs or organizations with an academic/vocational focus. These students were either not involved in activities or involved in athletic focused activities. Five out of 11 African American students indicated participation only in athletic focused activities. Furthermore, there were four out of 11 who did not participate in school activities. The remaining three African Americans and four White excelling students indicated participation in academic/vocational focused activities or a combination of academic/vocational focused and athletic activities.

The range of mathematics courses taken by African American and White excelling students, which included 9th through 12th graders, was two to five. The White

struggling students, which comprised 9th graders only, indicated that they had taken one course. The African American struggling students, which included 9th through 10th graders, had taken 1-2 courses (with the exception of one student, who had taken 3 courses). Table 4 lists the students enrolled in various mathematics classes from intensive mathematics classes to AB Calculus.

Table 4

Mathematics Course

	African American		White	
Course	Excelling	Struggling	Excelling	Struggling
Course				
Intensive Math	1	4		
Algebra I	7	5	4	
Geometry	1			
Algebra II Honors	1	2		
Trigonometry	2			
AP Stats	1		1	
AB Calculus			1	

Note. These data do not include pilot study participants.

Data Collection

The qualitative data were gathered using the demographic questionnaire, focus groups and interviews. Quantitative data were gathered via an attitude inventory, specifically, the Attitudes Toward Mathematics Inventory (ATMI). Before each focus group, the researcher administered the ATMI and demographic questionnaire to all participants. Questions addressed in focus groups and interviews were designed to have students discuss constructs measured by the ATMI and their mathematical experiences. These ATMI constructs were self-confidence, value of mathematics, enjoyment of

mathematics, and motivation. The demographic questionnaire was used to gather information about parents in the home, the number of mathematics courses taken by participants, and participants' extracurricular activities and favorite school subjects.

The ATMI and demographic questionnaire were administered using a group administration format. Prior to the focus group discussion, the ATMI was distributed to each student so that a group of individuals could complete the inventory and demographic questionnaire at one time. The format allowed the researcher to read the instructions and each item of the inventory to limit the impact of possible reading disabilities, difficulties, confusion, or other impairments. However, this was offered as an option and not a requirement for each group.

To link ATMI data to interview data while still maintaining student confidentiality a coding procedure was used. The researcher created a four-column list that included students' names in the first column and then in the second, third, and fourth columns the unique number assigned to each name. This list was printed on labels. The first label remained on the student list and the second number label was put on the ATMI and the third number label was put on the interview notes. This information was kept confidential.

Focus Groups

Eight focus groups were conducted to allow students to share their thoughts and describe their experiences. Each group consisted of 4-6 participants. Due to student absence, two focus groups contained only two participants (i.e., pilot group and primary study group). The students were separated into the excelling or struggling group to

address the aforementioned research questions.

The purpose of having homogeneous groups, based on performance and race, was to give the students an opportunity to openly share their experiences in a group with peers who may share similar cultural and mathematical experiences. The assumption was that students grouped by common characteristics would allow for uninhibited dialogue amongst the participants. The intent was to also limit the possibility of peer pressure, which may influence how students respond to questions. The groups were labeled as AA students excelling in mathematics, AA students struggling in mathematics, White students excelling in mathematics, and White students struggling in mathematics.

During the focus group, a name card was used to identify each student. The name card allowed the researcher to direct questions to students. To prevent students from disclosing identifiable information, the name cards used student initials in reverse along with middle initial. For example, a student named Kisha Mahogany Jones, would have JMK written on her name card.

The researcher facilitated the focus group discussion. The facilitator's role was to direct the discussion and take notes (Krueger & Casey, 2000). A research assistant was present during the focus group discussion to operate audio and video tape and attend to unexpected interruptions (Krueger & Casey, 2000). The research assistants, one undergraduate and one graduate, worked separately. Prior to collecting data, both research assistants were given a review of how focus groups are conducted, a list of the guiding questions, and an explanation of her role as described above. In addition, both research assistants were given an opportunity to ask questions pertaining to the study and

procedures.

Interviews

As a means to provide readers with an in-depth understanding of the experiences students discussed during the focus groups, two interviews were conducted. The intent was to use randomly selected participants from the focus groups to illustrate a comprehensive picture of a few students' educational triumphs and battles endured to excel in mathematics as well as a depiction of the struggle, if applicable. The researcher also planned to use a semi-structured interview approach using open-ended questions based on follow-up inquiry from the focus group sessions. Although semi-structured interviews were conducted, the interview participants were not focus group participants. The interview participants were two White excelling students from School C. This choice was made because there were a limited number of White participants in the study and the researcher determined that their voices needed to be heard and would add to the knowledge obtained from the White excelling focus group. The interviewees' ATMI surveys and interview data were encompassed with the White excelling group. The principal investigator used probing techniques to prompt participants to elaborate and to obtain a deeper understanding of the individuals' experiences and perspectives. For example, as a probing tactic, the researcher asked the student to "tell me more about that" when a student gave an unclear or terse response.

Review of Educational History

To provide additional data about each student's educational history, a review of student records was conducted. Information such as grades in all subjects, standardized

test scores, and number of mathematics courses taken was used as background information to describe the students and add information pertinent to the students' experiences. The permission of each school's principal was obtained before the researcher reviewed students' records. This review process also was disclosed as part of the parental consent and student assent process.

Historical, demographic, and extracurricular activity data were used to describe and understand the dynamics of each focus group and interviewee (see Tables 4 and 5). These data were gathered from cumulative records review and the demographic questionnaire. The groups will be referred to by number in order to provide a composite overview of each group (e.g., Group 1). The composites are as follows:

- Group 1: This group was comprised of four White female students from School A. The students were identified as struggling. These 9th grade students were enrolled in Algebra I and had only taken one course at the time of the study. Students' extracurricular activities ranged from participation in programs with a focus on college preparation for low-income students, programs with a military focus, and programs with a focus for on the job training.

- Group 2: This group included four White male students from School B. These students were identified as excelling students in grades 10^{th} and 11^{th}. The students were enrolled in Algebra II Honors, Advanced Placement Statistics, or Advanced Placement Calculus. Each student in this group had taken two to five courses. According to the school district's mathematics

sequence chart, the classes were advanced classes for their grade level. Their extracurricular activities included programs with a focus on military skills, academic achievement, foreign language enrichment, and robotic or technological design.

- Group 3: African American male and female students identified as excelling in mathematics comprised this group. There were two students, a 9th and 10th grader. Each student had taken two courses prior to the study. At the time of the study, the students were enrolled in Algebra I at School A. Unlike the 10th grade male enrolled in a mathematics course below the targeted mathematics courses for his grade level, the 9th grade female student was enrolled in a mathematical course targeted for her grade level. The male student indicated that football was his only extracurricular activity. The female student indicated that she did not participate in extracurricular activities.

- Group 4: This group was comprised of African American students identified as excelling. There were five students, three males and two females. The students were enrolled in Algebra I at School B. There were four 9th graders; these students had taken one course prior to the study and were enrolled in a targeted mathematics course for their grade level. This group included an eleventh grade student who had taken four mathematics courses prior to the study and was enrolled in a mathematics course below courses targeted for his grade level. The 9th grade female and male indicated that their extracurricular activities included sports. The other three students did not indicate

participation in extracurricular activities.

- Group 5: Four African Americans comprised this group from School B. The group included three females and one male. Three of the students were in 12th grade and one in the 9th grade. The 12th grade students had taken four to five courses prior to the study and were in a mathematics course targeted for their grade level or a more advanced class (e.g., two students in trigonometry and one student in advanced placement statistics). The 9th grade student had taken two courses prior to the study and was in intensive mathematics, which was below the targeted mathematics courses for 9th graders. Their extracurricular activities ranged from sports to computer technology.

- Group 6: African American struggling students from School A were included in this group. The group included four 9th graders and one 10th grader. Each student had taken one to two courses prior to the study. The students were enrolled in Algebra I at the time of the study. The 10th grade student was the only one in a mathematics course below the targeted mathematics courses for 10th grade.

- Group 7: This group consisted of four African American struggling students from School B. The students were 9th graders enrolled in Intensive Mathematics and each student had taken two courses prior to the study. Thus, the students were enrolled in a course below the targeted mathematics courses for their grade level. One student indicated participation in an extracurricular

activity that focused on college preparation for low-income students.

- Group 8: This group was comprised of two 10th grade African American students identified as struggling in mathematics. There was one male and one female student. The male student was enrolled in geometry, which was a targeted mathematics course for his grade level. The female was enrolled in Algebra II honors, which was an advanced mathematics course. The students had enrolled in two to three mathematics courses prior to the study. The female student's extracurricular activities included sports and the male student's activities included band.

- Interviewees: Two students were interviewed from School C. These were White students identified as excelling in mathematics. They had taken one to two courses prior to the study. At the time of the study, the 9th grade students were enrolled Algebra I honors, which was an advanced, targeted mathematics course for their grade level. The female student's extracurricular activities consisted of participation in clubs geared toward a health occupation and sign language. The male student participated in sports and clubs geared toward industrial organizations.

Instrumentation

Attitudes Toward Mathematics Inventory

In an effort to collect quantitative data to supplement the qualitative data, the Attitudes Toward Mathematics Inventory (ATMI) was used to assess students'

perceptions, motivation, and values related to mathematics. The ATMI is an instrument designed to assess the attitudes of secondary school students, specifically those in grades 8 through 12 (Tapia & Marsh, 2004). The inventory measures the following four constructs: self-confidence, value of mathematics, enjoyment of mathematics, and motivation. The ATMI consists of 40 items, and uses a Likert-type response scale format. Students were asked to rate items on a five-point scale from strongly agree (5) to strongly disagree (1). The ATMI takes approximately 10 to 20 minutes to complete.

