

## **ABSTRACT**

GREEN, MARCUS ALLEN. "Effective" Mathematics Teaching of African American Adolescents and the Development of a Mathematics Identity. (Under the direction of Dr. Jessica DeCuir-Gunby and Dr. Teomora Rutherford).

In order to increase mathematics achievement, persistence, and participation in mathematics-related careers and majors for African American adolescents, researchers have discussed the need for students to develop positive mathematical identities (English-Clarke, Slaughter-Defoe, & Martin, 2012; Gutstein, 2003; Larnell, 2013; Martin, 2000, 2006, 2007, 2009). These studies and others have implied that the classroom teacher plays a critical role in either bolstering or limiting the formation of a positive mathematics identity of the students in their classes. However, there still remains a lack of clear understanding of how mathematics identity manifests and operates in African American students. In addition, research has yet to yield lucid descriptions of the characteristics of an effective mathematics teacher for African American adolescents that supports positive mathematics identity development.

This mixed-method study examines the relationship between developing racial and mathematical identities of 102 African American adolescent students in mathematics across five public secondary schools. Quantitative research centred on student surveys that probed on various dimensions of their mathematical proclivities and their racial-mathematical beliefs. This study also included a qualitative investigation into the characteristics of two designated "effective" teachers from two adjacent school districts in the rural, southeastern U.S.

Findings indicate a positive association between students' racial identity and their

overall mathematics identity and provide support of mathematics identity theory in contemporary research (Martin, 2000). In addition, findings showed descriptions of teachers designated as “effective” by their beliefs, demeanors, and practices engaging African American adolescents. The results unearth the resilience of problematic perspectives and practices among the sample of teachers that could impede further progress of African American adolescents in mathematics. The study critically examines the implications regarding what it means to be an “effective” mathematics teacher of African American adolescents.

**Keywords:** mathematic identity, math education, pedagogy, teacher effectiveness, racial identity,

© Copyright 2016 by Marcus Allen Green

All Rights Reserved

“Effective” Mathematics Teaching of African American Adolescents and the Development  
of a Mathematics Identity

By  
Marcus Allen Green

A Dissertation Submitted to the Graduate Faculty of  
North Carolina State University  
In Partial Fulfillment of the  
Requirements for the Degree of  
Doctor of Philosophy

Curriculum and Instruction

Raleigh, North Carolina

2016

APPROVED BY:

---

Dr. Jessica DeCuir-Gunby  
Committee Co-Chair

---

Dr. Teomara Rutherford  
Committee Co-Chair

---

Dr. Karen Keene

---

Dr. Deleon Gray

## **BIOGRAPHY**

Marcus A. Green was born in Anchorage, Alaska. He has lived in eastern North Carolina since the sixth grade. After graduating high school, he attended East Carolina University, where he earned a Bachelor's degree in Secondary Mathematics Education. After college, Mr. Green began his professional career working as a high school mathematics teacher in eastern North Carolina. Mr. Green then went on to attend Liberty University, where he earned a Master's degree in Administration & Supervision while also receiving North Carolina principal licensure.

After completing an administrative internship at the high school level, Mr. Green obtained a position as an elementary and middle school (K-5, K-8) assistant principal and enrolled in the doctoral program at North Carolina State University. His research explores issues related to how teachers (most often white teachers) respond to African American adolescent learners, and he is particularly interested in the complexities of teacher beliefs, demeanors, and practices and how these proclivities might shape their ability to serve students effectively in their classes.

Mr. Green's career aspiration is to obtain a district, state- or federal-level position where he is able to apply his skills and knowledge to improve education particularly through direct work with teachers and students. Alternatively, he would seek to secure a tenure-track professorship in a university environment working directly with pre- or in-service educators in a College of Education.

## ACKNOWLEDGMENTS

First, I would like to express my sincere gratitude to my advisor(s) Dr. Jessica DeCuir-Gunby for her continuous support throughout graduate school and my dissertation study. I have made it this far largely due to her patience, motivation, and immense knowledge! Her guidance has helped me persevere through the grueling experience of researching and writing this dissertation.

Besides my advisor, I would like to thank the rest of my committee: Dr. Karen Keene, Dr. Teomara Rutherford, and Dr. DeLeon Gray, for their insightful comments and encouragement, but also for their hard push which has incited me to build much needed skills throughout this study and graduate school. I will never forget the multiple phone calls and emails exchanged with Dr. Keene in times of need. I will never forget the conversation Dr. Gray and I had in his office before class one Fall afternoon. I stand a much greater chance of success as a scholar thanks to Dr. Rutherford's expertise and guidance through this dissertation study.

My sincere thanks also goes to Dr. Heather A. Davis and Dr. Patricia Marshall. Dr. Davis served as my initial advisor, guided me through a successful master's thesis, and helped me to develop the dissertation proposal before she left NC State to move to California. Much like Dr. DeCuir-Gunby, I would not be at this point today without her support. Dr. Marshall may not even know that large impact that her advanced multi-cultural education seminar had on the development of my own racial identity beliefs and the way it informed this dissertation. Thank you so much Dr. Marshall.

I thank my fellow peer Dr. Hannah Baggett for stimulating discussions and for her collaboration and support throughout our time together in the program.

Last but not least I would like to thank my family: my wife Sara, and my parents Diane, Gary, Marty, and Debbie who supported me through prayer and holding down the home front so that I could attend classes and spend days a time reading and writing. I have to thank all my students whose faces I see and think about every day and who inspire me as an educator. I'd like to thank my first cousin and brother Christopher DeVerse for the days we sat outside burger king mapping out "The Blueprint." "We made it fam!" I'd like to thank friends Loren Edwards, and Chris Stilley for their support. Finally, a very special thanks goes out to GOMJ, my "day-ones", whose voices and lives have parenthetically inspired this study. "Oooh Oooooooooo! We in here!"

## TABLE OF CONTENTS

LIST OF TABLES .....	vii
LIST OF FIGURES .....	ix
CHAPTER 1: INTRODUCTION .....	1
Background of the Study and Researcher Subjectivities .....	2
Statement of the Problem.....	4
Purpose of the Study .....	4
Definition of Terms.....	6
CHAPTER 2: LITERATURE REVIEW .....	7
African American Underperformance in Mathematics.....	7
Implications of African American underachievements in mathematics .....	9
Research studies on African American underperformance in mathematics .....	10
Research studies on African American and mathematics pedagogy .....	14
Effective Teaching of African American Students .....	15
Identity .....	24
Overarching Framework .....	33
CHAPTER 3: METHODOLOGY .....	41
Research Questions and Hypotheses .....	41
Research Design.....	42
Participants.....	45
Measures .....	54
Data Collection .....	64
Data Analyses .....	60
Quantitative Data Analysis .....	60
Qualitative Data Analysis .....	65
Mixed Method Data Analysis .....	68
CHAPTER 4: RESEARCH RESULTS .....	75
Phase 1: Quantitative Results.....	75
Hypothesis 1: Racial Identity and Math Attitude .....	75
Hypothesis 2: Perceived Discrimination and Math Attitude .....	77
Hypothesis 3: Perceived Discrimination, Racial Identity, and Math Attitude.....	81
Quantitative Results Summary .....	84
Phase 2: Qualitative Results.....	85
Mr. Ramses .....	87
Ms. Alice.....	100
How the Teachers Portrayed Effective Teaching of African American students .....	107
What are the beliefs, demeanors, and practices of nominated effective mathematics teacher of African American adolescents? .....	112
How were Teachers Cognizant of Racial Identity? .....	119
How did Teachers Build Student Confidence in Mathematics? .....	120

How did Teachers Guide Students to see Mathematics Relevant to their Lives and Futures? .....	121
Phase 3: Mixed Methods Analysis.....	123
CHAPTER 5: DISCUSSION OF FINDINGS .....	140
Connecting Racial Identity to Mathematic Identity .....	141
What does it Really Mean to be an “Effective” Math Teacher of African American Students? .....	143
Implications.....	149
Limitations of the Study.....	146
Conclusions.....	152
REFERENCES .....	156
APPENDICES .....	177
Appendix A: Interview Questions .....	178
Appendix B: Survey Questions.....	181
Appendix C: Sample Coding of Teacher/Students Interviews .....	183
Appendix D: Distribution of Survey Responses .....	190

## LIST OF TABLES

Table 1	<i>Recruitment Criteria for Recruiting Effective Teachers in Phase</i> .....	46
Table 2	<i>Participating Schools and Teachers</i> .....	47
Table 3	<i>Recruitment Criteria Fulfillment by Selected Teachers for Interview</i> .....	49
Table 4	<i>Grade and Gender of Student Participants Surveyed by School</i> .....	51
Table 5	<i>Focus Group Participants at Fortress High</i> .....	53
Table 6	<i>Focus Group Participants at Hometown High</i> .....	53
Table 7	<i>Math Attitude Subscales and Reliabilities</i> .....	57
Table 8	<i>Race and Math Attitudes Subscales and Reliabilities</i> .....	60
Table 9	<i>MIBI-T Survey Subscales and Reliabilites</i> .....	63
Table 10	<i>Descriptive Statistics of all Used Variables</i> .....	66
Table 11	<i>One Way ANOVA between Schools on Variables</i> .....	68
Table 12	<i>Descriptive Statistics on Variables by Teacher and School</i> .....	70
Table 13	<i>Bivariate Correlations between Math Attitude, Racial Identity, and Demographic Variables</i> .....	76
Table 14	<i>Summary of Step-Wise Regression Analysis for Variables Predicting Students' Math Attitude controlling for demographic variables</i> .....	79
Table 15	<i>Summary of Step-Wise Regression Analysis for Variables Predicting Students' Math Attitude</i> .....	80
Table 16	<i>Summary of Step-Wise Regression Analysis for Race Identity and Perceived Discrimination Predicting Students' Math Attitude (n=102)</i> .....	83
Table 17	<i>The Beliefs of an "Effective" Mathematics Teacher of African American Adolescents</i> .....	113

Table 18	<i>The Demeanors of an “Effective” Mathematics Teacher of African American Adolescents</i> .....	116
Table 19	<i>The Practices of an “Effective” Mathematics Teacher of African American Adolescents</i> .....	118
Table 20	<i>Teachers’ Cognizance of Racial Identity</i> .....	119
Table 21	<i>Teachers Building Confidence in Mathematics</i> .....	120
Table 22	<i>Teachers Guiding Students to see Mathematics Relevance</i> .....	123
Table 23	<i>Summary of Mixed Method Analysis</i> .....	124

## LIST OF FIGURES

Figure 1. <i>Tenets of mathematics identity mapped upon Expectancy-value Model of Achievement Motivation</i> (adapted from Eccles et al., 1983; Martin, 2000). Numbers 1-4 represent tenets of mathematic identity and are placed within relevant points on the expectancy value model of achievement motivation .....	36
Figure 2. <i>Overview of research steps taken for sequential-explanatory mixed-methods study</i> .....	43
Figure 3. <i>Hypothesized interaction between perceived discrimination, racial identity, and Math Attitude variables</i> .....	81
Figure 4. <i>Frequency of demeanor comments by teacher and their respective Students</i> .....	114
Figure 5. <i>Frequency of practice comments by teacher and their respective Students</i> .....	117

## CHAPTER 1: INTRODUCTION

The past three decades, scholars have documented an achievement gap between African American and White or Asian/Pacific Islander student groups related to classroom performance in mathematics. (Snyder, Thomas, & Dillow, 2006, 2011; Vanneman, Hamilton, Anderson, & Rahman, 2009). Several equity scholars have sought to understand this underperformance problem by further examining adolescent identity, particularly: the ways in which African American youth may negotiate mathematical and racial identities along with how such identities may help encourage or discourage improvements in mathematics (Martin, 2000, 2006a, 2006b; Stinson, 2006). This line of research, focused within the context of teaching and learning, intuitively has implications for the role of practicing teachers, for example: their pedagogical practices, beliefs, and demeanors in regards to teaching African American adolescents.

For some adolescents, figuring out who they are (their identities) can be a major crisis (Erikson, 1968). Depending upon a multitude of factors, students may identify with a variety of groups simultaneously (whether racial, social, or academic) and behave according to the norms of the groups with whom they identify. It is not unusual for adolescents to try out several types of identities before they find one (or more) they fit in (Erikson, 1980). Conceivably, in order for adolescents to engage in the behaviors or practices of a mathematics community, it may be important for them to perceive themselves as a capable participant and stakeholder in that community. Engaging in the community may require a sense of membership that might hold intrinsic and inherent value. This leads to the following

questions. What might happen when and if membership/participation in that community interacts with membership/identification with another community such as ones' race? What happens when and if membership/participation is enhanced by memberships/identification with race? What roles do teachers play in all of this? Are teachers aware of issues related to adolescent identity development? Does it inform their practice? What does a mathematics identity even look like? This study explores this question set, along with other themes at the intersection of pedagogy, identity formation, and social stratification.

### **Background of Study and Researcher Subjectivities**

My decision as a researcher to investigate such a critical crossroads of issue areas in education has been motivated by the personal connections I have experienced with the African American community. These connections began in my adolescence and have continued into my teaching career. Ethno-racially, I am a White male who spent his childhood years in rural Vermont, but I have lived in the southern U.S. for more than 18 years. As a teenager, my closest friends (those from whom I found the most acceptance) were African Americans. My positive relationships with these friends (particularly during my teenage years) imprinted me with a lasting sense of advocacy for African American students as both an educator and a researcher. The trust I earned from my closest African American friends has given us an invaluable opportunity to reflect and discuss our experiences in school together. These conversations have proven to be integral to my dissertation research. Furthermore, throughout graduate school, I have been challenged to explore the development of my own racial identity. In due course, at the outset of graduate school, I would have described my intentions in education as being that of some sort of a "savior" or someone who

wanted to help all the poor and/or African American children; the children who were like me and my friends growing up and needed the help. I did not openly reflect on my status and privilege of being a White male in today's *de jure* color-blind U.S. society and how this may impact my beliefs as a teacher. At this same time I held a neutral perspective on race, identity, and power. At the time of crafting my research proposal, I was transitioning between what would be considered a pseudo-independent and an immersion stage of White racial identity (Helms, 1984). These stages were best characterized best by: 1) an intellectual acceptance of my own and other's race, evolving more towards; 2) an honest appraisal of racism and the significance of Whiteness. In other models of White racial identity, I could also have related to what Terry (1997) calls "White Blacks" characterized by some form of abandoning Whiteness and possibly over-identifying with African Americans, receiving personal recognition from African Americans for being "almost Black."

Before I began graduate school, I taught high school mathematics for seven years and was an assistant principal for three years. During my career, I observed and interacted with a variety of teachers whom I perceived to be both effective and less effective when working with their students, particularly African Americans. As a teacher, I was recognized by peers and supervisors to possess an ability to lead African American students to strong performance in mathematics courses. My reputation was based on student test results, student testimonies/relationships, rapport with parents and the community, and teacher evaluations. Over time, I realized that not all teachers were as motivated or able to be successful in these contexts. I came to graduate school with the goal of developing an understanding as to why some teachers possessed the demeanors and practices necessary to

effectively connect and teach African American students and others did not. Admittedly, it was a source of professional frustration to know that there were so many teachers in my district, state, and nationwide who were ill equipped in this regard. I believed that through research, I could discover how certain teacher orientations, beliefs, and practices were necessary to successfully empower African American adolescent students. Inevitably, I learned even more about myself through coursework and research.

### **Statement of the Problem**

Effective teachers and mathematics identity can be very curious terms depending on the context. Literature on “effective” teaching abounds, but in a variety of broad contexts. Mathematics identity is a relatively new theory in identity development and mathematics education literature (Leung, 2001). Potentially, understanding mathematic identity could bolster efforts that support African American adolescents to improve their performance in mathematics. However, we do not know enough about mathematic identity (in application) to move this effort forward. How does one recognize and/or describe a positive mathematics identity? How does it manifest or develop in African American adolescents? How should this inform instruction?

### **Purpose of the Study**

The broad purpose of this study was to examine mathematic identity theory and effective ways teachers might improve African American performance in mathematics. More specifically, the purpose of the study was to catalogue the demeanors, beliefs, and practices those deemed “effective” mathematics teachers possess and use to support African American student achievement in mathematics. A secondary purpose was to describe and/or

confirm the application of mathematical identities in African American adolescent math students as presently understood. As a part of this second goal, it was important to determine if there exists a relationship between students' racial and mathematical identities. Subsequent findings confirmed the presence and importance of a positive mathematics identity in African American adolescent math students. Results also provided recommendations for modifications as to what elements should comprise a mathematics identity whereas elucidating positive and negative beliefs of teachers' beliefs, demeanors, and practices that support or hinder African American students' racial and mathematical identities in the context of classroom teaching and learning.

## **Definition of Terms**

**Beliefs:** “A proposition, which may be consciously or unconsciously held, is evaluative in that it is accepted as true by the individual, and is therefore imbued with emotive commitment; further it serves as a guide to thought and behavior. Beliefs play an important role in many aspects of teaching, as well as in life. They are involved in helping individuals make sense of the world, influencing how new information is perceived, and whether it is accepted” (Borg, 2011, p.186).

**Demeanors:** A person’s appearance and behavior: the way someone seems to be to other people. The outward manifestation of personality or attitude (Merriam-Webster Online, 2016)

**Practices:** The actual applications or use of an idea, belief, or method as opposed to theories

**African American Adolescent:** An African American adolescent is a person between the ages of 10 and 19 whose race/ethnicity has been reported as African American at the school level. Student participants ranged from 14-19 in this study.

## **CHAPTER 2: LITERATURE REVIEW**

For the purposes of this study, a review of literature from several fields was necessary. The first section provides a detailed examination of the persistence of African American underachievement in mathematics, its manifold implications, and the evolution of research approaches to this issue. The second section reviews a diverse array of studies on effective teaching and teachers, in general and specifically pertaining to African American adolescents in the mathematics classroom. The third section provides an overview of identity research in education that includes the histories of both racial identity and mathematic identity research. The final section provides a summary of the chosen overarching framework and further contextualizes the purposes of the current study.

### **African American Underperformance in Mathematics**

The National Assessment of Educational Progress (NAEP) is the country's largest and acknowledged body that assesses the academic performance and progress of students. NAEP has documented and tracked a persistent achievement gap between White and African American students in mathematics (Vanneman et. al. 2009, NCES, 2011). Although math performance has improved for both groups of students since 1990, African American students still are unable to perform equal or better than White students (Vanneman et. al. 2009, NCES, 2011). For example, in 2008, the score gap between White and African American 17-year-olds was 26 points in math, roughly equivalent to two to three school years' of learning; in 2009, the difference increased to 32 points (Gompa Vijaya, 2012). Analysis of results from the NAEP considered factors besides race to predict achievement, such as socioeconomic status, but race alone accounts for the largest differences in math

scores (Berry, 2003). This difference also exists in testing data from the scholastic aptitude test (SAT). The SAT assesses mathematics knowledge in alignment with high school mathematics curriculum (often for the purposes of college admissions). In 2011, the average SAT math scores for African American students were 427 compared to 535 for White students. In addition to that, inequities in math performance also translate into the workforce, as only about 6% of the nation's engineers and scientists (professions heavily reliant upon mathematics) are minorities (O'Brien, Martinez-Pons, & Kopala, 2010).

Only 49% of African American students have taken pre-algebra or algebra before high school, as compared to 68% of White students (Berry, 2008; The Education Trust, 2014). Studying algebra during middle school puts students on a trajectory to study advanced mathematics into high school. In my own experience I have witnessed placement decisions for advanced mathematics courses influenced by factors other than performance, that is, parent advocacy (requesting to be placed in honors classes), which has been controversial and has tended to disfavor African American students, may place in advanced mathematics courses (Berry, 2008).

High school graduation rates have highlighted inequity between White and African American students. In 2008, a total of 78% of White males graduated from high school with their cohort, whereas only 47% of African American males graduated with their cohort. In the southeastern United States (hereafter: "the South"), African American male graduation rates have been the lowest percentage compared to the national average (Schott Foundation for Public Education, 2010). Although mathematics performance (or the lack of) cannot solely be blamed for students dropping out of school, one recent study did unearth a linkage

between increased mathematics requirements for graduation by states and an increased dropout rate (Plunk, Tate, Beirut, & Grucza. 2014). As states across the country adopt more rigorous standards and requirements for high school mathematics, it is possible that a lack of strong math skills could lead to more African American students failing to graduate high school if such trends were to continue (Ravitch, 2016).

### **Implications of African American underachievement in mathematics.**

Possessing mathematical knowledge has been found to be critical for individual and corporate success in a rapidly growing technological society (Bonner & Adams, 2011). Access to higher-level mathematics (and proficiency in) increases the educational and economic opportunities for most students (Ladson-Billings, 1997). According to Moses and Cobb (2002), mathematically literate citizens acquire greater opportunities to control their career paths. They argued that underachievement in mathematics should be seen as the new “Civil Rights Battleground.” The authors also described how mathematics has been closely connected with the direction of global innovation over time. In a similar way, they believed that lacking mathematics and computer science knowledge in modern society would phase out and isolate those who lacked such knowledge. Therefore, Moses and Cobb (2002) explained how mathematics knowledge was actually a form of “capital,” and that without possessing this knowledge, African American students might not be able to succeed in today’s competitive and demanding market and society in general.

Martin (2009) mentioned how African American mathematics underachievement should be seen as a national priority. He argued that mathematics represented the height of

intellectual ability and that having this ability in modern society was a valuable (although often overlooked) form of capital that African American children would need to remain competitive in the world. Martin argued that thinking of mathematics in this way might bring a whole new level of importance for improving mathematics achievement for African American adolescents.

Addressing the inequity in mathematics performance for African Americans has become a priority for the three leading national organizations that support mathematics teaching: the Association of Mathematics Teacher Educators (AMTE); the National Council of Supervisors of Mathematics (NCSM); and the National Council of Teachers of Mathematics (NCTM). Recent special journal issues from these organizations have been published and calls for proposals have been made, devoted to increase equity in mathematics with specific focus in theoretical frameworks. In addition to that, definitions for math equity, roles that culture has played in math, the influence of schools and course placement, students' attitudes/beliefs along with their self-perceptions regarding their ability to do math, and teacher influences on students' mathematics identities (Strutchens et al., 2012). Of these, the latter two were of the most interest for the current study.

### **Research studies on African American underperformance in mathematics.**

An examination of studies that have set out to better understand the causes and solutions to African American low performance in mathematics yielded a variety of findings. Traditionally, quantitative studies on this topic have relied on statistical tests, using indicators like socioeconomic status, racial demographics, and even intelligence to explain the disproportionate achievement in math for African American students (Gillborn, 2010). One

reason for this was that most researchers (especially in mathematics) had their primary training in cognitive sciences (Lubienski & Bowen, 2002). Unfortunately, by simply looking to one's skin color, bank account, or ability to take a test, these studies have proven limited in scope and have contributed to a negative narrative of African American students' causes for underachievement. Gillborn (2009) contended, "statistical methods themselves have encoded particular assumptions which, in societies that were structured in racial domination, often carried biases that were likely to further discriminate against particular minority groups" (p. 254). Howard (2001) pushed back against the idea that predictors like intelligence could adequately explain African American underachievement. His study highlighted that inequities in achievement are often not existent until fourth grade and counteracted the notion that African American children were simply less capable or less intelligent than other children from birth. Some researchers have also labeled these limited quantitative studies as "literatures of failure" that have maintained the perception of African American students as generally less capable than students from other racial groups (Gutierrez, 2008; Ladson-Billings, 1997).

Contenders to traditional quantitative research on this particular topic have discussed how practicing educators have been negatively influenced by such information and, as a result, they have impaired the opportunities for their African American students. According to Bol and Berry (2005), teachers have "attributed the achievement gap to student characteristics such as differences in motivational levels, work ethic, and family support" (p.32). Berry (2011) explained that the "master narrative" in the research literature on African American's inabilities in math are engrained in the beliefs and practices of teachers

and policymakers. This “deficit view” of thinking about African American students has also diffused across the broader public (Weiner, 2003). Such critiques, however, have not been calls to divert attention away from the analysis of the achievement gap between African American and White students, or even to argue methodology, but to call for more holistic and sensitive research that would be “focused on advancement, on excellence, and on gains within marginalized communities” (Gutierrez, 2008, p.362).

Analyzing the problem from a different perspective, researchers have explored the lack of an “opportunity to learn” rather than the lack of intelligence, motivation, or other internal characteristics. Marginalized students, from this perspective, often had less *access* to high quality teachers, higher level math courses, school funding, and materials which have been shown to be important for academic success (Flores, 2007). As an example, classes that served mostly African American students were twice as likely to be taught by inexperienced teachers as classes in which the majority of students were White (Clotfelter, Ladd, & Vigdor, 2003). The same study showed that in North Carolina novice teachers have been unevenly distributed across districts with race and ethnicity.

The issue of access to the teachers who held the beliefs, demeanors, and practices which served the needs of African American adolescents was of most interest to this study and directed the review of literature. Arguably, the greatest challenge facing American education is the unequal distribution and availability of effective teachers among schools, especially those schools that are labeled as underperforming schools (Murnane & Steele, 2007). Students who often need the best teachers in the U.S. are the least likely to have them (Darling-Hammond, 2006).

Researchers have investigated issues of equity in math education for African American students (Ladson-Billings & Tate, 1995). Snipes and Waters (2005) used Critical Race Theory as a lens for studying the nature of African American students' mathematics experiences in North Carolina from 1950-1980. Using counter-storytelling, former state consultants in North Carolina described institutional and structural racism along with property rights that existed for African American students in that time. African American students may not simply need more experienced teachers, but also better quality instruction. Based on NAEP data of instructional practices used by teachers, Berry (2003) contended that African American students did not receive "instructional practices consistent with recommendations from the National Council of Teachers of Mathematics" (p.245). His study mapped the cultural characteristics of African Americans (Boykin, 1986) against traditional teaching approaches. His claim was that if instruction were provided in the way prescribed by the NCTM, African American students would not be so far behind other students in mathematics. He argued that traditional instruction historically favored "analytic" orientations typical to that of White-middle class culture. He insisted that culture-based math focused on the cultural characteristics of African American students (such as leveraging themes like rhythm and pattern). He surmised how problem solving, communication, connections, and representations (all NCTM priorities) could draw upon African American cultural learning styles (Boykin,1986). In order to focus on the dynamics of mathematics instruction/pedagogy and mathematics teachers, this study's literature review specifically examined past work on mathematics pedagogy particularly in regards to serving the needs of African American mathematics students.

**Research studies on African Americans and mathematics pedagogy.**

Lubienski and Bowen (2000) investigated approximately 3,000 mathematics education research articles published between 1982 and 1998. They found that very little consideration was given to mathematics equity or the needs of specific racial groups like African Americans. These studies largely highlighted approaches emphasizing cognitive processes in the individual mind and did not account for socio-cultural influences or the motivation to attain mathematical knowledge. These studies also typically held the assumption that math was a race neutral subject matter, devoid of culture, and based on a system of meritocracy (Battey, 2013). Research in mathematics education shifted to focus beyond the traditional teacher-student-subject matter context discussion, which ignored issues of culture and socialization. Constructivism and social constructivism became frameworks for newer studies. These theoretic approaches suggested that for mathematics education, the foundation for learning was that each individual constructed his own mathematical reality within his space of experience (Steffe & Kieren, 1994). As stated by Hand and Taylor (2008), “Knowledge [of math] is fundamentally tied to the kinds of people we view ourselves to be and the trajectory we view ourselves to be on. Issues of identity are not only critical to understanding the development of mathematical knowledge for individuals and communities, but also to considering how we draw lines between cultural and domain knowledge” (p.188). As an example of identity influences, research examined how engaging in academics might be seen by African American students as participating in an “out-group” institution, and that by engaging in such activity, they ran the risk of not fitting in with their “in-group” (Oyserman, 2003). Yet, there has been research contradicting this

notion, showing that Black adolescents are generally more achievement-oriented than other racial groups and that racialized peer pressure against high academic achievement is not prevalent in all schools (Tyson, Darity, & Castellino, 2005).

The focus on mathematics learning as socially-constructed has been described as a “social turn” as well as a “new wave” in mathematics education research (Larnell, 2013; Lerman, 2000). At the center of this social turn has been the work of Martin (2000), who highlighted the importance of racial and mathematics identity in understanding mathematics learning and how African American learners could develop a sense of membership in mathematics. At the forefront of his work on mathematics identity has been the intersection of race and power in the discussion of achieving equity in mathematics education (Martin, 2009). The current study relies heavily upon the mathematics identity research of Martin and his colleagues and will be described in the subsequent section on mathematics identity.

### **Effective Teaching of African American Students**

Many of the educational researchers interested in the problems and solutions related to African American underachievement and equity have specifically investigated teachers to seek out what defines successful teaching and learning contexts for African American students. Some ways that effective teachers have been identified include: looking at results from standardized achievement scores; principal and community recommendations; and student rapport. In the first section, I report findings that took a particular look at employed pedagogical practices by teachers. In the second section, I report findings on the nature of the teacher as an individual (beliefs and dispositions). In the third section, I will summarize the findings and discuss some challenges with these findings.

**Practices of effective teachers.** Mckinney, Bol, and Berube (2010) studied 31 identified “star” teachers who taught in urban settings to assess their instructional practices. They wanted to know which practices were most used by these “effective, star” mathematics teachers. Their findings showed that of the practices used by the effective teachers, the most crucial practices were direct instruction and skill practice. Direct instruction and skill practice in a teacher-centered classroom were also found to be the most highly used practices in successful teaching contexts in other studies (Love & Kruger, 2005; Thompson et. al, 2005).

Wilson, Cooney, and Stinson (2005) wrote about what constituted good mathematics teaching and how it was developed. By interviewing and observing nine in-service “effective” mathematics teachers, they identified a set of important behaviors and how teachers developed these behaviors. The practices found included having a strong mathematics understanding (content knowledge), making connections to prior skills (scaffolding), using multiple representations, developing effective class management, allowing reflection, and refraining from telling. In another study, Thompson, Ransdell, and Rousseau (2005) analyzed the practices of 14 “effective” teachers in urban school settings. The practices identified were diverse and included the following: engaging students in a teacher-centered classroom; developing rapport through good verbal and nonverbal communication; establishing strong class management; and ensuring a commitment to helping students through repetition.

The majority of studies I encountered on effective teaching of African American students referenced the works of Ladson-Billings (1994). A critical race theorist, Ladson-Billings proposed the following framework of Culturally Relevant Pedagogy (CRP): (1)

academic success; (2) cultural competence; and (3) ability to critique the existing social order (referred to as critical consciousness) (Ladson-Billings, 1994). In the CRP framework, academic success was defined as gaining knowledge beyond minimal skills and allowing for students to experience success in doing so. Cultural competence was “the ability to function effectively in one’s culture of origin” (Ladson-Billings, 2000, p.210). This meant that teachers recognized the valuable forms of “capital” and norms across cultures, knew how to navigate them, and knew how to teach students to do the same. Developing students’ critical consciousness helped them to challenge the status quo and recognize the way that things might be within the greater society (examples included stereotypes, systems, policies, and discrimination). The culturally relevant approach to teaching challenged a hegemonic education where minorities were not shown to have substantively contributed to civilizational development throughout. In a similar fashion, culturally responsive teaching has been described as “using the cultural knowledge, prior experiences, frames of reference, and performance styles of ethnically diverse students to make learning encounters more relevant and effective for them” (Gay, 2010, p. 31). Although CRP and culturally relevant teaching have provided frameworks for effective instruction, they did not prescribe how teachers were to fulfill each part of the framework in a prescriptive way.

Leonard et al. (2010) purported that CRP approaches to instruction should be paired with teaching for social justice or social justice pedagogy (SJP), specifically in mathematics. Research on social justice pedagogy was similar to that of CRP and Culturally Relevant Teaching in that its current form is more of a recommended framework and less of an empirically proven practice for successful mathematics teaching of African American

students. Employing an SJP approach, students learned not only mathematics skills but also self-empowerment (Gutstein, 2003). The priorities of social justice mathematics pedagogy included: access to high quality mathematics instruction; curriculum focusing on minorities' experiences; use of mathematics as a critical tool; and use of mathematics to transform society to make it a more just system.

