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ACCEPTANCE

This dissertation, AFRICAN AMERICAN MEN AND COLLEGE MATHEMATICS: GAINING ACCESS AND ATTAINING SUCCESS, by CHRISTOPHER CHARLIE JETT, was prepared under the direction of the candidate's Dissertation Advisory Committee. It is accepted by the committee members in partial fulfillment of the requirements for the degree Doctor of Philosophy in the College of Education, Georgia State University.

The Dissertation Advisory Committee and the student's Department Chair, as representatives of the faculty, certify that this dissertation has met all standards of excellence and scholarship as determined by the faculty. The Dean of the College of Education concurs.

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ABSTRACT

AFRICAN AMERICAN MEN AND COLLEGE MATHEMATICS: GAINING ACCESS AND ATTAINING SUCCESS
by
Christopher Charlie Jett

The research literature regarding African American male college students reports that they often experience difficulties with mathematics (Stage & Kloosterman, 1995; Treisman, 1992). It is also reported that many African American students enter college seeking to complete their degrees in mathematics and science, but few of these students successfully complete the core requirements (Hrabowski, Maton, & Greif, 1998; Treisman, 1992). In spite of these reported trends, there are some African American male students who, indeed, achieve in college mathematics. The purpose of this study was to analyze how being African American and male might play out in the college mathematics experiences of high-achieving African American men.

Employing qualitative research methodology, specifically, multiple case study research (Bogdan & Biklen, 2007; Merriam, 1998) situated in critical race theory (CRT; Bell, 1992; Tate, 1997), I administered a survey instrument, conducted three interviews, and solicited artifacts from four African American men who are currently pursuing graduate degrees in mathematics or mathematics education. Coupling multiple case study research with CRT, I explored how they gained access to college mathematics, how they

achieved in college mathematics, and how their race and/or racism affected their performance in mathematics.

An analysis of the data revealed that the participants' achievement and persistence in mathematics was explained, in part, by the participants' (a) internal characteristics such as strong cultural identities as African American men, persistent attitudes, and spiritual connections; (b) ability to negotiate racial injustices as African American men; (c) positive mathematics identities developed as undergraduate mathematics majors at historically Black colleges and universities (HBCUs); and (d) positive outlooks concerning the participation of African American male students in mathematics. Findings from the study suggest that methodological and theoretical approaches that foreground race and utilize "voice" must be employed in mathematics education research, especially regarding African American male students. Furthermore, findings suggest that those invested in the mathematics education of African American male students should ensure that African American male students are granted access to mathematics, including at the collegiate level.

AFRICAN AMERICAN MEN AND COLLEGE MATHEMATICS: GAINING ACCESS AND ATTAINING SUCCESS

by

Christopher Charlie Jett

A Dissertation

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in
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in
The Department of Middle-Secondary Education and Instructional Technology
in
the College of Education
Georgia State University

Atlanta, GA
2009

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ABBREVIATIONS

ADHD	Attention-Deficit/Hyperactivity Disorder
AMATYC	American Mathematical Association of Two-Year Colleges
BBA	Benjamin Banneker Association
CD	Compact Disc
CIAA	Central Intercollegiate Athletic Association
CLS	Critical Legal Studies
COGIC	Church of God in Christ
CRM	Critical Race Methodology
CRT	Critical Race Theory
DE	Differential Equations
DVD	Digital Video Disc
ESL	English as a Second Language
GSU	Georgia State University
GTA	Graduate Teaching Assistant
HBCU	Historically Black College or University
LatCrit	Latino/as Critical Race Theory
MATLAB	Matrix Laboratory
MSIT	Middle-Secondary Education and Instructional Technology
MSRC	Moorland-Spingarn Research Center
MWP	Mathematics Workshop Program

NAM	National Association of Mathematicians
NCTM	National Council of Teachers of Mathematics
PSI	Packard Science Institute
PWI	Predominantly White Institution
RAND	Research ANd Development
SAT	Scholastic Aptitude Test
SEM	Science, Engineering, and Mathematics
STARS	Students of Technology Acquiring Research Skills
STEM	Science, Technology, Engineering, and Mathematics
TribalCrit	Tribal Critical Race Theory
TSU	Tennessee State University
UC	University of California
USDA	United States Department of Agriculture
YPP	Young People’s Project

FOREWORD

MY MATHEMATICS STORY

What I offer in this foreword is my mathematics story. Because of my own experiences in mathematics as an African American male student, I have been led to conduct my study on high-achieving African American men in mathematics. I am in no way suggesting that my four participants have experienced the same things that I have experienced. As a matter of fact, you will see that while our stories as African American men might have some similarities, they are distinctly different. I am offering my story for the reader to make clear how I position myself, how I have been led to this field of inquiry, and to highlight my subjectivity as a mathematics education researcher and an emerging scholar.

I have decided to write my mathematics story in my "everyday" voice. I first attempted to write the story using "academic" language, but at times, I felt that I was somehow losing the essence or authenticity of my story. Moreover, it was becoming more difficult to write using academic prose. My dissertation itself uses "scholarly" language. This story is designed to be more conversational, and it chronicles my experiences as an African American male student in mathematics. I present my mathematics story below.

Mathematics

As I reflect back on my mathematics experiences, I remember that I was always a little whiz kid in mathematics. I cannot fully explain how I developed such a passion for

mathematics, but I was instantly drawn to mathematics. I even remember, as far back as elementary school, being labeled as the kid who was smart because of my mathematical abilities. All of my elementary school teachers believed that I possessed a “special gift” in mathematics, except for Ms. Williams, my first grade teacher.

Ms. Williams appeared to be a middle-class, White woman, and I should not say that she did not notice my gift. Rather, she would never let me “glory in my gift.” There were only a few African American students in her class, and I remember vividly how differently she treated us. I remember one incident when I was running down the hall with one of my White classmates. She yelled at me, and it seemed like she really disliked my actions and me as a student. I don’t even recall her saying anything to the White student. I might have been out of order in my conduct, but the way that she yelled at me seemed to be extremely out of order. I felt her hostility, and that moment seems to resurface in my mind every time I think about the marginalization and treatment of African American male students in schools today, especially by those who do not understand the African American culture. I knew then that her yelling had to do more with my race than with my behavior. At the age of six was when I believe that I developed my first critical race eye.

I have always been a critical race theorist—I just did not know the language to support this epistemological, philosophical framework. I attribute my critical race stance to my grandfather who seemed to be more race conscious than anyone else in my entire family. As I reflect on his “race consciousness,” I deduce that it could be contributed to his firsthand experiences with race. My grandfather moved with us (my mother, little

brother, and little sister) when I was in elementary school. I do not recollect how that came about; however, my grandfather was very influential in my academic success.

Although my grandfather only possessed an elementary school education and would call me in to read his letters in the mail because he could only read his name, he was extremely wise concerning life. My father, possessing some college education, has never really focused on race in our many conversations about mathematics, science, history, and life. My mother, on the other hand, who has a high school diploma, has always possessed a critical race eye. I consistently question her long commitment, however, to work as a cleaning lady in a White family's home with such a strong position on race.

While I might not have particularly noticed my gift in mathematics at the outset, my family members, church members, and friends noticed my gift almost immediately. I remember my mother's friend who used to sell clothes that she used to boost. She would always have a calculator with her. One time she was trying to multiply two numbers, and I blurted the number out before she could even input the numbers into her calculator. She said, "That boy is smart as hell." Whatever happened to watching your language around children and not exposing them to adult business (i.e., her clothes business)?

On the other hand, my neighbor was also another person who noticed my gifts in mathematics. She hired me to tutor her son who was struggling with first-grade math. She did not hire me in the traditional sense (i.e, x amount of dollars per hour). The deal was that I was to help her son, Antonio, with his mathematics homework after school every day, and she would take us both to McDonald's on Fridays when she got paid. Let me digress and talk a little about McDonald's. I was like 10 or 11 years old when I was

assigned this tutoring task, and it was a big deal to me. For her to take me to McDonald's every Friday was like heaven on Earth. McDonald's was definitely a treat, especially given that my family treated McDonald's like a reward system, only taking me there when I had done something noteworthy.

Antonio had been placed in a special education class because his mathematics "skills" were not up to par. He, as an African American male student, was labeled as a special education student while he was in either kindergarten or first grade. Nonetheless, I took my tutoring "job" very seriously. I studied that mathematics textbook religiously. I started off helping him with the basic arithmetic operations. Soon I realized that he had the basics down pat. Then, I started teaching him concepts that extended beyond his homework and his grade-level curriculum. Well, to make a long story short, Antonio went back to the "regular" classroom and even outperformed the students in his regular class. His mother said that it was because of my working with him that he had done so well that school year, particularly in mathematics.

As a result of my hard work and Antonio's progress, she asked me what I thought was an acceptable reward for a job well done. I thought the McDonald's deal was payment enough for my tutoring services. I cannot remember what else special she did for me. I do remember, however, that she gave me the nickname "professor" because she believed that I had exceptional intellectual abilities. "Professor" was the nickname given to me as a child and now that I reflect on it that is probably why I decided that was what I wanted to be when I grew up. After that year, I do not recall really helping Antonio with his mathematics again. He, however, became the top mathematics student in his class every academic year thereafter, and I became "professor" to everyone on Faxon Street.

My next mathematics student was my little sister. I am 9 years her senior, so I was 13 years old when she was 4 years old. My little sister was a challenge for me to work with. I expected her to be an Antonio (spitting out addition facts and multiplication facts when prompted), but I did not process that she was only 4. I think I wanted her to be a number theorist at the age of 4; my mathematics expectations were beyond high for her. I highlight my little sister because she has been my continuous mathematics student throughout the years, even until this day as she pursues her college education at my alma mater, Tennessee State University (TSU).

I first noticed my interest in mathematics when I was in the sixth grade. I would define this moment as my moment of mathematical consciousness or my “aha” moment. I will talk more about that defining moment in the next section, chronicling my own K–12 mathematics experiences. Ever since that moment, I have implanted that idea into my head: the idea that I am an exceptional mathematics student.