Tapia and Marsh (2004) used the ATMI to assess 545 high school students. The only student characteristic discussed in their study was gender (302 boys and 243 girls). Information pertaining to race/ethnicity or socioeconomic status was not provided. To determine the four factors the authors used an exploratory factor analysis that involved extraction and a varimax, orthogonal rotation (Tapia & Marsh, 2004). Tapia and Marsh used the Kaiser-Guttman criterion and Cattell's scree test to determine what factors to retain. By connecting items to variables, content validity was measured using a four-factor model. The scores for items measuring Factor I (self-confidence) had a Cronbach alpha of .95, items for Factor II (value) had a Cronbach alpha of .89, items for Factor III (enjoyment) had a Cronbach alpha of .89, and items for Factor IV (motivation) had a Cronbach alpha of .88. After Tapia and Marsh's a four-month follow-up with 64 students from the previous administration, test-retest reliability resulted in the following Pearson correlation coefficients: self-confidence (.88), value (.70), enjoyment (.84), and motivation (.78) (Tapia & Marsh, 2004). As a result, Tapia and Marsh (2004) concluded that the ATMI yielded reliable subscale scores. The following are the items associated

with each construct:

(a) Self-confidence: Items 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, and 40

(b) Value: Items 1, 2, 4, 5, 6, 7, 8, 35, 36, and 39

(c) Enjoyment: Items 3, 24, 25, 26, 27, 29, 30, 31, 37, and 38

(d) Motivation: Items 23, 28, 32, 33, and 34

Focus Group and Interview Questions

In Table 5, the questions used in this study were designed to prompt discussion about students' experiences related to beliefs and attitudes, curriculum, instructional and remedial strategies, peer relationships as well as parental, community and teacher support. For instance, participants were asked to share information about obstacles, strategies used to succeed, experiences in school, likes and dislikes pertaining to mathematics instruction and available courses. Appendix C has a list of guiding questions that were used to gather data for both focus groups and interviews. In addition, Appendix C includes a pool of questions that were used for additional probing for both focus groups and interviews.

Table 5

Data Source for Research Questions

Research Question	Data Source
Research Question 1	Attitudes Toward Mathematics Inventory (ATMI) Appendix C: Questions: Question 4and probing questions Question 7and probing questions Question 8 and probing questions
Research Question 2	Appendix C: Questions: Question 1 and probing questions Question 6 and probing questions
Research Question 3	Appendix C: Questions: Question 2 and probing questions Question 3 and probing questions Question 5 and probing questions Question 6 and probing questions

Pilot Study

The pilot groups were from School A. A pilot study was conducted to evaluate the procedures as well as the wording of focus group questions. The pilot study was conducted after students were identified and grouped by race and by performance (i.e., struggling and excelling). Three pilot focus groups were conducted (1 AA excelling group with 2 members, 1 AA struggling group with 5 members, and 1 White struggling group with 4 members). Due to consent forms not being returned, a White excelling

group was not a part of the pilot study. The procedures outlined under the data collection section were implemented.

In addition to the researcher evaluating the procedures, the pilot study participants' input was valued and gathered to inform procedures for the primary study. Upon completion of the ATMI and focus groups and before students were dismissed, they were asked questions pertaining to their understanding of focus group and interview questions and their understanding of inventory directions and statements. Participants' input regarding the grouping system also was gathered (i.e., African American and White students separated in groups).

Based on student feedback and active participation, data collection procedures proposed were modified only slightly. Instead of two or three focus group sessions for 90 minutes, the pilot study participants participated in one focus group, which provided enough time to collect data within 30-50 minutes. Therefore, the subsequent groups that were involved in the primary study met for one focus group session. Students commented that the study's questions and expectations were understood and rephrasing, deletion, or the addition of new questions was not required. Thus, it was determined that the proposed amount of time needed for the focus group could be reduced from approximately 90 minutes over one to two sessions to 30 minutes in one session. Principals and teachers perceived this as a favorable change.

Data Analysis

This section describes the data analysis procedures used to address the research questions. First, the analysis of the quantitative data is discussed. Then, the analysis of

qualitative data is explained.

Inventory Data

Descriptive analysis of the ATMI data was conducted to examine the four constructs. The information consisted of the mean, standard deviation, range, skewness, and kurtosis. These data were used to describe scores for each set of variables and to integrate the data with the qualitative analysis. For instance, a particular group's (e.g., excelling AA) mean score for the motivation construct was linked to focus group and interview discussions related to motivating factors which fostered their success in mathematics. The scores were examined within and across groups. For example, a within-group analysis of scores for the students in the African American excelling group was conducted as well as for each of the other groups. In addition, the scores across groups were analyzed. Lastly, these data were summarized by group and across groups to reveal students' attitudes toward math. The ATMI data addressed research question one by providing a measure of students' attitudes toward mathematics. In addition, during focus groups and interviews, students expounded on their attitudes measured on the ATMI and the influential factors related to their mathematical experiences.

Focus Group and Interview Data

The focus group and interview data addressed research questions one through three, in which students provided information on mathematical experiences and factors that shaped their attitudes and performance. The researcher used analysis processes described by Creswell (2005), Bogdan and Biklen (1998), and Mertens (1998). These anecdotal data were analyzed from the focus groups and interviews by determining core

themes. The researcher transcribed recordings from both focus groups and interviews by hand. To ensure reliability of transcription, an accuracy check was completed with a research assistant to verify transcription with participants' spoken statements. For example, 20% of an audiotape or videotape was played, the segment on the tape was located on the transcript, and then the research assistant determined whether the participant's statement was written as it was spoken. The transcript with pilot study data and primary study data totaled 25 typed single-spaced pages. Once transcriptions were prepared, member checking was used to confirm whether or not individuals' experiences were accurately documented (i.e., thoughts, comments) (Gall, Borg, & Gall, 1996). The researcher returned to participating schools to conduct member checking. During a one-on-one session with the researcher, the participant was given an opportunity to review draft versions of the transcript specific to his/her comments during the focus group or interview. Since participants did not comment or request changes, revisions were not necessary.

The principal investigator and research assistant used recommended coding processes to identify core themes within the transcripts (Creswell, 2005; Mertens, 1998). The research assistant was a graduate student in the College of Education with research interests in academic achievement. Due to the assistant's limited experience with qualitative data analysis, the research assistant was provided guidance on the coding procedure. The guidance involved the researcher using selected portions of the transcript to describe what comprised a thought unit (a statement made by the participant) and how to categorize a thought unit using the list of existing themes derived from the literature.

Once the procedure was explained, a portion of the transcript was used to check for understanding. The research assistant was provided opportunities to ask questions.

The coding of data occurred in several phases. The first phase involved the researcher and research assistant reading through the transcripts. During the second phase, a sampling of the pilot group's transcript was used to practice the process of questioning the meaning in a person's statement. The researcher and research assistant collaborated to ensure understanding of this task. Once this process was understood, the process of coding thought units was accomplished by assigning a code or phrase that generalized the meaning or the thought expressed in a thought unit.

The next phase involved determining agreement on the coded pilot group's transcripts. Once the procedure was explained, the researcher provided the research assistant with a sample to determine agreement and disagreement between coders to check comprehension and accuracy. The research assistant was given opportunities to ask questions. Agreement was established by comparing the coded thought units of the researcher and the research assistant. This agreement procedure was completed using the pilot group data in order to provide numerous opportunities for accuracy checking. The following formula was used to calculate agreement: agreement / agreements + disagreement x 100 = % of agreement (Cooper, Heron, & Heward, 1987). The agreement obtained was 80% or higher to indicate accurate and reliable coding. The criterion was met after using several samples of an entire pilot transcript. These phases aided in increasing the reliability of data coding so that the resulting data accurately reflected the students' experiences as they related to the research questions. Once reliability was

obtained, the researcher and the research assistant worked independently on coding the themes.

Next, the researcher and research assistant, individually, used the transcripts to code thought units. Again, thought units (e.g., statements made by participants) were used to categorize information. Phrases or codes were used to provide an overall meaning of the unit (i.e., a student's perspective about teacher's willingness to help).

Once thought units were coded, the researcher and the research assistant read through and compared coded units. The discussion led to consensus building on the meaning of thought units and the development of existing and emergent themes. Existing themes were those derived from the literature on mathematics and the educational experience of African American students. The following existing themes were identified in the analysis: beliefs about importance of education; attitude toward mathematics; differential treatment by teachers; support from family, community and teachers related to academics; support from family, community, and teachers related to mathematics; and factors students report as contributing or hindering their success in mathematics. Additional or emergent themes were derived during the analysis of the data by grouping related thought units together to create a category that best fit the related units. Using this process the following themes were identified: resourcefulness, goals/aspiration, anxiety, benefit of good grades, and guidance. For example, the impact of race on teacher and student interactions was a theme derived from the focus group or interview discussions.

Delimitations

There were factors that were imposed by the researcher and those imposed by the school district that narrowed the study's targeted sample. These factors could have had an impact on the results and conclusions drawn from the data. Thus, the delimitations were criteria used to define excelling and struggling students and the fluidity of the school district's student progression sequence chart in mathematics courses.