In the SJP framework, social justice includes: equal opportunities; access; ability of all to reach life's potential; informed citizenship; and self-empowerment (Leonard et al., 2010). It has been frequently reiterated across read literature that this type of approach *could not* be prescribed or scripted; teachers had to be learners of students in order to implement this framework successfully. This was further emphasized by Bartolome (1994) who pointed out the error of "thinking that replication of instructional programs or teacher mastery or particular teaching methods, in and of themselves, will guarantee successful student learning, especially when discussing populations that are historically mistreated and mis-educated" (p.1).

Strutchens (2000) found that effective teachers helped students to develop a relational understanding of concepts (not merely procedures), helped students develop number sense, expressed deep beliefs in student capabilities, held high expectations of students, enabled students to use mathematics as a tool to examine issues of race (CRP), created a class environment where students could talk and justify solutions and developed partnerships with parents. Parsons (2005) highlighted one effective practice: culturally relevant caring (i.e., a caring that communicated an appreciation for students' culture, by sending certain messages through words and actions). He described how the teacher equalized access by: disrupting

dominance (racial) from class peers, which created space for learning in the class; providing assistance in a spirit of belief and pride rather than remediation; and devising opportunities to enforce competence through students helping peers.

In another study on effective teachers of African American students Noblit (1993) highlighted ways that teachers practiced taking *care* of their students. He showed that practicing care required “power manifested” (p.67). He also illustrated this power in one of his profiled teachers named Pam. Pam demonstrated moral authority over her pupils as a collective rather than as a group of individuals. Noblit described how Pam demonstrated caring as “moral authority,” shown by taking charge of what her children did while also protecting them from outside influences. Caring was seen through the formation of "tough" relationships.

A substantial literature review by Jackson and Wilson (2012) surveyed studies around effective teaching practices for African American students’ learning of mathematics. This review provided a holistic summary of the relevant research studies to date. Upon reviewing key studies from the previous decades, they realized that prescriptive characteristics that would mark one as being an effective mathematics teacher of African American students were most often NOT recommended and/or not available. They contended that new studies should generate at least high-leverage forms of practice that were grounded in African American students’ experiences and that were researched to empirically show their participation and achievement in rigorous mathematics. The authors argued that much of what had been found and suggested over the past decade were “mainstream” criteria and frameworks and that these were inadequate. They contested that the goal should not just be

about specifying practice (e.g., “Do this and you will have success”), but to “unpack” the best practices of successful mathematics teachers of African American students.

**Beliefs and demeanors of effective teachers.** In searching for literature on effective teachers, I came across more studies focused on the role of teachers’ beliefs and demeanors for effective teaching of African American students than on their practices. Many of these studies were conducted under the belief that ‘who’ you are influenced ‘what’ you did as a teacher (Andrzejewski, 2008; Barta, 2010; Love & Kruger, 2005;). Teacher beliefs have been a challenge to study through empirical research and have often been described as a “messy” construct (Pajares, 1992). This appeared to be supported in my review of literature. In some instances, teacher beliefs have shaped teachers’ professional practice (Davis & Andrzejewski, 2009). It has also been shown that that the quality of instruction and the quality of teachers’ interactions with students can be shaped by their beliefs (Davis, 2003). In other cases, research has illustrated inconsistency between what a teacher may express in their beliefs and what they actually do in classroom practice (Raymond, 1997; Skott, 2001). A study conducted by Fives and Buehl, (2009) showed how certain teachers’ beliefs might predict student outcomes using performance data for various racial groups.

In her study of effective White teachers of African American children, Cooper (2003) found that effective teachers possessed an authoritative demeanor when interacting with students. Her choice to focus on effective White teachers was motivated by the growing number of African American students in U.S. schools and the prevalence of White, middle-class, teachers (most often female) who dominate the teaching workforce. It has been estimated that around 90% of teachers identified themselves as White (Cooper, 2003). In

other words, teachers, who have been responsible for successfully teaching mathematics (and other subjects) to African American students, were more likely from a different cultural group. This type of demeanor was described similarly in other literature as being “warm demanding,” as well as being a second mother to students (Ware, 2006).

Love and Kruger’s (2005) study on effective teachers of African American students, found that teachers were most notably relationally available and engaged with their students. Particularly for minority students, having positive relationships with a teacher can improve their social/emotional stability, which can also bolster their academic achievement (Baker, 1999; Decker et al., 2007). Plainly speaking, students who had a sense of “belonging” to a class and had a connection to a teacher were more likely to engage academically and have a better psychological well-being. Decker et al. (2007), showed how at-risk African American students desired to have positive relationships with their teachers and felt that such a relationship was important. Howard’s (2002) study attempted to draw upon the voices (counter-narratives) of elementary and secondary African American students to develop descriptors of effective teachers they had in school. Demeanors underscored by the sample of African American students included: teachers who established a familial, community-like atmosphere; connected culturally to classroom stakeholders through genuine relationships; and leveraged unique forms of communication. Although it was clear to see that effective teachers were able to form relationships and carry themselves with a certain authority in their communication with students, My desire for details as to what precisely these teachers possessed and what permitted them to carry out these relationships was unsatisfied, which further motivated this study.

Interestingly, not all findings on the beliefs of effective teachers were positive. A dual finding of the Love and Kruger (2005) study was that the sample of effective teachers collectively expressed colorblind beliefs, reflected best by a teacher, “I do not see students as Black and White. I just see students, and I treat them all with the same expectation.” Although this sentiment appeared to represent equity to these teachers, it also expressed a “blind eye” towards the unique experiences, histories, forms of capital, and preferences of different racial groups. This portrayal was similar to what King (1991) described as White “dysconscious racism” and has arguably been ingrained in the U.S. psyche (Parsons, 2005). According to Lisa Delpit (1995), “Those with power are frequently least aware of—or at least willing to acknowledge—its existence. Those with less power are often most aware of its existence” (p.101). Martin (2009) also contended that it was this area (teachers’ troubling beliefs about race) where most work was needed in teacher preparation and recruitment to be able to have a withstanding impact on African American students in the U.S.

African American students are aware when their teachers hold lower expectations for them compared to White students (DeCuir-Gunby, 2009). Evident in Ruck and Tennenbaum’s (2007) meta-analysis of 20 years of studies on teacher expectations and beliefs regarding African American students. They found that, in terms of overall expectations, teachers rated African American students lower on referrals for higher-level course work and the use of verbal praise. When they analyzed the bias of the participants favoring White children over ethnic minorities, the largest effect size seen ( $d = .39$ ) was for teachers in the South (p. 263). Further studies found that highlighted journeys of effective White teachers who realized their problematic beliefs about race (Howard, 2006; Paley,

2009).

Alternatively, some studies suggested the necessity of employing more male and African American teachers to further provide students with people who may already possess the demeanors and understandings of African American students (Dilworth & Brown, 2008; Naman, 2009; Zumalt & Craig, 2008). With such a variety of findings related to the effective instruction of African American students the following section will seek to summarize these findings.

### **Analyzing the findings on effective teachers of African American students.**

In trying to grapple with the variety of findings from the studies exploring effective teachers of African American students, I could not help but seek to revisit the studies and other literature to analyze how “effectiveness” was defined and how “effective” teachers were selected across the studies. In each of the references above, teacher effectiveness criteria largely involved the teachers’ contribution to student achievement via standardized test scores. As stated in Thompson, Ransdell, and Rousseau (2005), “We invited these classroom teachers to participate in the study because their principals perceived them to be effective classroom teachers and had high student achievement rates based on standardized test scores.” (p.26). As stated in Cooper (2003), “They [principals] based their nominations [of participants] on the children’s academic achievements, including standardized test scores” (p.416). As useful as testing data can be to gauge the effect of a teacher, this should not be the sole criterion for effectiveness. Test scores do not capture all of the ways teachers could and should contribute to students and the larger education community (Goe, Bell, & Little, 2008).

In the aforementioned studies, teacher-centered classrooms, direct instruction, and repetitive skill practices most significantly contributed to African American student achievement on assessments. Achievement was shown to be attainable by teachers who may not even hold positive beliefs about African American children or people. Teacher-directed teaching and skill and drill practice have both been highly used over the history of teaching (Park & Ertmer, 2007). However, the sense of “control” backing this form of pedagogy was precisely what Haberman (1991) referred to when he coined the “pedagogy of poverty.” He argued that in this type of instructional model, students were not involved in the planning processes, discussions, interactions in heterogeneous groups, and other necessary tasks that would provide opportunities to bring “themselves” into the classroom. The direct teaching model (at its worst) assumed that teachers served as the people who made students learn and positioned teachers as the sole disseminators of knowledge within the class, without regard for who the students were or what they might be able to contribute. Even then, handbooks on effective teaching would argue the following fundamental instructional functions of effective teachers to include: review of previous day’s work, the presentation of new material, and guided practice with revision and feedback from the instructor (Rosenshine and Stevens, 1986). It may also entail independent practice and review at different intervals. These instructional practices mirror that of the teacher-directed classrooms referenced throughout the literature. In the next section I will focus on findings from literature reviewed on identity.

## **Identity**

This section will provide an overview and definition of what is meant by identity and discuss in detail both racial and mathematics identity, as both have highly informed the current study.

**Adolescent identity research.** Child and adolescent psychologist Erik Erikson's psychosocial model arguably introduced the concept of identity and the need to consider identity development during adolescence (Erikson, 1950, 1968). Broadly, identity integrates all the different aspects and roles of one's self and can be thought of as people's general sense of themselves (Wigfield et al., 2006). More specifically, identity is the incorporation of one's drives, abilities, beliefs, and histories into a consistent image (Penuel & Wertsch, 1995). According to Erikson (1968), the major goal of adolescents is to make sense of their identity to move forward into a healthy adulthood. That is to say, teenagers seek to begin satisfying the question "Who am I?" Now, consider the fact that this crisis is ongoing while students are going through school and teachers are teaching academic content. In thinking of who a student wants to be (in a variety of regards), academics and schooling at some point will be considered. For example, thoughts like "Am I good at school (or certain subjects)?" "Is school for me?" "What do others like or not like me think about school?" and so forth. Scholars such as Wenger (1998) found identity to be critically related to the concept of learning, that is, the participation, performance and other curricular activities of a student – either African American or White – depended highly on how that student acknowledged or understood his/her own learning capabilities. Lave and Wenger (1998) emphasized that individuals have grown identities as they participated in the activities of a given community

in thoughtful ways. Based on this perspective, students who meaningfully participated in the practices of a mathematics classroom/community could develop identities as capable doers of mathematics. For this reason, mathematics educators should understand the implications of adolescent identity formation. These foundational ideas concerning identity development in adolescence have been examined in further complexity in studies yielding profiles of certain types of identities and sub-identities like racial identity and mathematics identity.

**Racial identity research.** Identity development in adolescence further studied at a more specific level focused on sub-identities like one's racial identity and their content-based identities (in this case mathematics).

*African American racial identity models.* Racial Identity Theory has focused on how people of color perceive themselves to belong to their corresponding racial group (Helms, 1990). More specifically, Seller and colleagues (1998) described racial identity as “the significance and qualitative meaning that individuals attributed to their membership within the Black racial group within their self-concepts” (p.23). Moreover, it is quite possible that one's racial identity dominates other identity concerns when trying to make sense of one's self (Charmaraman & Grossman, 2010). If this be the case then racial identity development should be a focus for educators. The goal of understanding a racial identity is to have strong feelings about one's own racial group, which supports good mental health (Steinberg, 2005). For this particular research on African-American students and mathematics teaching and learning, African American Racial Identity was of particular interest (also referred to as Black Racial Identity (BRI)).

Cross and Cross's framework (Cross & Cross, 2007; DeCuir-Gunby, 2009) addressed

African American racial identity development using a process called *nigrescence*, which developed over five stages. Pre-encounter was characterized by African Americans having neutral feelings about their race and possibly valuing other aspects of their identity such as their social status or religion. The encounter stage was often triggered by experiencing some event of racism. This is when the African American person is first encountered with examining their Blackness. Immersion/Emersion stage is a point in time that, in response to their encounter stage, an African American person seeks information about being Black, for example, socializing primarily with other African Americans and perhaps seeking out literature on African American history. The internalization stage occurs when an African American person becomes satisfied in their own Blackness and less reactive to what others may think or stereotypes they may hold. Lastly, the internalization/commitment stage is an advanced stage of the internalization stage where an African American person is not only secure in their Blackness, but they also make conscious efforts to connect and contribute to African American society.

The Multidimensional Model of Racial Identity (MMRI) (Sellers et al., 1998) has been frequently used as a model to profile youths' racial identity. The MMRI assumes individual differences exist regarding perceptions of what it means to be African American. The model did not assume a certain orientation or profile as optimal for a positive racial identity. There were four assumptions to the model: (1) Black Racial Identity consists of both situational as well as stable properties; (2) all individuals embrace a different hierarchy of identities; (3) individuals' perception is the most valid indicator of his or her racial identity; and (4) individuals hold different perceptions of what it means to be an African American

(Harper & Tuckman, 2006). There were also four dimensions of the model: (1) racial salience; (2) racial centrality; (3) racial regard; and (4) racial ideology. Salience referred to how relevant one's racial identity was to the individual at a given time. Centrality referred to whether or not one defined themselves in terms of race. Regard has been theorized as both private and public. Private regard referred to one's own racial feelings and judgments, whereas public regard referred to how one perceived others judge their race. Ideology referred to one's viewpoints on African American behavior. The Multidimensional Inventory of Black Identity (MIBI) was an instrument that was developed and used to measure some of these elements (Sellers et. al., 1987).

*African American racial identity studies.* Multiple studies have attempted to use such models to discover possible connections between racial identity profiles and academic achievement (Andrews, 2009; Chavous et al., 2003; Harper, 2007; Thomas et al., 2009). Results bore contradictory discoveries across various samples as to what forms of racial identity were most conducive to positive academic attitudes and outcomes. Pervading each study was the assumption that racial identity was key to the puzzle of academic success and improvement for African American students. Chavous et al. (2003) has been frequently cited, as they discussed and described how certain profiles of racial identity impacted achievement in their longitudinal study of over 600 African American students. After measuring educational and racial beliefs (measured by the MIBI) through extensive interviews, they placed students into groups labeled as "buffering/defensive," "low connectedness/high affinity," "idealized," and "alienated." The buffering/defensive group were students who reported a high race centrality (defined themselves closely as African American and that race

was important to their identity), a high private regard (thought of African Americans in a positive way), and a low public regard (did not think African Americans were perceived positively by others). The “buffering and defensive” label emerged because the idea was that students protected themselves through the use of racial pride (centrality/private regard) against negative stereotypes and discrimination. The “low connectedness/high affinity” group was the students who reported low race centrality (race was not a central piece to their identity), high private regard (being African American was viewed positively), and low public regard. This group was similar to the first, except that they did not report that the issue of race was central to their “being.” The “idealized” group reported above average in centrality, private, and public regard, thus the name “idealized.” Lastly, the alienated group was lowest in all subscales, that is, race was not central to these students; they did not think positively of African Americans and felt others did not as well.

Analyses of the groups from this study showed that having high centrality, high private regard, and high public regard (the idealized group) correspond to more positive academic beliefs. Group identification was, therefore, considered important for positive academic attitudes. Inversely, the alienated group showed the highest number of students out of school in twelfth grade and the lowest college attendance. These results challenged disidentification theory and aligned more with the notion that having strong group connection (centrality/private regard) facilitated academic success.

Harper and Tuckman (2006), using a similar protocol, found that racial profiles appeared to be largely different for ninth grade adolescents (largely buffering/defensive) and twelfth grade adolescents (highly low connected/high affinity). Results showed that alienated

students achieved significantly higher grade point averages than idealized students. This finding was consistent across grade levels and inverse to Chavous' findings. Students who did not report a high regard (public or private) or centrality had much higher GPAs than students who reported high on all three categories. Unlike Chavous et al. (2003), their results supported the phenomenon where students who held "raceless" or disidentifying beliefs about their own race appeared to achieve higher than the other profiled groups (see Fordham & Ogbu, 1986).

Using in-depth qualitative methods, Andrews (2009) discovered that high-achieving African American students (in predominantly White schools) appeared *not* to equate being successful as related to race (or being White). This could be understood as these students having a low racial centrality. However, they appeared to have high group pride (private regard), awareness of racism (perhaps low public regard), and they viewed themselves as being successful members of their group (more private regard).

They appeared to most associate with the connectedness/high affinity group defined from Chavous' study. Thomas et al. (2009) used similar profiles in their discussion of reactions to teacher discrimination with Caribbean and African American students. Most relevant (highlighting the diversity of results throughout literature) was that students' racial identity attitudes (high centrality, high public regard) did not directly associate with academic achievement after controlling for demographics. The authors noted that having high centrality served as a kind of "buffer" to overcoming the impact of teacher discrimination.

More studies exploring academic achievement across these four racial profiles are

still needed. Most interesting was the contradictions and lack of consensus that African American student racial identity profiles associate with academic achievement. In one way, it appeared that developing students' connection to their own group and throughout adolescence (centrality and private regard) was most important. In other cases, students who were disregarding race (centrality) and disconnecting from their own group (private regard) appeared to be more academically successful. It was also noted that students who were in the latter group (taking an oppositional identity) could be victim to symptoms of depression or other psychological issues because it was quite a demanding psychological task to disconnect with one's group and, consequently, presented further social challenges (Chavous, 2009).

### **Mathematic Identity Research**

A mathematics identity is a "person's self-understanding of himself or herself and how they are seen by others in the context of doing mathematics. Students often express mathematics identity in narrative form as a negotiated self always under construction, and results from the negotiation of our own assertions and the external ascriptions of others" (Martin, 2007, p. 41). Martin (2000) provided the first framework of a mathematics identity by establishing the following tenets: (1) students' beliefs about their *ability* to perform in mathematical contexts; (2) students' beliefs about the *importance* of mathematical knowledge; (3) students' beliefs about the *constraints* and opportunities in mathematical contexts; and (4) students' beliefs about the *motivations* and strategies used to obtain mathematical knowledge" (p.19). These tenets are incorporated in the theoretic framework used in the current study and explained in more depth in the next section.

Learning the norms and discourse practices of the mathematics classroom, along with

gaining a positive perception of oneself as a capable “doer of mathematics” has been shown to be important for mathematics success (Boaler, 2000). In line with this idea, it would appear that racial, academic, and specifically mathematics identity would hold the most promise for explaining what schools, teachers, communities/families, and students, along with other stakeholders may need to address to improve mathematics achievement for African American students (Berry, 2008; Jackson & Wilson, 2012; Martin, 2000, 2009). Mathematics identity is thought to be connected to racial identity as Martin (2000) stated, “...there appears to be a close connection between mathematics identity and African-American [racial] identity...” (p.20). Mathematics identity was shown to also be similar to personal identity in that it was fluid and susceptible to changes based on an individual’s experience (English-Clarke, Slaughter-Defoe, & Martin, 2012; Nasir & de Royston, 2013). Erickson also supported the idea that identity was fluid and could change describing it as an continuous process whereby individuals establish recurrently a self-image, balancing both his own feelings about himself and how he thinks others judge him (Erickson, 1968, pp. 22-23).

Tatum (2003) explained “the parts of our identity that *do* capture our attention are those that other people notice, and that reflect back to us. The aspect of identity that is the target of others’ attention, and subsequently of our own, often is that which sets us apart as exceptional...” (p.21). Tatum’s quote would hold teachers and others in a school (like peers) responsible in helping African American students to see themselves as capable mathematics students. Inversely, teachers who communicate low-achievement expectations could negatively impact a student’s mathematics identity. Students need help in negotiating their membership (e.g., in mathematics class) and in learning ways of participating in each

community of practice (Hodge, 2006). Unfortunately, there has not been enough research that has utilized mathematics identity as a framework to investigate the merits that might help in improving the performance, persistence, and the choice to pursue mathematics careers and majors of African Americans adolescents in mathematics. Martin pointed out that research has yet to fully understand the intersection of what it means to be a mathematics learner and what it means to be an African American and exactly how a student is to, “construct mathematics learner identities and racial identities” (Martin, 2007, p. 41). The current study seeks to move this line of investigation a step further.

### **Overarching Framework**

In this study, mathematics identity drew upon an established, theoretically-supported framework: the Expectancy-Value Model for Achievement Motivation (Eccles et al., 1983; Eccles & Wigfield, 2005; Wigfield, 1994). This social-cognitive model stresses the role that students’ expectancies for academic success and their perceived task value have on their academic achievement, persistence, and engagement (Pintrich & Schunk, 2002). As discussed in the literature review, mathematics achievement research traditionally has focused on limited demographics and general motivation without regard to students’ social, cultural, and environmental situations.

The Expectancy-Value Model for Achievement Motivation helps to situate the process of learning around issues like social class, race, culture, language, and gender (Nasir, 2002; Spencer, 1995). Of these issues, race was the focal point of my research. Using the Expectancy-Value Model for Achievement Motivation, this study took students’ expectancies for success and their subjective task value and compared some of the same

factors that are defined by Martin (2000) as pertinent to developing one's mathematics identity. To reiterate, mathematics identity was theorized as being students' beliefs about: "(1) their *ability* to perform in mathematical contexts; (2) the *importance* of mathematical knowledge; (3) *constraints* and opportunities in mathematics contexts; and (4) *motivations* and strategies used to obtain mathematics knowledge" (p.19).

An underlying assumption of the Expectancy-Value Model of Motivation is that one may feel capable of doing a task (e.g., achieving in mathematics), but if there is not value placed on the task, then one would be less likely to engage in said task (Eccles et al., 1983). Additionally, a task may be valued, but if one does not feel capable of accomplishing it and expects to fail, then that person might be less likely to engage in the task. The Expectancy-Value Model for Achievement helped to elucidate some of the social-cognitive factors and specified a way in which those factors might be influenced by prior experiences. Altogether, these would contribute to whether a student chose to persist and achieve in an academic domain (Eccles et al., 1983; Eccles & Wigfield, 2005; Wigfield, 1994). Eccles (2009) opines that particularly in adolescence, our expectance value is driven by two core perceptions that shape our identity: our perceptions in terms of our skills and competences and our perceptions in terms of our personal values and goals. These core perceptions inform an individuals success expectations and their motivation to get involved.

A representation of the Expectancy-Value Model for Achievement Motivation has been provided in Figure 1. This figure includes an adaptation of the model using numbers, which corresponds to the tenets of mathematics identity (Martin, 2000). This adaptation seeks to unite the foundational elements of both the Expectancy-Value Model for Achievement

Motivation and mathematics identity. Whereas expectancy-value motivation may be a more general description for how any student may achieve in a subject area, I believe that mathematics identity can be seen as a context-specific adaptation of expectancy-value motivation that can prove useful in explaining how African American students may come to achieve in mathematics.

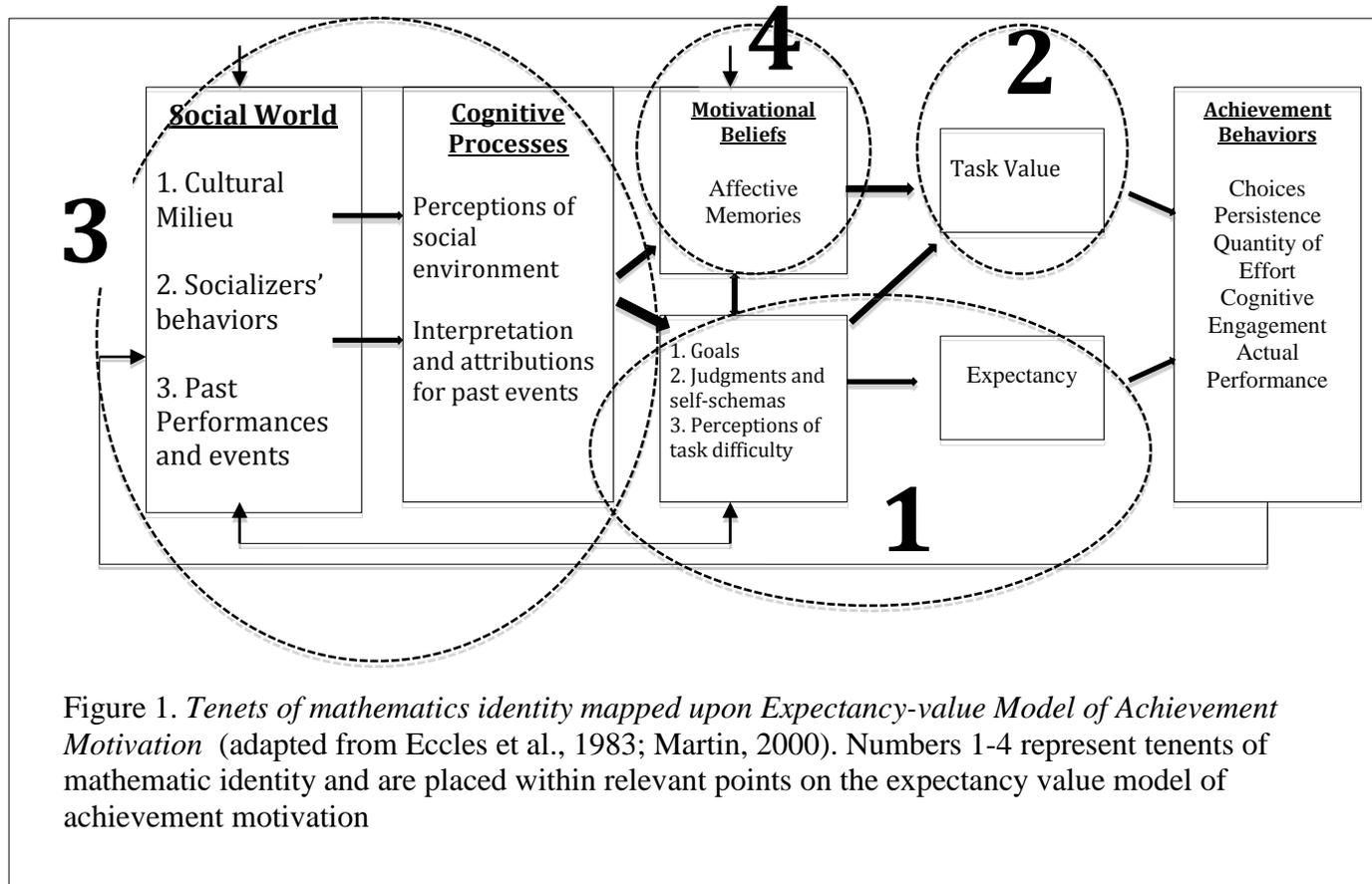


Figure 1. *Tenets of mathematics identity mapped upon Expectancy-value Model of Achievement Motivation* (adapted from Eccles et al., 1983; Martin, 2000). Numbers 1-4 represent tenets of mathematic identity and are placed within relevant points on the expectancy value model of achievement motivation

The far right of Figure 1 defines a set of achievement behaviors connected to learning. Outcomes for secondary mathematics courses could include results such as high performance/proficiency on mathematics achievement tests or other more general exams such as the SAT/ACT. Another important outcome is observing more African American mathematics students persist, engage, and identify with mathematics beyond just passing the mathematics course. Ideally, a greater portion of African American adolescents would set their trajectories to include higher-level mathematics courses in high school and college. It is also favorable that they would choose to pursue mathematics-related majors and careers. In the figure, Martin's four tenets of mathematics identity are placed at relevant points along the model. The number represents the following: 1) beliefs about one's ability to perform in mathematics; 2) beliefs about the importance of mathematics knowledge; 3) beliefs about the constraints and opportunities to learn mathematics; and 4) motivational beliefs about mathematics. The two main variables that directly influence achievement outcomes in the expectancy-value model are a student's *task values* and *expectations for mathematics* (Eccles et al. 1983). Task values and expectations, although not specifically named mathematics identity definitions, are very similar to what is included. The following paragraphs will explain the posited alignment of the two frameworks.

First, *expectations for mathematics* refer to the degree a student expects to do well or experience success in mathematics. This corresponds to the first tenet of mathematics identity: one's beliefs about their ability to perform in mathematics. Beliefs on ability parallel expectancy, thus, the number 1 surrounds expectancy in Figure 1, suggesting this connection. Eccles and Wigfield (2002) have shown that adolescents with high expectations for their

performance in an academic domain tended to show improved achievement. By the same, Martin (2000) believes that having high expectations for success is a critical component to having a positive mathematics identity.

Secondly, *task values* refer to the value students placed on engaging in mathematical learning tasks. This corresponds to the second tenet of mathematics identity: one's beliefs about the importance of mathematical knowledge. If a student finds mathematical tasks important, then they may allocate a significant value or level of importance to mathematics. These concepts are not completely synonymous. This point will be further explained in later sections. In Figure 1, the number 2 surrounds *task values*.

Task values include the general importance of mathematics to a student, but also include a student's interest, the utility/function of mathematics, and are offset by the cost for students to engage in mathematics as shown in Figure 1. Regarding the utility/function of mathematics, African American students may have unique obstacles in appreciating the utility of mathematics the way mathematics has been historically contextualized. Regarding the students' perceived value of mathematics, the comparison of the two models theorizes that students may be required to negotiate elements of their African American identity to increase the value of mathematics, especially if it is perceived as a non-Black activity through the socialization messages of in and out group stereotypes (Oyserman et al., 2003). Students could then perceive the cost as being too high based on their prior exposures to discrimination and stereotypes. Together, having high expectations for success in mathematics and placing a high value on obtaining mathematical knowledge provides a foundation for the desired mathematical outcomes shown on the right side of Figure 1.

In this study, survey measures sought to assess the types of mathematical expectancies and task values held by a sample of African American mathematics students. Initially, both students' expectancies and task values were hypothesized to be influenced by beliefs about the task such as competence in mathematics, perceived difficulty of mathematics, and one's self-schema (whether the student identified with math). For the purpose of this study, race was explored as a salient piece of one's identity and the possible relatedness of racial and mathematics identity was examined.

Furthermore, mathematics expectancies and task value were influenced by a student's perceptions of how others feel about them. The remainder of the model (Figure 1, number 3) includes these types of influences and obstacles. These entities include peers, family members, communities, teachers, media, and schools. From multiple angles, students can be impacted by expectations for the better or for the worse. Additionally, students' own early experiences in mathematics classes, along with other positive or negative stereotypes of mathematics as a difficult subject, allow them to build their own effective memories pertaining to mathematics. This is thought to increase task values and future expectancies to succeed in mathematics. This is an ongoing process that begins at an early age for students and is reinforced or interrupted as new experiences in mathematics are gained. In this study, African American students' experiences were explored in relation to their mathematics teachers and classrooms, which are both believed to be critical contributors to mathematics experiences and task values.

Other constraints and opportunities that have contributed to memories/feelings have the potential to be discovered (Figure 1, number 3). These can result into motivations for and

about mathematics (Figure 1, number 4). Constraints resulting from discrimination (racial or otherwise) are identified as socializing experiences around mathematics. Students' interpretations of these socializing experiences are the foundation of their motivational beliefs. For this study, it was critical to learn from both students and teachers about the specific teacher practices and student experiences that significantly contributed to the positive socialization, which improved affective memories. These affective memories could then translate into high expectations and task values for mathematics. These task values could then support an overall positive mathematics identity and achievement outcomes.

### CHAPTER 3: METHODOLOGY

The purpose of this study was to examine mathematic identity theory and methods of effective teachers to improve African American students' performance in mathematics. More specifically, the purpose of the study was to describe the demeanors, beliefs, and practices that "effective" mathematics teachers used to support African American students' achievements in mathematics.

#### Research Questions

Two broad questions guided the different phases of this study:

1. To what extent are African American adolescent students' mathematical identities related to their developing racial identity?
  - a. How are components of students' mathematical identities related to different types of racial identification?
  - b. What are the characteristics of a positive mathematics identity?
2. What are the beliefs, demeanors, and practices of an "effective" mathematics teacher of African American adolescents that support both achievement and mathematics identity development?
  - a. How do those nominated as "effective" mathematics teachers describe themselves and their practices within the context of teaching mathematics to African American students?
  - b. To what extent are mathematics teachers cognizant of racial identity as a part of the mathematics learning process and what role does this play in promoting a sense of who they are as members of their cultural group?