At times prior to my current experience of earning a Doctor of Philosophy in teaching and learning with a concentration in mathematics education, I used to believe that in order to be a success in mathematics you had to possess a Ph.D. in mathematics. I would now define success in mathematics as being able to use mathematics as an analytical tool to educate, stimulate, and liberate the (my) people. This definition excludes so much, but it shows my growth from defining success in mathematics by what your mathematics grades were. My doctoral studies and my outside readings of scholars’ works such as bell hooks, Asa Hilliard, Abdulalim Shabazz, and others have strongly influenced my definition of success in mathematics. I think this definition is a work in progress, and I do not believe that I will ever have reached the essence of all that success

in mathematics entails. Generally speaking, however, I feel that I am a success in mathematics.

K–12 Mathematics Experiences

In grades K–6, I attended elementary school at a predominately White school. My kindergarten experience was the best ever. My teacher, a middle-class, White woman, absolutely adored me. The funny thing is that I adored her more. She even recommended that I be placed in an “optional” class in first grade; optional is synonymous with magnet or honors.

Ms. Williams, my first-grade teacher, was also a middle-class, White woman. The thing about Ms. Williams was that she hated me. It seemed like she hated all of the African American kids. There had to be about three or four of us in her class, and the other students were White students. The other non-optional classes were filled mostly with African American students. In the first grade, I remember wondering why the majority of the White kids were in optional while the majority of the African American kids were in the traditional classes.

With regards to Ms. Williams, I remember one incident when Chris and I were playing in the hallway. Chris was also in my class, and he was a playful little White boy. If there was ever a case of attention-deficit/hyperactivity disorder (ADHD), he had it to the second power. I remember several occasions where he was given time-out. There was one time when Ms. Williams had him put a dictionary on his head. He was standing on one leg and acting a clown. Everyone laughed at this, even Ms. Williams. The thing about Ms. Williams was that she laughed at Chris’s behavioral problems. African American students dare not ever think about getting the entire class to laugh at them if we

were acting out. If we did, she would probably have thrown a dictionary at our head. I remember how she openly gave preferential treatment to her “certain” students.

It’s funny that I had my share of opposites when it comes to Ms. Williamses. During my last year in elementary school, I was presented with another Ms. Williams. This teacher was also a White woman, but she was a little younger. Ms. Williams, my sixth-grade teacher, really liked mathematics. As a matter of fact, she was our mathematics and science teacher, while another teacher was our language arts and social studies teacher. This Ms. Williams recognized my abilities in mathematics, and I think she really helped me to notice them myself. I remember when she recognized me in front of the entire class with a certificate because I had straight 100’s across her grade book for that particular grading period in mathematics. That was the one and only time I had ever received an A+ on my report card.

In grades 7–9, I attended a predominately African American junior high school (my mom’s old junior high school). This school seemed to have the oldest teachers there. As a matter of fact, several of the teachers who taught me also taught my mom approximately 25 years prior. In the seventh grade, Mrs. Blabley was my mathematics teacher. She was a White woman as well. Mrs. Blabley looked like someone’s grandmother; she looked as if she should have retired 10 years ago. She wore those old grandmother sweaters, and she had like ten million wrinkles in her face. She was one of my favorite mathematics teachers ever. We had her class right after lunch, so we were a bunch of energetic African American children. I remember one time we came in class so rowdy. She really let us have it; I think she even raised her voice, which was something that she should not have been doing at her age. When she reprimanded us, I felt that she

did it out of love. In our minds, she could do it because she cared about us and was concerned about us learning mathematics. It is funny how differently I interpreted her yelling from my first grade teacher's yelling.

Although I remember Mrs. Blabley being at the overhead at times, she also let us work together in groups. She definitely knew how to incorporate different pedagogical strategies. She always had mathematics activities; I now wonder if it was because she had so many years of teaching experience. She was also the sponsor of the school newspaper. Because I liked her so much, I joined the newspaper staff. My writing has gotten a lot better since then. (I hope my doctoral committee can attest to this as well). Let's just say that I was not the best writer at that time, so why did I even think about joining a newspaper staff? Due to Mrs. Blabley's warmth and caring personality, I joined the newspaper staff and even continued with it until I graduated from high school. I believe it was her belief in me that made me think that I could do anything, even if it was as crazy as joining a newspaper staff.

My ninth grade mathematics experience was quite a unique one. My algebra teacher was a novice teacher. She was a young, thin White woman who looked like she had just walked off of a college campus, or high school for that matter, straight into our classroom. She had no idea how to handle us. I remember she told us that she had just graduated from Christian Brothers University, a private college directly across the street from my junior high school. This lady tried her best, but she had no idea about our culture as African American students. It was completely evident that we were from Mars, and she was from Venus. She ended up quitting a few weeks into the school year, which would leave us without a mathematics teacher for weeks.

We had a few substitute teachers here and there. Because our initial teacher quit, in our minds it gave us the idea that we could make any teacher quit. We had another teacher come in. She quit faster than the initial one. I remember the mean English teacher from next door coming to our classroom and telling us to quiet down because we were disturbing her class. She called the office over the intercom. When the secretary came over the public address system, one student coughed, which made it difficult for her to hear. The secretary asked her to repeat what she said. At this point, everyone in the class was making a coughing noise. This scene was hilarious. The English teacher walked out of the room and slammed the door.

After a few weeks of all this fun, we finally got an algebra teacher. She was an older African American woman who was either about to retire or had recently retired. Mrs. Frazier was her name (good memory), and she taught us sitting in her chair, heavily dependent on the overhead. I remember one occasion when we were acting out because we thought she was eventually going to quit as well. Well, she didn’t quit. She had an approach that was more like a mom or aunt looking at us like we were stupid and causing us to question why we were acting so immaturely ourselves.

The one thing that I remember about Mrs. Frazier was that she had high expectations for us. I think that was what made her so successful with us. I remember her telling us about the mathematics competition at Rhodes College. That was a big thing for us because White, nerdy kids were the ones (I thought) who went to these mathematics competitions. She gave all of us a chance to compete for a slot; there were only three students who could attend from each school. I was one of those students from our school, and I was so excited about this endeavor.

The mathematics competition was nothing like I imagined. I thought that the instructors would pose problems to us and ask us to solve them like I had seen in the movies. Our competition was not really a competition per se. We were all algebra students, and we were all in one big auditorium classroom, similar to the lecture halls I had seen college students cram into on television. We were given a multiple-choice test with approximately 50 problems on it. We were given two or three hours to complete the test. We had lunch on the campus and then we reassembled for the instructors to announce the first, second, and third place winners. I thought I had done extremely well, but I did not place in the top three. What a weird way to have a mathematics competition!

In grades 10–12, I attended a predominantly African American mathematics and science magnet high school. Initially, I did not want to attend this school because it was too far away from my house and all of my friends from junior high school were going to another school. After reviewing my test scores in mathematics, some lady at the board of education convinced my mother that I should attend the magnet mathematics and science school even though my mother would have to provide me with weekly bus fair to get to the other side of town.

In high school, my sophomore and senior years were great mathematics experiences. My junior year was when I took Algebra II, and I remember my Algebra II class well. My teacher was a White woman, and she needed some serious professional development. Now that I reflect on it, I realize that she must have been teaching outside of her content area. She had one Algebra II class, which was our class, and she clearly looked dumb-founded when students asked her any questions pertaining to mathematics. I remember telling my mom and a neighbor about this teacher. My neighbor responded

by telling me that I knew more mathematics than my teacher, and I believed my neighbor was speaking the truth.

While our Algebra II teacher might not have been the best teacher, she actually helped strengthen my mathematics skills. The reason being is that many of my classmates would come to me for help with the mathematics assignments. This experience caused me to study my Algebra II more because I knew that my classmates were going to come to me for help. Another thing about this experience was that it gave me access to the "cool" kids. In my mind, this assisted with my self-esteem because it allowed me to be with the in-crowd as well as maintain my "math" status.

As I reflect on my K–12 mathematics experiences, I remember my mathematics teachers vividly. I was blessed to have some exceptional mathematics teachers (at least I thought they were exceptional). Most of my mathematics teachers were White females. I never had a single African American male mathematics teacher in grades K–12. This experience highlights the shortage of African American male teachers in mathematics and the importance of connecting African American male students with mathematics so that more African American male students will not go through their entire K–12 educational experience without an African American male mathematics teacher.

Undergraduate Mathematics Experiences

I completed my undergraduate studies in mathematics at TSU, a historically Black college/university (HBCU). I applied to TSU because of the college tour I took with the National Honor Society in high school. Besides, my dad was pushing for me to apply to various HBCUs because he had attended an HBCU, LeMoyne-Owen College in

Memphis, Tennessee, as a college student and understood the support that I would receive at an HBCU.

When I applied to TSU and declared that I wanted to pursue a degree in mathematics, I got a letter from the Packard Science Institute (PSI). This program was a 6 week summer program designed for students in mathematics and science-related disciplines. It provided a $2,000 scholarship for participants, provided that participants kept a certain GPA while in college. Because I had been awarded a full scholarship to college, I figured that it was not advantageous for me to complete the program. Plus, I wanted to work during the summer at Arby's (a fast food restaurant) to have more money for college. In addition, I wanted to spend my summer at home with my friends and family given that I would be headed off to college in August anyway. I do not remember discussing this decision with either parent; I wanted to make my own "adult" decision. Therefore, I respectfully declined the offer of participating in the program.

Well, Dr. Jackson, the program's coordinator and a mathematics professor, did not take no for an answer. When she got my letter stating that I would not come to the program, she immediately called my mother and questioned her as to why I elected not to complete the program. Once Dr. Jackson finished talking to my mother (I should have known that I could not win this argument against two Black women), my bags were being packed to head to TSU the next week or so to enroll in the summer program.

The program was actually the best thing that could have happened to me. It allowed me to become familiar with the campus, engage in a small research project, and take courses in pre-calculus and physics. While I was not awarded the $2,000 immediately because of my academic scholarship, I was able to use the scholarship

money that summer for summer courses. In addition, I served as the mathematics counselor for the program for the next cohort and got a nice little summer job (with free housing and a meal plan).