The definitions related to excelling and struggling students did not delineate success based on level of mathematics course (e.g., intensive mathematics versus advanced placement calculus). For example, the excelling group included students enrolled in advanced mathematics, targeted mathematics course for grade level, and remedial mathematics. Since the definitions did not exclude students enrolled in remedial courses from the excelling group, the excelling group analysis of data included remedial students' voice in an excelling group. Thus, this delimitation could impact the internal and external validity of data, specifically credibility and generalizability.

The second delimitation, district's mathematics course sequence chart and fluidity of course offerings in the high school, restricted the number of students accessible for a representative sample of White students enrolled in Algebra I at the high school level. This delimitation impacts external validity, specifically generalizability.

Chapter IV

Results

This chapter presents the results gathered from the attitude surveys, focus groups, and interviews. Descriptive statistics and reliability coefficients for the ATMI derived from its use in this study are presented. Students' experiences from each of the four groups (e.g., African American excelling, White struggling) and interviewees are presented in the sections that follow. However, the interview data are discussed separately from the focus group data. Although pilot study data are typically used to test procedures and to determine necessary changes to improve data collection, the quality and the depth of information provided by pilot study participants rendered that information as valuable as the information from participants in the actual study. To not include pilot study participants' experiences would have eliminated a great deal of insight about students' mathematical experiences. Therefore, pilot study data are included in the results for this study.

The results are discussed by common themes or factors. These common themes and factors are based on findings from the literature as well as from themes or factors derived from the analysis of the focus group data. These data highlight what students voiced about their attitude toward mathematics and the factors that led to negative or positive mathematic experiences.

Attitude Towards Mathematics

Insight into students' attitude toward mathematics was provided through an analysis of the ATMI survey data as well as focus group and interview data. The ATMI results are presented first, followed by the relevant focus group and interview data. These data are aggregated by race and performance level.

Data from the ATMI

Tapia and Marsh (2004) designed the ATMI to gather data regarding students' level of self-confidence, value, enjoyment, and motivation in the area of mathematics. It is important to note that the self-confidence construct also measured feelings of anxiety related to mathematics. To understand the meaning of the survey data, Tapia and Marsh's scale ranking is used to depict how students rated themselves along each of the constructs measured using the ATMI. Tapia and Marsh based the means on a scale from 1 to 5, in which 1=strongly disagree, 3=neutral, and 5=strongly agree.

In this study, as shown in Table 6, the ATMI data were analyzed using the Statistical Package for the Social Sciences (SPSS). Means, standard deviations, skewness, kurtosis, and reliability were derived for each subscale of the ATMI. A two-way ANOVA was used to determine between and within group differences related to race, gender and performance (i.e., excelling or struggling). An alpha level of .05 was used for all statistical tests.

As for variability, the standard deviation for each subscale indicated that the scores fell close to the mean. The score distribution for self-confidence (skew = 0.29) was positively skewed, while the value (skew = -0.99), enjoyment (skew = -0.38), and

motivation (skew = -0.37) subscales had negatively skewed score distributions. The negative kurtosis of the self-confidence (kurtosis = -0.14), enjoyment (kurtosis = -0.55), and motivation (kurtosis = -0.07), subscales indicated that there were fewer extreme scores than what is found in a normal distribution.

Table 6

Statistics of Attitudes Toward Mathematics Inventory: Present Study (n = 32)

Subscale	
Self-confidence	
Mean	3.50
SD	0.72
Skewness	0.29
Kurtosis	-0.14
Value	
Mean	3.80
SD	0.63
Skewness	-0.99
Kurtosis	1.80
Enjoyment of Mathematics	
Mean	3.39
SD	0.88
Skewness	-0.38
Kurtosis	-0.55

Table 6 (Continued)

Statistics of Attitudes Toward Mathematics Inventory: Present Study (n = 32)

Motivation	.
Mean	3.40
SD	0.76
Skewness	0.37
Kurtosis	-0.07

The reliability results for each subscale on the ATMI are presented in Table 7. Reliability coefficients (Cronbach's alpha) ranged from .75 to .92, with the self-concept scale being the highest and the motivation scale having the lowest reliability. These results were similar to the Cronbach alpha coefficients Tapia and Marsh (2004) reported for each subscale: self-confidence (.95), value (.89), enjoyment (.89), and motivation (.88).

Table 7

Cronbach Alpha: Attitudes Toward Mathematics Inventory

	Tapia and Marsh's Study[a] (*N*=545)	Present Study[b] (*N*=32)
Subscale		
Self-confidence	.95	.92
Value	.89	.84
Enjoyment of Mathematics	.89	.91
Motivation	.88	.75

Note. The values represent the reliability for each subscale.
[ab]There were 40 items on the inventory.

A two-way ANOVA was used to analyze the main effects and interaction effects of each subscale across race and performance. One statistically significant main effect was found between the performance groups (e.g., excelling and struggling) on the self-confidence construct. The effect size comparing the two groups on the self-confidence construct was large (d = 0.85). The self-confidence of the excelling group was higher. There were no other statistically significant main effects or interaction effects for the other variables on the ATMI constructs. Thus, performance differences on the value, enjoyment, and motivation constructs were not dependent on the race variable. In

addition, race differences on attitude constructs were not dependent on level of performance. Results from the two-way ANOVAs are presented in Table 8 and effect sizes for mean score main effects in Table 9.

Table 8

F-Ratios and p-levels from Two-way Analysis of Variance for Each Subscale (*n* = 32*) Present Study:*

Variable	Performance Level	Race	P x R
Self-confidence			
	6.08	0.76	1.18
	(*p* = .02)	(*p* = .39)	(*p* = .29)
Value			
	0.44	0.82	2.32
	(*p* = .51)	(*p* = .37)	(*p* = .14)
Enjoyment of Mathematics			
	1.94	0.12	0.06
	(*p* = .18)	(*p* = .73)	(*p* = .81)
Motivation			
	3.14	1.10	0.03
	(*p* = .09)	(*p* = .31)	(*p* = .87)

Table 9

Effect size of ATMI Subscale scores by Performance Level and Race

Variable	Performance	Race
Self-confidence	0.85	-.046
Value	0.65	-0.35
Enjoyment of Mathematics	0.58	-0.21
Motivation	0.77	-0.49

Data from Focus Groups and Interviews

Several themes were derived from the focus group data. The identified themes were: (1) that students expressed mixed attitudes with various factors identified as shaping their positive and negative mathematic attitudes; (2) the importance and utility of mathematics; (3) the influence of home/community- and school-based supports; and (4) the impact of mathematics classroom factors, including those that students believed contributed to success and those that students believed hindered their success. These themes encompass the experiences shared by the high school students. Thus, the following sections will highlight the students' voices and support for the aforementioned themes. When examining the data from the excelling groups, data from cumulative review and demographic questionnaires revealed that three of the African American

excelling groups had one student in each group enrolled in a remedial course or a course below the targeted mathematics course for his/her grade level.

Contributing Factors to Attitude Formation

The students expressed mixed attitudes toward mathematics. Their responses varied in identifying whether they had a positive or negative attitude. Factors that shaped their attitudes shifted or remained constant and included students' perception of their student-teacher relationships, students' judgment of teachers' instructional ability, teachers' temperament, students' mastery of mathematics concepts, and students' past performances in mathematics.

Positive attitudes toward mathematics. Students in the White excelling group reported having positive attitudes about mathematics. These students attributed their attitude to teachers' ability to instruct, to encouragement from teachers, and to the harmoniousness of student-teacher relationships. Of the four students in the White struggling group, one indicated having an overall positive attitude while the others indicated a more negative attitude. For example, the student in the White struggling group expressed a positive attitude towards mathematics that was rooted in one's confidence in his/her mathematic abilities.

> *WT (White struggling group): Yes, positive, but my teacher doesn't explain things well. [For example]…my teacher doesn't explain things well. He teaches a different method than the way I learned it in eighth grade. So I just do it my way.*

The African American excelling students, generally, expressed a positive attitude

in mathematics. Positivism was attributed to how well they performed in mathematics based on perceived innate abilities, the amount of effort he/she put forth, or comments teachers and parents made about their ability. Students reported feeling confident because of comments made by parents and/or teachers about their abilities. Students in the excelling group were also forthcoming about enjoying mathematics. Similar to some of the students in the White focus groups, some African American students' attitudes were influenced by self-confidence in their mathematical abilities. For example:

GZ (African American excelling group): I was always good at math. I like doing math. It was always easy for me.

DG (African American excelling group): It is easy. I like to argue about formulas.

Some of the African American excelling students indicated that their goals influenced their outlook on mathematics. Some students expressed a positive attitude in mathematics that was shaped by what they aspired to do in the future. The meaning of the future varied, in that it meant performance on the next test or in the next mathematics course. For others in this group, the future was adulthood and working. For example:

BJ (African American excelling group): Positive…I know I will have to use math when I am older. So why not learn it now because when I get older I don't want to mess up with my money.

Those students in the African American struggling group with positive attitudes spoke about becoming successful in life and/or were focused on overcoming obstacles to do better in mathematics such as difficulty paying attention. A focus on goals appeared

to be the root of their positive view towards mathematics, despite performing below their other peers. The following quote depicts this mindset:

> *McClo (African American struggling group): It [mathematics] was difficult, but as I got in eighth grade it got better. I like it. Since I want to be a hairdresser, then I have to do all of my work. I need to know how to count my money.*

Negative attitudes toward mathematics. The students shared that unexpected poor performance in a mathematics class, strained student-teacher relationships, perceived ineffectiveness of instruction, and difficulty of mathematics content contributed to negative attitudes. For students in the White struggling group, many indicated that their attitudes were shaped by their middle- and high-school experiences. A student from the struggling group, who had a negative attitude, attributed this mindset to being unsuccessful in a subject in which she was once successful.