- c. How do those nominated as “effective” mathematics teachers help African American students’ confidence in mathematics and how do they encourage students’ to value mathematics as relevant and useful to their current and future lives?
- d. How do African American students perceive their mathematics teacher and their experiences with mathematics?

### **Hypotheses for Research Question 1**

**Hypothesis one.** A positive and statistically significant relationship between racial identity (private/public regard and centrality) and mathematics attitude (confidence, usefulness, and effective motivation) will be observed among African American adolescent mathematics students.

**Hypothesis two.** A negative and statistically significant relationship between perceived discrimination in mathematics contexts from teachers and peers and Math Attitudes (usefulness, confidence, and effective motivation) will be observed among African American adolescent mathematics students.

**Hypothesis three.** Racial identity will moderate the relationships between students’ perceived discrimination in mathematics contexts from teachers and peers and their Math Attitudes.

### **Research Design**

This research study employed a sequential-explanatory, mixed-methods design (quantitative → qualitative) in that qualitative data helped to explain the initial quantitative

data (Creswell et al., 2003). The study was undertaken as illustrated in the diagram below in Figure 2.

**Phase 1:** Implementation of the quantitative strand. African American high school students (n = 102) completed the following survey measures.

<p><b>Measure:</b> Math Attitude Scale (MAS)</p> <p>Subscales: A) Perceived confidence in mathematics; B) Usefulness of mathematics; and C) Effective motivation</p>	<p><b>Purpose:</b> To collect measures for mathematics identity, specifically students' overall mathematics attitude.</p>
<p><b>Measure:</b> Youth Survey of Race &amp; Mathematics (YSRM)</p> <p>Subscales: A) Experience with mathematics and race and B) Racial-mathematical stereotypes</p>	<p><b>Purpose:</b> To collect further measures of mathematics identity, specifically students' experiences with discrimination in mathematical contexts.</p>
<p><b>Measure:</b> Multidimensional Inventory of Black Identity – Teen (MIBI-T)</p> <p>Subscales: A) Centrality; B) Private regard; C) Public regard</p>	<p><b>Purpose:</b> Collect measures of the students' racial identity.</p>



**Phase 2:** Analysis of the quantitative data and planning for qualitative phase:

<p><b>Step 1:</b> Analyze the descriptive statistics of all survey responses from students. Analyze ANOVA output among all five teacher groups on mathematics identity variables.</p>	<p><b>Purpose:</b> To determine teacher/student groups that are the most appropriate for in depth qualitative exploration and where positive math identity and achievement appear most salient.</p>
<p><b>Step 2:</b> Analyze correlations between mathematics identity variables with racial identity variables.</p>	<p><b>Purpose:</b> To determine how math identity may be associated with racial identity.</p>
<p><b>Step 3:</b> Adjust interview questions as needed to investigate further relatedness of math identity and racial identity.</p>	<p><b>Purpose:</b> To allow the quantitative results to inform the exploration questions during qualitative analysis.</p>



**Phase 3:** Analysis of the qualitative phase. Teachers and students will be interviewed using the interview protocol.

<p><b>Step 1:</b> Interviews were conducted with two selected teachers where math identity and achievement were comparatively higher.</p>	<p><b>Purpose:</b> To gain teacher perspectives of their practices and beliefs that support African American students' mathematics achievements and positive mathematics identity.</p>
<p><b>Step 2:</b> Focus interviews were conducted with students of the two corresponding teachers from Step 1 (n = 4-7 per students per school).</p>	<p><b>Purpose:</b> To compare student perspectives with teacher perspectives (from Step 1) on instruction and classroom practices and to learn from students how they perceive their racial identities may be related to their mathematics attitudes/identity.</p>



**Phase 4:** Compare and contrast the quantitative and qualitative results: Interpretation of how the quantitative and qualitative phases informed each other.

Figure 2: *Overview of research steps taken for sequential-explanatory mixed-methods study.*

## **Participants**

**Teacher participants in phase one.** Five teachers were identified and recruited to participate in the initial phase of the study using the recruitment criteria in Table 1. After receiving approval from North Carolina State University Institutional Review Board (IRB), I sought out uniquely talented and effective high school mathematics teachers who had demonstrated the ability to help their African American students achieve in their mathematics courses. I utilized my prior employment relationship with one school district, along with my professional relationships with two different school districts to obtain permission from key administrators and district superintendents to include three school districts in my study. These relationships proved important in the recruitment of teachers during the busy end-of-year testing period in Spring, 2015. Initially, I sent each superintendent a copy of the recruitment letter describing the criteria I needed for teachers to be included in my study. I then followed-up with each superintendent with an in-person meeting. In each of these meetings, I was able to obtain the names of at least one teacher and was directed to conference with the teachers' corresponding principals. The superintendents also provided the contact information for the principals and helped to set up those meetings. Next, I had in-person meetings with each of the schools' principals and verified the recruitment criteria for each of the teachers. During this time, I also obtained information about the nature and status

of the school. After each of these conversations, I was escorted to the teacher's classroom and allowed to introduce myself in order to set up a time for a more detailed conversation about participating in the study. Each of the five teachers I met, were interested and eager to participate in the study. I had no prior relationship with any of the five teachers.

Table 1

*Recruitment Criteria for Recruiting Effective Teachers in Phase 1*

Criteria	<u>Detail</u>
Achievement	Evidence of African American student growth and/or proficiency on state tested math courses.
Principal Observations	Most recent ratings on North Carolina rubric for teacher evaluations were at least proficient on all standards, but desirable to have high ratings on standards related to teaching diverse student groups and pedagogy. Informal observation by principals also confirmed proficient and higher ratings.
Student Rapport	Evidence of positive student interactions, praise from African American students, requests by students to have the teacher, and a low record of discipline referrals.
Parent/Community Rapport (desired but not required)	Evidence of positive interactions with parents, families, and/or community members of African American students. Teacher logs kept of parent contact, parent conferences held, etc.

*Note.* Achievement, student rapport, and parent community rapport were verified via school principals. Each principal discussed these criteria with the PI. No confidential documents were obtained or shared. Principals confirmed that the teachers were above standard on evaluations.

To better plan for the analysis, it was important to know the contexts that interactions occurred among the five teachers and their students. Table 2 contains demographic information on each of the participating schools organized by each of the five teachers.

Table 2  
*Participating Schools and Teachers*

Teacher Name	Ms. Alice	Mr. Ramses	Ms. Faithful	Ms. Free	Ms. Gretter
Race/Gender	White Female	White Male	White Female	White Female	White Female
School Name	Fortress High	Hometown High	Center High	Swamplands High	Academic High
School Size (approx. based on enrollment)	900	900	900	1100	400
District	District A	District B (largest in sample and region)	District C	District A	District C
Grades Taught	9-12	9-11	9-12	9-12	9-12
Number of Participating Students	22	16	35	17	12

*Note.* Information on each school group and corresponding teachers for the initial phase of the study. All teacher names are pseudonyms.

**Teacher participants in phase 3.** In line with the sequential-explanatory mixed-methods design, the third phase sought further investigation through interviewing two selected teachers. In order to achieve an in depth analysis, I only chose two teacher/student contexts among the five. I sought contexts where there was evidence that African American adolescents held positive attitudes about mathematics and where there was support of an emerging positive mathematics identity. A full description of how survey data were used to pinpoint and select these two teacher/student contexts can be found in the data analysis section. It is in these two contexts that I hoped to learn what teachers were doing to influence students' attitudes/identification with mathematics and to confirm, within a small group of

students, how these attitudes had emerged. Two of the five teachers who administered the surveys to their African American students were recruited and selected for the qualitative phase of my study. Each of the two teachers fulfilled the recruitment criteria listed in Table 3.

Table 3

*Recruitment Criteria Fulfillment by Selected Teachers for Interview*

<u>Criteria (from protocol)</u>	<u>Teacher 1 (Ms. Alice)</u>	<u>Teacher 2 (Mr. Ramses)</u>
Practicing Math at least 2 years grades 8-12, preferable 10-12 <sup>th</sup>	8 years	15 years
Teacher majority state-tested non-elective math	Yes – Math 1, Math 2	Yes – Math 1, Math 2
Recognized by school admin and/or district leadership to have exceptional skills teaching AA students	<p>A. Superintendent reported scores for individual student growth highest in district.</p> <p>B. Principal confirmed that ratings from informal and formal observations were satisfactory and higher.</p> <p>C. Principal described the way the teacher bonds well with students and rarely referred students for discipline. Had received positive feedback from students and parents regarding her class.</p> <p>D. Parents –some evidence (see C)</p>	<p>A. Superintendent and Asst. Superintendent of 9-12 reported scores for individual student growth highest in district over the past two years.</p> <p>B. Principal confirmed that ratings from informal and formal observations were satisfactory and higher; in fact, the principal recently completed PHD in culturally relevant leadership and was privy to the nature of research. Eagerly suggested Mr. Ramses.</p> <p>C. Principal described the way the teacher bonded well with students and rarely referred students for discipline. Had received positive feedback from students and parents regarding his class over past two years during his tenure.</p> <p>D. Parents –some evidence (see C)</p>

The first teacher selected was Mr. Ramses who taught at Hometown High School, home to approximately 900 students. Hometown was one of six high schools in the largest geographical district that served approximately 24,000 students. The second teacher selected taught at Fortress High School, home to approximately 900 students. Fortress was the largest

school in the district and was considered an inner-city school. Approximately 68% of students qualified for free or reduced lunches at Fortress High School. Mr. Ramses and Ms. Alice taught in districts geographically bordering each other in Southeastern US.

**Student participants surveyed in phase 1.** Before recruiting students, I first explained the study design to the participating teachers via phone conference and reviewed the consent form for students. Teachers were then allowed to ask any questions regarding the study. The teachers then presented the study goals, procedures, and the consent forms to their students and then these documents were sent home with all of the African American students in their classes during the Spring 2015 semester. Only students who were identified as African American by the school demographic student management system were included. Students who returned the signed consent forms over the course of the next week and that received parental consent were surveyed the following week. All student surveys were conducted in a computer classroom.

This process produced a sample of 102 African American students at five public high schools (ninth through twelfth grades). These students completed three surveys: the MAS, the YSRM, and the MIBI-T. The grade and gender distribution of these students is in Table 4.

Table 4

*Grade and Gender of Student Participants Surveyed by School*

	<u>Fortress</u> <u>High</u>	<u>Hometown</u> <u>High</u>	<u>Center</u> <u>High</u>	<u>Swamplands</u> <u>High</u>	<u>Academic</u> <u>High</u>
Gender					
Male	13	7	18	8	8
Female	9	9	17	9	4
Grade					
9 <sup>th</sup>	9	8	25	8	3
10 <sup>th</sup>	1	4	8	4	2
11 <sup>th</sup>	0	2	2	4	2
12 <sup>th</sup>	12	2	0	1	5
Total (n)	22	16	35	17	12

*Note.* Academic High was an early college high school.

**Student participants for interviews in phase three.** In line with the sequential-explanatory and mixed-methods design, the third phase would foster further understanding through student focus group interviews. Students participating in this phase were a small sample of students who attended Fortress High (n= 4) and Hometown High (n= 6) and were taught in the most recent semester by Ms. Alice or Mr. Ramses, respectively. They also participated in the surveys during the initial phase. Prior to the administration of the survey, I invited students to participate in a focus group after the survey. I also explained the general format and what to expect if students were interested in participating in the focus group. The teacher and I discussed the recruitment for focus group interviews. The teachers expressed two potential obstacles anticipated to student participation in the focus groups. The first concern was that there were only two weeks remaining left in school. The second concern was that students might not want to participate due to general apathy. This discourse was an opportunity for me to show my respect for time, context, and place (White & Corbett, 2014).

As a solution, the teachers and I discussed that involving the teacher in the organization of the focus groups would encourage students to participate and that without teacher involvement there would likely be low voluntary participation in the focus groups. This method of recruitment was also useful for ensuring students' willingness, comfort, and interest to participate in the focus groups. As a result, during the invitation, students were asked to indicate their interest in participating in the focus groups to the teacher as well. This allowed their teacher to discuss participating in the focus groups after they finished the surveys.

At Fortress High, six students expressed interest in the focus groups and seven students expressed interest at Hometown High. In assembling the sample of students, the goal was to obtain a representative, mixed-gendered sample of students who were willing to share and discuss their experiences related to mathematics and race. Students who "liked" mathematics were particularly encouraged to participate. Each of the interested students was then given the consent forms for participating in the focus groups. Of the six students from Fortress High, two were unable to participate in the focus group. Of the seven students given consent forms from Hometown High, all returned their forms, but one student was absent the day of the focus group. While conducting the focus group sessions, I wore a shirt and tie, business attire, for Mr. Ramses focus group, and I happened to wear bright pink Kobe's, athletics shorts, and a t-shirt for my interview with Ms. Alice's focus group. A summary of those students participating in the focus-group interviews is provided in Table 5 and Table 6.

Table 5

*Focus Group Participants at Fortress High*

<b>Fortress High Focus Group n=4</b>				
<u>ID</u>	<u>Gender</u>	<u>Grade</u>	<u>Age</u>	<u>Overall Math Attitude</u>
1	Female	12	19	3.59
2	Male	9	15	3.65
3	Male	12	19	4.36
4	Male	9	14	4.15
				$\bar{x} = 3.96$

Table 6

*Focus Group Participants at Hometown High*

<b>Hometown High Focus Group n=6</b>				
<u>ID</u>	<u>Gender</u>	<u>Grade</u>	<u>Age</u>	<u>Overall Math Attitude</u>
1	Female	10	15	4.33
2	Female	10	16	4.15
3	Female	9	14	4.68
4	Male	9	16	4.21
5	Male	9	15	4.69
6	Male	10	16	3.74
				$\bar{x} = 4.30$

## Measures

**Math Attitudes.** Martin (2000) defined mathematics identity as students', "(1) Beliefs about their ability to perform in mathematical contexts, (2) Beliefs about the instrumental importance of mathematical knowledge, (3) Beliefs about constraints and opportunities in mathematical contexts, and (4) Beliefs about the resulting motivations and strategies used to obtain mathematical knowledge" (p. 21). I employed three subscales of the Fennema and Sherman (1976) MAS that was designed to measure three of the above factors of mathematics identity. Each subscale had 12 items students used to respond to the questions. All questions can be found in Appendix A.

The first subscale of the MAS was called *Confidence in Math*. This aligned with Martin's (2000) definition of "beliefs about [students'] ability to perform in math" (p. 21). Students rated their agreement to questions like, "I know that I can do well in math," and "I'm no good in math."

The second subscale of the MAS was called *Usefulness of Math*. In Martin's definition, he referred to students' beliefs about the importance of math knowledge. I noted that the terms importance and usefulness are not synonyms. It is quite possible that a person can perceive a thing as useful but not necessarily important, for example, space travel is useful for others but it is not necessarily important to me. Martin's tenet of importance did not lend itself well to measurement. It was not a quantitative term. However, I felt comfortable using importance and usefulness synonymously largely because within the survey questions, students rated their agreement to questions that asked about *importance* such as "Math is *important* to my future," and "Math is a waste of time."

The third subscale of the MAS was called *Effectance Motivation*. In Martin's definition, he referred to students' beliefs about their motivations and strategies used to obtain mathematics knowledge. Students rated their agreement to questions like "When a math problem arises that I can't immediately solve, I stick with it until I have a solution." The answers on this subscale reflected how motivated students were and, to some extent, how they persevered through challenge to obtain mathematics knowledge. Here again, I did not assume that Effectance Motivation completely covered Martin's third tenet of student's beliefs about their motivations and strategies. However, I felt that at a minimum perseverance and motivation would be captured in the Effectance Motivation subscale.

Questions on all scales were posed as statements, and students were asked to rate their agreement on a 5-point Likert scale ranging from "strongly disagree" to "strongly agree." Higher values suggested greater endorsement for the statement. It is relevant to highlight that the scale used a middle-term option labeled "not sure." Although this decision may be controversial from a psychometric perspective, which will be discussed in the limitations section of this study, it did not appear to significantly affect the results. I confirmed this by weighting scale values after Hernandez, Dragow, and Gonzalez-Roma (2004), with "not sure" assigned the weight of zero and the remaining values for levels of agreement retained. Zero weighting was used to account for respondents that did not have enough information to form an opinion. Assigning a weight of zero to the 'not sure' responses removed their impact on the mean scores. The resulting difference to the quantitative results was small. Qualitatively, this procedure helped to check the validity of the scales using "not sure" as a middle point. Furthermore, Nowlis, Kahn, and Dhar (2002), in their exploration of the effect

of removing a neutral option on attitude and preference judgments, found that there were no statistically significant differences in the effects across the categories when the scores in their study were averaged. The final MAS survey for this study had 35 items. In addition to these three sub-scales, the original MAS included six other subscales: math anxiety, success in math, mathematics as male domain, mother scale, father scale, and teacher scale (Fennema & Sherman, 1976). These other subscales focused on constructs that were considered as “external” socializing beliefs. Because they were not directly related to the goals and research questions of the study, they were not employed.

Studies that were conducted after the creation of Fennema and Sherman’s math attitude scale successfully provided empirical evidence that supported the theoretical structure of the Fennema-Sherman MAS (Broadbrooks et al., 1981; Mulhern & Rae, 1998). Mulhern and Rae (1998) reported internal consistency for all of the original subscales. The three subscales used in this study (confidence, usefulness, and effective motivation) had Cronbach alphas of approximately 0.91, 0.88, and 0.86, respectively. These values were consistent with prior research with adolescent and college-aged participants (Mulhern & Rae, 1998; Hackett & Betz, 1989; Bramlett & Herron, 2009; Rattan et al., 2012). We can use the internal consistency for each of the three subscales in these prior studies to establish a baseline and compare it with the internal consistency in the current study (Table 7).

Table 7

*Math Attitude Subscales and Reliabilities*

Authors, years	N	Sample description	Internal consistency (Cronbach's $\alpha$ )		
			Confidence	Usefulness	Effectance
<b>Current study</b>	105	High-school students	.89	.87	.79
<b>Previous studies</b>					
Bramlett & Herron, 2009	224	College students	.95	.93	.89
Fenneman & Sherman, 1976	1233	College students	.93	.88	.87
Mulhern & Rae, 1998	196	School children	.91	.88	.86

*Note.* Fenneman and Sherman (1976) reported half-split coefficient.

**Attitudes about race and math.**

The one component of Martin's (2000) mathematics identity definition that was *not* measured on the MAS was the students' perception of constraints and opportunities in mathematical contexts. This final (and critical) component of Martin's definition took into consideration the issues of access and discrimination in mathematics contexts that had been the focal point of many research studies (Ladson-Billings, 2000; Thomas et. al., 2009; Berry, 2009; Leonard et. al., 2010). All questions can be found in Appendix A. Some of the MAS items reflected negative math attitudes. These items were reverse-coded in the analysis.

To measure the presence of constraints and opportunities perceived by students, I employed two subscales from the Youth Survey on Race and Mathematics (YSRM). This scale was only recently developed with the intention of studying the racial and mathematical socialization messages received by African American adolescent students in relation to their

developing mathematical identities (English-Clarke, 2011; English-Clarke et. al., 2012). As with the MAS, I did not employ all of the subscales of the original survey. I used two subscales: *Experiences with Race and Math* and *Racial-Mathematical Stereotypes and Beliefs*.

The first subscale, *Experience with Race and Math*, consisted of seven questions that were designed to assess students' perceptions of their teachers and how students felt other students perceived their mathematical abilities. Students rated their agreement to questions like "I have been discriminated against by a math teacher because of my race."

The second subscale was called *Racial-Mathematical Stereotypes and Beliefs* and consisted of six questions. These questions were designed to assess students' level of agreement with various stereotypes and beliefs that addressed both mathematics and race. Students rated their agreement to questions like, "The popular Black students in my school don't do well in mathematics." All questions were posed as statements and students were asked to rate their agreement on a 5-point Likert scale ranging from "strongly disagree" to "strongly agree." Higher values suggested greater endorsement for the statement. The resulting survey had 13 items.

The scales unused from the YSRM were attitudes about mathematics, knowledge of parents' and others' experiences with mathematics (English-Clarke, 2011). The rationale for omitting the "attitudes about mathematics" subscales was that it was a repeat subscale from the MAS. The remaining two subscales of the YSRM were not used because they did not fit the scope of my study.

The entire YSRM scale was written with the five subscales in mind; however, it was

noted by the research team (which included Martin) that the subscales likely represented more than one distinguishable construct (English-Clarke, 2011). With this in mind, certain items were removed, and English-Clarke conducted factor analyses to redefine and organize items into meaningful factors or clusters. These analyses identified four factors. One of the strongest factors that resulted through this process was “experienced discrimination by others in math.” Cronbach’s alpha for this new factor on discrimination (referred to in Table 8 as *negative perception by others in math*) was 0.582. It was suggested that more items could have been created to refine the scale and increase reliability (English-Clarke, 2011); however, these have not been created. I chose to use the current version of this instrument with a similar sample of adolescent high school students and conducted the same type of factor analyses.

I was able to extract a similar factor that conceptually measured the extent students had perceived discrimination from teachers and peers in mathematics contexts because of their race. The internal consistency for this cluster of five items was adequate (Cronbach’s alpha = 0.729). There was no other instrumentation available that assessed students’ perception of restraints and opportunities in math contexts. The YSRM scale was used despite low reliability because there was only one study that used the tool and it was the only tool available that measured students’ perception of discrimination in mathematics and racial/math beliefs/stereotypes. Together, questions from the MAS and the YSRM were used to approximate students’ mathematics identity and encompassed the majority of the four elements noted by Martin (2000).

Table 8

*Race and Math Attitudes Subscales and Reliabilities*

Race and Math Subscale (Factors after Analyses)	Previous Consistency (Cronbach's Alpha)	Internal Consistency
Negative Perception by Others in Math	.582	.729
Negative Racial-Math Beliefs	.583	N/A
Beliefs about Math Opportunity	.335	N/A

*Note. Math confidence was the fourth factor omitted and not listed. Previous consistencies were reported from only other studies available (English-Clarke, 2011; English-Clarke et. al., 2012)*

**Racial identity.** To assess adolescent racial identity, students completed the MIBI-T (Scottham, Sellers, & Nguyễn, 2008). The MIBI-T was an instrument designed to assess the three dimensions (Centrality, Regard, and Ideology) of the MMRI, which, prior to 2008, was one of the most accepted conceptualizations of African American racial identity (Sellers et. al, 1998). Due to the differences in age, experiences, and context with adolescent students compared to college or adult students, the teen version of this tool was appropriate. Through a three-year longitudinal study using 489 African American adolescents, the MIBI-T was found to demonstrate construct validity; therefore, it was considered an acceptable instrument for use with African American teenagers. The resulting survey measure had 21 items and was organized into subscales measuring racial centrality, regard (public/private), and ideology (nationalism, assimilation, oppressed minority, and humanism). Subscales from the MIBI-T had been related to phenomenon pertinent to African American young adults including

experiences with racial discrimination (Sellers et. al, 2006; Sellers & Shelton, 2003). All questions can be found in Appendix A.

The racial centrality, private regard, and public regard subscales were used for this study. Ideology was not included. Together these subscales were designed to assess various aspects of African American adolescents' racial identity. The first subscale, private regard, consisted of three questions that were designed to measure how students felt about other African Americans and about being African American. Students rated their agreement to questions like, "I am happy that I am Black," and "I am proud to be Black." The second subscale, public regard, consisted of three questions that were designed to measure students' perception of other groups' feelings towards African Americans. Students rated their agreement to questions like, "Most people think that Blacks are as smart as people from other races," and "People think that Blacks are as good as people from other races." The third subscale, racial centrality, consisted of three questions that were designed to measure the extent that students felt that race was an important aspect to their identity. Students rated their agreement to questions like, "I feel close to other Black people," and "I have a strong sense of belonging to other Black people." These measures were collected and analyzed to determine if any or all of these subscales corresponded with higher or lower mathematical attitudes or identities. These data were used to answer research questions about whether mathematics identity and racial identity were related among African American adolescents.

In their study, Scottham et al. (2008) found that internal consistency for the three subscales used in this study were adequate. Cronbach alphas for *racial centrality*, *private regard*, and *public regard* were 0.55, 0.76, and 0.66, respectively; but they corrected these

values with the Spearman-Brown formula, obtaining Cronbach alphas of *0.78*, *0.87*, and *0.79*, respectively. Other studies that used the MIBI-T had lower reliability and alpha levels for these subscales.

Rogers, Scott, and Way (2015) used the MIBI-T, with 183 male African American students from low-income families, and Cronbach's alpha for racial centrality was *0.55* and private regard was *0.81*. Public regard was not reported. They hypothesized possible instability in racial centrality in the middle adolescent years. The internal consistency for the racial centrality subscale in the current study was poor (Cronbach's alpha =*0.38*). The internal consistency for private regard and public regard were adequate (Cronbach's alpha =*0.75* and *0.63*, respectively Table 9). Seaton, Sellers, and Yip (2009) studied 314 African American teenagers in a Midwest public high school and found the Cronbach's alphas for *centrality*, *private regard*, and *public regard* were *0.52*, *0.66*, and *0.64*, respectively. Other studies that used the MIBI-T resulted in a lower Cronbach's alphas (between *0.50* and *0.60*) for the racial centrality subscale as well (Thompson & Gregory, 2011; Lim et. al., 2012; Hood et. al., 2013; Okeke-Adeanju et. al, 2014).

Table 9

*MIBI-T Survey Subscales and Reliabilities*

<u>Subscale</u>	<u>Previous Consistency</u> (Cronbach's Alpha)	<u>Internal Consistency</u>
Centrality	0.38 - 0.65	0.38
Private Regard	0.87	0.75
Public Regard	0.76	0.63

*Note.* Previous consistencies from (Seaton, Sellers, and Yip, 2009; Thompson & Gregory, 2011; Lim et. al., 2012; Hood et. al., 2013; Okeke-Adeanju et. al, 2014)

## **Data Collection**

### **Administering surveys**

On the day of surveys, students reported to a computer classroom at a designated time set by the principals and teachers. A day before the surveys, principals emailed the teachers the list of students who needed to report to the classroom. This reduced the time away from reviews that were ongoing during these last weeks of school. During each session, the participating teachers accompanied me to ensure all students were present and to provide a level of comfort for students. Before the survey, I did a quick verbal presentation on the goals of the study and the nature of the survey questions and then I gave students an opportunity to ask questions before they began. The URL for the surveys was written on a Whiteboard. Students who were absent on the day surveys were administered, were given the survey the next day they were present in school. The make-up process was done with three students across the five schools. The surveys took approximately 25 minutes to complete. Students did not receive compensation for their participation in the survey.

### **Teacher interviews.**

In addition to the surveys, digital audio-recordings of individual teacher interviews were collected. After all surveys had been conducted, two teachers were selected to participate in an individual interview session with me. Interviews averaged 80 minutes. Prior to the interview session, I re-stated the purposes of the study and answered any questions regarding their participation. The formats of the interviews were semi-structured, and I utilized the interview protocol in Appendix A. During the interviews, I explored teacher narratives and used clarifying questions to explore their experiences teaching mathematics to

African American adolescent students.

### **Student focus group interviews.**

Digital audio recording was also used during student focus group interviews. These were conducted one week after teacher interviews. Focus group interviews averaged 80 minutes. Prior to the interview session, I re-stated the purposes of the study and answered any questions regarding the students' participation. There was also "small talk" between myself and the students to provide students with a level of comfort. The formats of the interviews were semi-structured, and I utilized the interview protocol in Appendix A. During the interviews, I delved into collective and individual student narratives using questions from the protocol along with clarifying questions and others to explore their experiences with mathematics and race.

### **Data Analyses**

#### **Quantitative data analysis.**

The quantitative analyses consisted of two parts: 1) using the survey results from the initial phase of the study and 2) addressing my quantitative research questions on the relatedness between mathematics identity and racial identity

### Definition of variables

Variables in table 10 were generated from the survey measures collected from 102 African American adolescent students.

Table 10

#### *Descriptive Statistics of all Used Variables*

<u>Variable</u>	<u>Mean</u>	<u>Std. Deviation</u>	<u>Min</u>	<u>Max</u>	<u>Skewness</u>	<u>Kurtosis</u>
Confidence	3.41	.78	1.36	4.91	-0.28	-0.32
Perceived Usefulness	3.80	.69	2.18	4.91	-0.47	-0.44
Effectance Motivation	3.34	.60	1.83	4.42	-0.13	-0.69
Math Attitude (Overall)	3.51	.56	2.07	4.69	-0.15	-0.30
Private Regard	4.47	.60	2.67	5.00	-1.27	0.94
Public Regard	3.27	.91	1.00	5.00	-0.29	-0.64
Perceived Discrimination	1.47	.50	1.00	4.80	0.13	-0.21

*Note.* 1.-Strongly Disagree, 2.-Disagree, 3.-Not Sure, 4.-Agree, 5.-Strongly Agree;  $n = 102$  for all variables.

The average reported public regard was “Not Sure” (3.2), indicating that most students were not sure how others perceived African Americans. The average reported private regard was between “Agree” and “Strongly Agree” (4.47), indicating that most students valued themselves as African American. The average reported confidence in mathematics was slightly above “Not Sure.” The average reported perceived usefulness of mathematics was between “Not Sure” and “Agree” (3.8), indicating that most students were

closer to seeing mathematics as useful and relevant to their current and future lives. The average reported effective motivation score was slightly above “Not Sure,” indicating that most students felt unsure about their ability to persevere through challenging mathematics tasks. The variable Math Attitude (Overall) was a computed variable of the combined mean of the three subscales (confidence, perceived usefulness, and effective motivation). The average reported overall Math Attitude was between “Not Sure” and “Agree” (3.5), indicating that students were unsure about their overall attitudes in regards to mathematics. Moreover, values of Skewness are not far from normality (not far from zero) except for Private Regard; where it is more concentrated in lower values. On the other hand, Kurtosis values are distinct from a normal distribution (not close to three) indicating a flat distribution of the mentioned variables.

**Selecting two representative teacher/student contexts.** The explanatory mixed-method design was appropriate for “using quantitative results about participant characteristics to guide purposeful sampling for a qualitative phase” (Creswell et al., 2003, p. 82). In line with this design, data from survey results were used in the selection of the two teachers (Mr. Ramses and Ms. Alice) for the qualitative investigation. This step included some light analyses of quantitative data. As a result, this section may read like quantitative findings, but it is the stage in analysis that aided the teacher selection and so appropriately I situated it in this section.

I began by comparing all five “groups” of students from corresponding teachers (numbered 1-5) on variables grades in mathematics and Math Attitudes using a one-way ANOVA (Table 11). This ANOVA was necessary as the sample sizes of students varied

between schools. These variables were selected because the design of the study was to collect data from environments where mathematics attitudes and student grades/achievements were high.

Table 11

*One Way ANOVA between Schools on Variables*

<u>Variable</u>	<u>df</u>	<u>F</u>	<u>Significance</u>
Confidence	4	1.62	0.174
Perceived Usefulness	4	2.27	0.067
Effective Motivation	4	4.71	*0.002
Math Attitude (Overall)	4	3.41	*0.012
<i>Note. * Indicates <math>p &lt; .05</math></i>			

I began by identifying which variables had significant differences in means based on students' responses. This analysis indicated that overall Math Attitude and Effectance Motivation had statistically significant difference among the groups. Further reading of the post hoc test (Tukey HSD) showed specifically which schools had statistically significant mean differences between each other on these variables.