Because of PSI, I enrolled in Dr. Jackson's calculus classes during freshman year. Dr. Jackson was an alumnus of TSU and was deeply committed to the university. She was an excellent mathematics teacher, and she really "broke it down." During calculus I, which was fall semester of my freshman year, my roommate was also taking the same course. He was enrolled in another section. I remember telling him how great my teacher was and that he should enroll in her class next semester. Because of her passion about mathematics, I, too, was passionate about it and kept my head in those mathematics books, a trend that I continue today. She was my mentor during my college mathematics experiences and is still my mentor today.

As a mathematics major, I studied mathematics a lot to get good grades and succeed in college mathematics. On our campus, it seemed that the engineering majors did the most studying. Next, the chemistry majors and the mathematics majors did a lot of studying. Everyone knew the engineering, chemistry, and mathematics majors because we stuck together like glue. During my freshmen year, I typically studied my first semester of Calculus alone. I would help my roommate every now and then. The second semester of Calculus I remember helping a small group of students. This group consisted of a young lady from New Orleans who I had met at church, and we discovered that we were both taking the Calculus II course. She sort of formed a study group. Well, it really was not a study group; it was a group of students who asked me calculus questions in the library. I loved it though because I always met them in the study room with the

chalkboard. They were actually my first mathematics class. Also, Calculus II was known as the killer course. If I could help them survive Calculus II, then I would be considered something.

At TSU, the mathematics majors were so close that we thought of ourselves as a miniature fraternity. (Greek life was really big on our campus.) On our campus, the band, choir, performing arts club, and many other organizations acted as if they were a fraternity/sorority. The mathematics majors did the same thing. Although we were not as extreme as some of the other groups (i.e., establishing by-laws and the like), we were still fixated on this idea of Greek life. We all had line names and numbers. I remember that my line name was calculator. One of my fellow mathematics majors gave me the name because I sat next to her in Differential Equations, and I never took a calculator to class. When the professor put a program on the board, I would always have it solved first (no matter how strange the numbers) without a calculator. While the other students were number crunching with their calculators, I already had the answer written on my paper. Because of that class, she said that my name would be calculator.

During my sophomore year, we, as mathematics majors, started to get to know one another better because we were moving up in mathematics courses together. We took Differential Equations, Linear Algebra I & II, Probability & Statistics, and Calculus III together. These classes also had computer science and engineering majors in them as well. There were usually just two sections of each mathematics course, so we were bound to run into the same people in a couple of courses.

My junior and senior year mathematics courses were filled with mathematics majors only. These courses consisted of Analysis, Number Theory, Advanced Calculus I

& II, and Mathematics Senior Project as well as two other mathematics electives. We really studied together for these courses. I really would not call it studying; I think we collaborated more with these courses. These courses consisted mostly of proofs. We would go home and work on the proofs on our own. Then, we would go to the mathematics building the next day and put our heads together and come up with a unified proof.

We had one professor, our advanced calculus professor, who did not understand our method of doing mathematics. He was new to the university and new to the United States. I remember he told us that we all copied someone's work. We explained to him that we all worked together on the proofs. This collaborative effort was literally the case. Unlike some other classes where one or two students would do the work and the rest of the class or group member would also get credit for putting in half the work, we all contributed to these mathematical proofs equally. After having us for a few weeks, he saw that we were seriously collaborating. We would be in the classroom often before he got there discussing the theorems, proofs, and other stuff too.

As an undergraduate student in mathematics, I learned mathematics best by using index cards. I started using index cards in Calculus II when we had to learn all of those freaking integrals. I thought it was actually fun, but there were like a hundred of those things. I went back and added my derivatives from Calculus I to my stack of index cards. From that point forward, I placed all of my important mathematical concepts and formulas on index cards.

In the mathematics department, I was the star student. I always got the award for outstanding scholastic mathematics abilities. I even got a "Model Scholar" award when I

completed the McNair Post Baccalaureate Achievement Program at the University of Tennessee at Knoxville during the summer of my junior year. At TSU, I believe that my summer in PSI sort of sent the message to the professors that I was a serious student. I do not know why they felt that way. I never sat in the front of the classroom or did anything that I thought would stereotype me as a nerdy student.

Although I was the star student, the mathematics department chair was not fond of me at all. She was an elderly, White woman. The department chair was not racist; I sort of messed up in her class. She taught a Geometry class that included both undergraduate students and graduate students (specifically graduate students pursuing a teacher's certificate in mathematics education). In this class, there was a war against the undergraduate students and the graduate students. There were maybe like 10 students in the class, approximately four graduate students and six undergraduate students. It wasn't necessarily the department chair that I had a problem with; it was those darn graduate students. They acted as if they were God's gift to mathematics, and like we, undergraduates, were beneath them. They also treated us as such.

As an undergraduate student, I noticed the rift between the graduates and the undergraduates and mentioned it in class. Well, the department chair literally took sides and sided with the graduate students. She was not joking, and one graduate student mentioned something about us (the undergraduates) not being serious about the class because we did not put as much work as they did into the class. My close friend made a joke about the graduate students, and she and I laughed. The department chair was not happy about this and thought we were indeed not serious about our work. That incident was the reason why she was not fond of me in the beginning.

She later realized that I was a serious mathematics student. Although I performed the poorest in my Geometry course (I got a low B) throughout college as opposed to my other mathematics courses, she did recognize my mathematical potential. The department chair was the only mathematics professor that I had a brief issue with in college. My relationships were fine with the other mathematics professors. With regards to the mathematics professors, I had three African American professors in mathematics. One of those was (finally) an African American male mathematics professor, Dr. Richardson. The other two African American professors were Dr. Jackson and Professor Wade.

Professor Wade was not really my mathematics professor; she was the coordinator for the Students of Technology Acquiring Research Skills (STARS) summer program. She used that position to sort of develop her own course on African Americans' contributions to mathematics and science. I probably should not stop there; I need to call it what it really was: Black History 6000. To call it Black History 1101 would be an understatement. This lady was deep and was seriously down for the people. We were all African American students, so I would say that we understood her agenda and concern for our well-being as African American students.

My first impression of Professor Wade was that she was a little weird. She always wore African attire, which I did not understand why she wore it at the time. She seemed to know what was going on in our lives and what we were into; she also spoke our language. This lady was beyond culturally relevant. The thing that stuck out to me the most was her experience in a doctoral program at Vanderbilt. She went through hell with those people at Vanderbilt with regards to racism. Although I did not experience racism directly while at TSU, I knew from her many testimonials that racism was alive and well.

As I began to think about her experience, I realized that racism was happening to one of my fellow mathematics majors. Out of approximately eight mathematics majors in my graduating class, two of us were African American male students. I was one of them, and the other guy was a person who I had many conversations with. I remember that professors did not look favorably on him because he did not look a “certain” way. He wore cornrows in his hair and wore baggy clothes to class. He represented the media’s image of an African American man, whatever that is. Well, I found out what that was during my graduate school experiences.

Graduate Mathematics Education Experiences

My graduate experiences have been drastically different. I completed my master’s degree in mathematical sciences at TSU where I completed my undergraduate studies, so I had a feel for the environment of the institution. My master’s classes had approximately three to five students per class. The classes were extremely small, and our classes were occupied with the same seven or eight graduate students in the mathematics program. The department seemed to have difficulties attracting students to pursue their master’s there. I believed this difficulty was because of the shortage of African American mathematics majors in general and the more attractive assistantship packages at Vanderbilt University, which is approximately three miles away from TSU.

Because I am currently completing my doctoral studies in teaching and learning with a concentration in mathematics education, I have had the privilege of taking both mathematics and education courses. I have had three courses in mathematics, and I know firsthand how it can feel to be marginalized from the rest of the class members,

specifically as an African American male student. My mathematics classes have gotten progressively worse since I have been in the program.

My last mathematics course and my worst mathematics class ever was my History of Mathematics course. I had wanted to take History of Mathematics before during my other degree programs, but the course always seemed to conflict with a course that was required for me to take. Nonetheless, I was extremely excited about the course because I thought it would offer a diverse perspective about the contributions of different cultural groups to mathematics. Once I started attending the class, I was sadly mistaken.

I believe that the reason why this history of mathematics course was so useless to me was due to the class project. For our project, we had to write a paper on a historical mathematician. The professor gave the class a list of suggested mathematicians, but we could have chosen someone else, pending the professor's approval. When I approached the professor about doing my paper on an African American mathematician, she told me that my chosen mathematician did not fit the time period; the course spanned from ~3000 B.C. to ~1600 A.D. I did not question it. I did a little research and went back to her with an African American mathematician who did fit the time period. Again, she refused this time telling me to pick someone off the list because those mathematicians were listed in the book. From this list, there was not a single African or African American mathematician listed. I could not believe her response.

Although I did not pick up any racial undertones from my history of mathematics professor throughout the course, that example brought issues of race to the forefront for me. I had just started reading literature on critical race theory, so I was starting to critically analyze situations like that one through a critical race lens. I wanted to

withdraw from the course because I was taking it for fun, but for some strange reason I remained in the class. I ended up doing a paper on some European mathematician. I cannot even remember who I did my paper on, and that was a year ago. With my exceptional memory (recalling tons of mathematical formulas without hesitation), this example shows how disempowering this experience was for me. This experience was beyond disempowering; it was dehumanizing. Needless to say, after that encounter, I have never taken a class offered through the mathematics department again.

There have been other accounts where I have had to deal with subtle (and not so subtle) instances of racism during my doctoral program. I do not believe that I can fully ascertain all of the examples. Neither do I believe that I can fully analyze them at this juncture in my life. I believe, however, that they are a starting point that I will consider in the future as I begin my career as a critical race theorist in mathematics education.

Conclusion

As a result of searching for, reading, and rereading literature for my dissertation study, I developed a new passion for my research. Reading the stories concerning the life and schooling experiences of African American mathematicians as well as the experiences of African American students has garnered a new interest in this area of research. Although the doctoral program is intentionally designed to groom me to become a junior scholar, I feel that the program has also allowed me to find my voice in the academy and in society-at-large.