> *LL (White struggling group): I have a negative attitude because I'm used to having an A and now I have a D. Math used to be so easy, but now the math teacher we have can't teach. So I don't understand it.*

A White student from the excelling group attributed his negative mindset to his attitude and the relationship he had with his teacher:

> *RXA (White excelling group): My experiences have been like a roller coaster because it is all about the relationship with the teacher and my attitude about the class…whether or not I want to be there or not.*

As for students in the African American excelling group who reported negative attitudes, they linked their attitudes to negative experiences due to ineffective teacher

instruction or disappointment regarding performance in a previous class. For example, a student from the excelling group reflected on a time when she had negative feelings about her mathematics class. She attributed her negativity to poor performance in a past class and being around others who were excelling in the particular class.

Unanimously, all of the students in one of the African American struggling groups reported negative attitudes in mathematics because of the complexity of the subject. Students from a different African American struggling group expressed negative attitudes towards mathematics that surfaced from experiences in their current mathematics class. The students believed their negative attitude was a result of their teacher's inability to teach. It was later found that the teacher was an international teacher with a strong accent, which made it difficult for the students to understand instruction. In the other African American struggling group, the majority of the students' frustration was due to their perception that mathematics went from a subject they could understand to a challenging subject. For example:

WC (African American struggling group): We really didn't do a lot of math in elementary school. We went from 1 + 1 to a + b. It went from fun to boring.

BN (African American struggling group): It went from easy to hard.

In sum, The African American and White excelling students expressed having positive attitudes; similarly, these students perceived themselves as "good" at mathematics. White excelling students focused more on how effective instruction shaped their positive attitudes. However, African American excelling and struggling students and White struggling students expressed that the cause of their negative attitudes,

whether pervasive or specific to a particular mathematics class, was the ineffectiveness of the teacher's instruction.

Importance and Utility of Mathematics

Another theme identified through the collection of focus group data was the importance and utility of mathematics. Students, across both racial and performance groups, spoke of the importance and utility of mathematics as it related to their present and future goals. In the White excelling group, students indicated that mathematics was important for bargain shopping, scheduling, saving money, and attaining a career. One student in this group viewed the amount of mathematics needed to be successful dependent upon one's career path. As for the White struggling group, they believed mathematics would be important for managing bills, furthering their education, and preparation for their careers. However, one student in the White struggling group viewed the use of mathematics limited to basic mathematic skills. For example:

> *MD (White excelling group): It is important to a point…after that it is more about specialization.*
>
> *RXA (White excelling group): I was thinking of an example of a sale two for five dollars. You have to know if you are saving money or not.*

Similar to the White students, African American students related the importance and utility of mathematics to everyday life and careers. Many of the students in the African American excelling group believed that they would need mathematics for taxes, cooking, careers, school, and to survive in the world. One student shared how a shoe store gave him a mathematics test before he was hired. A second student indicated

needing to use mathematics when older as a reason to learn as much as she could now. In the African American struggling group, students stated reasons mathematics was important, but one student questioned the utility of some of the skills they were taught in school. For example:

> *BJ (African American excelling group): Why not learn it now because when I get older I don't want to mess up my money. I want to learn all the math I can.*
>
> *KG (African American excelling group): Everything requires math. Even if I wanted to throw a ball to you along with science. It is good for accuracy.*
>
> *DG (African American excelling group): For your taxes and cooking to measure stuff.*
>
> *DN (African American struggling group): For me I want to be a physical therapist. You can't do physical therapy without having science under your belt. You can't really do chemistry or anything without math.*
>
> *CW (African American struggling group): You may need it for your job, other than that math is not that useful.*

Influence of Home/Community and School Factors

Focus group data also were used to understand how home/community and school factors influenced students' mathematics attitudes and performance in mathematics. Across race and performance level, students expressed supports related to the impact of school and home/community. The common themes in this area guide the discussion that follows.

Student identified school-based supports. The students from each group reported

tutoring services in mathematics being available at their schools. These services were available after school and struggling students as well as African American excelling students took advantage of these services. Many students indicated that transportation was a limitation to access after school services. For example, in response to questions that inquired about where students get help for mathematics, students said:

CC (White struggling group): I would see if I could get tutoring.

LL (White struggling group): Yes, you have to sign up and go everyday and some people can't stay every day.

WT (White struggling group): So people can't get a ride every day. Like me, I can't get a ride.

KK (African American excelling group): Ask my teacher and to the after school program.

NB (African American struggling group): I go to the park…or ELP (extended learn program) after school tutoring.

Students identified elementary and middle school teachers and principals as persons who provided support through encouragement and guidance. This sentiment was expressed across all groups. During their high school years, a few White struggling and African American excelling and struggling students had difficulty identifying teachers who provided an increased level or a commensurate level of support as elementary and middle school teachers. For example, in response to questions inquiring about the type of help students received from their teachers, students said:

WT (White struggling group): My eighth grade teacher was really nice. If you

don't get something, she would calmly explain it to you. We had it on the computers because we had to learn everything on the computers, but if you don't get it she would explain it. My teacher now, he is like come on you have to know this and you got it. But I don't get it.

S (African American struggling group): I hate to ask for help. In my class, he asks why are you not understanding or have you not been paying attention.

LA (African American excelling group): In middle school it [teacher support] was. I still see my basketball coaches.

White and African American excelling students were able to identify high school teachers who encouraged and supported their enthusiasm in mathematics. However, only White excelling students voiced teacher encouragement to participate in extracurricular or enrichment activities related to mathematics. This group was the only one to express that teachers informed them about ways to advance their mathematic skills. For example:

AR (White excelling group): With me, I had a teacher who encouraged me to join the math team.

GZ (African American excelling group): A lot of my teachers told me I was pretty good at math.

KK (African American excelling group): My teachers have influenced me and that makes it seem easy.

Student identified home/community support. Among all groups, the majority of students from each group identified one or more parents as contributing to their success. The type of parental support changed once students were enrolled in advanced classes or

classes beyond basic mathematics. For some students, the support consisted of assistance with assignments along with encouragement in their earlier years with mathematics. When students enrolled in advanced classes or classes beyond basic mathematics, students reported continued encouragement from parents with little assistance on difficult assignments. This was expressed by excelling African American and White students. For example:

> *MD (White excelling group): My parents are really not the best in math so they can't really help me and if I am doing bad they encourage me to do better.*
>
> *RA (White excelling group): Now, one of the problems in my home is that I am more advanced in math when before they [parents] could help me but not so much now.*
>
> *GD (African American excelling group): My parents try to help, but I pretty much know more than they do.*

Each African American and White student identified school and home supports that influenced their attitude toward mathematics and their mathematics performance. It was evident that each participant had one or two parents in the home to encourage their efforts in mathematics. There were two students among the African American and White groups that noted a non-relative as primary support outside of school. The most significant difference was the absence of teacher encouragement for African American excelling students to participate in extracurricular or enrichment activities related to mathematics.

Impact of Factors Relating to the Mathematics Classroom

A final theme identified through focus groups data was the impact of mathematics classroom factors on their success in mathematics. These results are discussed first in relation to those factors students identified as contributing to success. Lastly, those factors students identified as hindering their success are presented.

Factors contributing to success. All students reported that hands-on activities, the use of manipulatives and visuals, use of note-taking skills, use of group work, practice of giving step by step instruction, use of flashcards, and use of calculators contributed to success in the classroom. Specifically, White excelling students stated that hands-on activities allowed them to visualize a concept and that teachers' willingness to provide one-on-one assistance had a positive impact on their mathematics performance. These students viewed learning in groups as a common ground, meaning, they were learning the same information as the other students. They viewed groups as a way to master a skill (i.e., helping others in the group fostered the helper's mastery of the skill) or as a way to challenge each other's minds (i.e., working together and coming up with different ideas to solve a problem). White excelling students who participated in gifted classes during elementary and middle school expressed that having more than one teacher or a smaller class was helpful (i.e., low student to teacher ratio). In this setting, teachers were more available to assist if they had difficulties with a problem. These students indicated that, in this setting, teachers spent extra time with students, which allowed for more encouragement from teachers and students observed that teachers displayed interest in their successes. As for White struggling students, they preferred working in groups and

perceived it as a supplemental method when a teacher could not attend to all of their questions and needs. Consequently, the support from their peers who understood the skill or concept sufficed. For example:

Researcher: We talked a little bit about things or people who have helped you in math. Describe that a little more.

RXA (White excelling group): What has always helped me out is to be very hands on. In math it has always been about me be being able to see it and have it right in front of me.

RA (White excelling group): Teachers who provided more one-on-one help has helped me.

Researcher: How do you prefer to practice math skills such as group, independent, one on one?

CC (White struggling group): A group so that we can help each other.

LL (White struggling group): Yeah, someone might get it better than you.

Similar to the White excelling group, African American struggling and excelling students expressed what worked for them in mathematics. Students indicated that learning songs, classroom competitions, using flash cards, using manipulatives, and step-by-step instructions were key in helping them learn mathematics. One-on-one with the teacher and group work were also preferred methods. African American struggling students stressed the following as beneficial: the use of the board to explain and provide examples, the teachers' willingness to break down a concept, and the task of taking notes to use as references. For example:

Researcher: Did working in groups help you?