**Effectance Motivation.** Effectance motivation dealt with the extent students persevere through challenging mathematics tasks and whether they found enjoyment through such challenges. When looking at this variable across groups, students' scores' from Academic High stood out as significantly lower than students of the other four teachers. This indicated that students from Academic High did not seek or enjoy challenging math tasks/problems. The students' scores from Academic High were also significantly lower than all other teachers' students on overall mathematics attitudes. This metric removed the teacher from Academic High from participating in the qualitative phase of the study. From the

ANOVA, it appeared that students who possessed higher Math Attitudes and achievement were represented in the remaining three schools. It was at this point that teachers from Fortress High, Hometown High, and Swamplands High emerged as leaders for participation in the qualitative phase of the study. I then relied on the demographics of each school to narrow down the selection to two teachers (Table 12)

Table 12

*Descriptive Statistics on Variables by Teacher and School*

<u>Fortress High</u> <u>N=22</u>	<u>Mean</u>	<u>Std.</u> <u>Deviation</u>	<u>Hometown High</u> <u>N= 16</u>	<u>Mean</u>	<u>Std.</u> <u>Deviation</u>	<u>Swamplands</u> <u>High N= 17</u>	<u>Mean</u>	<u>Std.</u> <u>Deviation</u>
Confidence	3.66a	.79	Confidence	3.52a	.83	Confidence	3.33a	.76
Perceived Usefulness	3.82a,b	.56	Perceived Usefulness	3.91a,b	.82	Perceived Usefulness	4.05a	.50
Effectance	3.30a	.64	Effectance	3.45a	.53	Effectance	3.36a	.51
Math Attitude (Overall)	3.60a	.56	Math Attitude (Overall)	3.63a	.60	Math Attitude (Overall)	3.63a	.41
Grade Level	10.68a	1.5	Grade Level	9.8a	1.1	Grade Level	9.9a	.99
<i>Note.</i> Values in the same row and sub table not sharing the same subscript are significantly different at $p < .05$								

**Student Grade Level.** Students from Fortress High had an average grade level of 10.68 (more upper classman represented). These students had been in the high school context longer. This was more desirable as these students had more time in school and experiences to reflect upon. Students from Hometown High and Swamplands High had average grade levels of 9.8. Although there were only a small age difference between students from Hometown High and Swamplands High, there were some other considerations that supported selecting the teacher from Hometown High over the teacher from Swamplands including the school context.

**Context.** It was desirable to have a variety in teaching contexts to support the future analyses and ensure that results were not confounded by geography or other factors (e.g., the gender of the teacher). Swamplands High and Fortress High were in the same school district; therefore, I only wanted to include one in my qualitative study. The teacher from Fortress High had a better recommendation from the superintendent than the teacher at Swamplands High. She was described to be “the best in the district.” This recommendation helped to support the decision in selecting the teacher from Fortress High for the qualitative study. In addition, selecting teachers from separate districts would provide variability in their perspectives, actions, and feedback because all districts train and support teachers differently and have different expectations. Selecting Ms. Alice and Mr. Ramses (Fortress and Hometown respectively) also allowed for one male teacher and one female teacher which further added variability to the study.

**Addressing quantitative research: question one.** A major goal of this study was to describe the connections between African American adolescents’ mathematics

identity and their racial identity. The first research question was the following: How are components of students' mathematical identities related to different types of racial identification? To investigate this question more specifically, three hypotheses focused the analyses. Hypothesis one was that a positive and statistically significant relationship would be identified between racial identity (private/public regard and centrality) and mathematics attitude (confidence, usefulness, and Effectance Motivation). Hypothesis two was that a negative and statistically significant relationship would be identified between perceived discrimination in math contexts from teachers and peers and Math Attitudes (usefulness, confidence, and effectance motivation). Hypothesis three was that racial identity moderated the relationship between students' perceived discrimination in mathematics contexts from teachers and peers and their Math Attitudes.

To test each of these hypotheses, I used the survey data to examine bivariate correlations between Math Attitude variables and racial identity variables. I conducted multiple linear regression analyses to determine the variance accounted for by racial identity in Math Attitude and then perceived discrimination in Math Attitude. To test the third hypothesis, a multiple regression analysis was conducted including the interaction term of racial identity and students' perceived discrimination to test the moderating interaction.

**Qualitative data analysis.** Interviews were transcribed and analyzed by identifying and grouping parts of the transcripts as they related to categories and the targeted research questions. The analyses used open coding (Strauss & Corbin, 1990) in developing themes that emerged within and across interviews. Teacher and student interviews were analyzed using thematic content analysis (Coffey & Atkinson, 1996). Transcripts of interview dialogue

were open-coded at the sentence/paragraph level (Strauss & Corbin, 1990). Transcripts of interview dialogue were open-coded at the sentence/paragraph level (Strauss & Corbin, 1990). The analysis involved compound phases of coding. Codes were developed for the beliefs, demeanors, and practices, components of mathematics identity, descriptions of students' racial identities, and possible connections between students' racial and mathematical identities. All of the codes were listed and organized into categories (Strauss & Corbin, 1990). Direct quotations that best illustrated these categories were then combined to construct each participant's overall narrative (whether individual teacher or corporate focus groups).

**Mixed method data analysis.** Perception is not always reality, so it was important to compare and contrast reported experiences of teachers and students from the interview process with the survey data/results to help triangulate all of the findings. This process was accomplished by revisiting the quantitative findings and then searching through the themes and overall narratives of the teacher and student interviews to find supporting evidence or contrasts. The process of using multiple methods for triangulating findings has been established through the use of the sequential-explanatory mixed methods design used in this study (Creswell et al., 2003). Although initial research questions lent themselves to quantitative analyses, understanding these relationships from the qualitative analyses was the overall goal of the study. This was to understand how racial identities and perceived discrimination experiences related towards positive orientations and attitudes towards mathematics for African American adolescents. Although this multi-method process was

very time-consuming, it was necessary to address the overall research questions related to the nature of a positive mathematics identity for African American adolescents.

## CHAPTER 4: RESEARCH RESULTS

The research results are presented in a sequential order based on the sequential-explanatory mixed methods design. The quantitative results are presented first, then the qualitative data, followed by the interpretation/synthesis of the two in the mixed method analysis. A summary of the quantitative and qualitative findings is presented at the end of each section. The qualitative and quantitative findings were synthesized, combined, and presented at the end of the chapter.

### **Phase 1: Quantitative Results**

**Hypothesis 1: Racial identity and Math Attitude.** It was hypothesized that a positive and statistically significant relationship would be identified between Math Attitude (Confidence, Usefulness, and Effectance Motivation), measured by the MAS, and racial identity (Private/Public Regard and Centrality), measured by the MIBI-T. The analysis indicated a statistically significant positive correlation among some of the subscales. Table 13 shows the bivariate correlations of the MAS, MIBI-T, and demographic variables.

Table 13

*Bivariate Correlations between Math Attitude, Racial Identity, and Demographic Variables.*

Variable	1	2	3	4	5	6	7	8
1.Age	--							
2.Gender	-.031	--						
3.Math Attitude	-.127	.024	--					
4.Math Confidence	-.091	-.097	.835**	--				
5.Math Usefulness	-.084	.134	.738**	.330**	--			
6.Math Effectance Mot	-.140	.040	.862**	.653**	.487**	--		
7.PercieveDiscrimination	.219*	-.125	-.297**	-.176	-.203*	-.367**	--	
8.Race Regard Private	-.111	.079	.269**	.165	.301**	.191	-.282**	--
9.Race Regard Public	-.042	.018	.200*	.194	.100	.190	-.067	.292**

\*  $p < .05$ , \*\*  $p < .01$

There were statistically significant positive correlations between private regard and overall Math Attitude ( $r = .269$ ,  $p = .005$ ); private regard and math usefulness ( $r = .301$ ,  $p = .004$ ); public regard and private regard ( $r = .292$ ,  $p < .01$ ); and public regard and overall Math Attitude ( $r = .200$ ,  $p = .003$ ). How participants perceived themselves racially as African American/Black was significantly and positively related to their overall mathematical attitude. As students possessed a positive sense of being Black, their overall Math Attitudes were more positive. A closer look within the Math Attitude subscales showed that students appeared to see mathematics as more useful to their current and future lives if they possessed a positive sense of being Black. There was also a

statistically significant negative correlation between private regard and perceived Math discrimination ( $r = -.282, p = .004$ ). Perceived discrimination was analyzed in detail in the next research question; however, as it relates to participants' private regard (racial identity), the more positive students felt about being Black, the less students' perceived discrimination from teachers and peers. Gender and age were not found to influence math attitudes overall, perceived math discrimination and race regard (private).

**Hypothesis 2: Perceived discrimination and Math Attitude.** It was expected that a negative relation would emerge between perceived discrimination in mathematics contexts from teachers and peers. This was measured by the YSRM and Math Attitudes (Usefulness, Confidence, and Effectance Motivation) and measured by the MAS for the sample of 102 African American adolescent mathematics students. There were statistically significant negative correlations between: perceived discrimination from teachers and peers and overall Math Attitude ( $r = -.297, p < .01$ ); perceived discrimination and math usefulness ( $r = -.203, p < .01$ ); and perceived discrimination and math Effectance Motivation ( $r = -.367, p < .01$ ). How participants perceived experienced discrimination in mathematics contexts by teachers and/or peers due to their race decreased their overall attitude toward mathematics. Perceived discrimination from teachers and peers was significantly and positively associated with students' grade ( $r = .219, p < .01$ ).

**Controlling for Demographic Variables.** In addition to checking the correlations above, multiple regression analyses was performed to investigate the ability of racial identity and perceived discrimination to predict levels of students' overall Math Attitude. In the first step, school, gender, grade, age, grades in school and grades in math were entered into the

model. The model was significant for grades in math ( $F(6, 99) = 3.179, p=0.007$ ), with the % variance of 16.7%. In the second step of the stepwise multiple regression, perceived discrimination was entered. This model was significant ( $F(7, 99) = 4.394, p=0.000$ ) for grades in math and perceived race discrimination. The addition of the perceived race discrimination variable improved the model to 24.7% variance. In the third step racial identity (private regard) explained an additional 12.7% variance in overall Math Attitudes, with no significant impact for school, gender, grade, age, grades in school ( $F(8, 99) = 6.943, p=0.000$ ). The final model consisted of three statistically significant predictor variables; grades in math, racial identity and perceived racial discrimination having positive  $\beta$  values ( $\beta = 0.344, p = 0.001$ ), ( $\beta = 0.197, p = 0.036$ ) and ( $\beta = 0.384, p = 0.000$ ). The summary of the multiple regression analyses for variables predicting overall Math Attitudes is provided in Table 14.

Table 14

*Summary of Step-Wise Regression Analysis for Variables Predicting Students' Math Attitude controlling for demographic variables*

Model	Predictor variables	B	SE	$\beta$	T	P	$\Delta R^2$	Adjusted $R^2$
1	(Constant)	2.794	1.266		2.208	.030	.167	.167
	What school do you attend?	-.090	.070	-.127	-1.287	.201		
	What is your gender?	.030	.171	.016	.174	.862		
	What grade are you in?	-.219	.161	-.288	-1.358	.178		
	What is your age	.096	.138	.150	.695	.489		
	What kinds of grades do you get in school?	.047	.117	.044	.405	.687		
	What kinds of grades do you get in math?	.253	.087	.324	2.896	.005*		
2	(Constant)	3.155	1.216		2.595	.011	.247	.079
	What school do you attend?	-.103	.067	-.146	-1.543	.126		
	What is your gender?	.034	.164	.019	.206	.838		
	What grade are you in?	-.050	.164	-.066	-.306	.760		
	What is your age	-.049	.139	-.077	-.353	.725		
	What kinds of grades do you get in school?	-.043	.115	-.040	-.369	.713		
	What kinds of grades do you get in math?	.258	.083	.330	3.087	.003*		
	Perceived Racial Discrimination	.294	.093	.306	3.146	.002*		
3	(Constant)	1.351	1.189		1.137	.259	.374	.127
	What school do you attend?	-.057	.062	-.080	-.907	.367		
	What is your gender?	.119	.151	.066	.790	.432		
	What grade are you in?	-.031	.150	-.040	-.204	.839		
	What is your age	-.025	.128	-.039	-.196	.845		
	What kinds of grades do you get in school?	-.026	.106	-.025	-.249	.804		
	What kinds of grades do you get in math?	.269	.076	.344	3.513	.001*		
	Perceived Racial Discrimination	.190	.089	.197	2.131	.036*		
	Racial Identity (Private Regard)	.281	.065	.384	4.349	.000*		

Note: Dependent Variable: Math Attitude Overall

Note: B, unstandardized regression coefficient; SE, standard error;  $\beta$ , standardized regression coefficient; t, obtained t-value; p, significance;  $R^2$ , proportion variance explained;  $\Delta R^2$ , change in variance; \*  $p < 0.05$

The results of the linear regression analysis of students' math attitude based on racial discrimination and racial identity was significant as ( $F(99, 2) = 4.251, p = 0.017$ ), with an  $R^2$  of 0.079. Participants predicted Math Attitude is equal to  $2.99 - 0.011(\text{racial discrimination}) + 0.130(\text{racial identity})$ . Math attitude declined 0.011 units for each racial discrimination perceived and increased 0.130 units for each racial identity perceived. This suggests that students' math attitude decreased when they felt that there was racial discrimination from peers or teachers regarding math but increased when students have a positive racial identity. Only racial identity was a significant predictor of math attitudes in the model (Table 15).

Table 15

*Summary of Step-Wise Regression Analysis for Variables Predicting Students' Math Attitude*

Variables	Model 1			Model 2		
	Unstandardized Coefficients		Standardized Coefficients	Unstandardized Coefficients		Standardized Coefficients
	B	SE	$\beta$	B	SE	B
(Constant)	3.44	0.136	-	2.99	0.204	-
Perceived Racial Discrimination	.036	.060	.060	-0.011	0.060	-0.018
Racial Identity				0.130	0.046	0.286
$R^2$		0.004			0.079	
F for Change in $R^2$		0.355			4.251	

*Note: Dependent Variable: Math Attitude Overall*

\* $p < .05$  \*\* $p < .01$

**Testing for differences among teachers.** A two-way analysis of variance or factorial ANOVA was conducted on the influence of two independent variables (teacher and racial identity) on students' overall Math Attitudes to determine if statistically significant

differences existed on each of the discovered relationships. A two-way ANOVA was also conducted on the influence of two independent variables (teacher and perceived discrimination) on students' overall Math Attitudes. There were no statistically significant differences between teacher groups and perceived discrimination.

**Hypothesis 3: Perceived discrimination, racial identity, and math attitude.** It was hypothesized that racial identity moderated the interaction between students' perceived discrimination in mathematics contexts from teachers and peers and their Math Attitudes. This hypothesized relation is diagrammed in Figure 3.

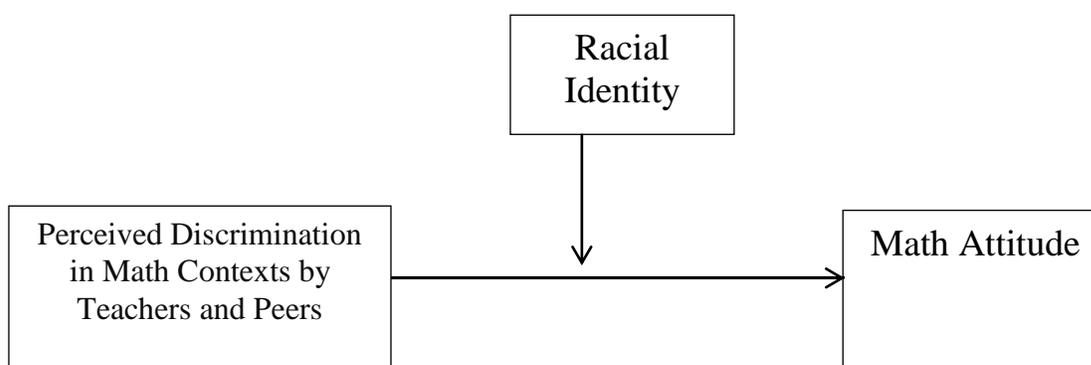


Figure 3. *Hypothesized interaction between perceived discrimination, racial identity, and Math Attitude variables.*

To test this hypothesis, hierarchical multiple regression analyses were conducted. To begin, an interaction variable was created by using the product of the two independent variables private regard (race identity) and perceived discrimination. I ran the multiple regression both with and without the new interaction variable. Model 1 (without the interaction variable) was significant ( $F(2, 99) = 15.701, p=0.000$ ). Model 2 (with the interaction variable included) was also significant ( $F(3, 98) = 10.472, p=0.034$ ). However,

model 2, with the interaction between perceived discrimination and racial identity included, did not account for significantly more variance than the model with only perceived discrimination and racial identity by themselves,  $\Delta R^2 = 0.220, p = 0.617$ . Therefore, it appeared that there was no moderating effect. Table 16 presents a summary of this regression analysis.

Table 16

*Summary of Step-Wise Regression Analysis for Race Identity and Perceived Discrimination Predicting Students' Math Attitude (n=102)*

Variables	Model 1			Model 2		
	Unstandardized Coefficients		Standardized Coefficients	Unstandardized Coefficients		Standardized Coefficients
	B	SE	$\beta$	B	SE	B
(Constant)	2.909	.079		2.899	.082	
Race Identity	.295	.067	.403*	.316	.079	.431*
Perceived Discrimination	.184	.087	.192*	.190	.089	.198*
Race Identity Perceived Discrimination Interaction				.030	.061	.054
$R^2$	0.241			0.243		
$F$ for Change in $R^2$	15.701			10.472		
<i>Note: Dependent Variable: Math Attitude Overall</i>						

## **Quantitative Results Summary**

The initial quantitative findings provided a basis for the qualitative exploration. Results from the survey responses of sampled African American students indicated several meaningful relationships, which I summarize below.

Hypothesis 1 predicted that higher scores on private regard and public regard subscales on the MIBI-T scale would show positive correlation with Math Attitudes for African American adolescent mathematics students. The results demonstrated that the more optimistic African American adolescent students felt about being African American (and how they sensed non-Blacks feel about being Black), the more positive they felt overall about mathematics. Therefore, hypothesis 1 was supported by the data provided by the African American adolescents (N=102) in the study.

Hypothesis 2 predicted that higher scores on the perceived discrimination from teachers and peers generated from the YSRM would demonstrate a negative correlation with overall mathematics attitudes for African American adolescents. The African American adolescents in the study had significantly lower Math Attitudes when they perceived racial discrimination from teachers and peers in mathematics contexts, thereby supporting hypothesis 2. In addition, a significant negative correlation was observed between perceived discrimination from teachers and peers in mathematics contexts and private regard. Thus, to some extent, the more African American teens perceived and experienced racial discrimination in mathematics contexts the less optimistic they felt about being African American. These three findings were further explored in the qualitative phase of the study.

Hypothesis 3 predicted that racial identity interacted as a moderating variable between perceived discrimination in mathematics from teachers and peers and overall Math Attitudes. A model involving the interaction between the two variables did not account for any significant variation in overall Math Attitudes. Therefore, hypothesis 3 was not supported by the data.

### **Phase 2: Initial Qualitative Analysis**

Two teacher interviews and two student focus group interviews were conducted between April and May of 2015. A thematic analysis (Coffey & Atkinson, 1996) of the qualitative data was conducted beginning with transcribing more than four hours of audio-recordings of the interviews. Generally, the process used followed the six-step process as outlined by Creswell (1998).

The first two steps involved organizing and preparing the data and then carefully reading and transcribing the data. During these steps, I organized and prepared a table to record and sort comments to aid the coding process. I listed all of the different components that were sought in the posed research questions creating a column for teacher beliefs, demeanors, practices, cognizance of racial identity, building student confidence, and helping students to see mathematics as relevant to their lives and futures. In addition, broad columns were created for students' expression of mathematical identities (Martin, 2000), descriptions of students' racial identities, and possible connections between student racial and mathematical identities. Step three used the coding to design a detailed analysis of the information. Significant comments were recorded and organized into the columns that represented answers to these categories. Upon completion of this step, the table contained an

exhaustive list of all relevant comments from transcripts related to the broad categories. Coding is a judgment call and inevitably can be subjective (Sipe & Ghiso, 2004). For this reason, additional coding passes were made through the transcripts after themes were developed to ensure that additional comments were not missed. Additionally, another PhD candidate was enlisted to compare the codes against the transcripts for inter-rater reliability. A sample of coding tables is provided in Appendix C. In step four, I generated a description of the findings by themes. It was at this point that comments were interpreted and organized into possible themes by considering similarities and differences among comments within corresponding categories. In some cases, there were multiple and unique themes between each of the teachers and focus groups. In other cases, themes spanned across both teachers and/or focus groups. In this study, I relied upon the explanations of both the teachers and their corresponding students to develop themes for each teacher. The fifth and sixth steps included representing the descriptions in a narrative and visual form and analyzing to make meaning of the data.

The results of this process are presented below, with combined qualitative findings summarized in tables 17-23. They begin with findings about each teacher, presented in detail, followed by the finding of the corresponding focus groups. Findings from the qualitative investigation were not what I expected from a study on effective teachers of African American students. Comments, themes, and their interpretations that follow could be viewed as troubling and/or controversial.

### **Mr. Ramses**

Mr. Ramses was the mathematics teacher (white male) interviewed from Hometown High School. After originally attending school for political science, he went on to take a position at Hometown High teaching mathematics as a non-traditional teacher (He taught civics first and added on his math license. He is highly qualified) . He has taught at Hometown for 15 years. Mr. Ramses described himself as a teacher who held high expectations for himself professionally and for his students. He has lived in the same area and attended Hometown High when he was a student. The cohorts of students Mr. Ramses taught were organized based on the premise that they struggled in eighth or ninth grade mathematics classes.

**Mr. Ramses' beliefs.** Two relevant themes and two subthemes were identified during the thematic analysis process. The first theme was a belief that African American students *were lacking basic supportive elements to succeed*. These needs were that they lacked home support and were academically substandard. The second theme was that African American students were *easier to speak to*.

**First belief theme: African American students lacked basic needs.** Mr. Ramses first theme was that African American students had greater needs than students from other races, specifically in regards their home lives and that they lacked basic academic skills. His perspective about African American students' home lives had been built upon his fifteen years of teaching, years of visiting student homes, conversations with his students, and his life-long inhabitation in the geographic region of Hometown High and the resulting biases and experiences from his background. During our interview, he said that, "Most of the

students I teach don't have a father figure, or they don't have a positive one if they do," and "...a lot of kids come from broken homes where they only might have an uncle or a preacher." In conducting home visits from the school, he noted that, "...you get to see that there is no air conditioner (in the home)," and "there are seven brothers and sisters or cousins (in the house) aged four through nine." He shared a conversation with me that he had with a male student where he learned that the student "...hadn't seen his daddy in five years." He stated, "...it is easy for them (students) to go in the neighborhood and do 'god knows whatever they do' and not come to school." In addition to comments focused on students' home lives, he expressed a clear lack of students' proficiency in basic academic skills and that they lacked motivation. In discussing challenges teaching his students, he stated, "It goes back to basic math, things you think kids should know. Anything we might think is common or ordinary, they don't get as much," and "African American students are more apathetic compared to White students." In terms of skills, Mr. Ramses reasoned that "many lack social skills (...) and I think a lot of kids are not good at reading," and "...they come in here and think that they have always sucked at math." He did admit, "...math *can* be boring" and addressed these assumed deficiencies with his students by "...telling them to forget where you have been [referencing math achievement]" and "Most of them feel that they can't do it). He was generally negative when describing the nature of his African American adolescent mathematics students' lives and abilities.

***Second belief theme: African American are easier to speak to.*** Throughout the interview, there were several key and subtle comments that Mr. Ramses made that were important because they represented a unique perspective of his African American students.

He expressed a general enjoyment and preference for teaching and working with African American students because they possessed what he described as a more ‘down to earth’ personality. In regards to teaching honors classes with a majority of White students, he admitted, “I do get bored, since personalities in there are not as open to those sort of antics [describing his teaching methods]” and “I just don’t like it as much, the kids who just sit there and take up space.” He shared that “one thing I always loved about Black friends [referencing friends from his time in school] were that they were not fake like a lot of other friends...my Black friends were always down to earth.” He said that “...they [African American students] are easier to talk to and I want them to be successful.” Although contradicting to his descriptions of African American children’s backgrounds, this theme clearly developed while interviewing him on his experiences with African American students.

In assessing Mr. Ramses’ overall beliefs, there were substantial comments related to how his students are generally lacking in their home lives and academic abilities. Other researchers and practitioners that study teachers of African American students have identified similar stereotypical beliefs held by teachers (Ogbu, 2003; Rosenbloom & Way, 2004). I then sought to learn more of what he was like as a person and how his students’ perceived him.

**Mr. Ramses’ demeanors.** Three relevant themes were identified during the thematic analysis process in regards to Mr. Ramses demeanors. The first theme was a demeanor of being *relational*. The second theme was a demeanor of an *appeal for professional achievement*. The third theme was a demeanor of a *balance between work and play*.

*First demeanor theme: Mr. Ramses as relational.* The first theme identified in regards to Mr. Ramses' demeanors was overwhelmingly represented throughout the conversation with him as well and his students. His comments hovered around an idea that since he was from the area (attending school at Hometown, and having a deep experiential knowledge of the people and places) he was able to build a positive relationship with his African American students. He believed that he was able to easily form meaningful relationships with his African American mathematics students. This was best understood from his comment, "I like that I can relate to them [African American students] because I was in seats where they are; I grew up in the same neighborhoods...these were the same type of kids that I was friends with in school." On four occasions, he provided this rationale for why he "could relate to them more [than other teachers]." This priority for getting to know students spanned into a form of practice he identified. Although only a few students expressed knowing he was from the area, one of his female ninth grade students explained that "we got a bond" in describing their relationship with him. Additionally, three of the six students in the focus group admitted that they had a sibling who had him as a teacher. They accredited this as one of the reasons they could trust and relate to him in the class context from the start. One student described how having him as a basketball coach was also helpful in their relationship. Students made mention that he was "kind-hearted" and "caring."

During our interview, Mr. Ramses described his time in high school as "I had just as many Black friends as White friends," and "...so I've always been surrounded with Black people...but I've always had a relationship with them." Through time, he had built a reputation as a teacher and member of the school community. To him, having experiences

growing up and now teaching at Hometown provided him with the knowledge necessary to form relationships with his students. Perhaps another word for this relational demeanor would be a social demeanor. In using social to describe him, he was able to talk and use common elements of the geographic culture in communicating with his students.

***Second demeanor theme: Mr. Ramses as appealing for professional achievement.***

Throughout the interviews, there were also frequencies of comments from both Mr. Ramses and his students that supported that he had a strong desire for personal achievement (via corporate student achievement). This was paired with his dissatisfaction of historical results. Throughout the interview, implicitly, and explicitly, I could not deny his competitive and challenging nature. He shared that his "...EOC scores were first in growth, second in proficiency" (in the district) and that he had "really good scores; I always get really good scores with challenging kids..." He admitted that "I'm a competitive person, and kids kind of read into that," and that "I'm not one to just sit here [referencing accepting a challenge]" as well as "I try to make it competitive for them [students ]; they get juiced up..."

In discussing Mr. Ramses with the focus group of his students, one male tenth grade student described, "To me he's very serious. What he does is really important to him," and "It's very competitive. Every time we would like be talking about the exam, he would be like you have to be in this percent [talking about academic growth] ...he is very competitive." Another male tenth grade student went as far as describing him as "impatient," and "Ramses is always talking about how last semester he was number one." Mr. Ramses perceived his task of teaching students as a challenge, but that he did not "mind the challenge because I love a challenge [laughing]" while at the same time saying that students "sense how much it

is challenging.” This was certainly validated from the interview with the Hometown students; however, they appeared proud of this fact and gave him credit for his hard work. This demeanor was defined by him as part of his own achievement orientation (i.e., desiring to do a good job and excel at his profession).

**Third demeanor theme: Mr. Ramses as balancing between work and play.** There was equal commentary by Mr. Ramses and his students on his demeanor of being balanced between a fun/funny teacher and a teacher who was business-like. Students described their class saying, “it’s very fun,” and “it’s like fun and hard, at the same time.” When asked to tell me how this balance was possible, one male tenth grade student replied “cause like when you working, he’s keeping you laughing; he’ll make jokes, but if you don’t get something, he’ll make you go to the board in front of everybody and like to teach you how to do it...” Another male student described Mr. Ramses as “funny and hardworking” and told me “...like I said before it would also be fun (...) like he keeps you laughing while doing work.” Mr. Ramses also shared this about himself in saying that “I’m very humorous,” “I just try to do anything I can to get kids to relax a little bit...,” but that “...there is a fine line between playing and doing a lot of work, but I actually cut it down a little bit and even cut it off [talking about joking].” This fun and business-like demeanor held by Mr. Ramses also manifested itself in practice.

**Mr. Ramses’ practices.** Three relevant themes and five subthemes were identified during the thematic analysis process in regards to Mr. Ramses’ practices within the classroom. The first theme was a practice of *increasing pressure* that manifested in three subtheme practices related to *fast pacing*, *raised class structure*, and *hefty volumes of work*.

The second theme was a specific form of *communication with students* that was further organized into two subthemes of *entertaining delivery* and *direct regarding academic progress*. The third practice, which was described and identified almost solely by students, was *providing extra and individual assistance*.

***First practice theme: Mr. Ramses increasing the pressure.*** Mr. Ramses accredited his success as a teacher to raising the intensity in his classroom practices. His comments along with student comments were organized three ways and showed increased intensity and pressure manifested throughout classroom practices.

*Fast pacing.* When asked about his classes and what he did as a teacher, he admitted, "...I teach really fast." In fact, he went on later to say, "Delivery is really fast, just because everything in here is fast." By fast he was referencing the pacing in the curriculum as well as his actual delivery. In his classes, "quizzes take like ten minutes," and "we only stop 30 seconds to get calculators..." One of his female students contended, "...when I first got in there he was a fast teacher..." and "[referencing her need to have to focus hard] ...because he's fast!" Students differentiated Mr. Ramses from previous mathematics teachers because he "would do two or three lessons a day instead of one." They described not being able to fall behind because "he do a whole lot in such a little time." In his mind, Mr. Ramses felt that he was on a mission to cover a lot in a little amount of time and that students needed to work hard and see a lot of problems. He felt like "I can't hold up the whole class ... [referencing not stopping for one student who is absent or behind]."

*Structured routines.* When asked about his classes and what he did as a teacher for success he explained that "I am very rich and structured (...) each day it is like the same

structure, the same rigidity; it's almost like a machine that keeps going." He explained that because he was so structured students would know exactly what to do when he would be out of class for coaching (basketball) and that "...they never stopped working. That's what I expected from them." He believed that "when they [students] are not good in math that structure helps." By structure he discussed things like students being seated at the bell, the process of quizzing every other day, homework checks daily, daily class practice, and regular, frequent feedback from assessments. Students interviewed did not explicitly describe much about the routines and procedures that he identified. Their comments were more directed towards the fast pacing and the large amount of work required in his class.

*Large volume of work.* In regards to his teaching, Mr. Ramses and his students had a lot to say about the amount of work required and completed. In describing some of this work, Mr. Ramses stated, "we have homework every night, we do a lot of work and we don't do much group work. We are always evaluating ourselves; then we check it [classwork] on the board, and then we do another lesson. I want to do like four problems in a row [in class teaching ]," and "I grade that day; sometimes I get half of them done so I know what to do with them the next day." Students conveyed that "we have a lot of homework assignments in our textbooks" and that "we do like very big packets [referencing exam review]."

Overall, Mr. Ramses' practice of increasing pressure for students could best be summed up by his comments "[regarding his teaching philosophy] ...have very, very, very high expectations, and no matter how much you want to lower that expectation, don't!" and "...I don't do stuff like that [participation grades ]; for me, it's all about numbers. I'm a number person, so I need to be hard on them, have very high expectations, that is what I

like.” Students from the focus group stressed Mr. Ramses’ high expectations of them, the fast the pace of the class, and large amounts of work were all helpful for succeeding on Mr. Ramses’ tests.

*Second practice theme: Mr. Ramses’ communication with students.* Mr. Ramses and his students spoke about the forms of communication used in class throughout the interview process. These comments were organized into two specific forms: those that pertained to communicating in an entertaining fashion and communication that was upfront, direct, and “real” with students about their progress.