I now have a poster with the African American pioneers in mathematics including Benjamin Banneker, Elbert Cox, Evelyn Granville, Marjorie Browne, J. Ernest Wilkins, and David Blackwell displayed proudly in my living room. I have other cultural images

displayed, including an image of an African American male scholar, a statute of an African American male musician, and an African wallet with a symbol of excellence featured on the front of it. In addition, I have accumulated a couple of bookshelves with several books by African American authors such as bell hooks, Gloria Ladson-Billings, and Eric Jerome Dickey, to name just a few along with a host of other African American books. What is lacking is the same knowledge base regarding African Americans in mathematics.

In presenting my mathematics story, I hope that I have given the reader a sense of my experiences in mathematics as an African American male student. Also, I hope this foreword helps the reader to understand how I have arrived at this area of research. I hope that my story paints a better portrait of me so that the reader might better understand the lens through which I view the world as you engage in reading this dissertation study. Moreover, I hope and trust that this foreword assists in understanding the experiences of four African American men who were able to gain access to college mathematics and attain success.

CHAPTER 1

INTRODUCTION

The schooling experiences of African American male students have been documented in the research literature (see, e.g., Duncan, 2002; Jackson & Moore, 2006; Noguera, 2008). These studies, regarding African American male students, most often focus on their "failure" in school, their "behavior" issues, and the like (Davis, 2003; Noguera, 2008). With respect to African American male students' college experience, most of the research focuses on how African American men experience racism (see, e.g., Bonner & Bailey, 2006; Davis, 1994). Research specifically on African American men's college mathematics experiences highlights the fact that many of them often experience difficulties with mathematics (see, e.g., Fullilove & Treisman, 1990; Stage & Kloosterman, 1995; Treisman, 1992). Moreover, it is reported that many African American students enter college seeking to complete their degrees in mathematics and science, but few of these students successfully complete the core course requirements (see, e.g., Hrabowski, Maton, & Greif, 1998; Treisman, 1992). Despite these reported negative findings regarding African American students in mathematics, there are, nevertheless, African American students who achieve in mathematics. At the middle and high school levels, the schooling experiences of mathematically successful African American students have begun to be documented in the research literature (see, e.g., Berry, 2008; Martin, 2000; Moody, 2000; Stinson, 2008; Walker, 2006); however, there

is still an absence of these students' schooling and mathematics experiences at the college level.

While it is necessary (and helpful) to examine the negative experiences that African American male students face in school, in college, and in mathematics to reverse this trend, it is also important to gain insights from studying high-achieving African American male students (Harper, 2005). The purpose of this study was to analyze how being African American and male (might) play out in the college experiences of high-achieving African men. In other words, I sought to understand how African American men gained access to college mathematics and were high achievers in college mathematics. Moreover, I sought to understand what led them to continue in the mathematics pipeline by pursuing a graduate degree in mathematics or mathematics education. Research in this area has the possibility of providing an avenue for mathematics educators to (re)discuss schooling practices that enhance the (mathematics) achievement outcomes for African American male students (Moody, 2000; Stinson, 2006). Furthermore, by attempting to understand the experiences of African American male students, educators, researchers, and policymakers can work to create college mathematics practices that might work for all students (Matthews & Williams, 2007).

Harper (2005) sees the value in drawing from success stories, which also aligns with my research. Harper poses the following important questions: "But what about those among this population who beat the odds, make the most of college, and achieve in multiple ways inside and outside of the classroom? Who are they, and what can they teach us?" (p. 8). These questions speak volumes to the purpose of my research study. I

conducted my study on four African American men who were high achievers in college mathematics to seek out knowledge from them regarding their mathematics experiences.

Research Questions

Employing qualitative research methodology situated in critical race theory (CRT), I studied mathematically successful African American men who are currently graduate students in mathematics or mathematics education who negotiated the mathematics pipeline at their respective colleges and universities. Moreover, I explored how they gained access to college mathematics, how they achieved in college mathematics, and how their race and/or racism affected (or not) their performance in college mathematics. More specifically, the following research questions guided the study:

1. To what factors and/or experiences do mathematically successful African American men attribute their success with mathematics as a major in college?
2. What did these mathematically successful African American men do inside and/or outside of the college mathematics classroom to warrant success as college mathematics majors?
3. How did these mathematically successful African American men negotiate their race and/or racism during their mathematics experiences and as African American men in general?

Definition of Key Terms

The following terms appear throughout the study. Here I offer the definitions that I am using for these terms to provide a clear understanding of how the terms are being used. In the literature, there are several definitions provided for these terms from various

scholars. I am not suggesting that I am using the "best" definition; rather, I am stating that these are the chosen definitions used for the purposes of this study. In addition, more detailed discussions of these terms are provided throughout the study in various respective sections.

African Americans – individuals of African descent who were born and reared in the United States[1].

Access to Mathematics – the right or opportunity to participate in advanced mathematics that connects to students' experiences (Anderson, 1990).

Access to Higher Education – the right or opportunity for students to be granted an equal opportunity to participate in postsecondary education that connects to students' experiences (Anderson, 1990).

Case Study – "an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 2003, p. 13).

Critical Race Theory – a theoretical perspective that seeks to transform relationships among race, racism, and power (Delgado & Stafancic, 2001).

Equity – fair treatment to all students regardless of race, ethnicity, gender, sexual orientation, different physical abilities, socioeconomic status as it relates to quality, resources, and access to challenging curricula so that students "develop sociopolitical consciousness, develop sense of agency, and develop positive social/cultural identities" (Martin, 2003, p. 14).

Historically Black Colleges and Universities (HBCUs) – "equality-minded colleges and

[1] For the purposes of this study, I use the term *African American*. I use *Black* only when I am citing a study or a direct quote from an author who uses the term *Black*.

universities that cater to the African American population but welcome students of all backgrounds" (Funk, 2008, p. 1).

Multiple Case Study – an investigative approach used when researchers conduct an investigation on several cases (Merriam, 1998).

Predominantly White Institution (PWI) – a college or university in which the majority of the student population is White.

Race – "notion of a distinct biological type of human being, usually based on skin color or other physical characteristics" (Delgado & Stefancic, 2001, p. 153).

Racism – "any program or practice of discrimination, segregation, persecution, or mistreatment based on membership in a race or ethnic group" (Delgado & Stefanic, 2001, p. 154).

Success in Mathematics – students earned an undergraduate degree in mathematics and continued in the mathematics pipeline by pursuing a graduate degree in either mathematics or mathematics education.

Rationale

Equity and Access

Some researchers purport that there is an achievement issue when it comes to the (mathematics) education of African American students (Davis, 2003; Rampey, Lutkus, & Dion, 2005). I concur with other scholars that mathematics success is not an issue of who can achieve success in mathematics, but who is granted access to mathematics in the first place. I challenge scholars to move beyond the discourse on mathematics achievement and examine more closely issues related to equity and access (Gutiérrez, 2008).

Access exists under the construct of equity. For the purposes of this study, access means the right or opportunity to participate in advanced mathematics (i.e., equal access to mathematics) that connects to the students' experiences (Anderson, 1990). Because of the paucity of research around issues of equity and access, particularly for African American male students, we do not know what questions could be asked to focus on mathematically successful African American male students (Stinson, 2006). In addition to access to advanced mathematics, students need the opportunity to gain access to higher education.

Students are often told that by obtaining a good education (i.e., college degree), they will be provided with great opportunities. Unfortunately, many African American students never reach the American dream because of limited opportunities to higher education (Maton, Hrabowski, & Schmitt, 2000). There are those who are granted access to higher education but do not perform well academically, especially in the field of mathematics (Treisman, 1992). Therefore, studying those, particularly African American men, who have gained access to mathematics, who have gained access to higher education, and who achieved success in college mathematics is a significant under-researched domain.

Historically, equity has been an issue concerning the education of African Americans. Carter G. Woodson (1875–1950), who is considered the father of Black history, was an African American scholar who brought issues of equity to the forefront. In *The Mis-Education of the Negro*, Woodson (1933/2000) argued for a more inclusive representation of African American history in the schools' textbooks. He was also able to witness other issues of inequity operating in his time. For instance, he discussed various

other inequities in his text (i.e., small number, if any, of African Americans on school boards, lack of qualified teachers for African Americans, the unfair resource distribution, the controlled nature of the curriculum, and the thinking that such education brings about). Despite his vocal outcry for assistance concerning these issues, little research was done to bring about equitable conditions for African American children (Darling-Hammond, 2005).

A few decades ago, the existing mathematics education research literature that examined equity was limited (Lubienski, 2002; Rousseau & Tate, 2003). Moreover, issues surrounding equity and access to mathematics regarding African American students were scarce in the literature as well (Martin, 2003; Rousseau & Tate, 2003). This phenomenon suggests that equity was not a main priority for most researchers whose work was accessible in the mainstream literature (Martin, 2003; Rousseau & Tate, 2003).

Within the last 15 or so years, however, there has been an increase in the attention given to the concepts of equity and access from researchers, educators, policy-makers, and the general public (Gutstein et al., 2005; Oakes, 1990; Tate, 1995). Scholars have addressed equity as it relates to gender disparities (e.g., Boaler, 2007), socioeconomic status (e.g., Lubienski, 2002), and ethnicity (e.g., Martin, 2003). Additionally, scholars have examined equity issues for African American students through the lens of teacher quality, accessible resources, and access to advanced mathematics curricula (Darling-Hammond, 2000, 2005; Hilliard, 2003; Moses & Cobb, 2001). I seek to explore these aspects of equity and understand how African American male students navigated through these inequities to gain access to college mathematics.

Within the last decade, there has been a shift in mathematics education in terms of achieving equity for all students. Many competing definitions of equity exist in the mathematics education research literature (Allexsaht-Snider & Hart, 2001; Gutiérrez, 2007; Martin, 2003). The prevailing definition of equity comes from the National Council of Teachers of Mathematics (NCTM). Out of the six unifying principles outlined in the NCTM's *Principles and Standards for School Mathematics* (NCTM, 2000) document, equity is mentioned first. According to the *Principles and Standards for School Mathematics*, "excellence in mathematics education requires equity—high expectations and strong support for all students" (p. 12). Furthermore, the document calls for an equal distribution of resources and professional talent among all students, along with the incorporation of accommodations when needed.