HN (African American excelling group): A lot because somebody might know what they are doing.

LA (African American excelling group): Yes and they [students in groups] can explain it better than the teacher.

Researcher: What about different things teachers did in the classroom? Were there things they did for you to have a positive attitude in math or influence your performance?

BJ (African American excelling group): Some taught you songs and stuff to help you.

Researcher: What helps you learn math better such as activities or strategies?

CW (African American struggling group): When it is step by step.

NB (African American struggling): On the board and explaining and examples.

Factors hindering success. Across race and performance level variables, students reported a teacher's negative demeanor or lack of willingness to provide supplemental instruction (e.g., breaking down instruction) as a hindrance to their success. In comparison to the White excelling group, the White struggling group's experiences with high school teachers who did not explain material or provide supplemental instruction overshadowed their overall mathematics experiences. This group consistently reiterated how they were struggling due to teachers not having the patience to explain in detail or re-teach a concept. These students readily identified hindrances to their mathematics success such as teachers' impatience and unwillingness to re-teach. For example:

WT (White struggling group): I might ask the teacher but he is so impatient with you.

TT (White struggling group): They [teachers] just tell you what to do and don't explain it.

RXA (White excelling group): They [teachers] would put the math up on the board and hope they [students] understand it.

Two of the students in the African American excelling group discussed the use of computers in eighth grade as a hindrance. One out of six of these students viewed the use of computers as a great learning tool. The student's comment illustrated his positive view of the use of computers for mathematics:

HN (African American excelling group): You get to move at your own pace. It teaches you first and makes you take notes, then you take quizzes, and at the end you take a test (talking about his experience with 8th grade math on computers).

Many disliked the use of computers because it limited access to the teacher. This was true for excelling students as well as struggling students. For example:

JL (African American excelling group): It is better with a teacher (talking about his experience with eighth grade math on computers).

NB (African American struggling group): Yeah, when you are on the computers, math is kind of hard instead of being taught.

African American students in both groups also reported that a hindrance outside of the classroom was their school's focus on what they did wrong such as arriving late to school and wearing clothing viewed by the school staff as inappropriate for school. For

example:

Researcher: What are things that might hold you back from being successful in your community or school?

LA (African American excelling group): Teachers at school. They suspend us for tardies or wearing the wrong clothes to school. They want us to come to school, but suspend you for tardiness or wearing the wrong clothes.

HN (African American excelling group): Yeah, or they suspend us for talking in class, not having your id, or absences.

LJ (African American excelling group): They are always talking about the bad stuff.

Across racial and performance groups, students voiced that asking for help was a hindrance. Those students were apprehensive because of teachers' response to questions or peers' response. Students reported that these issues limited their ability to take the initiative to ask for problems to be clarified. In these cases, students either relied on peers for assistance or dealt with the consequences of not asking for help. For example:

LK (African American excelling group): …because you think you might sound retarded…you don't want to hear other people's [students'] mouths.

KW (White excelling group): Students would be afraid to ask questions if they didn't understand…I haven't been able to ask a teacher if I don't understand it.

CC (White struggling group): If you don't get it, they [teachers] get fed up.

Another hindrance was parents' level of support. A few students reported that their parents expressed a dislike for mathematics or a limited understanding of

mathematics. For those students, their parents' dislike or limited understanding reduced the level or amount of support with mathematics assignments. For example:

Researcher: What kind of help have you received from your parents to help you learn math?

S (African American struggling group): Well, my mom never liked math…No, so I don't get much help.

WT (White struggling group): My dad dropped out in 11th grade. So he doesn't know.

LA (African American excelling group): They'll [parents] say we didn't do this.

Data from Interviews

The interviewees were two White students identified as excelling in mathematics from School C. The 9th grade students included one male and one female student. These students shared similar experiences to the students in the White excelling group from School B. The students expressed a positive attitude towards mathematics. When talking about her positive attitude, the female student stated, " I like math, it's fun, and I do well." The male student was unable to give any specifics about his positive attitude other than, "I just like math".

When examining student statements regarding importance and utility of mathematics, the female student indicated that mathematics is important to get what you want in life. For this student, she indicated that she believes mathematics will help her get into college and become a veterinarian. As for the male student, he expressed that mathematics is needed to understand taxes and to get into college.

Home/community factors. The female student indicated that her mother being a teacher "pushed her to do good in math" as well as people who dropped out of school as support and contributing factors to her success in mathematics. The male student indicated that his mother's support influenced his mathematic experiences. He shared that his mother would scaffold support by making him figure out how to do problems and not tell him the answers. He describes this as his mother "making it look like she was helping me." He indicated the questioning techniques his mother used helped him remember how to solve mathematic problems.

School and mathematics classroom factors. The students shared that pictures or fun posters that help them understand concepts, strategies that help them remember steps, and group work were helpful in learning mathematics concepts. As for groups, the male student expressed that groups were helpful to learn other ways of doing math problems. The female student shared that groups were helpful because her peers could help her through a problem. The female student also stated, "good teachers help you want to do mathematics." She later added, "I had really good teachers in 8th grade. We always worked in groups with mixed abilities." Neither of the students interviewed expressed hindrances to their mathematics success.

Summary of Results

The ATMI data and qualitative data were analyzed to learn about students' attitudes toward mathematics and what factors were perceived to contribute to their success or lack of success in mathematics. The identified themes derived from the qualitative data were: (1) that students expressed mixed attitudes with various factors

identified as shaping positive and negative mathematic attitudes; (2) the importance and utility of mathematics; (3) the influence of home/community- and school-based supports; and (4) the impact of mathematics classroom factors, including those that students believed contributed to success and those that students believed hindered their success. The students' voices provided examples of how they perceived their mathematical experiences.

In addressing research question one, these data indicated that African American and White excelling students agreed with statements on the ATMI that supported having self-confidence in mathematical abilities, valuing mathematics, enjoying mathematics, and being motivated to take more mathematic courses. However, except for students in the White struggling group reporting a similar level of moderate agreement in valuing mathematics, African American and White struggling students ratings were more neutral in response to statements on the ATMI that suggested self-confidence in one's mathematics abilities, enjoyment of mathematics, and motivation to participate in mathematic courses beyond those required.

The students' responses on the ATMI were supported by comments regarding their attitude about their experiences. For the majority of African American and White excelling students in focus groups and interviews, they reported a positive attitude about mathematics. As for the African American and White struggling students, the responses were mixed with some students having a positive attitude while others had a negative attitude. In examining students' responses, their attitudes and experiences were impacted by relationships with teachers, teachers' attitude, and students' confidence in their

mathematical abilities. It is important to note that three of the African American excelling groups had one student in each group enrolled in a remedial course or a course below the targeted mathematics course for his/her grade level. Thus, this finding may have impacted overall mean scores on the ATMI for each group. However, it is uncertain because the students were identified as excelling and may have had positive mathematics experiences based on current performance at the time of the study.

As for the importance of mathematics, students across groups reported that mathematics was important for their present and future endeavors such as for the advancement to other mathematics courses, careers, and daily living. Although the ratings of students in the African American struggling group on the ATMI's value construct were neutral, collectively students identified a need for mathematics. However, few students across groups questioned the utility of mathematics beyond basic skills.

In addressing research question two and three, the data from the other themes such as influence of home /community and school factors and factors that supported or hindered students' success were instrumental in uncovering what students perceived as vital in learning mathematics. The perceived level of teacher support was a catalyst to students' positive or negative experiences. Students in the struggling group indicated that the level of teacher support decreased over the years, while excelling students reported a constant presence of teacher support. However, in comparison to their White excelling peers, the absence of encouragement to take advanced courses appeared to be a reality for African American excelling students. Across groups, students indicated the availability of supports in the school and community such as tutoring. The level of parental support

decreased as students advanced through the mathematics curriculum. However, many students expressed support in the form of encouragement when the mathematics content was beyond parents' level understanding. As for interview participants, they expressed continued assistance and support in the home for mathematics achievement.

It was evident that supplemental instruction was a common component focus group students identified as missing to support learning and applying mathematical concepts. Student responses indicated that instruction that provided hands-on opportunities or provided steps would increase the likelihood of their success in mastering mathematic skills. Interviewees indicated that visuals in the form of classroom posters, memory strategies, and group work foster mathematics success.

The data represented in this section depict students' experiences as expressed during focus groups, interviews, and reported on the ATMI. The aggregated data provided the basis for examining experiences across race and performance levels to highlight similarities and difference among and between groups.

Chapter V

Discussion

In this study, the differences and similarities amongst groups were explored in an effort to understand the mathematics achievement gap. Specifically, the experiences of African American and White high school students were examined to learn about factors that shaped their attitudes towards mathematics and their perceptions about their experiences related to mathematics. It is important to note that the differences among or between the groups were not statistically significant. However, the qualitative data provided insight into what students perceived as supports and hindrances to their mathematics achievement.

Attitude Towards Mathematics

Although the difference between White and African American excelling students was not statistically significant, the moderate effect size of -0.69 indicated that White excelling students had slightly more self-confidence in their mathematics abilities and performance than African Americans students. The ratings of African American excelling students suggested a level of confidence; however, their mean score was about 0.58 points lower than the White excelling students. The students in both groups indicated having positive mathematics experiences. Focus group data indicated that the White excelling group attributed their experiences to "good teachers," whereas, the African-American excelling students, attributed feelings of confidence to teachers and parents. The White excelling group discussed repeated experiences related to teachers

encouraging them to take more advanced classes as well as to participate in mathematics clubs and organizations. These students attributed these experiences to their level of confidence, which was related to their ability and performance. The White excelling interviewees attributed their attitude to mathematics to fun or "just liking math. " In this study, African-American excelling students shared the common experience of being encouraged by teachers. Teacher encouragement is a factor reported in the research in which many successful African American mathematic students attributed to their success (Moody, 2004; Sheppard, 2006).