*Entertaining delivery.* When describing his communication with students, Mr. Ramses explained, “I talk to the kids; I think in a way they are familiar with. I don’t want to say cutting up, but kinda talking their language, like saying something that might be in a song [that students listened to].” He continued by saying, “...because I’m like loud, I will step aside and be real with them, and sing a song or say some of the lyrics.” Students also mentioned his ability to sing and even dance at times, but they also mentioned how he brought up sports, particularly local college basketball teams, and that these were entertaining conversation points during class. One female tenth grade student said, “Sometimes he does special talk to you, like talk to you about your hair or something.” He utilized his demeanor of being fun or funny through communicating with students in ways that they might relate to and at a minimum were entertained by.

*Direct with students about their progress.* Students from the focus group interview discussed Mr. Ramses’ frequent communication with them about their progress and how he did so in a “real” and direct way. One male tenth grade student began by saying, “...he’ll

stick to you a lot; he'll call on you constantly" and continued by saying, "...I hate using this word, but he's straightforward. Like he'll tell you that you will fail if you are goofing around, that you'll probably not pass because you are goofing around. He will put your grades out in front of everybody and stuff; he'll tell you that you need to do better." Another female student attested, "He talks to us like a normal person," and "he keeps it real" and "... he tells you your grade, and he says you are capable of better work." Mr. Ramses also shared that he would say things to students like, "What are you going to do about it?", referencing lack of past success in math, and "I'm always telling them that it's about *you*, what *you* 've done." He also will text and email students their scores on important tests and discuss their growth with them. It was apparent from both student and teacher interviews that test scores, percentages, and growth were all frequent topics of conversation. All but one student in the focus group had something to say about how he would call them out in class. This "in your face" approach appeared to provide a significant level of accountability and push students in the class as they learned that Mr. Ramses was going to be in their business about their progress.

***Third practice theme: Providing extra assistance.*** This final practice theme emerged almost exclusively from student comments during the focus group interview. On multiple occasions, students described how Mr. Ramses would come to their desk to work one on one, give extra credit assignments, and provided extra practice assignments to help them improve. They also mentioned that he would sometimes share shortcuts and worked to "put the words in a way that you will understand." One male student shared, "He always give you an opportunity to make your grade better like through extra credit or extra assignments." In his

interview, Mr. Ramses did not make any reference to extra assignments or help. He did, however, describe working with students one on one in close proximity to them and working to "...do it [a problem] with me [Mr. Ramses] each step at a time." The presence of this theme showed that students valued the ability to improve their understanding and grades through extra assignments and did appreciate the way he would assist in that process. The fact that he did not discuss this during his interview could have been that he did not realize that students perceived this practice as helpful. He may also have viewed this to be something common and not worth mentioning amidst other practices described. This assistance was the only such case where students produced a theme that was not strongly supported by the teacher interview.

In addition to learning about each of Mr. Ramses' beliefs, demeanors, and practices, I sought to find answers to three additional research questions. First, I wanted to know to what extent teachers were cognizant of racial identity as an element of their mathematics instruction. Second, I wanted to know how teachers built student confidence in mathematics. Third, I wanted to know the ways that teachers helped students to see mathematics as relevant to their lives and future lives.

**Mr. Ramses: Cognizant of racial identity?** In regards to our conversation about race, Mr. Ramses had only a few remarks and they did not easily organize into a theme. Overall, it appeared that racial identity did not play a role in his thoughts on instruction and views of students' racial identity were fairly limited. He did perceive that students were aware of their racial identity by stating, "I think they [students] identify with their race. In the beginning of the year, all the White kids were sitting together, all the Hispanics, and all the

Blacks sitting together. I think they thought, 'I'm a Black-male, I'll find another Black male in here.' So I think they do see and sense race. I think they see it. I think they are used to looking at the board [of top grades] and seeing White student names or whatever...." His students did discuss that "Sometimes we choose groups based on race, we have to have one person of each race in our group, and like we have to compete with the other teams to see who will be first." One student described how he thought this helped him interact with students he typically would not have. On two occasions, students were asked if Mr. Ramses ever discussed race in class (for any reason), all six members reported, "No." In discussing growing up as the only White guy on his high school basketball team, Mr. Ramses explained, "Race didn't mean so much to me..." Based on all that Mr. Ramses and his students shared, there was a very minimal amount of evidence that he was cognizant of students' racial identity and there were minimal concerted efforts to address racial identity beyond the one example of mixed-race groups. It is important to note that the students also generally downplayed race having a role to in their learning.

**Mr. Ramses: How to build student confidence in mathematics?** One relevant theme surfaced during the thematic analysis process in regards to Mr. Ramses' ability to build student confidence in mathematics. This theme was *communicating positive messages/preaching*.

**Theme: Communicating positive messages/preaching.** From speaking with Mr. Ramses and his students, there was adequate commentary about how he continually praised and repeated certain messages to students, particularly about overall success and individual improvement. One female tenth grade student said, "He [Mr. Ramses] boosts your

confidence. Like, he's been telling other classes about me, like how I am so smart. He'll be telling them like that I was kinda' slow at the beginning and I've gotten better. He'll make you feel good about yourself," and another female student shared, "He will call you up in front of people and brag on you." The first tenth grade female student continued, "He let me help kids that are *actually* good at math, that makes me feel pretty good about math." Some of the messages that Mr. Ramses used were "I tell them that they can still do it!" "...You can look at it [the past] and it's just the past. Like an old picture, this is the new picture...of the new you," "You are an individual person, and you can do your best, so don't compare yourself to who's been sitting there, or what you did last year. You just need to do the best you can at this place, at this point..." "If you can do something else and you can do social studies, then you can do math. It's a little different but you can do it." "I tell them that they got to break that trend [of poor performance] and get their names up there [referencing top grades]," "I tell them that if you have always hated math, just take the chance, you might like it," and "If you pass Math 1, I know you're gonna pass Math 2, Math 3, and graduate." All of these comments represented what I interpreted as forms of "preaching," in that Mr. Ramses continually spoke positive messages to students about improvement and this was the primary way that he built confidence in his students. Most of these messages also maintained the assumption that his African American students had past performances of poor to failing.

**Mr. Ramses: How to help students see mathematics as relevant to lives and futures.** Admittedly, Mr. Ramses struggled with getting students to see mathematics as relevant to their current and future lives. He explained it was always very difficult to help students to make the connection. However, what he did was discuss the implications and

consequences of NOT having mathematics skills. He typically shared information with students about the college placement tests and ACT tests. He basically shared the notion that if you did not do well (on the test) you could not get into college. He mentioned that there was opportunity to make more money in the mathematics and sciences. He provided one example about Allen Iverson (former professional basketball player) by saying, “He was a millionaire; he blew all that money, and I joked and said if he had been good with money, or had someone around him that was, he could have saved some money.” His students and I discussed the likelihood of them pursuing higher-level mathematics and half of the students said they “likely would,” and the others said “not as likely.” One male tenth grade student stated, “I guess it prepares us for college. In college we’ll be doing it fast.” Overall there was not as much concrete support from students interviewed that Mr. Ramses did anything in particular to help them see mathematics as more relevant to their lives.

### **Ms. Alice**

Ms. Alice was the mathematics teacher (white female) interviewed from Fortress High School. She had taught within the district for eight years and was back at Fortress High after leaving to teach at the district’s early college high school for two years. She lived in the school district and attended school at Fortress High.

**Ms. Alice’s beliefs.** One prevalent theme emerged during the thematic analysis process in regards to Ms. Alice’s beliefs. This theme, similar to that of Mr. Ramses, was a belief that African American students *lacked basic academic support*.

**Belief theme: African American students lacked basic needs.** This theme emerged by connecting all of Ms. Alice’s comments that demonstrated a belief that her African

American students lacked basic needs compared to other students. For her this was seen primarily in her comments related to parenting and the communities where her African American students lived. Her perspective about African American students' home lives had been built through her personal experiences as a teacher in this inner-city school, living in the community, and her early experiences interning and visiting feeder elementary schools.

During our interview, Ms. Alice stated, "Thirty to forty percent of my students don't go home to a kitchen table where they can sit and do their homework." She continued, "...they go home together: they hang out together; in the housing project. I've seen it. Life is a party there, like a college; kids are everywhere having a good time, hanging out...then there are drugs; they are doing drugs, and then carrying guns. They are hiding this stuff and are not sleeping at night." In regards to parenting, she explained that "parents don't read to them," and "they don't go home to a place that when they get home to use ABC mouse [learning application] or practice math when they are three years old; that's just not happening." She attributed much of the challenges related to teaching her students to their home lives. At times, she was very open about her deficit perspective and even admitted during the interview, "I probably said more about the negatives than the positives. There are a lot of good moms and dads who want to know what is going on." However she did not elaborate on this point. In assessing her overall beliefs regarding the effective instruction and the nature of teaching African American students' mathematics, there were multiple comments related to how she perceived how her students lived in deficient communities and lacked healthy parenting. This belief appeared to influence her empathetic demeanor and her

teaching practices. By perceiving a lack of needs in her students, she began to feel sorry for them.

**Ms. Alice's demeanors.** Three relevant themes were identified during the thematic analysis process in regards to Ms. Alice's demeanors. The first theme was a demeanor of *relational*. This theme was the same disposition identified with Mr. Ramses. The second theme was unique to Ms. Alice, and it was a demeanor of *empathy*. The third theme was a demeanor of *indifference towards lofty expectations and state testing*.

**First demeanor theme: Relational with her students.** The first theme identified in regards to Ms. Alice's demeanors, was substantially represented throughout the conversation with her and her students. Through living and attending Fortress High, she felt that she had experiential knowledge of the people and places, aiding her to easily form meaningful relationships with her students. A noticeable side note was that her husband also attended Fortress High as a student and was the football coach at the school. She attributed some of her student relationships to forming common relationships with her husband as a coach. Together, Ms. Alice and her husband considered Fortress High their home. This was best understood from her comment,

“So, my husband works here; we met here; we graduated from here, so it's just home to me, and although I know that kids everywhere need something, I felt here like kids here need it more. I felt they needed me here more than anywhere else, so it was one of the reasons I came back here.”

On five other occasions, she provided the idea of Fortress High being her “home” and described the “peace” and “comfort” she had working with her students. Throughout the

interview, she described opportunities she had to form meaningful relationships with her students. She talked about how she would use those relationships to keep students engaged in mathematics class. Students also attested to these connections during our focus group interview. One male ninth grade student shared, “I wish we could have a lot of teachers like her because it’s easy to make a connection with her...” and continued, “ I guess it’s just the way she is...her personality [describing how they had a relationship].” Another male ninth grade student stated, “I would describe her as a mother cause she cares for us even if we bad sometimes; she still take care of us. She makes sure you don’t get in trouble, make sure you are doing well.” A female twelfth grade student said, “Yeah, we can relate to her more than other teachers.” Although students did not provide any attributions to these relationships being formed because they knew her husband or her background of being from the area, there was certainly existing connections and students recognized that this was something unique to Ms. Alice. Accordingly, her experiences growing up and teaching at Fortress High provided her with the relational demeanor necessary to form relationships with her students.

***Second demeanor theme: Empathy via her own personal experiences.*** Throughout the interview, I could not deny Ms. Alice’s telling of her own personal story of growing up without her mother and her descriptions of her own personal pain and struggles. She attributed her ability to recognize similar needs in her students to having her own familiar struggles. These stories she shared molded the way she worked with students in the classroom. Early in the interview, she shared, “I grew up not having a mom, so there’s a connection to a single family home. I feel relatable a lot of times to the way they [her students] feel, as far as like ‘meaning-to-please,’ always looking for approval at home, one of

the things they do.” At a later point in the interview she shared “[speaking of her step mother], I was constantly looking for her approval. I was constantly doing things for her love and that’s why I can recognize kids like that, when they hurt, how hurt they are, when they do something great and it’s not recognized.” Unrelated to her family, she shared her own struggle as a female mathematics major in college and how she felt

“Like I was always feeling like I was at the bottom of the class, all these White guys, exactly the same situation that I’m describing for many of my students. I never assume that anybody knows anything; I think that’s a lot of the problem with teachers of math...they assume that you’ve [students] got this, and go on to something else, so I tried never to assume that, I start as low as I can...”

This comment demonstrated how she understood that her own challenging experiences had contributed to her becoming more empathetic towards students. It could be said that she taught out of her own pains. She admitted, “At some point I have to let my heart go I think. My first couple of years teaching I felt like your heart can get you in a little too much. It’s hard to leave it [your heart] behind,” and “I’ve totally been guilty of saying, ‘I don’t think they can do that’ when probably they could have done that, and I should let them try...” One of her male students confirmed this by sharing that “I have a good relationship with Ms. Alice; my mother died and I get mad quickly. She knows how to tell me what to do, go outside and cool off, cause she already know.” Two students jointly shared that they considered her sort of a mother to them. This motherly nature appeared to stem from her own

personal pain of not having a strong mother. She spoke of her biological mother at the end of the interview, “My mom passed away when I was three, so I don’t remember much of her, but she was a teacher, elementary teacher, and her family was as well...It’s weird to think it [me teaching] could be genetic, but things like personality and compassion are things that can make up who we are... We are part of our parents.”

***Third demeanor theme: Indifference towards lofty expectations and state testing.***

Ms. Alice spoke a lot about her dismay with what was required by the state curriculum and her frustration that testing was the same for all students. She stated, “I really don’t think that it’s even feasible to do the amount of stuff [curriculum] in eighteen weeks....my kids last semester did better across the board in math. If they had one concept pretty good, they could figure out others, especially on these tests which are so generic to everybody, which isn’t fair.” She admitted,

“I know legally I have to cover it [curriculum] from A-Z, but I feel ok if I don’t teach all the material. I’m not stressing about it because I know if it takes three weeks to do linear functions, that’s ok, and I did, but everybody [students] knows how to graph a line; everybody knows what slope is. They do great, and so I feel successful, because everybody knows it.” “I’m not worried for saying this, but I don’t feel the pressure; I personally like the growth of students. The kids have to be growing because I don’t really take on the pressure of test scores. I have before, but I don’t take the pressure also of having to cover all the stuff and everybody having to know it all.”

Rather than focus on proficiency and standardized testing, she focused on her students' individual growth. She proudly stated that she, year to year, watched her students improving. She thought it was important when her freshman students came to her inadequately prepared that she helped them grow. She said, "We got a system where we have our feeder middle school, which is 99% minority I think, and we've got students promoted to ninth grade not because they are reading on level or on the right math level, but because they are 16, so they have to come to high school." Students did not make many comments contributing to this theme; however, when asked in the interview about how she grades, one student said, "She just wants to see what we know." The process of grading itself was not always Ms. Alice's first focus, but it was to let students learn the skills.

**Ms. Alice's practices.** Three relevant themes were identified during the thematic analysis process in regards to Ms. Alice's practices in the classroom. The first theme was a practice *communicating with students through open class dialogue*. The second theme was a practice of *lower volume of work*. The third practice was described and identified almost solely by students and was *providing individual help*.

***First practice theme: Communicating with students through open class dialogue.***

Ms. Alice described her classroom environment to be one where there were constant conversations taking place. She admitted, "...it's [speaking of class] kinda crazy sometimes." "We are constantly picking and joking, picking and joking." She described her use of sarcasm with her students and the way that they "talk a lot, a whole lot, and I guess sometimes it's kinda crazy sometimes; everybody doesn't listen all the time, but I guess from minute to minute, I am trying to stay on top of it." She described conversations they have had

in her class about her own life growing up, the telling of jokes, and a story about the time a student came to her class with a handful of brownies and how she used sarcasm to address the issue without sabotaging her relationship with that student. In describing her communication, she explained, "I'll be sarcastic with them; I really don't let things slide. I'm honest." She continued, "I can be 'mean' I guess, not necessarily in a mean way, just that I can get loud...kinda get in their mess." In an animated way, she described her chastising the class while she was on the class phone saying, "'Ain't nobody going anywhere!" and her students replying, "You sound like my momma!" The impression of her classroom was one where it was ok to have conversations. She shared, "We can come in here and it's okay to get off topic, to talk about something that is going on and talk about it." One of her students described the class saying, "Sometimes we talk and listen to music and be on our phone, but it look like we don't get good grades, but we do 'cause we do our work..." Another student said, "It's fun having her as a teacher." Students had much more to say about how Ms. Alice helped them individually through their math problems, but there was adequate evidence that students and the teacher did have a substantial amount of on and off topic dialogue and students appreciated her ability to navigate and permit this type of communication.

***Second practice theme: Lower volume of work.*** Ms. Alice and her students spoke about the fact that work (particularly homework, and graded assessments) were kept to a minimum in her class. It appeared that her empathetic demeanor and indifference towards testing lead her to require less of her students in this regard. She explained, "...I don't assign homework. If I do assign homework it's done in class, 10-15 minutes, short, and it can be turned in as extra credit on a test, so that's one thing I've done." Regarding testing, "I know

there are a lot of people who don't take tests at all, and some teachers feel differently. They give tests every week. I gave three tests through a nine weeks. I'm just not necessarily 'we need to have a test' kind of thing." When asked how she went about assessing students, she described, "I do take class grades, and it's always more like participation. It's 10% of their grade," and "it's not realistic to grade everything that is turned in everyday...I will look at 5-6 problems and give it back to them...I make the corrections, not them." She believed in taking "brain-breaks" during her 90-minute classes. Students verified, "I don't have to have homework in here." "If I had my homework, it would be extra credit." One student described how this practice was helpful to him. "She's nicer cause she don't say 'Try first!' Ms. Alice, she'll come and help you anyways, instead of telling you to try first, but a hardcore teacher will say 'Try first or I'm not helping you.' Two other students described Ms. Alice as "laid-back." This practice of doing less work appeared to be a theme of her instructional practice and educational philosophy that connected to her empathetic demeanor.

***Third practice theme: Providing individual help.*** This final practice theme emerged almost exclusively from student comments during the focus group interview. This theme was the primary practice that students attributed to helping them to achieve in their mathematics class. To a lesser extent, Ms. Alice described how she spent individual time with students saying that in class "...there is a lot of times I am walking around, and I can say, 'Do you mind if I take that paper?' or ask them how they did a problem." "I walk around, correct and stuff, things like that..." Students certainly recognized and appreciated these individual times of feedback and assistance in class. One male ninth grade student attested, "even though it was taught, she's been nice enough to come back and teach it again," and another male ninth

grade student shared, “She’ll actually sit you down and help you out. She even do the first problem for you, so I go there to see how she did it, and the second problem I do on my own.” In her interview, she did not make reference to providing this individual assistance. As a teacher, she may have considered this to be something ordinary. However, students appeared to recognize her personal assistance paired with her relationships to be the best practices that helped them to achieve in her mathematics class.

As with Mr. Ramses, I sought out findings to answer the same three additional research questions related to effective mathematics teachers of African American students. In looking at Ms. Alice’s commentary I wanted to know to what extent she was cognizant of racial identity as an element of her mathematics instruction? Second, I wanted to know how she built student confidence in mathematics? Third, I wanted to know the ways that she helped students to see mathematics as relevant to their lives and future lives? Comments supporting the findings came from direct questions on issues of race as well as indirectly through comments to more open-ended questions (see Appendix A for interview protocol).

**Ms. Alice: Cognizant of racial identity?** In regards to our conversation about race, Ms. Alice had only a few remarks regarding the role of race and/or racial identity. They did not organize into a single theme. She did share a sense that she was aware of the role her racial identity beliefs have on her expectations of students. She believed that lower expectations for African American students in mathematics were a prevalent form of racial discrimination. She stated, “...just because they are Black or male, and didn’t do well on this test or that, and then we give them labels. Let’s just make it a little more easier for them; it happens a lot. I’ve actually totally been guilty...” When we were discussing her instruction,

she described how students were shocked when they were required to complete word problems because prior teachers would only have them complete the computation problems. This comment showed how she had begun to deconstruct her own conceptualization of African Americans. At another point in the interview, she described how she constantly sought to recognize when she lowered expectations on students. She explained "...I think probably 90% of that battle [with lowering expectations] is just me realizing it; then it's easy the next day..." She spoke briefly in the beginning of the interview about how Black students initially perceived her as a White-female teacher saying, "... a couple times this year being White, a White female who from the outside she looks like she got it all together, to having a class full of Black students who think that no way on any level could this lady could have anything in common to them." All in all, she appeared to be sensing the role of race as it relates to her perception of students and her students' perception of her within the classroom. Student racial identity and/or mathematics identity was not something she addressed with her instruction of her African American students.

**Ms. Alice: How to build student confidence in mathematics?** From our conversation related to Ms. Alice's successful instruction of African American adolescents in mathematics, there were no explicit comments from students or from her towards the idea of building student confidence. However, from the focus group, it was evident that their experience in her class had helped to change how they felt about mathematics. One student shared, "Yeah, I used to have negative feelings about it [mathematics], and now I've got positive feelings about it. Cause it's very easy to me." The rest of the group varied from "used-to" liking mathematics more in elementary and disliking it as it has gotten harder to

saying that they feel “so-so” in regards to mathematics. From the testimonies of the students, it would be fair to contribute their improved attitude about mathematics to her individualized work and her relationships with them. She described that through focusing on student growth rather than proficiency she provided most of her students something to be proud and confident about. She described, “...but they are showing growth, and they are proud of that.” “All are excited for the fact they have grown this year...” As her students experienced small victories, they tended to feel better and more comfortable about the coursework in the mathematics class.

**Ms. Alice: How to help students see mathematics as relevant to lives and futures?** Admittedly, Ms. Alice also struggled with getting students to see mathematics as relevant to their current and future lives. When asked about the role that helping students to see mathematics as relevant, obtainable, and even pursuing higher level mathematics, she stated, “I have to say that it’s probably not something that I really think about...I should...I do try to get them to realize the everyday importance of math.” She proceeded to describe how during football season her students were tasked with using measurement to paint part of the football field for homecoming. The students from the focus group also described this saying, “We had to make a key. We had to spread a measurement line out, and when everyone came, it was perfect!” Ms. Alice attested, “I would love to help kids find that identity [with math].” She mentioned that she had also discussed with her seniors how doing poorly on the mathematics placement test in college could result in taking multiple remedial mathematics courses that would be waste of time and money. With many of her students enlisting in the military, she said that she talked with students about passing that ASVAB

test, particularly the parts with mathematics. Three of the four students from her focus group suggested that it was “not likely” that they would pursue higher-level mathematics or a mathematical related career or major.

### **Comparing the cases: How the Teachers Portrayed Effective Teaching of African American Students**

As a major goal of the study, I sought to learn the intricacies of what effective mathematics teachers of African American students understood (beliefs), what they were like (demeanors), and what they did within their classes (practices). In addition, I also wanted to see what evidence may have existed in how these type of teachers addressed issues like racial identity development, confidence building, and guiding students to see mathematics as relevant in their lives. The following research questions were answered by considering both sets of interviews jointly.

#### **What are the beliefs, demeanors, and practices of nominated effective mathematics teacher of African American adolescents?**

*Beliefs* . Teacher beliefs were identified through considering the full context of what was shared by teachers and students during their interviews. Both Ms. Alice and Mr. Ramses perpetuated their stereotypic beliefs about the nature of African American children. They both expressed the idea that African Americans were deficient largely in their home lives (communities and parenting) and their basic academic skills. However, Ms. Alice described this dynamic at play in her own instruction and provided evidence that she had started to complicate these problematic beliefs. On the contrary, by assuming intellectual deficits in his

African American students, Mr. Ramses' instruction was implemented on the assumption that students were best taught by telling them step-by-step procedures and repetitive skill and drill practices. Ms. Alice, on the other hand, appeared to allow much more time for deep learning of concepts to take place no matter how much time it took. Mr. Ramses also held a belief that African American adolescents were easier to work with because they were less judgmental and more "down to earth." This belief was derived through his experiences with African American students as well as African American people from his own personal social experiences. Both of teachers were geographically bound to the same region for their entire lives, and thus, their beliefs (as a function of their experiences) have been situated in a singular context. Each of the teachers' stereotypical and deficit beliefs about African Americans influenced their instruction, but in different ways.

Table 17

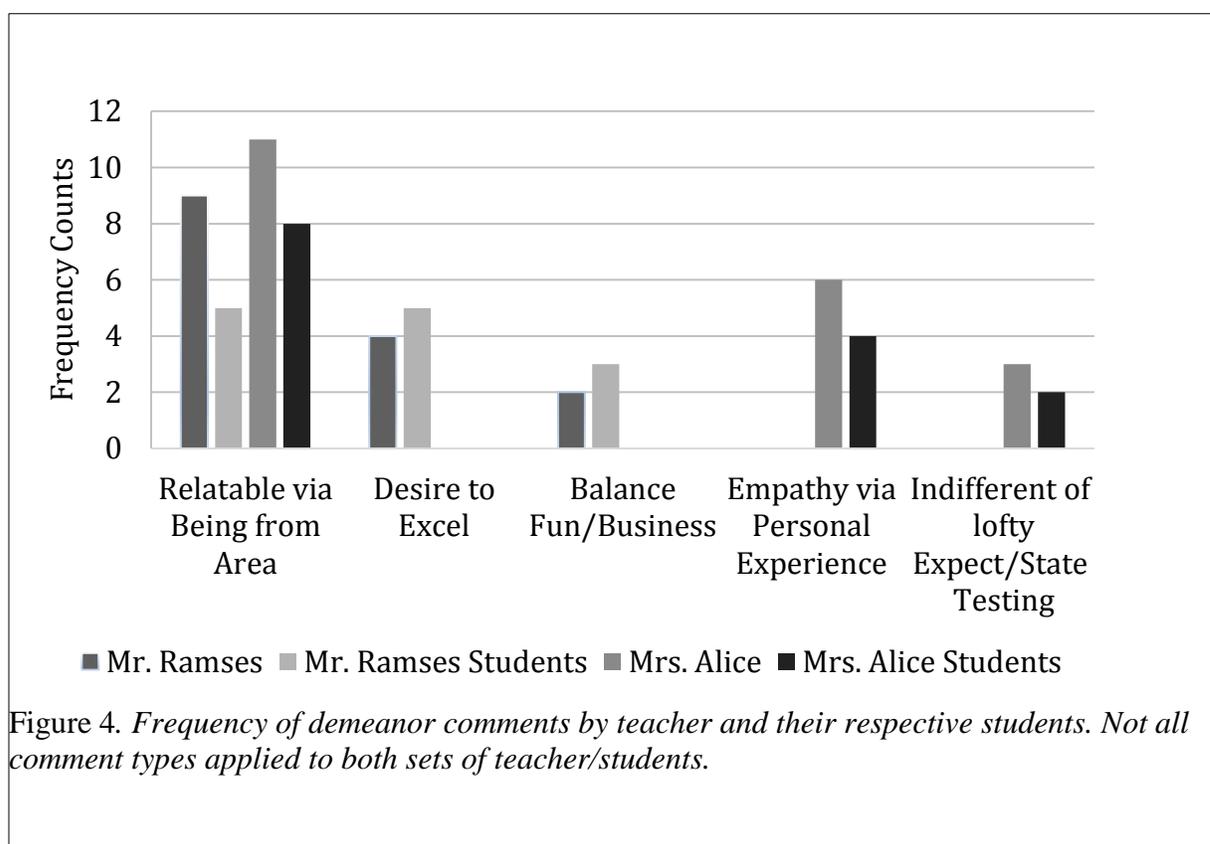
*The Beliefs of an "Effective" Mathematics Teacher of African American Adolescents*

Mr. Ramses	Ms. Alice
African Americans are deficient in their home lives and their basic academic skills.	
African American students are "down to earth" and easier to talk to	

***Demeanors*** . Mr. Ramses and Ms. Alice each held common and unique demeanors that influenced the ways they worked with their African American students. Through speaking to both students and the teachers, I was able to understand more about the essence and personality that each brought to the classroom. It was useful to compare demeanors that the teachers described and that were also identified by students. Each teacher utilized their

demeanors in different ways; however, between Mr. Ramses and Ms. Alice there was evidence that certain orientations were highly valuable to the instructional process and highly valued by their African American students. As Love and Kruger (2012) implied, “there may be multi-faceted pathways to teaching African American children successfully” (p.97).

Figure 4 compares the demeanors recognized by the teachers and students during all interviews.



Comments on being relatable were more frequent in the interviews from Ms. Alice and her students than Mr. Ramses. In both cases, the teacher had more comments on relationships than their students did; however, the differences were greater for Mr. Ramses and his students (Figure 4, relatable). From the teachers’ perspectives, the presence of this demeanor was largely developed through living near and attending corresponding schools.

Common to both teachers was a form of resistance of the status quo. In Mr. Ramses case, he was not satisfied with students performing poorly in mathematics, his class, and on the state tests. He was not accepting of the typical excuses and rationale of why Black students have not done well historically; although, this theme of poor performance was an assumption he had of all students. In Ms. Alice's case, she was more resistant to pressures for students to perform on tests (in regards to proficiency) and being bogged down by the weight of constant grades/grading. They both expressed a certain amount of personal defiance, but it was in completely inverse ways.

The demeanors of Mr. Ramses and Ms. Alice diverged further. Mr. Ramses' drive for personal and collective achievement paired with a balance between emitting a humorous and business-like persona contrasted with Ms. Alice's empathetic nature and general indifference towards state testing and curriculum. Each of these demeanors influenced how they went about instruction within the mathematics class. It should be noted that both Mr. Ramses and Ms. Alice were participants in the study due to their standout achievement with their African American students and high recommendations from their district and school level leadership. The findings in this case would suggest there exists multiple and varied demeanors that teachers may enact for similar outcomes.

Mr. Ramses and Ms. Alice described ways that they both communicated to students in tough ways when necessary. Mr. Ramses' personal desire for his students (along with himself) caused him to push students very hard. Ms. Alice's demeanor was more caring and perhaps overly empathetic at times. Her testimony demonstrated a better understanding of

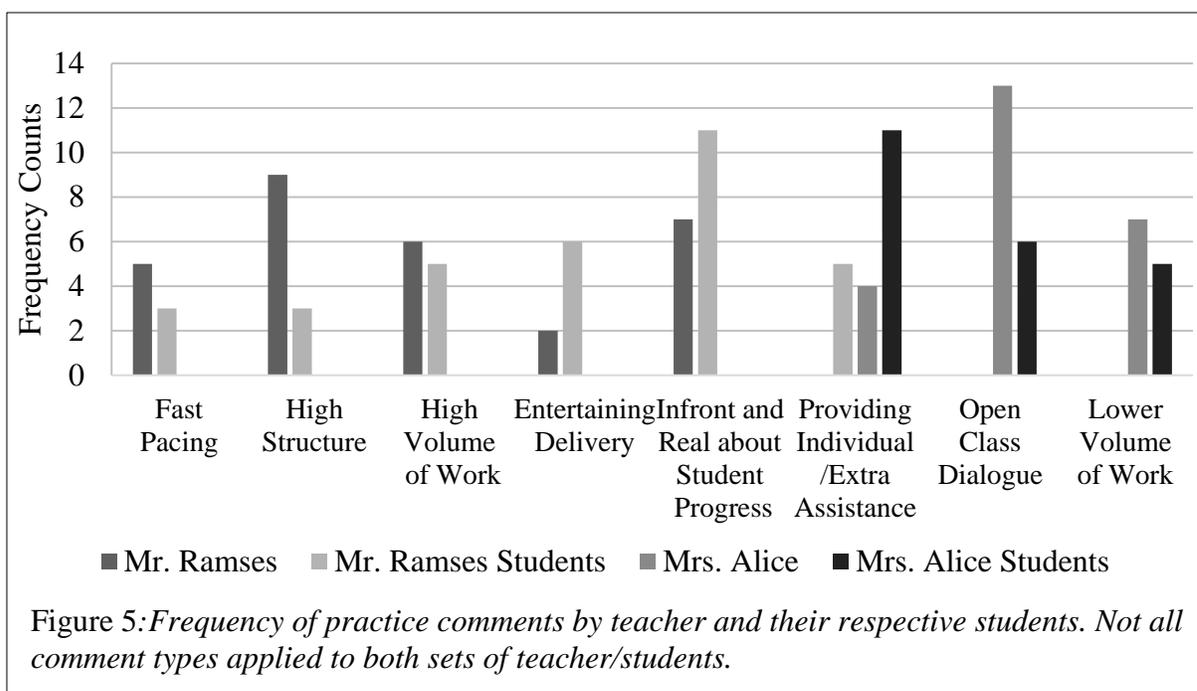
students' circumstances. Their approaches are further contrasted by looking at their classroom practices.