In undergraduate mathematics, *Beyond Crossroads*, a document published by the American Mathematical Association of Two-Year Colleges (AMATYC) that addresses mathematics standards for the first 2 years of college, lists equity and access as one of its basic principles (AMATYC, 2006). The document states: "All students should have equitable access to high-quality, challenging, effective mathematics instruction and support services" (p. 10). The *Principles and Standards for School Mathematics* and *Beyond Crossroads* documents, however, fail to provide suggestions on how to achieve equitable outcomes for students, particularly African American students. These documents also fail to thoroughly discuss how these inequities contribute to students' inability to have access to advanced mathematics. Additionally, while NCTM's document calls for meaningful experiences for all students, it does not mention taking into consideration the students' culture (Martin, 2003).

NCTM's (2000) equity definition is the prevailing definition in the mathematics education community. Even though NCTM has offered their definition of equity, several scholars have critiqued NCTM's definition and highlighted other areas under the umbrella of equity that the NCTM has failed to address (Allexsaht-Snider & Hart, 2001; Gutiérrez, 2007; Hart, 2003; Martin, 2003). Allexsaht-Snider and Hart (2001) define equity as:

> Equity in mathematics education requires: (a) equitable distribution of resources to schools, students, and teachers, (b) equitable quality of instruction, and (c) equitable outcomes for students. Equity is achieved when differences among subgroups of students in these three areas are decreasing or disappearing. (p. 93)

They highlight structural aspects of school districts (e.g., competitive salaries, resources for smaller class sizes and collaborative planning, and funds for high quality supplies), beliefs (e.g., beliefs about the nature of intelligence, beliefs about how students learn mathematics, etc.), and classroom processes and teaching practices (e.g., belongingness and engagement) as elements that are missing from NCTM's definition of equity.

Later, Hart (2003) defines equity as meaning justice. While Hart mentioned other scholars' definitions of equity, she did not adequately articulate her own definition of equity. Just to say that she was using equity to mean justice leaves many questions unanswered and causes the reader to make various assumptions. In both Allexsaht-Snider and Hart (2001) and Hart (2003), the equity frameworks presented do not include a critical analysis of race and/or racism.

Martin (2003), on the other hand, does include a critical analysis of race in his research on equity and poses some thought-provoking questions concerning the notion of equity in the context of African American children. He asks: "Do our definitions of

equity gloss over the deeply embedded structures that produce inequities? ... Do theoretical perspectives and equity-oriented rhetoric take into account the collective histories of the groups for whom equity is desired?" (p. 13). In addition to teaching mathematics for social justice, Martin suggests that "students also develop sociopolitical consciousness, develop sense of agency, and develop positive social/cultural identities" (p. 14). This rationale aligns with my research, which seeks to analyze the mathematics experiences of high-achieving African American men in college mathematics and to explore how their experiences assisted (or not) in their development.

Gutiérrez (2007) contributes to this discussion by pointing out that "equity is threatened by the underlying belief that not *all* students can learn" (p. 37). She also argues that another obstacle is the deficit theory that seems to be attached to students who have not been in the mainstream mathematics population (i.e., those who are not White male students). Additionally, she stresses that mathematics educators are operating under a poorly defined definition of equity and a poorly articulated agenda surrounding issues of equity. Gutiérrez's working definition of equity encompasses three tenets: (a) the inability to predict students' mathematics achievement levels based solely on their "race, class, ethnicity, gender, beliefs, and proficiency in the dominant language" (p. 41); (b) the inability to predict students' analytical abilities, reasoning skills, and critical skills based on the characteristics listed in the first tenet; and (c) erasing inequities between people from all over the world and mathematics. Her tenets, I believe, are the issues that mathematics educators might problematize in their dialogue about equity.

In terms of achieving equity, I embrace aspects of Martin's (2003) and Gutiérrez's (2007) definitions of equity. With regards to Martin's definition, research

could be done to understand how structures that produce inequities develop and sustain themselves. Moreover, theoretical and equitable perspectives should take into account the culture of marginalized groups, especially African American male students. Drawing from Gutiérrez, I stress the point that race and gender (i.e., being African American and male) should not be used as indicators for mathematical intelligence. If this type of stereotyping is occurring, then is mathematics really for all? Hence, my study seeks to understand the structures associated with being African American male mathematics majors so that educators and researchers might move one step closer to making "mathematics for all" a reality.

Moody (2001) suggests that instead of saying that the current equity agenda proposes mathematics for all, we might as well call it what it actually is "equality for some" and "mathematics literacy for a few" (p. 272). My argument presented throughout this study is that equity in mathematics education and mathematics literacy should be accessible to all students. I also concur with Oakes (1990) that we need to explore the opportunities (access) that students have with mathematics both inside and outside of the mathematics classroom at all levels. Her statement aligns with my work, which seeks to better understand the experiences (inside and outside the mathematics classroom) of successful African American male students who were able to gain access to college and to succeed in their mathematics endeavors.

Significance of the Study

This study provides a view of the mathematics experiences from the "voices" of African American male students who studied mathematics at various HBCUs. I am not claiming that all African American male mathematics majors enrolled in HBCUs have

the same experiences that these four men encountered. I am, however, stressing the uniqueness of each case by allowing the participants to speak their “truth” in their “own” voices. Moreover, this study brings race to the forefront of the participants’ experiences. Because of the manner that racism is entrenched in American society, African American men experience acts of racism in the United States whether they are subtle instances of racism or more defined acts of racism.

Several research studies examining the successful undergraduate experiences of African American mathematics majors have also studied students in science, technology, engineering, and mathematics (STEM) areas (Bonous-Hammarth, 2000; Hrabowski et al., 1998; McGee, 2005). In other words, their studies have not focused specifically on the discipline of mathematics. Other scholars, who have studied African American undergraduate students in the field of mathematics, have collected data from students who were still pursuing their undergraduate degrees (Moody, 2001; Treisman, 1992). This study is significant because it allows graduate African American male students in mathematics and mathematics education to reflect on their undergraduate mathematics experiences.

Much of the research conducted in the past examining students’ experiences in undergraduate mathematics has employed a quantitative approach (see, e.g., Stage & Kloosterman, 1995; Treisman, 1992). This study is significant because it employs a qualitative approach in assessing the experiences of four African American men. This study draws on interviews and surveys as data collection techniques. In addition, this study draws on artifacts and a discussion of a research article, which I discuss in more detail in the methodological chapter (see chapter 4). In addition, this study is significant

because it will provide insights to policymakers, educators, professors, and so on about the complexities of race. Moreover, this study will reveal how these complexities about race may influence the mathematics education of African American male students. I hope and trust that this study will also assist other African American male students in their mathematics endeavors.

Conclusion

While the research indicates that few African American students experience success in mathematics (Hrabowski et al., 1998; Treisman, 1992), little research is done to investigate this phenomenon; furthermore, little research exists that investigates why some African American students, particularly African American male students, achieve at high levels in mathematics (for exceptions see Berry, 2005, 2008; Stinson, 2008). Those African American male students who studied mathematics at the undergraduate level and decided to stay in the mathematics pipeline for graduate work are among those who have achieved in mathematics. Instead of placing the emphasis on the negative mathematics experiences and the so-called (mathematics) achievement gap (gap-gazing) (Gutiérrez, 2008), researchers could examine and listen to the mathematics stories that have worked for students, particularly African American male students who have continued in the mathematics pipeline (Ladson-Billings, 1997).

This research study focused on four African American male graduate students: two in mathematics education and two in mathematics. While I primarily focused on their undergraduate mathematics experiences during the study, I also chronicled their experiences with mathematics from elementary school through graduate school. Moreover, I employed CRT as a theoretical framework to investigate their mathematics

experiences. The next chapter reviews the literature on mathematics success stories of African Americans and the role of HBCUs in that success.

CHAPTER 2

REVIEW OF THE LITERATURE

This study examines the experiences of four African American men who were successful with mathematics as an academic major in college. This literature review focuses on three areas of scholarship that are instrumental in framing my dissertation study. In the first section, I highlight the African/African American legacy in mathematics by discussing the development of mathematics and providing biographies of some African American male mathematicians. In the second section, I focus on contemporary elementary, middle, and high school mathematics success studies among African American students, respectively. I then explore undergraduate mathematics studies and summarize the section by providing a brief discussion on successful African American men in higher education concerning college (mathematics). In the third section, I concentrate on the role of historically Black colleges and universities (HBCUs) in the production of African American collegians/graduates. I conclude the literature review by linking these three areas of scholarship to my dissertation study.

The Mathematical Legacy of People of African Descent

Introduction

The development and history of mathematics have been researched by various scholars (see, e.g., Gerdes, 1994; Joseph, 1990; Williams, 1997; Zaslavsky, 1999). While many different cultural groups have contributed to the development of mathematics, most scholars have presented the history and development of mathematics from a European

perspective (see, e.g., Burton, 2007). As a result of this one-sided perspective, "mathematical activity outside Europe has as a consequence been ignored, devalued, or distorted" (Joseph, 1990, p. 3). Are mathematical perspectives only viewed through a European lens or can a new perspective, such as an Africana perspective on mathematics be presented and valued in the field (Wynne, 2004)? In an attempt to debunk the myth that mathematics was developed solely by Europeans and to shed light on the contributions of the people of African descent to the field of mathematics, I provide a brief discussion of and highlight some of the mathematical contributions from Africa and mathematicians of African descent. (By no means is this discussion exhaustive of these contributions; it serves only as a brief introduction.)

The earliest known African mathematician, Imhotep (~2650 B.C. – 2600 B.C.), was an African genius (Hurry, 1990). He was known for his vast achievements in medicine and architecture, and he seemed to have received an education solely on the continent of Africa. It appeared that he came from a lineage of architects because his father, Kanofer, was also an architect. Imhotep is widely known for his construction of the famous Step-Pyramid of Sakkarah. According to Hurry, "The east and west sides of the base measured 396 feet in length, and the north and south sides 352 feet, while the height was about 195 feet. The six gigantic steps measure in height 38, 36, 34½, 32, 31, and 29½ feet respectively, while the width of each step is from 6 to 7 feet…This pyramid is the earliest large stone structure known to history" (p. 10). This pyramid is also one of the earliest accounts of mathematical expertise exhibited by an African scholar.