Of the African-American excelling students, one student mentioned being pushed by middle-school teachers to take advanced classes. However, the other students in this group did not speak of teachers pushing them to join mathematics clubs or organizations. Although it is unknown why these students believed they were not encouraged to take advanced classes, previous research has attributed teachers' neglect in encouraging African American students to take more advanced classes or engage in other mathematics learning opportunities to teachers' low expectations of African American students (Anderson 1990; Flores, 2007). Having opportunities to take advanced mathematics classes and exposure to challenging mathematics experiences contribute to students' success in mathematics (Byrnes, 2003; Flores, 2007). Regardless of the explanation for why students did not pursue advanced classes, finding a means to encourage those pursuits is important because doing so will help to create equity in schools. Such equity will help children receive the level of support necessary to not only be "A" students, but also to be competitive and well prepared for whatever endeavors they choose to pursue

for educational and economic gain (Ladson-Billings, 1997).

The African American and White struggling groups rated their level of self-confidence as slightly greater than neutral. This finding suggests that these students were less certain than excelling students about their math abilities and performance. In addition, both groups, overall, provided mixed responses to questions regarding their math attitude and math experiences. Approximately six students from the White and African American groups were definite in stating that they had a positive or negative attitude. However, they were the few who also had both negative and positive experiences in math. During the focus group discussion specifically related to their negative or positive attitudes, the White struggling students discussed how teachers influenced their attitudes, in addition to how the complexity of content and their past successes shaped their attitudes. However, the African American students focused more on the complexity of the content. For example, in response to the probe prompting students to tell about their mathematic experiences from elementary, middle, and high school, one student from the struggling group stated: "we went from 1 + 1 to a + b." In addition, African American students also focused on personal attributes or goals that influenced their attitude. This sentiment was expressed by one student who stated, "when I started to get into higher grades…it became difficult and harder for me to pay attention." The struggling students' perception about teachers and personal attributes as hindrances are discussed in more detail later.

On the other ATMI constructs, African American and White excelling students' ratings continued to be more similar than different for value, enjoyment of mathematics,

and motivation. Although differences were not statistically significant, African American excelling students' ratings were slightly higher than White excelling students for value of mathematics (see Table 9). As for the African American and White struggling group, they also tended to be more similar than different. The struggling students' rating on the value construct was similar to what was shared during the focus group. All groups expressed valuing and knowing the utility of mathematics. Across all performance groups, the value and utility of mathematics appeared to be influenced by career goals. The students viewed its value and utility as it related to attaining their dream of going to college and career goals.

When examining the information gathered across performance groups (excelling and struggling) and constructs, the differences suggested both African American and White excelling students were more certain about their attitudes related to mathematics than the struggling students. This finding was unexpected due to the assertive attitude most of the African American and White struggling students exhibited during the focus group. If it were not for the teachers grouping the students into the performance groups, one would not be able to detect this indecisiveness in conversation. The ratings of the African American and White struggling students were generally in the neutral to agree range with respect to the enjoyment of mathematics and motivation constructs, whereas, African American and White excelling students' rating ranged from moderately agree to agree on the enjoyment and motivation constructs. The assertive behavior of African American and White struggling students could be explained by the theory of social desirability and the knowledge of anonymity. Social desirability theory suggests that a

participant may respond in a manner favorable to peers in a group or to a researcher (Trichom, 2006). Likewise, the knowledge of anonymity allowed for a student to speak freely and respond to the questionnaire without concerns regarding teacher, parent, or peer verification of what he/she shared during the study.

Supports and Hindrances Influencing Mathematics Performance

Research on the African American-White mathematics achievement gap indicates that factors resulting in the gap are related to the value placed on mathematics, unequal access, racism, teacher competency in math and culture, limited exposure, low expectations, pedagogy, motivation, and other factors (Anderson, 1990; Byrnes, 2003; Flores, 2007; Lubienski, 2002; Stiff & Harvey, 1998). In this study, the African American and White struggling students expressed a valuing of mathematics and a desire to be professionals in society such as teachers or doctors. However, these students performed below grade level expectations in mathematics. In spite of their expressed desire to become successful professionals, both racial groups communicated shared experiences in regards to teachers' low expectations, and their perspective that teachers' lack competency in teaching mathematics.

Teachers' receptiveness to students in need of help was considered a hindrance and students were less likely to ask for help. One White student shared, "if you don't get it, they [teachers] get fed up." Likewise, one African American student stated "he [teacher] asks why are you not understanding or have you not been paying attention." The struggling students overwhelmingly voiced that when they did not understand, the teacher either got upset, refused to explain further, or suggested that it was something

wrong within them as to why they did not understand (i.e., paying attention).

A difference amongst the groups was whether or not they received encouragement and/or assistance. Many of the White struggling students indicated having family members in the home such as brothers, mothers, and fathers to assist with math. Although the African American students had encouragement from family members, the assistance with math was limited to those who had someone in the home who enjoyed the subject. Secondly, another difference was that African American struggling students were able to go beyond teacher temperament and working in groups when asked about classroom strategies that assisted or hindered them in math. The students named several classroom activities or instructional methods that helped them in elementary school that could have been beneficial in middle school and in high school such as step-by-step instruction, the use of the board to explain and provide examples, the use of flashcards, the use of calculators, the use of strategies that helped them check work, and notes-taken next to sample problems as a reference.

Based on the students' accounts of their experiences, it appears that the students' communication and learning styles and their need for more supplemental instruction either limited or enhanced their experiences. In Stiff and Harvey's (1988) discussion on identity in the classroom, they concluded that African American students find themselves weighing the need to cooperate in the manner teachers expect or expressing themselves. They found "that directness, elaborate syntactical demonstrations, conciseness, and competition are the valued attributes of a successful mathematics student" (Stiff & Harvey, 1988, p.198).

If students felt empowered, talking with their teachers about their needs would be of benefit to teachers and the students. Even when the White struggling students were asked about sharing their needs with teachers, they did not find talking with their teachers as a viable solution given their experiences in past attempts to talk to their teachers. In addition, allowing students to express what they believe helps them will provide teachers insight into what approaches or supports might work best for the students. In essence, this effort could lead to instructional scaffolding, which could assist with students' acquisition of knowledge and application of math skills (Ladson-Billings, 1997).

African American and White excelling students voiced that working in groups was helpful to them in learning math. They both viewed group work as a way to learn from others. All the students in the White excelling group and one student from the African American excelling group saw group work as way to challenge their minds (i.e., coming up with different solutions to a problem). Students from the African American excelling groups shared that they enjoyed the tasks of determining alternative ways to solve math problems and this was one reason why they liked math.

As for factors that impeded success, the White excelling group considered teaching style as a hindrance to mathematic success. For example, a student explained that teachers must give adequate time to those who do not understand instead of focusing on students who do understand. In addition, they expressed the same concern with the amount of explanation given to content as the African American struggling groups. They preferred for teachers to provide detail with respect to whatever is written on the board without assuming ease of understanding.

Both excelling groups expressed anxiety related to asking questions. Each group expressed a different catalyst that resulted in anxiety. For instance, a student from the White excelling group had a negative experience with a teacher who yelled and that resulted in his reluctance to ask questions. In the African American excelling group, a student spoke about his apprehension due to concerns about what his peers might think. For example, this student said "…you might sound retarded…you don't want to hear other people's [students'] mouths".

Conclusion

This study was designed to examine the common and different mathematics experiences of African American and White students. The motivation behind this study was to understand the White and African American mathematics achievement gap. Previous studies have provided evidence regarding factors that contribute to the gap. Byrnes (2003) found that 45%-50% of the difference in White and African American students' performance in math is due to parent education, number of parents in the home, exposure to learning opportunities, and motivational aspects of math and 4.5% is explained by ethnicity when added with the other variables. Other researchers have investigated the impact of factors related to curriculum and instruction, teacher experience, parent support, self-concept, learning style and socio-cultural factors (Butty, 2001; Ladson-Billings, 1997; Moody, 2004; Rech & Stevens, 1996; Sleeter, 1997; Stiff & Harvey, 1988). In this study, students themselves had the opportunity to voice what worked for them in the mathematics classroom and express their perceptions and attitudes about mathematics.

When examining the results and conclusion drawn from the data, the participating schools in this study were similar in demographics. Thus, the results cannot be generalized to schools with differing demographic characteristics because the composition of participating students was not a proportionate representation of the population. It is likely that schools with different demographic characteristics would result in a more or less representative sample of students by race and/or performance level.

In addition, school differences such as willing participation of school staff may have impacted results. Of the three participating schools, two of the administrators "demonstrated" a willingness to participate by expressing their approval of assisting in the study to mathematics department heads. Thus, the department heads were accessible. However, this did not lead to increased teacher access. As a result, the limited access to teachers resulted in less student participation than was desired.