Table 18

*The Demeanors of an “Effective” Mathematics Teacher of African American Adolescents*

Mr. Ramses	Ms. Alice
Relatable via being from the area	
Resistance to status quo (but in inverse ways)	
Personal and collective achievement	Empathy via personal experience
Balance between humorous and business-like persona	Indifference of lofty expectations/state testing

**Practices .** The practices recognized by teachers and students during all interviews according to frequency of related comments are presented in Figure 5. Mr. Ramses and Ms. Alice both utilized forms of direct and teacher-centered instruction, communication in class, and to a degree, offered individualized assistance/extra assistance. However, their approach to teaching students varied in other ways.



Mr. Ramses' use of a teacher-centered class structure was confirmed through student comments on the fast pace of the class, delivery, rigid daily structures/routines, and high quantities of practice (Figure 5, Fast Pacing, High Structure, High Volume of Work). Ms. Alice explained why she chose the traditional teaching approach explaining "It's hard for me to say, I don't know how to start that (talking about a "flipped" class approach) with this group, when I was at the early college I could do that, because you have five or six kids, who could really look at something and learn how to do it, and the class would be clear, because five or six kids can teach five or six more and there's constant like dialogue, and staying on task, but it just doesn't happen here, with the population here." In regards to Mr. Ramses communication form (Figure 5, Entertaining Delivery, Upfront and Real about Student Progress), students particularly appreciated his ability to keep the class interesting through an entertaining form of communication and talking about other student-relevant topics in class. Even more related to his communication was his constant talk to students about their

progress. He would regularly “call out students” to make individual gains. Students attested that these messages (paired with their relatedness with Mr. Ramses), although challenging to them, seemed to motivate them to work harder in his classes. His students also spoke about the way he offered extra opportunities to practice and get better. This was the only practice on that he and his students were not completely aligned. He made little mention about these extra opportunities which students attributed to helping them. This was the also seen between Ms. Alice and her students.

In contrast to Mr. Ramses, Ms. Alice required much less work of her students and eliminated the need for students to complete homework and take regular quizzes and tests. Her students appreciated and benefited from a more relaxed class structure. Through her stories, she shared how her classes could be seen as chaotic and students enjoyed that sort of environment.

Table 19

*The Practices of an “Effective” Mathematics Teacher of African American Adolescents*

Mr. Ramses	Ms. Alice
Form of direct and teacher centered instruction	
Fast pacing, high structure, high volume of work	Lower volume of work on a regular basis
Particular forms of communication in class with students	
Entertaining delivery, upfront and real about student progress	Open class dialogue
Individualized assistance/extra assistance	

### **How were Teachers Cognizant of Racial Identity?**

As one of the theorized factors of a positive mathematics identity for African American adolescents, this question was explored throughout the contexts of both interviews with Mr. Ramses and Ms. Alice. In both cases, there was minimal evidence that either teacher was overtly responsive to whether students' racial identity may be relevant to their role of instruction in the mathematics class. There was some minimal evidence that Ms. Alice had begun to deconstruct her racial beliefs and that these beliefs may have been impacting her expectations and instruction.

Table 20

#### *Teachers' Cognizance of Racial Identity*

Mr. Ramses	Ms. Alice
There was minimal evidence that either teacher was overtly responsive to whether students' racial identity may be relevant to their role of instruction in the mathematics class	
	There was some minimal evidence that Ms. Alice had begun to deconstruct her racial beliefs.

### **How did Teachers Build Student Confidence in Mathematics?**

Comments from student interviews, the survey responses, and teacher comments provided evidence that these students had become more confident in their mathematics abilities. Analyses of Mr. Ramses interview and those of his students provided some clear insights into how this might have occurred. Analyses of Ms. Alice's comments and those of her students' provided fewer insights into what attributed to gains in student confidence. There was enough commentary from Mr. Ramses and his students to support the overall practice of positive reinforcement communication through what I interpreted as "preaching."

Mr. Ramses had a handful of messages that he repeated to his students on an almost daily basis like, “Those who read, pass Math 1.” Students attested to how these messages challenged and supported their confidence in the class. By praising and “calling out” students on a regular basis, students admitted they became (for some the first time) more confident in their abilities. Mr. Ramses knew that many of his students had not experienced much success in mathematics in previous classes and was intentionally helping his students to experience small victories. He celebrated those victories through encouragement and praise.

Preaching/communicating positive messages on a frequent basis emerged as a method that effective teachers can use to build African American student confidence in mathematics.

Students gained confidence in their math abilities through their experience in Ms. Alice’s class through gaining understanding of large concepts and the continual support from Ms. Alice on an individual basis. They appeared to benefit from a slower pace and a looser class structure when approaching their mathematics work.

Table 21

*Teachers Building Confidence in Mathematics*

<b>Mr. Ramses</b>	<b>Ms. Alice</b>
Students had become more confident in their mathematics abilities	
Positive reinforcement communication (“preaching”)	Gaining understanding of large concepts and the continual support on an individual basis

## **How did Teachers Guide Students to see Mathematics Relevant to their Lives and Futures?**

As one of the theorized factors of a positive mathematics identity for African American adolescents, this question was explored throughout the contexts of both interviews with Mr. Ramses and Ms. Alice. In both cases, there was evidence that both teachers were generally stumped as how to get students thinking they were capable of taking higher-level mathematics classes and as future mathematicians, or even workers in mathematical related fields. This should not be ignored because the earning differentials attributed to having a strong mathematics education between Whites and Blacks has continued to increase over the past 20-plus years (Battey, 2013). By failing to find ways to make mathematics content relevant to African American adolescents, this disparity will likely be unchanged. Both teachers tried to help students to see connections between the mathematics skills they were building and success on college placement tests and military placement tests. In generalized ways, both teachers described the possible implications of doing poorly in mathematics and the doors that could be opened by doing well in mathematics. This message hardly seemed to transfer to students because half of the students from both focus groups admitted that they did not see mathematics as a part of their future lives and, to some extent, their current life.

Beyond understanding the make-up of the constitution mathematics teachers, the study also wanted to describe and characterize positive student mathematical identities. Initial quantitative analysis provided evidence that students from Fortress High and Hometown High held more positive mathematics attitudes compared to the other three student groups surveyed. I sought to gain further support of the existence of these attitudes

using the qualitative data gathered from student focus group interviews as well. Rather than discuss each group separately, findings are presented from the collective commentaries and themes from both focus groups (n=10 students). When necessary, I differentiated contrasting perspectives of the two groups.

Table 22

*Teachers Guiding Students to see Mathematics relevance*

Both teachers were generally stumped as how to get students thinking they were capable of taking higher-level mathematics classes and as future mathematicians, or workers in mathematical related fields
Both teachers tried to help students to see connections between the mathematics skills they were building and success on college placement tests and military placement tests

**Phase 3: Mixed Methods Analysis**

This dissertation used semi-structured interviews to investigate the forms and presence of a mathematics identity along with the beliefs, demeanors, and practices of effective mathematics instruction. First, this study interpreted data utilizing various instruments. The MAS was administered to African American mathematics students (N=102) that were taught by mathematics teachers designated as highly effective. In addition, the MIBI-T was used to provide information about these students' racial identities. The YSRM proved helpful in gaining a measure for the levels of racial discrimination students had perceived from mathematics teachers and students in mathematics related contexts. These measured helped to answer research question one in part.

Table 23

*Summary of Mixed Method Analysis*

	<b>Quantitative data/analysis</b>	<b>Qualitative data/analysis</b>
<b>Hypoth. 1</b>	There is a statistically significant and positive relationship between students' racial identity and their overall Math Attitudes.	Supports this positive relationship to an extent (interview with Mr. Ramses students).
<b>Hypoth. 2</b>	There is a statistically significant, negative relationship between students' perceived experiences with discrimination from teachers and peers in mathematics contexts and their overall mathematics attitudes. About 7% of the variation in students' Math Attitudes was attributed to students perceived discrimination.	Neither focus group admitted significant discrimination in mathematics from teachers and peers.

Next, this study analyzed interviews with two effective mathematics teachers and a sub-sample of their students to explore their experiences, beliefs, and practices related to mathematics. The second research questions were answered using this qualitative interview data. In this final findings section, I reexamine the first research questions (1a and 1b) related to how components of students' racial identity could be related to their overall mathematics identity. I did this by analyzing both forms of data collected (qualitative and quantitative) and presenting new conceptualizations and implications of the overall findings of this study.

**Revisiting research questions**

In the opening steps of analyzing student survey responses, it was confirmed that there was a statistically significant and positive relationship between students' racial identity

and their overall Math Attitudes (hypothesis one). Approximately 21% of the variation in students' overall Math Attitudes was attributed to students' racial identity.

Higher racial pride has been related to higher academic achievement specifically in mathematics (Chavous et al., 2003; Smith, Atkins, & Connell, 2003). To an extent, student focus group data supported positive relationships between students' racial identity and their Math Attitudes. As described previously, there were some similarities and some differences among students' experiences in their mathematics courses between focus groups, and our conversations went into depth in different ways in the semi-structured format. The Fortress High focus group (Ms. Alice's students) spent a lot of the interview discussing their mathematics journey, relationships with their teacher, and expressed to a lesser extent themes related to student racial identification. Students from the Hometown High focus group (Mr. Ramses' students), shared insights into how they viewed their racial identity related to their mathematics attitudes. I carefully considered the ten students from the focus groups' survey data and looked at their reported private regard. Private Regard was very positive with this sub-sample (n=10) and had means of 4.6 and 4.5 for each focus group. This indicated that these students positively identified as African American. The two female participants from Hometown High engaged in discourse with me that provided potential support of this association.

Student 3: I guess cause like, some people think that Black people can't do stuff as well as other races cause they not good enough or they don't have as much stuff as other people have, so that makes African Americans want to prove them wrong and try to be better than others and exceed in expectations. So that can be powerful.

Moderator: So you said a lot of "could" so I want to ask you, as you are an African American lady, have you felt like that? That others have felt that because you are

Black that you can't do math, and this give you more motivation to prove them wrong?

Student 3: Yes.

Student 2: I think African Americans work hard.

Moderator: Tell me more...

Student 1: Like if we don't answer something right, we try to figure it out...always trying to figure it out.

Moderator: So think about yourselves, how you responded to those questions (from the survey) and how you feel about yourself. How could your racial attitude maybe be related to your feelings about math?

Student 1: At first if you had a bad grade from the beginning I would feel bad cause I would feel like somebody would think "oh, she Black, she has a bad grade, she don't...(pause)" It makes me want to work harder. People will not pick on you like that.

Moderator: So you think like that? Did all of you guys hear what she said? (Student 1 repeats) ...How do the rest of you respond to that? Have you ever maybe felt what she just described?

Student 2: Yes.

Student 4: No.

Student 5: No.

Student 6: No.

Moderator: Boys and girls different on this one (smiles). Could this be by chance? But I see what you are saying. Do you feel a sense of responsibility to be better in math for your community? For your race? You said you did for yourself but is this true you think of all Black people?

Student 3: I guess because like every Black person makes a reputation for other Black people. We all are trying to work hard to be better, smarter and stuff.

Student 2: Me personally, I think about how a lot of Black people don't really do well, so I want to work hard and it can be difficult.

It was explained by students 1-3 that there existed a sense of personal responsibility (communalism) to overcome obstacles for those who underestimated African Americans and to work as an individual agent to build a better reputation for African Americans, particularly in math. The three boys disagreed, or at least said they did not feel that same sense. One of the boys even went as far to say “I don’t think that race has something to do with math.” For the three girls, their positive racial identity served as a motivating factor for them to perform better in mathematics and to persevere through challenging problems. They were cognizant of how their own actions contributed to the greater African American community. Other than this discourse, students from the interviews did not elaborate further to support this relationship. The agreement among the three female students could have been due to their friendship and their mutual engagement rather than generalized conclusions based on gender. However, the evidence provided by the three girls was an interesting insight into the connectedness between their racial and mathematics identities.

**Negative relationship between students’ perceived discrimination in mathematics contexts and their mathematics identity.**

In the opening steps, a statistically significant, negative relationship was identified between students’ perceived experiences with discrimination from teachers and peers in mathematics contexts and their overall mathematics attitudes (hypothesis two). Approximately 7% of the variation in students’ Math Attitudes was attributed to students’ perceived discrimination. Although perceived discrimination did not account for a large amount of the overall phenomenon, it still represented a significant relationship. I examined the levels of perceived discrimination from the focus group participants. The mean perceived

discrimination score for the Fortress High focus group was 1.8. This indicated a disagreement with statements regarding being discriminated against in mathematics classes by teachers and/or peers. The mean perceived discrimination score for the Hometown High focus group was 2.2. This indicated that these students had also not perceived discrimination by teachers and/or peers or may have been unsure of discrimination. Neither group represented expressed experiencing discrimination in mathematics from teachers and peers. This was reflected in the focus group interviews. When asked directly, only one student admitted he was not completely sure whether he had been discriminated against. The rest of the group emphatically responded, “No.” However, there was evidence that students had witnessed discrimination occurring to their African American peers. The three girls from Hometown High shared, “Some people don’t think that Black people can do stuff as well as others.” Two of the boys spoke about how this had occurred with African American teachers just as much as with White teachers. One of the boys shared a story about his sister’s African American teacher. He said, “she had did everything right and she was still counted wrong. My mom came down here and talked to the principal and got it situated.” A girl from Ms. Alice’s group admitted that she thought some teachers “showed favoritism” and interjected that “I think that sometimes teachers with White skin thinks that Black kids can’t do it. But I think they can if they want to. I guess teachers don’t always understand.” Overall, by looking across both data sources, there was only minimal evidences across data sources that a negative relationship existed between a student’s perceived discrimination in mathematics contexts by teachers and peers and their mathematics identity.

**Descriptions/Characterizations of a positive mathematics identity (research question 1b).** In considering the data collected, there were adequate descriptions and evidence of positive mathematics identities across the sample of students.

*Martin's first tenet.* In regards to confidence in students' mathematics abilities, findings supported this as a fundamental ingredient towards a positive identification with mathematics. From survey measures and student interviews, students reported a positive feeling of confidence in mathematics.

Between the two groups, there was adequate evidence that these ten students were growing in their confidence in mathematics. The six students from Mr. Ramses' class, when asked how they felt about mathematics in general, used responses like "feeling good," "confident," and "I have skills." When asked how they would rate or describe their abilities, three students described themselves as "average," two other students said, "above average," and one student said "improved." Two of the four students from Ms. Alice's class described their feelings about mathematics by saying, "I feel better because I have gotten better," and the other two stated, "I feel good." When asked how they would rate or describe their abilities, three students gave themselves a numeric rating of "8" and a "7." One of these students interjected, "I love to do my math." In the contexts of the entire interview, these general comments only served as a starting point for our conversation. Through thematic content analysis of all comments, the main theme that emerged was that students expressed confidence in their math abilities.

Through multiple questions, I asked students to share their stories about mathematics. In describing their current feelings, many shared that they had not always felt positive about

mathematics. On multiple occasions and in both groups, students attested that even though they had not always felt positively about mathematics their confidence had improved as their mathematics skills had improved. Two students from Mr. Ramses' class credited their teacher for helping them to make these improvements in mathematics. Another student accredited his personal drive along with his parents pushing him. Students from Mr. Ramses' class admitted that many of their African American friends in school complained that "math is bad," and that "they [Black peers] hate math.... they think it is hard." One student reasoned that his friends "haven't developed their skills, so they don't like it." In the interview with Ms. Alice's students, one student said, "Some say it's boring because they are not good in it," referring to her African American friends. This commentary provided a glimpse into the fact that students truly sensed that improved performance was connected to their improved confidence in mathematics. One of Mr. Ramses' students said it helped to "know what score I needed to make to improve." One student in Ms. Alice's class shared, "I used to feel like I didn't like it; now I feel positive, because it's getting easier." Although students had better attitude and were improved in mathematics, they admitted that the work had gotten harder. Overall, there was adequate support that possessing confidence in math was an accurate characterization of the students from both focus groups. It appeared that Martin's (2000) first tenet (confidence in abilities) of a positive mathematical attitude was present.

***Martin's second tenet.*** Perceived usefulness in mathematics was not supported. Evidence from student survey data suggested that students reported that mathematics was important and useful to them; however, there was not a strong agreement. Consequently,

when comparing this concept to the comments from the focus groups, there was little support that students would: 1) take higher level mathematics in high school; 2) seek out mathematics-related careers; or 3) perceive that mathematics was more than a utility for a limited amount of jobs and personal finances. Three students, in Mr. Ramses' class, stated that they would be "likely" to pursue higher-level math courses; one student said "possibly," and two others "not likely." In sum, four of the six students expressed interest in taking a higher-level mathematics courses. This articulation was more optimistic than students from Ms. Alice's group. All four students in Ms. Alice's group replied "not really" when asked about the potential for taking higher-level mathematics. Comments from both groups suggested there was some indifference towards the usefulness of math. One student in Mr. Ramses' class said, "I think it helps me, but not really. It's not what I want to do when I get older," whereas a separate student from Ms. Alice's group said, "I don't see math in my future, in a job-maybe, maybe measure a cup of food." The comment from this student gave birth to a central theme on how students perceived mathematics as useful. This theme emerged from both groups and was the idea that that mathematics was perceived as minimally relevant personally and nominally useful for some work/jobs.

This theme was also observed in a previous study (Lim, 2008). In Lim's study, students perceived mathematics as simple calculations of numbers and provided example jobs of working at a store or as a secretary. Our conversation resulted in student comments about how they thought they would use mathematics and their general skepticism that would need it. Although students from Mr. Ramses' class were more optimistic about taking higher-level math, they still had a limited expectation for the role mathematics would play in their

lives. This evidence was best seen from a student comment stating, “It’s important for any job that has money and counting stuff.” In fact, money and counting were common comments to both groups. These comments included, “My dad didn’t graduate, but he’s always using money, counting. I say Math is good on the streets for money.” “You might need math to pay for your car, your bills, your house,” and “...like working in a fast food restaurant, how much to return to a person when they pay.” One female twelfth grade student said she worked at Papa Johns (pizza) and that she frequently used mathematics. This same student mentioned that she went to church and believed in paying 10% in tithes. One student from Ms. Alice’s group said, “Math is good for certain jobs, like plumbing, building a house, how much cement, cuts of wood; they need math there but not in everything.” He even went on to admit; “I think it’s not true that math gets you a long way in life. Certain things in life do have math and certain things don’t.”

Based on this finding, it appeared that Martin’s (2000) second tenet was minimally at work in these groups of students. Mr. Ramses and Ms. Alice admitted that addressing usefulness was a weakness of their instruction. It could be argued that this was not a requirement for one having a strong, positive mathematics identity for adolescents. However, it does highlight a growing need in teacher development and curriculum development.

***Martin’s third tenet.*** Having an awareness of the obstacles and opportunities in mathematical contexts was present. The interview excerpt involving the three girls from Mr. Ramses’ class demonstrated this point. This study found that African American students with positive mathematics identities were aware of the obstacle of discrimination. From analyses of all commentaries from the student focus groups, there were two pertinent ideas that

emerged in relation to this third tenet. One was an awareness of discrimination as a real obstacle to overcome and the second was a belief that mathematics was for African Americans as much as others.

*Awareness of racial discrimination as a real obstacle to overcome.* Students, from both groups, did not admit to any experiences of racial discrimination in math classes by teachers and/or peers (when directly asked), but they were able to provide stories and experiences were they sensed other students had. When asked about other students (peers) in the same regard, only one student admitted he “wasn’t sure” whether he had been perceived negatively by a peer. Quantitative results from survey measures indicated that students with higher overall mathematics attitudes had perceived less racial discrimination in mathematics courses. However, some of the following comments did inadvertently suggest that students were aware of common stereotypes pertaining to African American students. For example, one female student admitted, “Some people think that Black people can’t do stuff as well as people from other races, thinking they don’t have as much stuff as other people.” Her friend in the group (also female) elaborated saying “...if someone [speaking about African Americans] got a problem wrong, students think ‘she’s Black, she has a bad grade’.” Two boys jointly shared their experiences stating, “Black people are sometimes more racist than White people, no offense, but some White people are racist to Blacks; it’s 50-50,” while going on to describe how they had a Black teacher once to pull him out of the room and inaccurately reprimand him. One of these male students described how Ms. Alice was different from other “hardcore teachers” he had in the past. When asked what a hardcore teacher was he said, “A hardcore teacher say ‘Try first or I’m not helping you’.” He went on

to say how this hardcore teacher would assign extra assignments or homework if he did not have his homework complete and was not understanding of his situation (not having time to complete homework). In his mind, he felt like this teacher had it out for him; although, it was unclear this assumption was due to the student being African American. Nevertheless, this hardcore teacher was an obstacle to the student. The one girl in Ms. Alice's group admitted, "I have not seen it [discrimination] happen to me, but I have seen it happen to other students."

*Belief that mathematics is for African Americans as much as others.* Although racial discrimination had been witnessed more than experienced, there was interesting commentary about the belief that mathematics success was obtainable for African Americans just as much as anyone else. Three of the four students from Ms. Alice's group said, "Yes, I think so," when asked directly about math being for African Americans as much as others. The one student, who did not default to the other three, said, "I know plenty of people who know a lot about math, and have used it to get where they are." In a later comment, she expressed, "Me personally, I think about how a lot of Black people don't really do well," and continued to discuss her own responsibility in reversing this pattern, "They can be just as good as any other race." All six students from Mr. Ramses group responded that they believed mathematics was for African American people just as much as any others, but did not elaborate further.

Overall, tenet three of Martin's (2000) mathematics identity appeared to not only be present in these two groups of students, but was actually given further conceptualization. They believed that mathematics was for African Americans as much as any other student.

These students, who possessed higher Math Attitudes, were overtly aware that African American students do perceive discrimination from teachers and peers, but also hold a belief that African Americans can achieve in mathematics. It appeared that these students perceived greater opportunities alongside discrimination (or obstacles) as related to mathematics. This likely served as an enabling force in their math identity. This idea is further conceptualized in this section. This element of overall mathematics identity should be explored in future studies.

*Martin's fourth tenet.* Student's motivation and strategies to obtain mathematics knowledge were present across both forms of data. Effectance Motivation was the key metric for studying these motivations. Both student focus groups had mean scores of 3.9 in regards to this form of motivation. This indicated that there was agreement and students tended to persevere through challenges in mathematics and found enjoyment/pleasure in doing so. When students provided their feelings and thoughts in the interviews, there were numerous comments referring to mathematics as a "challenge." Students shared that mathematics could be "frustrating," "confusing," and "more challenging than other subjects." There was evidence that students initially recognized the challenge of mathematics; however, there was not a singular theme that could be consolidated from their comments. There were a variety of descriptions of how they overcame these challenges. Students attributed their ability to overcome challenging mathematics problems, like "word problems," by getting assistance from their teacher. In students' descriptions of Ms. Alice, they said she routinely helped them on an individual basis. This idea was best observed from one male student who described how he "always asked the teacher for help; then I figure it out on my own." It appeared that

this regular process of getting help from their teacher was an enabling and motivating force that guided their own perseverance. One student admitted, “Sometimes when it gets real hard, I want to quit,” and that “if I don’t understand the problem, then I don’t like it, and don’t want to do it.” He identified that it was not his natural response to persevere through the problems, but with the help of the teacher he was more inclined to give it a try.

Students from Mr. Ramses’ group talked more about the personal dispositions they needed to draw upon to make it through the challenges such as “staying focused” and “if we don’t get the answer right the first time, we just work to figure it out.” One student from the group admitted that math was “a learning process...it take’s time,” but that he personally got through by “pushing myself” and “doing test corrections.” Another student thought that he “took it (mathematics) more seriously.” Reflecting on the descriptions of Mr. Ramses’ class, students quickly learned the effort required to achieve. It appeared that the nature of each teacher’s class contributed to the students’ motivation to overcome challenges, but in different ways.

In Ms. Alice’s case, individual assistance was used often to help students persevere and stay motivated. In Mr. Ramses’ case, students’ became more driven as a consequence of the high expectations placed on them and they rose to the challenges. Overall, there was evidence that this cohort of students had recognized math to be a challenging content area/class and had actively worked to overcome the challenge rather than give in to failure. This fourth tenet of Martin’s (2000) mathematics identity appeared relevant to this group of students.

In regards to Ms. Alice, her students gained motivation to persevere through challenge through personal assistance and care. Although these two forces contrasted greatly, there appeared to be gains in students' Effectance Motivation. In listening to how students described their peers, it was evident that they did not have this type of Effectance Motivation as the students explained, "They don't like it because they don't have the skills," and "They hate math." This study supported the role of Effectance Motivation as a component in an overall positive mathematics identification. I hypothesize further that the Effectance Motivation of students could be a function of their confidence, as student testimonies appeared to support to some extent that when they felt more positive about math and their own ability to do math, they were more likely to work through challenging problems with support from the teacher. The teachers in this study appeared to employ confidence-boosting techniques as highlight in their practices and demeanors.

Overall, three of the four tenets established by Martin (2000) were supported in this study. Overall, the data collected in the present study strongly supports the idea that the more teachers helped their students to feel confident about their math work, the more they would persist in it. I surmise that confidence could be a key starting point for students and teachers to address for improvement of mathematical identification. If a student can be marginally inspired to think they *can* do math (increase their confidence) they may be more motivated to persevere through challenges and resulting in gains in their math abilities. Somewhere within that path, I hypothesize that there exists a confrontation that occurs with African American students' racial-mathematics beliefs. If an African American adolescent senses discrimination in mathematics contexts, their ability to positively identify with mathematics

could be stifled to the point where that they remain minimally motivated and confident to achieve in mathematics. This is where a positive racial identity may be able to help students in the long run. With a positive racial identity, African American students may believe that mathematics *is* for them. This belief could support greater motivation and perseverance resulting in greater achievement in mathematics that is less dependent upon the confidence building techniques of the classroom teacher. To some extent the commentaries from the three girls from Mr. Ramses group demonstrated this as they appeared to benefit from their positive racial beliefs that mathematics was for their race.

On the other hand, if an African American student lacks a strong racial identification they may internalize that discrimination obstacles are greater than their opportunity to achieve in mathematics. For this reason, I would say that a positive racial identity could serve as a driving force and it could enable the ability to overcome obstacles of racism and perceived discrimination in mathematics. Strong group affiliation paired with an awareness of African Americans' past and current struggles for educational access and opportunity were linked to a strong value for learning in African American students (Chavous, Bernat, et. al, 2003; Cross & Strauss, 1998; Sellers & Shelton, 2003). Perceived discrimination from teachers has been shown to negatively relate to academic achievement (Thomas, Caldwell, et. al, 2009). This was further supported by the finding of a negative association between racial identity and perceived discrimination. The better students felt about themselves, the more optimistic they were towards seeing themselves as successful mathematics students. As one girl stated "this [overcoming discrimination] can be powerful." I hypothesize that

mathematics identification (top portion of model) gives students more motivation for future mathematics endeavors.

## CHAPTER 5: DISCUSSION OF FINDINGS

The purpose of this study was to examine mathematic identity theory and effective teachers that contribute to improving African American performance in mathematics. More specifically, the purpose of the study was to describe the demeanors, beliefs, and practices that nominated “effective” mathematics teachers used to support African American student achievement in mathematics. A secondary purpose was to describe and/or confirm the application of mathematical identities in African American adolescent mathematics students as presently understood. As a part of this second goal, it was important to determine if students’ racial and their mathematics identities were related. This study was motivated by the ongoing under achievement of African American students in mathematics.

Research on effective mathematics instruction did not often focus on the relationships between students’ racial identity development and the development of a positive mathematics identity. The interplay between these identities are shaped by how teachers and institutions create or limit opportunities for participation. Although mathematics identity (Martin, 2000) is valuable for research in African American mathematics achievement, accounts of this identity are underreported.

Mathematics identity was assumed to be related to African American racial identity (Martin, 2000); however, it is unclear how the two identities are related. Identity formation peaks during adolescence and includes the formation of multiple identities (Tatum, 2003). The period of adolescence is considered the most critical for identity development (Arnett, 2006). Having a meaningful and positive connection between an academic domain and other

identities related to self were hypothesized to interact with the building of ongoing motivation to achieve in mathematics for students.

### **Connecting Racial Identity to Mathematic Identity**

Mathematics identity was examined for connections to racial identity. Two of my three original hypotheses were supported. First, students who held more positive racial identities held higher overall Math Attitudes/identities. Student participants sustained this finding by their comments surrounding a positive belief that mathematics was for African American students as much as other students. As a result, it would appear that strategies and interventions that seek to support the development of a positive racial identity could contribute to the development of a positive mathematics identity. Students who had a sense of pride in their own race and who have a positive perception of their own people appeared more likely to see themselves as capable learners of mathematics. This was related to their level of confidence, their ability to overcome obstacles, and their motivation to persevere through challenges. This was a similar finding to Andrews' (2009) study of high-achieving African American students in predominately White schools. For these high achieving students, being an African American achiever in a predominately White school meant embodying high racial pride along with understanding the obstacles of racism and how these obstacles could constrain their success.

An unexpected discovery that challenged the full presence of a positive mathematics identity was that student participants did not exhibit a strong sense that mathematics was useful to their current or future lives. Further investigation into this process should occur. As

young adolescent students, this forecasting may have been challenging for them. This realization may not be appreciated by students until later in adolescence or early adulthood.

The second hypothesis supported in the study was that the more students perceived higher levels of discrimination in mathematics from teachers and peers, the lower their overall mathematics identity. This finding should place the issues of discrimination and racism from teachers and peers in the mathematics class as a real obstacle that needs further attention. I hypothesize that possessing a strong, positive racial identity may play a role in overcoming the obstacle of discrimination and racism in mathematics class from teachers and peers. A relationship between positive racial identity and domains of schooling have been discovered in African American students (Akom, 2003).

Not to be overlooked was the characterization of a mathematics identity. Students interviewed possessed three of the four mathematics identity tenets. They had confidence in their abilities, perceived and persevered through the obstacles of discrimination, and possessed strategies to persevere through challenging mathematics tasks. The only tenet that was not found was the perceived usefulness of mathematics. Therefore, this study has helped to substantiate the phenomenon and presence of a mathematics identity as conceptualized by Martin (2000). Because both positive racial and mathematical identities are desirable for African American adolescents, further research should focus on both forms of identity development.

### **What Does it Really Mean to be an “Effective” Mathematics Teacher of African American Students?**

It was expected that the study would describe some common beliefs, demeanors, and practices that nominated effective mathematics teachers used to raise African American adolescent achievement. Although some productive attitudes and actions were identified, the findings of what it means to be “effective” as a teacher of Black student were troubling. Teacher participants were recruited and selected through the recommendations of district superintendents and building level principals much like prior studies (e.g., Cooper, 2003; Thompson, Ransdell, & Rousseau, 2005 ). Recruitment criteria focused largely on a teachers’ ability to guide African American students to proficiency on state tests (achievement) over time, as well as rapport with African American students and their communities.

These teacher accounts were clear in that they saw this group of students from a deficit perspective and that they felt sorry for them. Both teachers held stereotypes about African American students’ characteristics resulting in lower academic expectations. What these teachers did not understand was that African American students live in communities that emphasize success in mathematics and they do have family and community members who value and advocate for them (Stinson, 2013).