In addition to the mathematical precision of the Step-Pyramid, several bones that have been traced back to Africa have shown to portray mathematical ingenuity. The

Ishango Bone, dating back to 9000 B.C., is the most well-known example (Bogoshi, Naidoo, & Webb, 1987). The Ishango Bone has notches or tally marks that indicate mathematical patterns. A piece of the fibula of a baboon dates back to 35000 B.C.; it may be the oldest mathematical artifact and it dates back to a period when writing was nonexistent in most cultures. In addition, Egyptian numerals as well as many mathematical symbols were used to express mathematical ideas (Zaslavsky, 1999). Therefore, people of African descent have a historical legacy of mathematical excellence. In the table below, I highlight some of the mathematics contributions of people of African descent in Table 1. (For a more thorough investigation of the information presented in Table 1, please see Houston, 1998; Kenschaft, 2005; Williams, 1997; Zaslavsky, 1999.)

Table 1

African Contributions to Mathematics

Mathematician(s) of African Descent, Institution, or Organization	Date	Contribution
Dogon People	3200 B.C.–	Architecture
Imhotep	~2650 B.C.	Architecture
Muhammad ibn Muhammad al-Fullani al-Kishnawi	16?? –1741	Magic Squares
Thomas Fuller	1710–1790	Calculating Prodigy
Benjamin Banneker	1731–1806	Surveying Washington D. C.
Charles Reason	1814–1893	First African American Mathematics Faculty Member at a PWI
Kelly Miller	1863–1939	First African American to Pursue a Doctoral Degree in Mathematics
Dudley Weldon Woodard	1881–1965	First African American to Publish a Research Paper in a Mathematics Journal
Euphemia Lofton Haynes	1890–1980	First African American Woman to Earn a Ph.D. in Mathematics (1943)
Elbert Cox	1895–1969	First African American to Earn a Ph.D. in Mathematics (1925)

Ali Mostafa Mosharafa	1898–1950	First African to Earn a Ph.D. in Mathematics (1923)
David Blackwell	1919–	First African American to Obtain a Position at a Research University (University of California at Berkeley)
J. Ernest Wilkins, Jr.	1923–	Considered a "Negro Genius" Because of His Mathematical Abilities
Abdulalim A. Shabazz	1927–	Influential in Producing African American Mathematicians
Scott Williams	1943–	Developed the Mathematicians of the African Diaspora Website
Alton Wallace	1944–	First African American to Obtain a Ph.D. with an African American Advisor (Raymond Johnson: University of Maryland in 1974)
National Association of Mathematicians (NAM)[2]	1969	Established
Jonathan Farley	1970–	Solved Mathematics Problems that Had Been Unsolved for Decades
Howard University	1976	First HBCU to Establish a Ph.D. in Mathematics

As mentioned previously, Table 1 is not an exhaustive list of the mathematics contributions of people of African descent. Rather, it is an introduction to the many mathematics contributions that have been made by people of African descent. Because this study focuses on African American male students in mathematics, I have chosen to highlight the following African American male mathematicians in this literature review: Thomas Fuller, Benjamin Banneker, Dr. David Blackwell, Kelly Miller, Dr. J. Ernest Wilkins, Jr., and Dr. Abdulalim Shabazz. These mathematicians stood out because of their unique life scenarios, significant contributions to mathematics, and/or their experiences with race/racism in mathematics. A brief portrait of each mathematician and their mathematical accomplishments is presented below.

[2] NAM is a mathematics organization comprised of minority American mathematicians to give "voice" to this group as it relates to their participation and awareness of things in the mathematical sciences community (Houston, 1998).

Thomas Fuller

Thomas Fuller (1710–1790) is credited with being the earliest known African American mathematician (Kenschaft, 2005). Fuller was an African, and he was shipped to America as a slave around 1724 (Fauvel & Gerdes, 1990). While Africans were not usually distinguished from others because of their intellectual abilities, Fuller was one of the few Africans who stood out because of his mathematical abilities.

Fuller was known as a calculating prodigy and possessed "the elements of a great mathematician" (Fauvel & Gerdes, 1990, p. 146). Fuller "could multiply two nine-digit numbers, state the number of seconds in a given period of time, and calculate the number of grains of corn in a given mass even though he never learned to read or write" (J. Fey & J. W. Alexander as cited in Fauvel & Gerdes, 1990, p. 142). It is significant to note Fuller's account of mathematical success because it poses the question of whether Fuller experienced mathematical training in Africa. As a matter of fact, Fuller was from a region of Africa where Africans exhibited exceptional computational skills (Kenschaft, 2005). Gerdes (1994) points out, "Fuller's exceptional abilities can be understood only through closer examination of the cultural context that stimulated their development" (p. 361).

Benjamin Banneker

No historical picture of African American mathematicians prevails without mentioning Benjamin Banneker (1731–1806). As a child, Banneker had an interest in science, statistics, and in other mathematical endeavors (Bedini, 1999). He also worked on his White grandmother's farm, Molly. Although Molly had a limited education, Banneker was partially educated by Molly who passed along Banneka's, Banneker's Black grandfather, African wisdom. It seemed that Banneker's grandfather gathered these

scientific facts from the Dogon, a group of African people living near Mali known for their architecture among many other things (Cerami, 2002).

Banneker learned to read and could recite Bible passages (Cerami, 2002). With this knowledge base, he developed exceptional written and communication skills that transferred to his work as a farmer. Moreover, he was approached by people within the neighborhood to check their financial accounts. Not only did he compute various people's financial figures, but also he was able to precisely remember each person's collection of numbers. Although controversial whether Banneker received formal schooling or not, it is known that he cultivated most of his own knowledge. With only a telescope and two books, he was able to make advanced astronomical conclusions for someone of his time.

Banneker was exposed to racial issues during his childhood (Cerami, 2002). During one incident, his grandmother was confronted by White men regarding her having Black children with her at a fair. His grandmother replied: "my slaves' children, of course" (p. 22). This encounter is cited as being of his first understandings of what it meant to be Black and the power that came along with being White. Banneker also recorded several dreams that indicated the he was haunted by the idea of Black people being inundated with great dangers. Banneker's example pinpointed race as a construct that was and still is used to marginalize people of African descent as well as other people of color. (I elaborate on race and/or racism in chapter 3 in which I focus on critical race theory [CRT].)

Nonetheless, it is believed that Benjamin Banneker had one of the greatest mathematical and/or scientific minds (Cerami, 2002). Among his most notable

mathematical accomplishments include: his unique wooden clock, his publication of an almanac, and his leading role in surveying Washington, D. C. The Benjamin Banneker Association (BBA), a non-profit organization designed to support the mathematics education of African American children, was established in his honor in 1986.

Kelly Miller

Kelly Miller (1863–1939) is known as being the first African American to pursue a doctoral degree in mathematics (Kenschaft, 2005). He was one generation removed from Africa, having a mother who was a slave. As a teenager, he attended Fairfield Institute. He won a scholarship to Howard University along with a train ticket and ten dollars. After receiving his degree, he worked in the U.S. Pension Office and saved enough money to buy a farm, which he gave to his parents.

Because John Hopkins's doctoral program required prospective students to be fluent in both French and German, Miller obtained tutoring in mathematics, French, and German (Kenschaft, 2005). Upon being accepted to John Hopkins University, the president invited him into his office and informed him that he was the first colored to be admitted to the university. Although he possessed exceptional mathematics abilities, he had to quit his doctoral program after 2 years because of an increase in tuition from $100 to $125. After leaving his doctoral studies, he went on to teach high school mathematics. He later joined the faculty at Howard and remained there throughout the rest of his career. As a friend to both W.E.B. Du Bois and Booker T. Washington, Miller was extremely adamant about lobbying for education for all African Americans.

At Howard University, he established the Moorland-Spingarn Research Center[3] (MSRC).

[3] "The Moorland-Spingarn Research Center (MSRC) is recognized as one of the world's largest and most comprehensive repositories for the documentation of the history and culture of people of African descent in

David Blackwell

David Blackwell (1919–), another African American mathematician, is considered one of the greatest African American mathematicians. Although he never met his grandfather, his grandfather left him a large number of books (Agwu, Smith, & Barry, 2003). Using these books, David Blackwell first experimented with algebraic concepts even though he was most interested in geometric concepts.

During his early childhood and high school education, David Blackwell's parents did as much as possible to protect their children from racism (Agwu, Smith, & Barry, 2003). In 1935, he enrolled at the University of Illinois at Urbana-Champaign, a campus that did not have a single Black faculty member. At the end of his freshman year after finding out that his father was borrowing money to finance his college education, he worked as a waiter/dishwasher and cleaner of laboratory equipment in the entomology lab to pay for his college education. By taking summer classes and testing out of some classes, he was able to complete college within 3 years with a degree in mathematics.

Because of his financial hardships, during his last 2 years of his doctoral studies, David Blackwell applied for and was awarded a fellowship (Agwu, Smith, & Barry, 2003). The university offered either a fellowship or a teaching assistantship to students. Although he was qualified to be a teaching assistant, he knew that there was no way that the university officials would allow an African American man in front of the class.

In 1941, David Blackwell earned a doctorate in mathematics (Agwu, Smith, & Barry, 2003). While applying for a professorship, the young African American scholar

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Africa, the Americas, and other parts of the world. As one of Howard University's major research facilities, the MSRC collects, preserves, and makes available for research a wide range of resources chronicling the Black experience." (*Preserving the legacy of the Black experience*, n.d., ¶ 1)

only sought work at HBCUs. He taught at Southern University, Clark College, and Howard University. At Howard, he became the department chair. While at these HBCUs, Dr. Blackwell had heavy teaching loads (at least 12 hours per week) as well as numerous administrative duties, but still managed to flourish doing research, publishing over 20 papers by the time he left Howard. In addition to these accomplishments, he also worked at the Research ANd Development (RAND) Corporation during some summers.