The varying schools' climates were another difference that was noted among each school. In the participating schools, one walked away with the belief that the participating teachers had either (a) given up on trying to reach all students or (b) that teachers were still fighting to reach each student. This was evident by negative comments made by department heads or teachers. For example, across the schools, there were a few teachers who expressed negative statements about their students. These negative attitudes could have impacted teachers' efforts in nominating students and maintaining necessary paperwork for students to participate in the study (e.g., collecting consent forms). In fact, there were students at one of the participating schools that

consistently reported turning in forms to teachers. However, teachers were unable to locate forms after students' first or second submission of consent forms.

A few differences were found across the racial groups when examining focus group data. Unlike White excelling students, African-American excelling students reported a lack of encouragement from teachers to go beyond mathematics in the classroom. African American struggling students expressed a need for more explicit and supplemental instruction. These students expressed the need and identified instructional methods they believed would be helpful. Interestingly, students in the White excelling group expressed a similar need in that they preferred hands-on activities and explicit instruction.

In this study, more similarities than differences were found in what the students' expressed across groups. All groups spoke to the need for teachers to be more patient, willing to provide support, and for teachers to not assume that something within them (students) is the reason why they have not grasped a concept (i.e., lack of attention during instruction). Whether or not parents liked math or completed their education impacted students across both racial groups. Parents who did not complete their education or had limited math skills were not available to help their children. However, students reported that such parents were encouraging, except for a student whose mother did not like mathematics.

Given the similarities, an overall conclusion is that the students expressed what supplemental learning strategies teachers used and how student-teacher relationships fostered an enjoyment and a desire to do math. However, the question of why is it that

this group of African American students' mathematics performance lags behind the performance of their White peers remains. This study's results and the reality of the achievement gap indicate a need to better equip teachers to be sensitive to the identified needs of these students. In particular, providing secondary mathematics teachers training that results in greater compassion and patience being evident in their teaching may be helpful. In the age of accountability and school sanctions, we must assess what teachers need to be effective mathematics teachers. First, teachers must be competent in their own mathematics skills in order to teach others. Overwhelming, African American and White students who struggled expressed the need for teachers to "break down information." Interestingly, those students who were excelling also expressed the same need. In addition, teachers must be cognizant and purposeful of what they do and say. The majority of students, whether identified as excelling or struggling, expressed a difference between the treatment by and patience of elementary teachers and secondary teachers.

Limitations

As with any research study, limitations that may have impacted the results should be considered. In this study, one limitation was the small pool of students from whom to select participants. This limitation was in part due to school principals' and teachers' reluctance to participate due to time constraints and pressures resulting from federal mandates. In addition, poor return and turn-around of parent consent forms impacted which students ultimately participated in the study. However, the overall availability of students during school hours was also a major related limitation. Students were in school for approximately seven hours a day. Within those seven hours, students were expected

to be present for classroom lessons, discussions, practice activities, assessments, and other learning opportunities. Thus, students were available for only a limited time to participate in this study. These factors affected sample size and generalizability of data (i.e., survey, interview, and focus groups).

Another limitation was accessibility of White students. A pool of White students from whom to select as participants was limited due to the decision to recruit students from Algebra I. After the study was broadened to include students from all mathematics courses, there continued to be a limited number of White students from whom to select. In turn, their voices were not equally represented in comparison to African American students. This limitation impacted the researcher's ability to compare African American and White students' experiences.

The limitations that resulted in a low number of participants and limited accessibility of White students were limitations that impacted external validity, more so the transferability of the findings across schools and mathematic classrooms and conclusion validity. Thus, the sample size limited statistical power and the researcher's ability to make definitive and reasonable conclusions about relationships found in the data (conclusion validity) as well as generalizability.

The participants' pre-high school experience was also a limitation for transferability because students were not grouped or identified by the elementary or middle school attended prior to high school. Thus, in understanding their mathematical experience, their diverse pre-high school experiences shaped their attitude and perspectives and limited the researcher's ability to generalize the students' experiences.

However, the intent of gathering data on students' perspectives was achieved.

As for internal validity or the credibility of data, the focus group approach limited anonymity within the group. The students within a particular group were pooled from the same mathematics classroom. So, to some degree, many of the students knew each other outside of the research study. Consequently, participants may have been less apt to disclose experiences that influenced their mathematics behavior or achievement due to concerns related to social pressures as an outcome of participation. This phenomenon is referred to as evaluation apprehension (Trichom, 2006). For example, a concern for a student may have been what his/her fellow group participant would share with others outside of the study or a concern with trying to "look good" for fellow participants or the researcher. Thus, internal validity may have been impacted.

The organization of focus group by race and performance level could also be a possible limitation in the study. Students in this study were grouped by race and performance to provide an environment for students to share with peers who might have similar racial and achievement experiences. However, this grouping could have limited students' recall of experiences or expression of various perspectives, thus, also impacting validity.

Random or extraneous variances in the setting are also threats to conclusion validity. Random or extraneous variance in the study's setting included disturbances related to traffic outside of the classroom and other disturbances near the setting that may have impacted researchers or participants (Shadish, Cook, & Campbell, 2002; Trichom, 2009). The research for this study was collected in the school's media center or cafeteria.

Therefore, the disturbances consisted of student and adult traffic. Although the study was conducted away from most of the traffic flow (i.e., corner in media center or cafeteria), the impact of the movement and noise could have affected students' attentiveness or willingness to respond candidly.

Despite these limitations, insight into students' experiences was provided by the study. The results provided information relevant to understanding how students perceived their mathematical environment. In addition, the limitations presented will inform researchers of school realities such as the knowledge that, depending on the school or district, many White students have taken algebra I in middle school.

Directions for Future Research

In essence, this research allowed students to voice their perspectives on factors that shaped their attitudes in mathematics and instructional practices that aided in contributing or hindering their success. From this study, we learned that students' attitudes seem to be shaped by their relationships with teachers and the level of support they receive at home and in school. In this study, students discussed the need for learning activities and instructional practices that allow for hands-on experiences, use of cooperative groups for support from peers, and the use of supplemental instruction that included more explicit teaching of concepts (i.e., breaking down steps or concepts). Some students also shared that positive teacher-student interactions played a role in their mathematics success.

Future research should answer the question: What is the impact of teachers' attitudes and instructional practices on students' mathematic performance? In Maslow's

hierarchy of needs, after an individual's physiological and safety needs are met, a sense of belonging and love is recommended to help the individual reach a healthy level of self-esteem and productivity (Ormrod, 2000). This basis must be embraced in all classrooms, elementary and secondary. In this study, a commonality across race and struggling students was the negative classroom experiences related to how students perceived teachers' attitude and willingness to expand on lessons to foster their understanding of mathematical concepts. Therefore, in observing the mathematics classroom setting, particularly, interactions between teacher and students, instructional practices, students' outcomes related to the instructional practices, and teacher and student attitudes, future investigations should examine how successful secondary mathematics teachers support struggling and excelling students. Observations within the classroom along with focus group or interview data would enhance the researcher's ability to make accurate connections across data. Thus, a more ethnographic or field research qualitative approach might be taken. This approach would allow for the researcher to use participant observation and/or direct observation data to understand what occurs in secondary mathematics settings, to observe the participants' interactions, to gain knowledge on various ways instruction is provided, and to connect practices and other teacher and student behaviors with students' outcomes.

Students across race and performance groups reported that the level of support in learning mathematics changed from elementary school to secondary school. In fact, many students reported that the level of support decreased over time. Based on students' report, this perceived decrease in support impacted how well they were able to master

mathematical concepts. Thus, future research is needed to examine available and practical resources to assist secondary mathematics teachers in designing mathematics interventions and progress monitoring tools to support the needs of students.

In reflecting on this study's outcomes and limitations, there are a number of steps that could be taken to reduce limitations, increase conclusion validity, and to support generalizability. As mentioned above, the researcher's familiarity with the setting through direct and/or participant observation would be necessary in this effort. In addition, methods to increase student participation also would increase statistical power and increase generalizability.

In this study, high school students appeared comfortable in sharing their experiences. However, to decrease evaluation apprehension, social desirability pressures, and other factors that impact students' response and credibility of the data, the use of groups comprised of students with similar profiles (e.g., race and performance level) and from different schools would be another tactic. In addition, to reduce the impact of extraneous variance in the experimental setting a well-thought out location within a school or neutral setting also would be helpful. Another would be to take into account prior schools attended and make groupings by elementary and middle schools the high school students attended, in addition to their race and performance level. This approach would allow for generalizations connected to specific educational settings. Lastly, defining excelling students with an exclusionary factor would ensure a more accurate representation of excelling students' experiences. The exclusionary factor would be that students identified as excelling must be enrolled in advanced or targeted mathematics

courses for their specific grade level.

In addition, an organization method altogether different from the aforementioned groupings would be to group students based on performance level alone. After allowing students to share experiences and recall experiences from others shared experiences, students would later be grouped by performance and race. This group organization may allow for more in-depth discussions related to supports and hindrances in the home or school environment.

Working with high school students was necessary to get a historical perspective of students' mathematical experiences. Collecting these historical perspectives through the use of a longitudinal study may have provided more comprehensive accounts of students' experiences. Overall, it was rewarding to work with high school students as they were able to share their perspectives and how they were able to connect mathematics with their future goals in life.

It is my hope that this research illustrates how valuable students' voices are in studying what students believe works in mathematic classrooms to promote student achievement. Students are vital in the process of change, not only as the unit of change or study, but as the link to discovering what needs to be changed and as the source in which to measure change in education. In combination with other empirical research findings, we can learn from students' experiences how to provide what it is needed for their success.