Ms. Alice appeared troubled with her perspective and the way that it might impact her expectations for her students. However, Mr. Ramses did not question his beliefs. The deficit orientation has been confronted by Gutstein et al. (1997) and characterized by “failing to challenge students academically.... the framing of students’ cultures and out-of-school knowledge as a hindrance or an obstacle to be overcome, or the romanticization of students’

cultures” (p.727). Gutstein contends that these beliefs or orientations need to be changed to empowerment orientations characterized by “establishing solidarity with students and their families, understanding cultural norms as shifting and providing academic challenges” (p.727). Strutchens (2000) contented “it is important that mathematics teacher educators overcome these [deficiency] beliefs” and that “we need to help teachers realize the existence of their beliefs and how those beliefs determine how people (teachers) perceive and interact with each other” (p.9), referring to mathematics teachers of African American students. The current findings support these notions.

It appeared that it is possible to be an “effective” mathematics teacher of African American students and maintain narrowminded beliefs. This is because “effective” has truly been defined by raising test scores. This is a very substantial conclusion of the current study. This also showed how schools/districts focus primarily on outcomes of these subgroups. The current meaning of effectiveness should therefore be challenged, because holding such a perspective/belief as a teacher will not benefit African American students and runs the risk of lowered expectations, inequitable pedagogy, and indirect forms of discrimination (Ruck & Tennenbaum, 2007). This finding highlighted the imperative need of all teachers to identify and challenge counterproductive beliefs and their resulting practices. Findings such as these showed that this line of inquiry remained largely separated from teacher professional development efforts and the evaluation of teacher effectiveness. Further research is needed to assess ways that professional development and pre-service teacher training might strategically allow teachers to challenge their beliefs and stereotypes, particularly in schools with high populations of minority students with White faculty.

**Problematic demeanors.** It was clear from the findings on teacher demeanors that teachers who experienced success raising African American achievement knew how to form positive relationships with their students. Both Mr. Ramses and Ms. Alice possessed a personality that allowed them to connect with their African American students. This ability was attributed to having lived in the area their entire lives. I hypothesize that this dynamic may have largely facilitated teachers' limited view of African Americans. Although both teacher participants held a common relational demeanor, they differed in other demeanors leveraged for success with their students. Mr. Ramses was generally direct and comical. Ms. Alice, on the other hand, exhibited more empathy manifested through her feeling sorry for students. This finding showed that there was not a sole demeanor that must be possessed by a teacher outside of the ability to connect relationally with their students.

**Problematic practices.** Based on their meta-analysis of effective instructional practices, Jackson and Wilson (2012) stated, "a central finding from our review is that in general, there is limited research that investigates instructional practices in contexts predominated by African American students in relation to students' learning and/or achieving on standardized assessments" (p.378). In response to this conclusion, this study sought to identify and describe instructional practices that were helpful for African American adolescents in their mathematics classes. Both teacher participants and their corresponding students shared that the teacher facilitated their mathematics classrooms.

Mr. Ramses and Ms. Alice found success using the typical skill and drill approach to their classrooms. This was characterized as a low involvement classroom model that used

initiation-response-evaluation sequences and emphasized procedures and extrinsic motivation (Turner et. al., 1998).

In a skill and drill teaching format, the teacher teaches a lesson to the class, students participate in guided and independent practice, and the teacher follows up with support. This was a highly supported format of instruction that was noted throughout literature on the successful instruction of African American students (Stein, Kinder, Silbert, & Carnine, 2005). However, this highlighted another problem with what it means to “successfully instruct.” For most schools/districts/teachers, the overall goal is to help students learn the needed mathematics skills in order to pass the end-of-course test. The nature of learning is oriented towards test preparation. In light of this “achievement reality,” practice and repetition would appear as appropriate strategies for teachers. However, this type of instruction solely seeks to improve test scores. Once test scores are improved, these teachers are then celebrated for their “effective” instruction of students. Mr. Ramses employed a high structure, fast pace, and a large volume of work to guide his students to better perform. This type of instruction is also not helpful for guiding students to develop deep conceptual understanding of important mathematics concepts and to see Mathematics as an essential field of study (Gersten & Chard, 1999). If we do not redefine what successful outcomes look like for African American high school students, we will not be able to determine what truly effective instruction is and who is a truly effective teacher. This is not to suggest there is no place for direct instruction as an effective instructional strategy, because it does have a role in teaching and learning. This is simply to reinforce the idea that it was possible to be

considered a highly effective mathematics teacher while holding negative beliefs regarding students' lives and abilities.

I could not deny the importance of communication in the studied contexts and in prior literature. Mr. Ramses and Ms. Alice effectively spoke to students in ways students appreciated. Both teachers were credited for their ability to keep things light through their comments and story-telling. Both teachers were credited for their ability to be serious and stern when situations necessitated it. Students truly thought their teachers' communication was different than their other teachers. In Ms. Alice's class, allowing discourse between teacher and student and student-to-student was normal. In Mr. Ramses class, students were continually reinforced through positive messages of growth and achievement through his regular "preaching." The ability to communicate with students effectively would be considered highly important to any teacher who desired to see their students buy-in to their class and instruction.

**Problematic unawareness of the role of racial identity.** In her analysis of effective White teachers of African American children, Cooper (2003) noted "teachers' disinclination to initiate discussion with the children around race and racism" and that "such failure to tackle racism openly with the children undermined the teachers' espoused beliefs and practices around respect for and empathy with the Black community at large" (p.425).

The limited amount of commentary from Mr. Ramses and Ms. Alice could highlight a color-blind ideology by maintaining the appearance that the role of teaching mathematics is not racial (Bonilla-Silva, 2003). This was supported by each teacher's comments that lower achievement of their mathematics students was a matter of cultural deficiency. Racial

identity researchers are encouraging the need for educators to create social contexts for learning that support their African American students' racial identity development (DeCuir-Gunby, 2009). In the present study, neither of the two teachers did this, their focuses with their Black students was, fundamentally, learning of mathematics concepts, test performance, and maintaining relationships with them. It seems that racial identity development of students remains off the radar of teachers and/or teacher staff development, and has yet to infiltrate the teaching practices of even the most "effective" teachers.

In my attempt to make sense of these different findings and narratives about what makes a teacher of African American students "effective," I am left at a similar point as Jackson and Wilson (2012) that findings have produced some themes across the literature, but have not yet produced strong forms of practice that have been able to be empirically studied on large scales. More detailed studies are needed that can generate some high-level practices teachers can use to address this problem. Jackson and Wilson's (2012) review also posed some interesting questions for future research: "How can teachers develop and enact productive relationships, which support African American students to participate in rigorous mathematics activity? How do teachers successfully support African American students to learn mathematics? And How do they develop productive relationships with African American mathematics students? Future research should seek to name and decompose such practices" (p.385).

## Implications

Findings from this study have practical implications for the role of racial identity, mathematics identity, teacher beliefs and practices in the schooling process, and the use of mixed methodological approaches. Findings are also pertinent to individuals, teachers, parents, administrators, school counselors, and policy-makers. Implications are organized based on topic examined.

***Racial identity.*** Possessing a positive racial identity as a adolescent African American student appeared to relate to one's mathematics identity. Knowing students' racial attitudes may provide information regarding their perceptions of discrimination and their Math Attitudes. This insight in the hands of school counselors and school leaders could be used to make school and curriculum-based decisions that could provide a more inclusive schooling experience for African American adolescents. Administrators could start monitoring teacher instruction and/or other school wide interventions that might help or limit students feeling discrimination. Staff developers and principals may be able to provide presentations to staff regarding the role of racial identity development in African American adolescence.

***Mathematics identity.*** Findings indicated that mathematics identity was comprised of students confidence in their mathematics abilities, ability to recognize and overcome obstacles of discrimination, and their resulting motivations. Stinson (2004) found that strong mathematical identities present in college-aged African American students impacted their sense of agency. He highlighted how these students understood the sociocultural structures of U.S. society and how they accommodated and overcame such obstacles (p.180). Mathematics teachers should be equipped with knowledge of these components, particularly the role of

perceived discrimination on students' overall Math Attitudes. This knowledge is likely to confront teachers to look at their own beliefs and practices that may be contributing to perceptions of discrimination by students, particularly lowered expectations and differential treatment. Beyond the simple knowledge of mathematics identity, curriculums, and pedagogies should be researched and leveraged that can help these various components.

*Teacher beliefs and practices.* What teachers think and believe about their students has important consequences (Davis, 2003). How students perceive their teachers is also important and it is essential that teachers understand how they have been socially encoded in their mindsets towards their African American students. Teachers must ask themselves: "Do my expectations for mathematics performance for my Black students match my expectations for White students?" Mathematics educators should view achievement disparities as part of larger social forces that privilege some and marginalize others rather than building problematic generalizations about the individuals or perceived group deficiencies. Then, they will be able to confront their biases and work to improve their beliefs. One greater revelation has been that practices and pedagogy may not be the only focus moving forward. As Martin (2009) stated, "Within mathematics education, the research that is valued most is that which gives primacy to teaching, learning, curriculum, and assessment. This work often proceeds without regard to issues of race, racism, and racialized inequality because it is believed that inequities will be remedied as a residual effect of good teaching" (p.331). The process for teachers realizing and confronting these issues of race requires time and can be stressful. The purposeful facilitation of a training program should seek to prompt teachers to think and discuss these issues without feeling threatened. Strutchens (2000) suggested prompts for such

discussions that included: “1) How would this belief affect instruction?; 2) What are the consequences for students when teachers hold this particular belief?; 3) How could you change the mind-set of someone who has this particular belief?; 4) What if someone felt this way about you or your children? How would you react?” (p.9). As a result of assessing their beliefs, teachers can then begin considering to what extent their commitment may be limiting certain groups of students. Teacher education programs and strategic professional development should also include the examination of beliefs related to knowledge, race and culture, and social relations beyond the classroom. Specifically, for mathematics teachers, training and implementation of culturally relevant pedagogies and/or social justice mathematics pedagogies should be explored. My own participation as a White male in an advanced multicultural education seminar was helpful in learning about my own racial beliefs. This would further suggest that policy-makers and school districts should reconsider the focus on testing as the primary indicator of “success.” Additionally, they should reflect on how focusing on test scores only maintains the marginalization of African American adolescents by inadvertently pressing teachers to employ those instructional practices that merely assist in test preparation.

These are but a few practical ways that these findings could make a difference in schools for African American adolescent mathematics students. However, as Martin (2009) stated, “top-down, externally generated solutions that are not responsive to the needs and conditions of the context in questions are unlikely to have a meaningful and lasting effect” (page 304). This would counter the idea that recommended forms of professional

development and reflection alone are enough to combat issues of racism in mathematics education.

### **Limitations of the Study**

No study is perfect. This was my first attempt at formally exploring very complicated phenomenas including race, identity, mathematics pedagogy, and the beliefs of teachers. Included below are limitations of the current study including ways to improve such as study going into future investigations.

**“Effective” teacher criteria.** Teacher effectiveness was established for the recruiting and selection of teacher participants. The description of an effective teacher is discussed in this chapter. Although the criteria included other items, high performance recommendations from superintendents and principals were important in the recruitment and selection process. Although a limitation, this criteria has given the study a great opportunity to expose problematic classifications and practices. The term ‘effective’ as pertained to the sample of teachers was modified by the word nominated in many cases for this reason. This was used to express that they had been nominated via the criteria. Teacher effectiveness must be expanded beyond the relying upon student test performance as the effective teachers in the current study had very negative views about their African American students. As a result they employed low-level teaching strategies. Future research should seek to define a more robust recruitment criteria.

**Survey data.** There were three issues pertaining to the survey data collected in the quantitative phase of the study. The first was the number of participants. In the initial proposal, the desired sample size was 200-250 students. The timing of the study affected the

number of teachers willing to participate. Student response rates to return signed consent forms also reduced the number of possible students surveyed.

The second issue involved the Likert scale used for all survey measures. On the five-point scale all middle responses (score of 3) read “unsure”. The appropriate wording would have been “neutral” or “neither agree nor disagree”. This was an oversight on my part (the PI) due to adopting a scale from another study. In prior uses, the YSRM had been administered and used with young adolescent students (English-Clarke, 2011; English-Clarke et. al., 2012). In developing and formatting the online surveys, I kept the choices consistent for all surveys. In personal communication with Dr. English-Clarke I learned that she used this particular scale with young adolescents in her investigation of similar experiences. Her rationale included using language with middle grade students that could be easily understood. The use of the word “unsure” could have been interpreted differently between student participants in this study. In the future a more accurate middle score on the likert-scale should be used. However, this had only a slight impact on how students reported on the measures as there is a difference between “not sure” and neutral/neither disagree or agree. The frequency and proportion of student responses on each of the questions items can be found in Appendix D.

The third issue was the challenge of measuring the tenets of Martin’s mathematic identity. There were times when there was not a perfect correspondence between the measures and the theory seeking to be measured. For example, the subscale measuring perceived mathematics usefulness would not be considered completely indicative of the perceived importance of mathematics. However, it was the closest approximation available.

The subscale measuring Effectance Motivation was not completely indicative of beliefs of the motivations and strategies used to obtain mathematics knowledge. However, I felt confident that the scale would capture students' motivation to persevere through challenging mathematics tasks. This would at least be able to approximate an adequate portion of Martin's third tenet. A more comprehensive measurement tool should be developed in the future to analyze quantitatively important constructs.

**Other limitations.** The limited geographic region studied was a limitation. All teacher and student participants were from one geographic region. The findings are therefore limited to this geographic context and even possibly to each school (micro).

Nasir (2002) sustained that "identity is not purely the property of the individual but is recreated over time through an individuals' agency in making meaning of and becoming aligned with communitites through engaging in social practices" (p.270). There is in fact plenty of room for additional identities and influences that were not mentioned.

The racial mismatch between the White principal investigator and the African American students during the Focus Group interviews should also be considered as a potential limitation. Although students appeared very willing to explore such a complicated matter, they may have held back or modified certain information shared.

A final limitation is the self-report nature of the interview process. As a researcher, I cannot know how truthfully participants answered questions. Desirability may have affected the ways that the participants answered prompts. Additionally, the interpretations of meaning for participants in the study were made without observations of class interactions and relied on the self-reports of teachers and students. For this reason, it would be important to involve

the qualitative methodology of observation to confirm interpretations and provide further triangulation.

### **Future Research Needs and the Utilization of Mixed Methodologies**

As stated by Turner and Meyer (2000) “educational psychology will not be viewed as relevant to educational practice, including having a role in the education of teachers, unless we conduct studies that investigate the relationship among cognitive, affective, social, and motivational aspects of learning from instruction” (p.71). This study sought to accomplish this using a mixed methods approach. Examining quantitative and qualitative data allowed for the exposure of some tough realities. Studies like this one should be replicated on a larger scale using more teachers and more students, particularly to confirm the positive associations found between racial identity and mathematics identity in the quantitative phase. Furthermore, it would be valuable for a research team to develop and validate a stand-alone survey protocol focused on the measurement of mathematics identity with subscales for each of the tenets to more easily measure this form of identity.

Although recommendations were made, there is an enormous need for the development of curriculums that will aid in the training process of teachers. Undergoing any form of training related to race is sure to insight disagreements and confusion if it is not approached in a developmentally appropriate fashion. Compiling testimonies of other educators who have gone through the process of troubleshooting problematic racial beliefs could be an empowering tool that could accompany such curriculums, particularly for White teachers.

Lastly, more research is needed to understand how African American students come to perceive mathematics as useful and decide to seek out mathematical related courses, majors, and careers. Qualitative case studies of African American adults who chose to pursue mathematics related majors or careers could be conducted to analyze their various trajectories. Information gained about these trajectories could help secondary educators obtain ideas to promote mathematics as a worthwhile endeavor to African American students. Data could also help to discover the age students begin to assess the usefulness of content areas to their futures.

### **Conclusions**

Overall, the findings of this study have made useful contributions in understanding the connection between a student's mathematics identity and their racial identity. The findings have also highlighted the problems connected to how effective mathematics teachers are identified for working with African American adolescent populations. African American adolescents with positive racial identities held more positive mathematical attitudes. African American adolescents who perceived less racial discrimination from teachers and peers in the mathematics context had more positive mathematical attitudes. Racial discrimination remains a real and present threat to African American adolescent students' identification with mathematics. A positive racial identity may help African American adolescents to overcome the obstacle of racial discrimination in mathematics contexts from teachers and peers. Results of this study serve to draw attention to some alarming realities regarding the identification of effective teachers/teaching of African American adolescents. Teachers are contributing to racial discrimination obstacles for their African American mathematics students by holding

deficit beliefs about their abilities and home lives. Successful outcomes for African American mathematics students have been focused on achievement on mathematics assessments. These “successful outcomes” have provided a dangerous target that has resulted in the unwarranted classification of a teacher as “effective” for teaching African American adolescents.

Some practical implications emerge as to how teacher effectiveness is defined, taking into consideration to what extent teachers build students’ mathematical identities i.e. helping students build their confidence in math, perceive greater use of math to their lives and future careers and majors, increase willingness to persevere in challenging math tasks, and reduce forms of racial discrimination in math settings; the importance of students’ racial identity in shaping the curriculums and teaching instruction so as to provide a more inclusive environment and limit feelings of discrimination among African American students; and the role of teacher beliefs and practices on students’ perceived discrimination and their overall math attitudes.



## References

- Andrews, D. J. C. (2009). The Construction of Black High-Achiever Identities in a Predominantly White High School. *Anthropology & Education Quarterly*, 40(3), 297-317
- Andrzejewski, C. E. (2008). *A Holistic Investigation of Teacher Identity, Knowledge, and Practice*. The Ohio State University, The Ohio State University.
- Arnett, J. J., & Tanner, J. L. (Eds.). (2006). Emerging adults in America: Coming of age in the 21st century.
- Baker, J. A. (1999). Teacher-student interaction in urban at-risk classrooms: Differential behavior, relationship quality, and student satisfaction with school. *The Elementary School Journal*, 57-70.
- Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological review*, 84(2), 191.
- Barta, B. L. R. (2010). *Certified Nurse Educators: Espoused and Enacted Teacher Beliefs and the Role They Play in Understanding Relationship with Nursing Students*. The Ohio State University, The Ohio State University.
- Bartolome, L. L. (1994). Beyond the methods fetish: Toward a humanizing pedagogy. *Harvard Educational Review*, 64(2), 173-195.
- Battey, D. (2013). Access to Mathematics: "A Possessive Investment in Whiteness". *Curriculum Inquiry*, 43(3), 332-359.
- Berry, B. (2004). Recruiting and retaining "highly qualified teachers" for hard-to-staff schools. *NASSP Bulletin*, 88(638), 5-27.

- Berry, I. I. I., Robert Q. (2003). Mathematics Standards, Cultural Styles, and Learning Preferences: The Plight and the Promise of African American Students. *The Clearing House*, 76(5), 244-249.
- Berry, I. I. I., Robert Q. (2008). Access to upper-level mathematics: The stories of successful African American middle school boys. *Journal for Research in Mathematics Education*, 464-488.
- Boaler, J., & Greeno, J. G. (2000). Identity, agency, and knowing in mathematics worlds. *Multiple perspectives on mathematics teaching and learning*, 171-200.
- Bogdan, R. C., & Biklen, S. K.(1992). *Qualitative research for education: An introduction to theory and methods*
- Boykin, A. W. (1986). The triple quandary and the schooling of Afro-American children. In U. Neisser (Ed.), *The school achievement of minority children* (pp. 55-72). Hillsdale, NJ: Lawrence Erlbaum
- Bramlett, D. C. & Herron, S. (2009). A study of African-American College students' attitude towards mathematics. *Journal of Mathematical Sciences & Mathematics Education*, 4(2), 43-51
- Broadbooks, W. J., Elmore, P. B., Pedersen, K., & Bleyer, D. R. (1981). A construct validation study of the Fennema-Sherman Mathematics Attitudes Scales. *Educational and Psychological Measurement*, 41(2), 551-55
- Charmaraman, L., & Grossman, J. M. (2010). Importance of race and ethnicity: an exploration of Asian, Black, Latino, and multiracial adolescent identity. *Cultural Diversity and Ethnic Minority Psychology*, 16(2), 144.

- Chatman, C. M., Eccles, J. S., & Malanchuk, O. (2005). Identity negotiation in everyday settings. *Navigating the future: Social identity, coping, and life tasks*, 116-140.
- Clotfelter, C.T., Ladd, H.F., & Vigdor, J. (2005). Who teachers whom? Race and the distribution of the novice teachers. *Economics of Education Review*, 24(4), 377-392.
- Chavous, T. M., Bernat, D. H., Schmeelk-Cone, K., Caldwell, C. H., Kohn-Wood, L., & Zimmerman, M. A. (2003). Racial identity and academic attainment among African American adolescents. *Child development*, 74(4), 1076-1090.
- Clotfelter, C. T., Ladd, H. F., & Vigdor, J. L. (2006). Teacher-student matching and the assessment of teacher effectiveness. *Journal of human Resources*, 41(4), 778-820.
- Coffey, A., & Atkinson, P. (1996). *Making sense of qualitative data: Complementary research strategies*. Sage Publications, Inc.
- Cooper, P. M. (2003). Effective White Teachers of Black Children: Teaching within a Community. *Journal of Teacher Education*, 54(5), 413-427.  
doi:10.1177/0022487103257395
- Creswell, J. W., & Clark, V. L. P. (2007). Designing and conducting mixed methods research.
- Cross Jr, W. E., & Strauss, L. (1998). The everyday functions of African American identity. Prejudice: The target's perspective (pp. 267-279). San Diego, CA, US: Academic Press
- Cross, W. E. (1978). The Thomas and Cross Models of Psychological Nigrescence A Review. *Journal of Black psychology*, 5(1), 13-31.

- Cross, W. E., Jr., Parham, T. A., & Helms, J. E. (1991). The stages of Black identity development: Nigrescence models. In R. Jones (Ed.), *Black psychology* (3rd ed., pp. 319-338). San Francisco: Cobb and Henry.
- Darling-Hammond, L. (2006). Securing the right to learn: policy and practice for powerful teaching and learning. *Educational Researcher*, 35(7), 13-24.
- Davis, H. A. (2003). Conceptualizing the role and influence of student-teacher relationships on children's social and cognitive development. *Educational Psychologist*, 38(4), 207-234.
- Davis, H. A., & Andrzejewski, C.E. (2009). Teacher beliefs. *Psychology of classroom learning: An encyclopedia*, 2, 909-915.
- Decker, D. M., Dona, D. P., & Christenson, S. L. (2007). Behaviorally at-risk African American students: The importance of student-teacher relationships for student outcomes. *Journal of School Psychology*, 45(1), 83-109.
- DeCuir-Gunby, J. T. (2009). A review of the racial identity development of African American adolescents: The role of education. *Review of Educational Research*, 79(1), 103-124.
- Delpit, L. (2005). Other people's children: Cultural conflict in the classroom, 1995. *New York: The New Post*
- Dilworth, M. E., & Brown, A. L. (2008). Teachers of color: Quality and effective teachers one way or another. *Handbook of research on teacher education: Enduring questions in changing contexts*, 3, 424-444.
- Dogbey, G. Y. (2010). Attitudes of community college developmental students toward

- mathematics and their perception of mathematically intensive careers (Doctoral dissertation, Ohio University).
- Eccles, J. S., & Wigfield, A. (2002). Motivational beliefs, values, and goals. *Annual review of psychology, 53*(1), 109-132.
- Eccles, J. S., Adler, T. F., Futterman, R., Goff, S. B., Kaczala, C. M., Meece, J. L., & Midgley, C. (1983). Achievement and achievement motivation. *Expectancies, values and academic behaviors San Francisco, CA: WH Freeman.*
- Eccles, J. S., O'Neill, S. A., & Wigfield, A. (2005). Ability self-perceptions and subjective task values in adolescents and children. In *What do children need to flourish?* (pp. 237-249). Springer US.
- English-Clarke, T. L., Slaughter-Defoe, D. T., & Martin, D. B. (2012). 'What Does Race Have to Do with Math?' Relationships between Racial-Mathematical Socialization, Mathematics identity, and Racial Identity.
- Eriksen, E. (1950). *Childhood and society. New York: Northern.*
- Erikson, E. H. (1959). 1980. *Identity and the life cycle.*
- Erikson, E. H. (1968). *Identity.* Norton.
- Fennema, E., & Sherman, J. A. (1976). Fennema-Sherman mathematics attitudes scales: Instruments designed to measure attitudes toward the learning of mathematics by females and males. *Journal for Research in Mathematics Education, 324-326.*
- Fives, H., & Buehl, M. M. (2012). Spring cleaning for the "messy" construct of teachers' beliefs: What are they? Which have been examined? What can they tell us?. In *APA Educational Psychology Handbook* (Vol. 2, pp. 471-496). American Psychological

- Association.
- Flores, A. (2007). Examining disparities in mathematics education: Achievement gap or opportunity gap?. *The High School Journal*, 91(1), 29-42.
- Fordham, S., & Ogbu, J. U. (1986). Black students' school success: Coping with the "burden of 'acting White'". *The urban review*, 18(3), 176-206.
- Fuller, B. The Caterpillar and the Butterfly.
- Gay, G. (2010). *Culturally responsive teaching: Theory, research, and practice*. Teachers College Press.
- Gersten, R., & Chard, D. (1999). Number sense rethinking arithmetic instruction for students with mathematical disabilities. *The Journal of special education*, 33(1), 18-28.
- Gillborn, D. (2009). Who's Afraid of Critical Race Theory in Education? A Reply to Mike Cole's 'the Color-Line and the Class Struggle'. *Power and Education*, 1(1), 125-131.
- Gillborn, D. (2010). The colour of numbers: surveys, statistics and deficit-thinking about race and class. *Journal of Education Policy*, 25(2), 253-276.
- Goe, L., Bell, C., & Little, O. (2008). Approaches to Evaluating Teacher Effectiveness: A Research Synthesis. *National Comprehensive Center for Teacher Quality*.
- Goldenberg, B. M. (2014). White Teachers in Urban Classrooms Embracing Non-White Students' Cultural Capital For Better Teaching and Learning. *Urban Education*, 49(1), 111-144.
- Gompa, V. (2012). Effective Mathematics Teaching Methodologies to Overcome Challenges and Increase Achievement in Mathematics. *The Exchange*, 1(1).

- Guskey, T. R. (2002). Professional development and teacher change. *Teachers and Teaching: theory and practice*, 8(3), 381-391.
- Gutiérrez, R. (2008). A “Gap-Gazing” Fetish in Mathematics Education? Problematizing Research on the Achievement Gap. *Journal for Research in Mathematics Education*, 39(4), 357-364.
- Gutstein, E. (2003). Teaching and Learning Mathematics for Social Justice in an Urban, Latino School. *Journal for Research in Mathematics Education*, 34(1), 37-73.  
Retrieved from <http://www.jstor.org/stable/30034699>
- Gutstein, E. (2007). “And That’s Just How It Starts”: Teaching Mathematics and Developing Student Agency. *The Teachers College Record*, 109(2), 420-448.
- Haberman, M. (1991). The pedagogy of poverty versus good teaching. *Phi Delta Kappan*, 73(4), 290-294
- Hackett, G., & Betz, N. E. (1989). An exploration of the mathematics self-efficacy/mathematics performance correspondence. *Journal for research in Mathematics Education*, 261-273.
- Hand, V., & Taylor, E. V. (2008). Culture and mathematics in school: Boundaries between “cultural” and “domain” knowledge in the mathematics classroom and beyond. *Review of Research in Education*, 32(1), 187-240
- Harper, B. E. (2007). The relationship between Black racial identity and academic achievement in urban settings. *Theory into Practice*, 46(3), 230-238.
- Harper, B. E., & Tuckman, B. W. (2006). Racial identity beliefs and academic achievement: does being Black hold students back?. *Social Psychology of Education*,

- 9(4), 381-403.
- Helms, J. E. (1990). *Black and White racial identity: Theory, research, and practice*. Greenwood Press.
- Hernández, A., Drasgow, F., & González-Romá, V. (2004). Investigating the functioning of the middle category by means of a mixed-measurement model. *Journal of Applied Psychology, 89*, 687-699.
- Hodge, L. L. (2006). An orientation on the mathematics classroom that emphasizes power and identity: Reflecting on equity research. *The Urban Review, 38*(5), 373-385.
- Howard, G. R. (2006). *We can't teach what we don't know: White teachers, multiracial schools*. Teachers College Press.
- Howard, T. C. (2001). Powerful Pedagogy for African American Students: A Case of Four Teachers. *Urban Education, 36*(2), 179-202. doi:10.1177/0042085901362003
- Howard, T. C. (2002). Hearing footsteps in the dark: African American students' descriptions of effective teachers. *Journal of Education for Students Placed at Risk, 7*(4), 425-444.
- Howard, T. C., & Aleman, G. R. (2008). Teacher capacity for diverse learners: What do teachers need to know. *Handbook of research on teacher education: Enduring questions in changing contexts, 3*, 157-174.
- Jackson, K., & Wilson, J. (2012). Supporting African American Students' Learning of Mathematics: A Problem of Practice. *Urban Education, 47*(2), 354-398. doi:10.1177/0042085911429083
- King, J. E. (1991). Dysconscious racism: Ideology, identity, and the miseducation of

- teachers. *Journal of Negro Education*, 133-146.
- Kozol, J. (1988). *Savage Inequalities: Children in America's Schools*. "From *Savage Inequalities*. New York: Harper Collins. 1991. p. 175-184
- Ladson-Billings, G. (1995). Toward a theory of culturally relevant pedagogy. *American educational research journal*, 32(3), 465-491.
- Ladson-Billings, G. (1997). It Doesn't Add up: African American Students' Mathematics Achievement. *Journal for Research in Mathematics Education*, 28(6), 697-708.  
Retrieved from <http://www.jstor.org/stable/749638>
- Ladson-Billings, G. (2000). Fighting for our lives preparing teachers to teach African American students. *Journal of teacher education*, 51(3), 206-214.
- Ladson-Billings, G., & Tate, W. F. (2006). Toward a critical race theory of education. *Critical race theory in education: All God's children got a song*, 11-30.
- Larnell, G. V. (2013). On "New Waves" in Mathematics Education Research: Identity, Power, and the Mathematics Learning Experiences of All Children. *New Waves-Educational Research & Development*, 16(1).
- Lave, J., & Wenger, E. (1998). Communities of practice. Retrieved June, 9, 2008.
- Leonard, J. (2008). *Culturally specific pedagogy in the mathematics classroom*. Routledge New York, NY.
- Leonard, J., Brooks, W., Barnes-Johnson, J., & Berry, R. Q. (2010). The Nuances and Complexities of Teaching Mathematics for Cultural Relevance and Social Justice. *Journal of Teacher Education*, 61(3), 261-270.
- Lerman, S. (2000). The social turn in mathematics education research. *Multiple*

- perspectives on mathematics teaching and learning*, 19-44.
- Leung, F. K. (2001). In search of an East Asian identity in mathematics education. *Educational Studies in Mathematics*, 47(1), 35-51
- Love, A., & Kruger, A. C. (2005). Teacher beliefs and student achievement in urban schools serving African American students. *The Journal of Educational Research*, 99(2), 87-98.
- Lubienski, S. T. (2002). A closer look at Black-White mathematics gaps: Intersections of race and SES in NAEP achievement and instructional practices data. *Journal of Negro Education*, 269-287.
- Lubienski, S. T., & Bowen, A. (2000). Who's counting? A survey of mathematics education research 1982-1998. *Journal for research in mathematics education*, 626-633.
- Martin, D. B. (2000). *Mathematics success and failure among African-American youth: The roles of sociohistorical context, community forces, school influence, and individual agency*. Routledge.
- Martin, D. B. (2006). Mathematics learning and participation as racialized forms of experience: African American parents speak on the struggle for mathematics literacy. *Mathematical Thinking and Learning*, 8(3), 197-229.
- Martin, D. B. (2007). Beyond missionaries or cannibals: Who should teach mathematics to African American children? *The High School Journal*, 91(1), 6-28.
- Martin, D. B. (2009). Researching race in mathematics education. *The Teachers College Record*, 111(2), 295-338.
- McKinney, S. E., Bol, L., & Berube, C. (2010). Mathematics Teaching with the Stars. *Online Yearbook of Urban Learning, Teaching, and Research*, 36, 50.