Dr. Blackwell gave the keynote address at the International Congress of Mathematics in Amsterdam in 1954 (Agwu, Smith, & Barry, 2003). This address was the motivating factor that led officials at the University of California (UC) at Berkeley to offer him a visiting faculty position. He accepted the position and remained at UC Berkeley as a faculty member. Although he contributed to the field of mathematics while he was at Howard, he did not gain world prominence until he was on the faculty at UC Berkeley. Altogether, Dr. Blackwell has published over 60 books and papers. He has held leadership roles in several mathematical and statistical organizations, including the American Mathematical Society, the International Association for Statistics in the Physical Science, and the Bernoulli Society for Mathematical Statistics and Probability, to name a few. Every year at MathFest,[4] the David Blackwell Lecture is given.

J. Ernest Wilkins, Jr.

J. Ernest Wilkins, Jr. (1923–) developed a strong interest in mathematics as a child and this interest was cultivated by his parents (Agwu & Nkwanta, 1997). His

[4] MathFest is an event sponsored each fall by NAM designed to encourage undergraduate mathematics majors to pursue graduate degrees in mathematics and mathematics education (Houston, 1998). The conference is also designed to expose students to research as well as invite them to present their research. As an undergraduate student, I had an opportunity to attend MathFest and it was an exciting scholarly endeavor to be in the midst of so many African American mathematicians.

mother was a teacher, and his father was a successful attorney. Because of his intellectual abilities, he was allowed to start school at 4 years of age. Additionally, he skipped several grades because of his intellectual abilities. In high school, he accelerated in mathematics classes and even took Geometry I and II concurrently. With his influential parents and supportive school structures, he was able to graduate high school at the age of 13.

At 13, J. Ernest Wilkins, Jr. was the youngest student on the University of Chicago's campus, a school where his parents were alumni (Agwu & Nkwanta, 1997). He graduated Phi Beta Kappa with a major in mathematics at 16; his father had done the same thing 22 years earlier. Because he had taken graduate courses as an undergraduate student, he was able to complete his Master's degree in mathematics in one year. Afterwards, he earned a Ph.D. in mathematics from the University of Chicago at the age of 18, making him the youngest African American to earn a doctorate in the sciences.

His formal educational experiences did not terminate with his doctorate degree (Agwu & Nkwanta, 1997). Dr. Wilkins worked as a postdoctoral fellow at the Institute of Advanced Studies. He taught at Tuskegee Institute and then went to work in the metallurgical laboratory at the University of Chicago. At the lab, he worked on the Manhattan Project; the goal of the project was to develop the atomic bomb of World War II. Dr. Wilkins, however, did not realize the purpose of the Manhattan Project until the subsequent day of Hiroshima's destruction. He later earned both Bachelor and Master's degrees in mechanical engineering from New York University. Between the years of 1970 and 1990, he alternately worked in both industry and academia. Among his awards are the Quality Engineering for Minorities Network Giant in Science Award and NAM's

Lifetime Achievement Award. In addition, NAM established The J. Ernest Wilkins, Jr. Lecture in his name and honor.

Adbulalim A. Shabazz

Abdulalim A. Shabazz (1927–) spent his childhood in Alabama, but went to Washington D.C. with his grandmother to take advantage of better educational opportunities (Kenschaft, 2005). He graduated from high school with honors and obtained a degree in both mathematics and chemistry from Lincoln University. A couple of years later, he obtained his Master's degree in mathematics from Massachusetts Institute of Technology. In 1955, he earned his doctorate in mathematics from Cornell University. In 1961, he changed his name from Lonnie Cross to Abdulalim Shabazz to embrace his commitment to the African American Moslem community (Williams, 1997).

In 1956, Dr. Shabazz became a faculty member at Tuskegee Institute (Kenschaft, 1995). In 1957, he went to Atlanta University as department chair where they only had a graduate program in mathematics with two students. During his tenure as department chair from 1957–1963, 109 students graduated with a Master's degree in mathematics. Many of his former students went on to earn doctorates in both mathematics and mathematics education. Approximately 50% of African American mathematicians in the United States today were either directly or indirectly influenced by Dr. Shabazz's 109 students from Atlanta University.[5]

In 1986, Dr. Shabazz returned to Atlanta University (Kenschaft, 2005). The mathematics department had many students who needed assistance in performing basic

[5] Dr. Raymond Richardson was one of Dr. Shabazz's 109 students from Atlanta University. Dr. Richardson went on to earn his Ph.D. in mathematics from Vanderbilt University. Dr. Richardson was a professor at Tennessee State University who taught me mathematics. Therefore, I, too, am indirectly related to Dr. Shabazz's mathematical legacy.

mathematical operations. He became the department chair again from 1990 to 1995. Once more, he increased the numbers of students pursuing majors in mathematics from 35 undergraduate mathematics majors in 1990 to 155 undergraduate mathematics majors in 1992. After he and his wife divorced after raising their three children, he adopted two Ethiopian boys, who are now both mathematicians. These examples, I believe, demonstrate his passion and commitment to assist people of African descent in maneuvering through the mathematics pipeline.

From 1997 to 2000, Dr. Shabazz became the department chair at his alma mater, Lincoln University (Kenschaft, 2005). While at Lincoln, he reformed the mathematics curriculum and developed a 4-year degree program in which students would earn both their bachelor's and master's degrees in mathematics. In addition, he has received numerous awards including the National Mentor Award from President Clinton, the Mentor Award from the American Association for the Advancement of Science, and NAM's Distinguished Service Award.

Summary

What is largely absent from the research literature is inspiring mathematics stories of African American mathematicians. The mathematics stories of Thomas Fuller, a slave who possessed a wealth of mathematical knowledge and Benjamin Banneker, considered one of the greatest mathematical scientists of all times are not stories that are in the forefront regarding the mathematical legacy of people of African descent. Likewise, Kelly Miller who left his doctoral studies because of $25 and Dr. David Blackwell who was not recognized for his mathematical abilities until he was employed at a White institution are stories that need to be highlighted to demonstrate how these mathematics

scholars overcame financial difficulties and issues of race. Similarly, Dr. J. Ernest Wilkins, Jr. who surpassed various grade levels and earned a doctorate in mathematics at the age of 18 and Dr. Abdulalim Shabazz who caused the number of African American students studying mathematics to grow exponentially during his reign as department chair are examples of influential mathematicians (as are others) that highlight the mathematical history of people of African descent. In an attempt to fill the void of a shortage of mathematics success stories of people of African descent, I have highlighted these mathematicians' stories and conducted my research study on the success stories of African American male students in mathematics.

If we, as mathematics educators, are to encourage more African American students to pursue careers in mathematics, and STEM professions in general, then it is necessary to illuminate the stories of the African American mathematicians who have shod similar paths (Agwu & Nkwanta, 1997). Furthermore, it is of paramount importance to present the mathematical contributions of people of African descent, especially given that this historical information is disproportionately absent from most mathematics historical accounts. My purpose in including the historical table of the mathematics contributions of people of African descent as well as the biographies of these five African American mathematicians is to bring to the forefront the contributions of African Americans to the field and to provide a historical perspective as to why current scholars in the field are mathematically successful.

Moreover, as the research literature indicates, Africans have established the foundations for mathematics (Zaslavsky, 1999). We, as people of African descent, have had a long and illustrious history and legacy of mathematical success. Given this

historical legacy, it is not surprising that African Americans are continuing in this intellectual tradition and achieving mathematical excellence. Because this study focuses on successful African American male students in mathematics, these stories provide a foundation for how contemporary scholars and students in the field became successful themselves. In the next section, I explore some contemporary research studies highlighting the mathematics success stories of African Americans.

Contemporary Empirical Mathematics Success Studies

Successful Elementary Mathematics Studies

Research examining the college experiences of successful mathematics students has found that early successful experiences in mathematics encourage continued success (Hrawbowski et al., 1998; Oakes, 1990; Moody, 2001). I examine two successful elementary mathematics initiatives for African American students.

The Martinez school approach was used with African American pre-kindergartens and kindergartners to promote success in elementary mathematics (Martinez, 2000). This approach used call-and-response teaching to teach mathematics skills to students. Using their hands, students were able to make connections to the mathematics with this approach by engaging in a dialogue with their “smart hands” (p. 75). Additionally, this approach included a tapping technique, which allowed students to use rhythmic sound and their kinesthetic abilities to learn addition. Martinez found that cultural practices such as the call-and-response and rhythmic patters were used in the homes of her African American students and brought those aspects into her classroom as a foundation for learning mathematics.

Another successful elementary program that focused specifically on mathematics was Project SEED (Hollins, Smiler, & Spencer, 1994). Project SEED was created with the goal of "changing teachers' attitudes towards low income African American youngsters by demonstrating their ability to learn high level mathematics concepts while still in elementary school" (p. 166). All of Project SEED's instructors have degrees in mathematics or a related subject area. Moreover, the instructors attend weekly workshops on pedagogy and mathematics content. The mathematics classrooms are representative of the African culture, and some of the pedagogical characteristics of the mathematics classrooms include "choral responses, co-operation, collective responsibility for problem solving, flexibility and strong adult leadership" (p. 166). These characteristics also align with elementary teachers who explored the African origins of algebra in efforts to show their African American elementary students how mathematics related to their own heritage (Ladson-Billings, 1994).

Both Martinez (2000) and Hollins et al. (1994) used techniques similar to those experienced in the African American culture to develop mathematical literacy among African American students. These findings highlight the importance of connecting students to mathematics in elementary school and support Bonous-Hammarth's (2000) and Oakes' (1990) findings that early interest in mathematics-related fields promotes success in these fields.

Successful Middle School Mathematics Studies

In the middle school setting, the mathematics education initiative that has been developed to further assist in promoting achievement outcomes for African American students is the Algebra Project (Moses & Cobb, 2001). The purpose of the Algebra

Project is to promote mathematical literacy among students who are living among a highly technological "mathematical" world: "The Algebra Project is founded on the idea that the ongoing struggle for citizenship and equality for minority people is now linked to an issue of math and science literacy" (p. 14). This movement of mathematical literacy seeks to close the achievement gap in mathematics by offering a college preparatory mathematics sequence to students starting in their middle school grades.