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Appendices

Appendix A
Focus Groups' and Interviewees' Student Demographics and Activities

Focus Groups' Student Demographics and Activities

Group 1: White Struggling (*n*=4)
School A

Student	Gender	Age	Grade	Number of math courses	Course enrolled during study	School clubs	Favorite subjects
WT	Female	14	9	1	Algebra I	Gear Up	None
TT	Female	--	--	--	Algebra I	--	--
LL	Female	16	9	1	Algebra I	JROTC, Drill team, Raider Team	English, "It used to be math"
CC	Female	15	9	1	Algebra I	Cosmetology	Science

Note. JROTC = Junior Reserve Office Training Corps

Group 2: White Excelling (n=4) School B							
Student	Gender	Age	Grade	Number of math courses	Course enrolled during study	School clubs	Favorite subjects
RA	Male	17	11	5	Advanced Placement Calculus AB	FBLA, NTHS, Web design team, Robotics team	Web design
DM	Male	15	10	2	Algebra II Honors	Japanese club	Japanese
RXA	Male	16	11	3	Advanced Placement Statistics	Baseball	Math
WK	Male	16	10	4	Algebra II Honors	Air Force JROTC, AIAA	Aerospace

Note. JROTC = Junior Reserve Office Training Corps, FBLA = Future Business Leaders of America; NTHS = National Technical Honor Society; AIAA = American Institute of Aeronautics and Astronaut; NTHS = National Technical Honor Society

Group 3: African American Excelling (*n*=2) School A							
Student	Gender	Age	Grade	Number of math courses	Course enrolled during study	School clubs	Favorite subjects
BJ	Female	14	9	2	Algebra I	None	Language Arts
GZ	Male	15	10	2	Algebra I	Football team	Math

Group 4: African American Excelling (n=5) School B							
Student	Gender	Age	Grade	Number of math courses	Course enrolled during study	School clubs	Favorite subjects
LR	Male	17	11	4	Algebra I	None	Physical education and computers
LA	Female	14	9	1	Algebra I	JV basketball, Varsity track, JV volleyball	American government
JL	Male	14	9	1	Algebra I	None	Math and English
HN	Male	15	9	1	Algebra I	Basketball	Math
JR	Female	14	9	2	Algebra I	--	Math

Note. JV = Junior Varsity

Group 5: African American Excelling (*n*=4)
School B

Student	Gender	Age	Grade	Number of math courses	Course enrolled during study	School clubs	Favorite subjects
GD	Male	19	12	4	Trigonometry	Ladies and Gents	Math
BK	Female	17	12	5	Trigonometry	Dance team, drama, FBLA, Student government, JR Civitans	English
WS	Female	17	12	5	Advanced Placement Statistics	SWAT, DECA, NHS, Auxiliary	Math
BI	Female	16	9	2	Intensive Math	NHS	Math

Note. FBLA = Future Business Leaders of America; SWAT = Students Working Against Tobacco; NHS = National Honor Society; DECA = Distributive Education Clubs of America

Group 6: African American Struggling (*n*=5)
School A

Student	Gender	Age	Grade	Number of math courses	Course enrolled during study	School clubs	Favorite subjects
BN	Female	15	9	2	Algebra I	Flag football, volleyball, karate	Medical skills
BS	Female	15	9	1	Algebra I	None	Reading
AC	Male	15	9	1	Algebra I	None	Reading
ED	Male	--	10	2	Algebra I	None	English
CS	Male	17	9	1	Algebra I	Computer Tech	English

Group 7: African American Struggling (*n*=4) School B							
Student	Gender	Age	Grade	Number of math courses	Course enrolled during study	School clubs	Favorite subjects
WX	Male	15	9	2	Intensive Math	None	Science
QE	Female	15	9	2	Intensive Math	None	English and math
WC	Female	15	9	2	Intensive Math	None	American government
BN	Female	15	9	2	Intensive Math	Gear Up	English

Group 8: African American Struggling (*n*=2) School B							
Student	Gender	Age	Grade	Number of math courses	Course enrolled during study	School clubs	Favorite subjects
McCla	Male	17	10	3	Algebra II Honors	Band	English and math
McClo	Female	16	10	2	Geometry	Softball	Science

Interviewees' Student Demographics and Activities

Interviewees: White Excelling (*n*=2) School C							
Student	Gender	Age	Grade	Number of math courses	Course enrolled during study	School clubs	Favorite subjects
HT	Female	15	9	2	Algebra I Honors	HOSA, ASL, Veterinarian	Math and ASL
MJ	Male	13	9	1	Algebra I Honors	Skills USA and baseball	Math

Note. HOSA = Health Occupation Student of America; ASL = American Sign Language; Skills USA = Industrial Student Organization

Appendix B

Demographic Questionnaire

ID#:_____ Age:_____
Grade:_____ # of Parents in home_____

List your hobbies:
_____
_____

List school clubs/activities:
_____
_____

How do you spend your free time (after school, weekends, etc):
_____
_____

When do you study (e.g., after school, weekends, never):
_____
_____

Describe a typical school week (include at school and after school experience):
_____
_____
_____

What is your favorite school subject:
_____
_____

How many close friends do you have?
_____

What kind of grades do you earn in mathematics: Circle the best answer
Mostly As Mostly Bs Mostly Cs Mostly Ds Mostly Fs

What kind of grades do you earn in English: Circle the best answer
Mostly As Mostly Bs Mostly Cs Mostly Ds Mostly Fs

What kind of grades do you earn in Science: Circle the best answer
Mostly As Mostly Bs Mostly Cs Mostly Ds Mostly Fs

What kind of grades do you earn in your elective courses: Circle the best answer
Mostly As Mostly Bs Mostly Cs Mostly Ds Mostly Fs

What kind of grades does your closest friend make in most subjects:
Mostly As Mostly Bs Mostly Cs Mostly Ds Mostly Fs

Appendix C

Focus Group and Interview Questions

Factors: family/community factors, school factors, self factors, early math experiences, teaching practices, tracking and ability grouping, courses taken, motivation, value, and utility.

Question #1: What kind of help did you receive from your parents in math?

Probing questions:
How would you describe the help parents gave you when you had a difficult time understanding how to solve a math problem? Was the help useful in helping you grasps the skill, did your parents seem impatient or usually willing to provide extra help?
Do you believe other Black youth have a chance to achieve the American dream if they do well in school?
Are there Black (White) people in your community or family who seem to have a hard time making it (being successful) in society?

Question #2: How would you describe the help teachers gave you when you had a difficult time understanding how to solve a math problem?
Was the help useful in helping you to grasp the skill, did teachers seem impatient or usually willing to provide extra help?

Probing questions:
Describe your elementary school (i.e., were minority teachers and administrators present, were most of your classmates White or Black).
In what subjects were you successful?
In what activities were you successful (school, home, community)?
In what subjects were challenging?
In elementary (middle, high) school, what kind of help did you receive from your teachers in math (e.g., assistance during independent seatwork, after school help)?
School: In elementary school, were you grouped for math instruction or work?
What kind of work did your group complete in comparison to other groups in class (i.e., advance work or work same as other students, etc).
How did you feel about being grouped in math?
In elementary (middle, high), do you believe you were in the right math groups or classes? If so, why? If not, why?
Do you believe what is taught in school is helpful to becoming a successful AA (White) adult?

Do you believe you were in the right math groups or classes in elementary, middle, high school? If so, why? If not, why?

Question #3: Who helped you select your math courses in middle (high) school?
Probing questions:
Were you advised as to what courses to take based on your future goals, grades, test scores, or enjoyment of math?
How many math courses have you taken?
How many math courses do you plan to complete by graduation?

Question #4: What are the benefits of getting superior grades in math?

Probing questions:
What does success mean to you?
If so, what will make you successful?
Do your grades show how you feel about school?
Do your test scores show how you feel about school?
What are your plans when you graduate from high school?
If you plan to attend college, what will be your major?
What does the term American dream mean?
What does it take to achieve the American dream?
If you do well in school, do you believe you have a chance to achieve the American dream?
If not, what will prevent you from achieving the American dream?

Question #5: How do you prefer to practice a new math skill (e.g., through group work, independent seatwork, discussion, pairs, etc.)?

Probing questions:
To whom do you turn when you need advice?
To whom do you turn when you need help understanding school work?
Did you fear asking for help in math?
Do you enjoy doing math problems?
Do you get nervous before going to math class or before math tests?

Question #6: Were you encouraged by anyone to do well in math?

Probing questions:
What or who influenced your decision to take X# of math courses?
Did a teacher, parent, friend, or someone influence your like or dislike for math? If so, in what ways?

Question #7: Do you believe math is important?

Probing questions
Why is math important?

Question #8: In what ways can you use math outside of school?

Probing questions:
How often does an individual use math?
What other areas will learning math help you

About the Author

Sharondrea Rotreece King received a Bachelor's Degree in Elementary Education in 2000. While completing her undergraduate degree, she earned scholarships and other awards such as the University of South Florida Honor Recipient, Multicultural Scholars Award, Black Scholars Award, and the Florida Fund for Minority Teachers Scholarship. During her junior year of undergraduate studies, she was accepted into the McNair Scholars Program. The McNair Scholars Program prepared her for graduate school and provided her with research opportunities.

Ms. King was accepted to the School Psychology program at the University of South Florida in 2000. She later earned her Master's Degree in Curriculum and Instruction in 2001 and her Educational Specialist's Degree in School Psychology in 2005. She currently works as a school psychologist in the state of Florida.