- Merriam, S. B. (2002). Assessing and evaluating qualitative research. *Qualitative research in practice: Examples for discussion and analysis*, 18-33.
- Moses, R. P., & Cobb, C. E. (2001). *Radical equations: Math literacy and civil rights*. Beacon Pr.
- Moustakas, C. (1994). *Phenomenological research methods*. Sage Publications.
- Mulhern, F., & Rae, G. (1998). Development of a shortened form of the Fennema-Sherman Mathematics Attitudes Scales. *Educational and Psychological Measurement*, 58(2), 295-306.
- Murnane, R. J. (2007). Improving the education of children living in poverty. *Future of Children*, 17(2), 161-182.
- Murnane, R. J., & Steele, J. L. (2007). What is the problem? the challenge of providing effective teachers for all children. *The Future of Children*, 17(1), 15-43.
- Naman, W. (2009). Who Should Teach Black Students? Research on the Role of White and Black Teachers in American Schools. *Ethnicity and Race in a Changing World*, 1(2), 26
- Nasir, N. I. S. (2002). Identity, goals, and learning: Mathematics in cultural practice. *Mathematical thinking and learning*, 4(2-3), 213-247.
- Nasir, N.I.S. & de Royston, M. M. (2013). Power, identity, and mathematical practices outside and inside school. *Journal for Research in Mathematics Education*, 44(1), 264-287.
- National Centre for Education Statistics (2011) The condition for education 2011. *The department of education*.

- Noblit, G. W. (1993). Power and caring. *American Educational Research Journal*, 30(1), 23-38.
- Nowlis, S. M., Kahn, B. E. & Dhar, R. (2002). Coping with ambivalence: The effect of removing a neutral option on consumer attitude and preference judgments. *The Journal of Consumer Research*, 29 (3), 319-334
- O'Brien, V., Martinez-Pons, M., & Kopala, M. (1999). Mathematics self-efficacy, ethnic identity, gender and career interests related to mathematics and science. *The Journal of Educational Research*, 92 (4), 231-235.
- Ogbu, J. U. (1992). Understanding cultural diversity and learning. *Educational researcher*, 21(8), 5-14.
- Oyserman, D. (2008). Racial-ethnic self-schemas: Multidimensional identity-based motivation. *Journal of Research in Personality*, 42(5), 1186-1198.
- Oyserman, D., Kimmelmeier, M., Fryberg, S., Brosh, H., & Hart-Johnson, T. (2003). Racial-ethnic self-schemas. *Social Psychology Quarterly*, 333-347.
- Pajares, M. F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of educational research*, 62(3), 307-332.
- Paley, V. G., & Paley, V. G. (2009). *White teacher, with a new preface*. Harvard University Press.
- Park, S. H., & Ertmer, P. A. (2007). Impact of problem-based learning (PBL) on teachers' beliefs regarding technology use. *Journal of Research on Technology in Education*, 40(2), 247-267.
- Parsons, E. C. (2005). From caring as a relation to culturally relevant caring: A White

- teacher's bridge to Black students. *Equity & Excellence in Education*, 38(1), 25-34.
- Peske, H. G. & Haycock, K. (2006). *Teaching Inequality: How poor and minority students are shortchanged on teacher quality*. Washington, DC: The Education Trust.
- Plunk, A. D., Tate, W. F., Bierut, L. J., & Grucza, R. A. (2014). Intended and unintended effects of state-mandated high school science and mathematics course graduation requirements on educational attainment. *Educational Researcher*, 0013189X14540207.
- Rattan, A., Good, C., & Dweck, C. S. (2012). "It's ok—Not everyone can be good at math": Instructors with an entity theory comfort (and demotivate) students. *Journal of Experimental Social Psychology*, 48(3), 731-737.
- Ravitch, D. (2016). *The death and life of the great American school system: How testing and choice are undermining education*. Basic Books.
- Raymond, A. M. (1997). Inconsistency between a beginning elementary school teacher's mathematics beliefs and teaching practice. *Journal for research in mathematics education*, 550-576.
- Rosenbloom, S. R., & Way, N. (2004). Experiences of discrimination among African American, Asian American, and Latino adolescents in an urban high school. *Youth & Society*, 35(4), 420-451.
- Rosenshine, B. Stevens,(1986). Teaching functions. *Handbook of research on teaching*, 376-391.
- Ruck, M.D., & Tenenbuam, H. R. (2007). Are teachers' expectations different for racial minority than for European American students? A meta-analysis. *Journal of*

- Educational Psychology*, 99(2), 253-273.
- Schott Foundation for Public Education. (2010). *Yes we can: The Schott 50 state report on public education and Black males*. Cambridge, MA: Author.
- Scottham, K. M., Sellers, R. M., & Nguyễn, H. X. (2008). A measure of racial identity in African American adolescents: the development of the Multidimensional Inventory of Black Identity--Teen. *Cultural Diversity and Ethnic Minority Psychology*, 14(4), 297.
- Sellers, R. M., Rowley, S. A., Chavous, T. M., Shelton, J. N., & Smith, M. A. (1997). Multidimensional Inventory of Black Identity: A preliminary investigation of reliability and construct validity. *Journal of Personality and Social Psychology*, 73(4), 805.
- Shuck, D. H., Pintrich, P. R., & Meece, J. L. (2008). *Motivation in Education Theory, Research, and Applications*.
- Sipe, L. R., & Ghiso, M. P. (2004). Developing conceptual categories in classroom descriptive research: Some problems and possibilities. *Anthropology & Education Quarterly*, 472-485.
- Skott, J. (2001). The Emerging Practices of a Novice Teacher: The Roles of His School Mathematics Images. *Journal of Mathematics Teacher Education*, 4(1), 3-28.
- Smith, E. P., Atkins, J., & Connell, C. M. (2003). Family, school, and community factors and relationships to racial-ethnic attitudes and academic achievement. *American Journal of Community Psychology*, 32(1-2), 159-173.

- Snipes, V. T., & Waters, R. D. (2005). The Mathematics Education of African Americans in North Carolina: From the Brown Decision to No Child Left Behind. *Negro Educational Review, The, 56*, 107-126.
- Snyder, Thomas D., and Sally A. Dillow. "Digest of Education Statistics, (2011). *National Center for Education Statistics*
- Spencer, M. B., Cunningham, M., & Swanson, D. P. (1995). Identity as coping: Adolescent African-American males' adaptive responses to high-risk environment.
- Steffe, L. P., & Kieren, T. (1994). Radical constructivism and mathematics education. *Journal for Research in Mathematics Education, 711-733*.
- Steinberg, L. (2005). Cognitive and affective development in adolescence. *Trends in Cognitive Sciences, 9(2)*, 69-74.
- Stinson, D. W. (2004). Mathematics as “gate-keeper”(?): Three theoretical perspectives that aim toward empowering all children with a key to the gate.
- Stinson, D. W. (2006). African American male adolescents, schooling (and mathematics): Deficiency, rejection, and achievement. *Review of Educational Research, 76(4)*, 477-506.
- Stinson, D. W. (2013). Negotiating the “White male math myth”: African American male students and success in school mathematics. *Journal for Research in Mathematics Education, 44(1)*, 69-99.

- Strauss, A., & Corbin, J. M. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Sage Publications, Inc.
- Strutchens, M. (2000). Confronting beliefs and stereotypes that impede the mathematical empowerment of African American students. *Changing the faces of mathematics: Perspectives on African Americans*, 7-14.
- Strutchens, M., Bay-Williams, J., Civil, M., Chval, K., Malloy, C. E., White, D. Y., ... & Berry, R. Q. (2012). Foregrounding equity in mathematics teacher education. *Journal of Mathematics Teacher Education*, 15(1), 1-7.
- Tatum, B. D. (2003). *"Why are all the Black kids sitting together in the cafeteria?": and other conversations about race*. Basic Books.
- The Education Trust. (2014). The State of Education for African American Students. Retrieved from [http://edtrust.org/wp-content/uploads/2013/10/TheStateofEducationforAfricanAmericanStudents\\_EdTrust\\_June2014.pdf](http://edtrust.org/wp-content/uploads/2013/10/TheStateofEducationforAfricanAmericanStudents_EdTrust_June2014.pdf)
- Thompson, S., Ransdell, M. F., & Rousseau, C. K. (2005). Effective teachers in urban school settings: Linking teacher disposition and student performance on standardized tests.
- Turner, J. C., & Meyer, D. K. (2000). Studying and understanding the instructional contexts of classrooms: Using our past to forge our future. *Educational Psychologist*, 35(2), 69-85.
- Tyson, K., Darity, W., & Castellino, D. R. (2005). It's not "a black thing": Understanding the burden of acting white and other dilemmas of high achievement. *American*

- Sociological Review*, 70(4), 582-605. Thomas, O. N., Caldwell, C. H., Faison, N., & Jackson, J. S. (2009). Promoting academic achievement: The role of racial identity in buffering perceptions of teacher discrimination on academic achievement among African American and Caribbean Black adolescents. *Journal of educational psychology*, 101(2), 420.
- Vanneman, A., Hamilton, L., Anderson, J. B., & Rahman, T. (2009). Achievement Gaps: How Black and White Students in Public Schools Perform in Mathematics and Reading on the National Assessment of Educational Progress. Statistical Analysis Report. NCES 2009-455. *National Center for Education Statistics*.
- Vijaya, G. (2012). Effective Mathematics teaching methodologies to overcome challenges and increase achievement in mathematics. *The Exchange*.
- Ware, F. (2006). Warm demander pedagogy culturally responsive teaching that supports a culture of achievement for african american students. *Urban Education*, 41(4), 427-456.
- Weiner, L. (2006). Challenging deficit thinking. *Educational Leadership*, 64(1), 42.
- Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. Cambridge University Press.
- Wigfield, A. (1994). Expectancy-value theory of achievement motivation: A developmental perspective. *Educational Psychology Review*, 6(1), 49-78.
- Wilson, P. S., Cooney, T. J., & Stinson, D. W. (2005). What constitutes good mathematics teaching and how it develops: Nine high school teachers' perspectives. *Journal of Mathematics Teacher Education*, 8(2), 83-111.

Zumwalt, K., & Craig, E. (2008). Who is teaching? Does it matter. *Handbook of research on teacher education: Enduring questions in changing contexts*, 3, 404-423.

**APPENDICES**

## Appendix A: Interview Questions

### Interview Questions – Teacher Interviews

*This study is about effective teaching of African American adolescent students and the development of mathematics identity. In this interview I will ask questions about your experiences as a teaching (general) as well as your experiences specifically teaching African American students in math.*

1. To get started can you tell me a little about yourself (allow for strong intro) Be sure to capture personal and professional background . Degrees, how long teaching, trajectory, etc.
2. How would you describe your teaching approach (in general). How would you describe your teaching approach specifically to African American students success?
3. If I were to visit your classroom on a regular, what types of things would I see going on? What are you doing? What are your students doing?
4. How would you describe your language/communication style with your students? With African American students?
5. What challenges exist with teaching math to African American students? What opportunities exist?
6. How do you think your African American students perceive studying mathematics? Do they think it is hard? Unobtainable?
7. Can you describe strategies you may use unique to African American students to help them to succeed in your mathematics courses.
8. How do you build/negotiate relationships with your African American students in the math class?
9. What role would you say that confidence plays in helping African Americans students to achieve in your math course? Same question substitute “confidence” with “ability” with “motivation” with “prior experiences/socialization from peers/family”
10. Have you ever sensed that African American students are discriminated against in a math class in some way?
11. How important would you say it is for students to develop a “mathematics identity”?
12. How would you say students perceive you as a teacher as well as your math class?

13. In what ways do you encourage students to seek out higher level mathematics or pursue mathematics related careers?
14. Is there anything else you would like to share with me on the topic?

### **Interview Questions – Student Interviews**

*This study is about African American adolescent math students' experiences with mathematics and race. In this interview I will ask questions about your experiences with schooling, math, race and about the kinds of messages and instructional strategies used by your teachers that may be helpful to your achievement in mathematics.*

1. What do you think of when you think about mathematics as a subject?
2. How do you feel about math? (Possible extensions – Do you like math? Why/Why not? Why do you feel that way? Did you always feel that way?)
3. How would you say you are at math?
4. What kinds of things do your peers think about math? African American friends?
5. Do you think that Math is for Black people just as much as it is for White people? Tell me more.
6. What is your math class like? What is your teacher like? What does your teacher do that makes you feel like math is something you can do? What does your teacher (or past teachers) do that makes you feel like math is not something you can do?
7. How likely is it that you will pursue higher level mathematics? How do you see math in your future?
8. Has your teacher ever discussed race in your class or with you personally?
9. Have you ever experienced discrimination because of your race in a mathematics course? Can you tell me about that? How did you feel about this?
10. Have you ever felt like a math teacher or other students didn't think you could do well in math because you are African American? Can you tell me more about that?
11. Do you feel like mathematics is something you can achieve in just as well as any other subject? Explain.



## Appendix B: Survey Measures

### **Attitudes about Mathematics**

I can get good grades in math.  
Most subjects I can handle OK, but I just can't do a good job in math.  
I'll need a good understanding of math for my future work.  
I study math because I know how useful it is  
Once I start trying to work a math problem, I find it hard to stop.  
Figuring out math problems does not appeal to me.  
Knowing math will help me to earn a living.  
I see math as something I won't use very often when I get out of high school.  
I don't think I could do advanced math.  
I am sure of myself when I do math.  
Math is worthwhile and necessary subject.  
Math is not important for my life.  
I do as little work in math as possible.  
Math is enjoyable and interesting to me.  
I'm not the type of person to do well in math.  
Generally, I feel secure about attempting math problems.  
Doing well in math is not important to my future.  
Math will not be important to me in my life's work.  
Math has been my worst subject.  
The challenge of math problems does not appeal to me.  
I don't understand how some people can spend so much time on math and seem to enjoy life.  
I think I could handle more difficult math problems.  
I am sure that I can learn math.  
I will use math in many ways as an adult.  
I don't expect to use much math when I get out of high school.  
Taking math is a waste of time.  
I would rather have someone give me a solution to a difficult math problem than to have to work it out for myself.  
I am challenged by problems I can't understand immediately.  
I am sure that I can learn math.  
I'll need math for my future work.  
When a math problem arises that I can't immediately solve, I stick with it until I have a solution.  
When a question is left unanswered in math class, I continue to think about it afterward.  
I'm no good in math.  
For some reason, even though I study, math is hard for me.  
I am sure that I could do advanced work in math.

### **Youth Survey on Race and Mathematics**

I have experienced racial discrimination.

People of my race are typically good at math.

At some point, I have felt like a math teacher really liked me or thought I could do well in math.

Black people are given as many opportunities to succeed in mathematics as people of other races.

At some point, I have felt like a math teacher didn't like me or didn't think I could do very well in math.

In my math classes, students of other races have gotten higher grades than Black students.

I have been discriminated against by a math teacher because of my race.

Adults of my race use math in their daily lives.

I have been helped by a math teacher because of my race.

African Americans are held held back in math because of their race.

At some point, I felt like a fellow student thought I could do very well in math.

The popular Black students in my school don't do well in math.

At some point, I felt like a fellow student didn't think I could do very well in math.

### **Multidimensional Inventory of Black Identity-Teen (MIBI-T)**

I feel close to other Black people.

I am happy that I am Black

I have a strong sense of belonging to other Black people.

Most people think that Blacks are as smart as people of other races.

People think that Blacks are as good as people from other races.

I am proud to be Black.

If I were to describe myself to someone, one of the first things that I would say is that I'm Black.

I feel good about Black people.

People from other races think that Blacks have made important contributions.

## Appendix C: Sample Coding of Teacher/Student Interviews

## Sample of codes for Teacher Beliefs

Open code	Properties	Examples of participants' words
<b>Beliefs about African Americans – AA students generally have less support at home and lack motivation in math.</b>	AA students tend to come from broken homes more often AA students usually more apathetic than others AA students generally do not have a positive father figure	Most of the students I teacher don't have a father figure, or they don't have a positive father figures if they do." "...a lot of kids come from broken homes where they only might have an uncle or a preacher" "...(regarding home visits) you get to see that there is no air conditioner" "(regarding home structure)...this kid has 7 brothers and sisters or cousins aged 4-9"
<b>Beliefs about math as a subject? Students come in generally unmotivated and unprepared in reading and basic math?</b>	Students struggle at reading and basic math Math is not exciting for students generally	"And I think a lot of our kids are not good at reading" "It goes back to basic math, things you just think kids know, anything we might think is common/ordinary, they don't get as much." "African American students are more apathetic compared to White students"

## Sample of codes for Teacher Demeanors

Open code	Properties	Examples of participants' words
<b>Toughness? Wants to excel – unsatisfied with status quo?</b>	Challenging Tough Love Very Direct – Straight Forward- Keeps it real	"I can't hold up the whole class...(referencing moving fast)" "I'm not one to just sit there" "I want to link them (topics), getting them together like a perfect string" "I'm a competitive person, kids kinda read into that" "I still love the fact that if I could get half of them straight and pointed in a positive direction that they could go on and do something great, graduate in 4 years" "My EOC scores were first in growth, second in proficiency"

<b>Fun/Entertaining</b>	Humorous Balanced in work/play in class	<p>“I’m very humorous”</p> <p>“...fine line between playing and doing a lot of work, but I actually cut it down a little bit and even cut it off.”</p> <p>“...I do something humorous”</p> <p>“ I did a joke”</p> <p>“I just try to do anything I can to get kids to relax a little bit...”</p> <p>“I always joke...”</p> <p>“...and sing a song and say some of the lyrics to a song they know sometimes just to get them to laugh”</p> <p>“It’s very fun...”</p> <p>“It’s like fun and hard, at the same time”</p> <p>“cause like when you working he’s keeping you laughing, he’ll make jokes, but if you don’t get something he’ll make you go to the board in front of everybody and like try to teach you how to do it...”</p> <p>“...like I said before it would also be fun -like he keep you laughing while doing work”</p> <p>“funny and hardworking (describing teacher)”</p>
-------------------------	--	--

### Sample of codes for Teacher Practices

<b>Open code</b>	<b>Properties</b>	<b>Examples of participants’ words</b>
<b>Very Fast Pacing – Skills/Drill Practice</b>	Structure/Rigidity in the class Fast Pacing Lots of practice problems in each class – multiple lessons taught daily	<p>“quizzes take like 10 minutes”</p> <p>“we are constantly building”</p> <p>“I can’t hold up the whole class...(referencing moving fast)”</p> <p>“We only stop just 30 seconds or 15 seconds to get calculators, no worksheets, even when I leave for basketball to go early (for coaching) I have prepared the class work for 45 minutes that I’m gone.”</p> <p>“...I teach really fast”</p> <p>“Delivery is really fast, just because everything in here is fast.”</p> <p>“I am very rich and structured”</p> <p>“...each day it is like the same structure, the same rigidity, it’s almost like a</p>

		<p>machine that keeps going”</p> <p>“When they come in they should be in their seat.”</p> <p>“We always check homework”</p> <p>“When they are not good in math that structure helps.”</p> <p>“The one’s struggling the most are in the front”</p> <p>“I am very rigid, very structured,...”</p>
<b>Fun/Entertaining</b>	<p>Humorous</p> <p>Balanced in work/play in class</p>	<p>“I’m very humorous”</p> <p>“...fine line between playing and doing a lot of work, but I actually cut it down a little bit and even cut it off.”</p> <p>“...I do something humorous”</p> <p>“ I did a joke”</p> <p>“I just try to do anything I can to get kids to relax a little bit...”</p> <p>“I always joke...”</p> <p>“...and sing a song and say some of the lyrics to a song they know sometimes just to get them to laugh”</p> <p>“It’s very fun...”</p> <p>“It’s like fun and hard, at the same time”</p> <p>“cause like when you working he’s keeping you laughing, he’ll make jokes, but if you don’t get something he’ll make you go to the board in front of everybody and like try to teach you how to do it...”</p> <p>“...like I said before it would also be fun -like he keep you laughing while doing work”</p> <p>“funny and hardworking (describing teacher)”</p>

### Sample of codes for How Teachers Cognizant of Racial Identity

<b>Open code</b>	<b>Properties</b>	<b>Examples of participants’ words</b>
<b>Evidence of Racial Identity?</b>	<p>Discussion – racial identity</p> <p>General Race</p>	<p>“I think they identify with their race. In the beginning of the year all the White kids were sitting together, all the</p>

	Influence on Academics	<p>Hispanics, and all the Blacks sitting together. I think they think – I’m a Black-male, I’ll find another Black male in here. So I think they do see and sense race. I think they see it, I think they are used to looking at the board (of top grades) and seeing White student names or whatever....”</p> <p>“...even when I was the only White person on my basketball team. Race didn’t mean so much to me.”</p> <p>“...I think society is getting better with race relations, for the most part, but I still think growing up and how you were raised is probably the most important even compared to (a person’s) age.</p> <p>“Sometimes we choose our groups based on race, we have to have one person of each race in our group, and like we have to compete with the other teams to see who will be first”</p> <p>“It makes me feel like he’s trying to make everybody work together..I used to pick people of just my race for working with”</p> <p>“No. (3 students , when asked if he ever talks about race in class)</p> <p>“No (5 students, when asked if he ever <b>had</b> race conversations with you for any reason)”</p>
--	------------------------	---

### Sample of codes for How Teachers Build Student Confidence

Open code	Properties	Examples of participants' words
<p><b>Confidence Built through communicating positive messages to students</b></p>	<p>Praising Students/Positive Talk - Preaching Talk about individual growth of students and help them to set realistic goals Sharing Success Stories</p>	<p>“But I tell them that they can still do it!” “There are a lot of success stories I try to share” “that’s what I tell them – you can look at it and it’s just the past. Like an old picture, this is the new picture – of the new you.” “I let them know this is a special class.” “If you can do something else and you can do social studies than you can do math. It’s a little different but you can do it!” “you can point out success stories of other students (that he taught) that lived in the same neighborhood” “If you pass Math 1, I know your gonna pass Math 2, Math 3, and graduate. If you pass Ramses class, you earned it pretty much. (referencing things he says to students)” “I tell them that they got to break that trend and get their names up there (referencing high grades top achievement). “...(parent told teacher her son wasn’t good in math)...yes he is!” “You are an individual person and you can do your best so don’t compare yourself to who’s been sitting there, or what you did last year, you just need to do the best you can at this place, at this point, no matter what they can all relate to that” “I think that when they see they are successful they develop that confidence and then they go to math next year and they know what they got to do.” “There is still a little bit of fear but they know now that they can do it because it’s been done in the past.” “I’m saying 87 (telling a student what they scored) on the test and he says what was the percent out of ? Did I make growth? And I’m saying , yes!”</p>

--	--	--

**Sample of codes for How Teachers Help AA Students See Math as Relevant to Lives and Futures**

<b>Open code</b>	<b>Properties</b>	<b>Examples of participants' words</b>
<p><b>Discussing the role of math skills in college futures.</b>  <b>Telling students the consequences of not having math in present and future?</b></p>	<p>Fail math and you won't graduate – don't graduate no prospects.            Good in math you can make more money            Discussing the college math placement tests and results</p>	<p>“I talk to them about the ACT score, how it will help you if you go to college”            “We take the placement test showing them what careers they think they could go into, based on how well they did. I tell them if you are good in math or science you are gonna make more money, usually, if you choose a job in that career, it's not for everybody”            “(talking about Allen Iverson in class)...He was a millionaire, he blew all that money, and I joked and said if he had been a good math person or had one around them he could have saved some money. I tell that that if you always hated math, just take a chance you might like it.”            “I guess it prepares us for college, in college we'll be doing it fast.”</p>

**Sample of codes for How Teachers Help AA Students See Math as Relevant to Lives and Futures**

<b>Open code</b>	<b>Properties</b>	<b>Examples of participants' words</b>
<p><b>Discussing the role of math skills in college futures.</b>  <b>Telling students the consequences of not having math in present and future?</b></p>	<p>Fail math and you won't graduate – don't graduate no prospects.            Good in math you can make more money            Discussing the college math placement tests and results</p>	<p>“I talk to them about the ACT score, how it will help you if you go to college”            “We take the placement test showing them what careers they think they could go into, based on how well they did. I tell them if you are good in math or science you are gonna make more money, usually, if you choose a job in that career, it's not for everybody”</p>

		<p>“(talking about Allen Iverson in class)...He was a millionaire, he blew all that money, and I joked and said if he had been a good math person or had one around them he could have saved some money. I tell that that if you always hated math, just take a chance you might like it.”</p> <p>“I guess it prepares us for college, in college we’ll be doing it fast.”</p>
--	--	--

Appendix D: Distribution of survey measures.

	Strongly disagree		Disagree		Not sure		Agree		Strongly agree	
	Count	%	Count	%	Count	%	Count	%	Count	%
I can get good grades in math.	0	0%	5	4.9%	14	13.7%	51	50.0%	32	31.4%
Most subjects I can handle OK, but I just can't do a good job in math.	13	12.7%	22	21.6%	23	22.5%	28	27.5%	16	15.7%
I'll need a good understanding of math for my future work.	2	2.0%	3	2.9%	22	21.6%	39	38.2%	36	35.3%
I study math because I know how useful it is.	16	15.7%	18	17.6%	44	43.1%	24	23.5%	16	15.7%
Math problems are boring.	10	9.8%	31	30.4%	21	20.6%	32	31.4%	8	7.8%
Once I start trying to work a math problem, I find it hard to stop.	13	12.7%	32	31.4%	17	16.7%	35	34.3%	5	4.9%
Figuring out math problems does not appeal to me.	10	9.8%	27	26.5%	21	20.6%	37	36.3%	7	6.9%
Knowing math will help me to earn a living.	1	1.0%	8	7.8%	17	16.7%	30	29.4%	46	45.1%

I see math as something I won't use very often when I get out of high school.	17	16.7%	22	21.6%	18	17.6%	25	24.5%	20	19.6%
I don't think I could do advanced math.	9	8.8%	15	14.7%	35	34.3%	28	27.5%	15	14.7%
I am sure of myself when I do math.	2	2.0%	19	18.6%	34	33.3%	36	35.3%	11	10.8%
Math is worthwhile and necessary subject.	3	2.9%	6	5.9%	16	15.7%	43	42.2%	34	33.3%
Math is not important for my life.	0	0%	7	6.9%	15	14.7%	40	39.2%	40	39.2%
I do as little work in math as possible.	10	9.8%	21	20.6%	15	14.7%	37	36.3%	19	18.6%
Math is enjoyable and interesting to me.	14	13.7%	24	23.5%	19	18.6%	27	26.5%	18	17.6%
I'm not the type of person to do well in math.	12	11.8%	19	18.6%	17	16.7%	34	33.3%	20	19.6%
Generally, I feel secure about attempting math problems.	4	3.9%	8	7.8%	28	27.5%	48	47.1%	14	13.7%
Doing well in math is not important to my future.	3	2.9%	6	5.9%	10	9.8%	47	46.1%	36	35.3%

Math will not be important to me in my life's work.	3	2.9%	15	14.7%	25	24.5%	32	31.4%	27	26.5%
Math has been my worst subject.	25	24.5%	16	15.7%	9	8.8%	31	30.4%	21	20.6%
The challenge of math problems does not appeal to me.	8	7.9%	16	15.8%	30	29.7%	30	29.7%	17	16.8%
I don't understand how some people can spend so much time on math and seem to enjoy life.	14	13.7%	23	22.5%	21	20.6%	33	32.4%	11	10.8%
I think I could handle more difficult math problems.	13	12.7%	22	21.6%	38	37.3%	17	16.7%	12	11.8%
I will use math in many ways as an adult.	1	1.0%	6	5.9%	27	26.5%	40	39.2%	28	27.5%
I don't expect to use much math when I get out of high school.	3	2.9%	17	16.7%	21	20.6%	36	35.3%	25	24.5%
Taking math is a waste of time.	0	0%	7	6.9%	10	9.8%	34	33.3%	51	50.0%

I would rather have someone give me a solution to a difficult math problem than to have to work it out for myself.	12	11.8%	19	18.6%	17	16.7%	34	33.3%	20	19.6%
I am challenged by problems I can't understand immediately.	1	1.0%	13	12.7%	19	18.6%	46	45.1%	23	22.5%
I am sure that I can learn math.	3	2.9%	10	9.8%	29	28.4%	60	58.8%	3	2.9%
I'll need math for my future work.	1	1.0%	11	10.9%	37	36.6%	26	25.7%	26	25.7%
When a math problem arises that I can't immediately solve, I stick with it until I have a solution.	4	3.9%	20	19.6%	21	20.6%	42	41.2%	15	14.7%
When a question is left unanswered in math class, I continue to think about it afterward.	1	1.0%	18	17.6%	17	16.7%	46	45.1%	20	19.6%
I'm no good in math.	13	12.7%	16	15.7%	16	15.7%	34	33.3%	23	22.5%

For some reason, even though I study, math is hard for me.	20	19.6%	30	29.4%	21	20.6%	26	25.5%	5	4.9%
I am sure that I could do advanced work in math.	7	6.9%	10	9.8%	37	36.3%	27	26.5%	21	20.6%
I have experienced racial discrimination.	18	17.6%	19	18.6%	18	17.6%	27	26.5%	20	19.6%
People of my race are typically good at math.	6	5.9%	17	16.7%	38	37.3%	32	31.4%	9	8.8%
At some point, I have felt like a math teacher really liked me or thought I could do well in math.	50	49.0%	37	36.3%	15	14.7%	0	0%	0	0%
Black people are given as many opportunities to succeed in mathematics as people of other races.	4	3.9%	16	15.7%	28	27.5%	26	25.5%	28	27.5%

At some point, I have felt like a math teacher didn't like me or didn't think I could do very well in math.	23	22.5%	22	21.6%	20	19.6%	22	21.6%	15	14.7%
In my math classes, students of other races have gotten higher grades than Black students.	17	16.7%	26	25.5%	41	40.2%	15	14.7%	3	2.9%
I have been discriminated against by a math teacher because of my race.	40	39.2%	34	33.3%	18	17.6%	8	7.8%	2	2.0%
Adults of my race use math in their daily lives.	0	0%	6	5.9%	24	23.5%	41	40.2%	31	30.4%
I have been helped by a math teacher because of my race.	4	3.9%	12	11.8%	27	26.5%	31	30.4%	28	27.5%
African Americans are held back in math because of their race.	32	31.4%	29	28.4%	27	26.5%	11	10.8%	3	2.9%

At some point, I felt like a fellow student thought I could do very well in math.	29	28.4%	54	52.9%	15	14.7%	4	3.9%	0	0%
The popular Black students in my school don't do well in math.	7	6.9%	10	9.8%	61	59.8%	19	18.6%	5	4.9%
At some point, I felt like a fellow student didn't think I could do very well in math.	9	8.8%	26	25.5%	26	25.5%	29	28.4%	12	11.8%
I feel close to other Black people.	4	3.9%	10	9.8%	23	22.5%	31	30.4%	34	33.3%
I am happy that I am Black	0	0%	1	1.0%	13	12.7%	20	19.6%	68	66.7%
I have a strong sense of belonging to other Black people.	2	2.0%	14	13.7%	34	33.3%	23	22.5%	29	28.4%
Most people think that Blacks are as smart as people of other races.	15	14.7%	21	20.6%	25	24.5%	24	23.5%	17	16.7%
People think that Blacks are as good as people from other races.	14	13.7%	17	16.7%	27	26.5%	26	25.5%	18	17.6%

I am proud to be Black.	0	0%	0	0%	6	5.9%	21	20.6%	75	73.5%
If I were to describe myself to someone, one of the first things that I would say is that I'm Black.	10	9.8%	18	17.6%	24	23.5%	30	29.4%	20	19.6%
I feel good about Black people.	1	1.0%	3	2.9%	13	12.7%	41	40.2%	44	43.1%
People from other races think that Blacks have made important contributions.	2	2.0%	11	10.8%	34	33.3%	35	34.3%	20	19.6%