Within this "Algebra Project network" (Moses & Cobb, 2001, p. 174), several young people have started The Young People's Project (YPP). The goal of the YPP is to allow young people to connect to other young people in an attempt to foster mathematics literacy. In addition, YPP continues to keep students in the mathematics pipeline who have gone on to college, graduate school, and/or the work force. An important aspect about the Algebra Project and YPP is that they are community-based initiatives. Furthermore, students participate in mathematics that is directly related to community issues (i.e., real-world *community* mathematics). For example, students explore the relationships of numbers by taking a trip around their community. Most of the students in these programs develop an excitement for mathematics and enroll in more advanced mathematics as they matriculate throughout high school and college.

Martin (2000) conducted interviews with 35 high-achieving African American seventh, eighth, and ninth graders after observing these students in their junior high mathematics classrooms. Although these students were being taught from the Algebra Project's curriculum developed by Moses, they did not cite the curriculum as a contributor to their mathematics success. Martin's results included: (a) all the students displayed strong personal identities that attributed to their "achievement-oriented

individual agency" (p. 123), (b) most of the students possessed mathematical confidence, (c) many of the students believed that their teachers were instrumental in helping students learn, and (d) nearly all of the students received some type of negative treatment such as being called "nerd" because of their mathematical intelligence and their success in school overall but negotiated those negative discourses. Martin found that these high-achieving students had a positive mathematics identity. The four tenets of a mathematics identity proposed by Martin include: "(a) their ability to perform in mathematical contexts, (b) the instrumental importance of mathematical knowledge, (c) constraints and opportunities in mathematical contexts, and (d) the resulting motivations and strategies used to obtain mathematics knowledge" (p. 19).

Berry's (2008) study with eight successful African American male middle school students in mathematics revealed the following five themes: (a) early educational experiences: exposing African American male students to educational materials before kindergarten, (b) recognition of abilities: placing African American male students in gifted classrooms and providing them with access to advanced mathematics, (c) support systems: having parents and extended family as models of (mathematics) success, (d) positive identity: being motivated and having a strong belief in self that they can be mathematically successful, and (e) alternative identity: participating in special academic organizations, church programs, and athletics to affirm a strong sense of African American culture. Coupling phenomenology, a methodological framework, with critical race theory, a theoretical framework, Berry used counter-storytelling with these eight African American male students to document their life, schooling, and mathematics experiences. Berry proposed that issues of race and gender be brought to the fore when

constructing methods to address the mathematics achievement of African American male students.

Successful High School Mathematics Studies

Thompson and Lewis (2005) conducted a case study on an African American male high school student, Malik, who petitioned to have another mathematics course added to the curriculum at his high school. Understanding that he would need advanced mathematics for his desire to become a pilot in the future, he went to the principal on several occasions to ensure that a Pre-Calculus/Calculus course would be offered. Malik's school offered Honors Algebra II as its terminal mathematics course. With Malik's perseverance, a Pre-Calculus/Calculus course was offered the next school year. Interestingly, Malik solicited 30 of his African American peers to sign up for the advanced mathematics course. This example illustrates not only how this African American male succeeded in mathematics, but also how he created his own access to higher-level mathematics.

Stinson (2004, 2008) examined the sociocultural discourses on the agency of four successful African American males in mathematics. The participants were African American men in their early 20s who were reflecting on their mathematics schooling experiences. Employing a critical postmodern theoretical framework, Stinson found that these African American men understood society's structures and negotiated the discourses that surround African American men in society.

Walker (2006) studied a group of high-achieving high school mathematics students in an urban high school. Her study included African American and Latino/a male and female students. Walker found that these students' communities were instrumental to

their success in mathematics; this finding is also consistent with Moses and Cobb's (2001). Additionally, she found that students benefited from peer support, intellectual communities, family support, and school adults' influences.

The work of Thompson and Lewis (2005), Stinson (2004, 2008), and Walker (2006) are not stories that are heard frequently concerning the mathematics education of African American students. These examples show how important it is to reframe research so that we can learn from the success stories of African American students in mathematics education, especially with regards to higher education (Moody, 2000; Stinson, 2006). As such, my study seeks to add to the knowledge base concerning the mathematics experiences of four African American male students who were successful with mathematics as an academic major in college.

Undergraduate Mathematics Study

A study was conducted by Treisman (1992) at UC Berkeley addressing the high failure rates of Blacks and Hispanics in Calculus. Although Treisman's study does not specifically focus on African American male students, his focus on students of color included African American male students. The goal of the research was "to improve the quality of instruction in Introductory Calculus at Berkeley" (p. 363). The study included 20 Black and 20 Chinese students. After analyzing data from surveys, moving in with students, videotaping students, and interviewing students' families, Treisman concluded that minorities failed because of these four reasons: a motivation gap, a lack of academic preparation, a lack of family support or a lack of knowledge about higher education, and a lack of income. Treisman also found that Black students typically worked alone whereas Chinese students worked in groups. It can be argued that Treisman studied

mathematically successful African American students because students must have exceptional grades and standardized test scores to be admitted into UC Berkeley.

Treisman's (1992) study is seminal regarding the mathematics achievement/underachievement among undergraduate students of color. Even though the goal of the study was to improve the Introductory Calculus course, the study was somewhat deficit in theory as it pinpointed "problems" with Black students. Although Treisman recognized a void in the research literature, he did not consider interviewing the Black students themselves to validate or refute his conclusions. On the other hand, my study seeks to draw on several methodological tools, including interviewing students, to bring attention to the successful undergraduate mathematics experiences of African American male students.

Successful College (Mathematics) Studies

McGee (2005) studied 14 high-achieving African American mathematics and engineering majors in their junior and senior years of college. Employing a critical race theoretical framework, she found that these students exhibited positive racial identities and continued in the African American spiritual tradition. She also found that parents were important factors in the students' success. Furthermore, she found that most students embraced a "succeeding against the odds" ideological paradigm. In McGee's study, she studied both engineering and mathematics majors. My study is unique in that I sought to study only mathematics majors and African American male students.

Moody (2001) studied two African American female students in mathematics; one participant was finishing her undergraduate mathematics degree while the other student was completing her master's degree in mathematics education. She conducted a

phenomenological study examining African Americans' experiences within a social context arguing

> conceptualizing African-American students' cultural orientations, the role of their ethnicity in their experiences in mathematics classrooms, and the social effects of schooling on their succeeding in mathematics are essential in circumventing schools' active roles in perpetuating inequalities and inequities that exist in society as a whole. (p. 255)

Moody found that perception and response are connected and that this connection can be powerful in motivating African Americans to succeed in mathematics:

> There is a need to question schooling practices that cause African-American students to feel "badly" about being the only African American in advanced mathematics courses….To eradicate such perceptions, schooling practices must ensure that African-American students understand that they are "welcomed" and expected to partake of "unlimited" mathematical knowledge and understanding. (p. 272)

Moody's argument assisted me in reflecting on my mathematical experiences (which was discussed in the foreword and will be discussed in my subjectivity section in chapter 4) and in framing questions to draw out the ways in which African American male students have been welcomed (or not) in college mathematics courses because of their race and gender.

A research team at the University of Maryland-Baltimore County studied high-achieving African American men (Hrabowski et al., 1998). At this institution, researchers became concerned about the status of African American male students in college science, mathematics, and engineering (SME) (SME is synonymous with STEM: science, technology, engineering, and mathematics) majors and decided to learn more about this group by studying the habits of the highest-achieving students who were enrolled in the Meyerhoff Program. The goal of the Meyerhoff Program is to have students complete SME degrees and then pursue a doctorate in one of these areas. The program provides

scholarships to students, academic advising, and tutoring to name a few of the benefits. Although the program now serves African American women and other minorities, the first year consisted of African American male students only.

By focusing on the highest-achieving African American male students in this program, Hrabowski et al. (1998) hoped to identify attitudes, behaviors, habits, perspectives, and strategies in hopes of reversing the downward spiral that seems to be occurring among African American male students in education. Additionally, they were concerned with the small number of African Americans who decided to continue on to graduate school to pursue advanced degrees in these fields.

In years prior to the creation of the Meyerhoff Program at the University of Maryland-Baltimore County, students who entered this university with above average high school grade point averages and SAT scores comparable to the students in this program and with majors in mathematics and science usually got Cs in their college mathematics and science core courses (Hrabowski et al., 1998). The Meyerhoff Program has not only helped to reverse this trend, but a large majority of the students who completed the program went on to pursue graduate degrees in the STEM disciplines. According to Hrabowski et al., the following factors are critical for success in college among African Americans in mathematics and science: an adequate high school academic preparation, analytical skills, strong study skills, time management skills, advising, academic as well as social integration, and motivation and support. These findings support other research findings of success factors among African American students (e.g., Brown, 2006; Fullilove & Treisman, 1990; Maple & Stage, 1991).

Bonous-Hammarth (2000) examined the flow in and out of SME fields by African American, American Indian, and Chicano/Latino SME majors. She found that these groups were leaving SME majors during their undergraduate experiences. She suggested that educators need to provide minority students pursuing SME majors with exposure to the culture that they will encounter in the workforce as well as in college in these fields. In addition, she proposed that educators identify ways in which SME professions would benefit from broadening their current values and practices so that students perceive that they are welcomed for SME study.

One effort that has been successful in promoting high levels of undergraduate mathematics performance among African American students is the Mathematics Workshop Program (MWP) at UC Berkeley (Fullilove & Treisman, 1990). The MWP is cited as being successful for the following reasons: the workshops create environments that promote mathematics academic excellence among peers; the students spend more time on learning activities and learning tasks as opposed to just solving mathematics problems; and the students who participate in MWP are believed to continue in college longer than those students who do not participate in the workshop because they obtain social and study skills that can be used throughout their college matriculation. In addition, the researchers found that students who achieve success in an extremely difficult subject typically remain focused on maintaining that success.

Warde (2008) conducted focus group interviews with 11 African American male graduate students who were successful in obtaining their bachelor’s degree. Although his study did not include participants who were studying mathematics, his study yielded valuable insights as it pertains to the participation of African American male students in

college in general. Warde's participants were to recount "the key events and/or experiences that contributed to their successful completion of a baccalaureate degree" (p. 61). The focus groups were separated into two groups (one group had six participants while the other group had five). His phenomenological investigation revealed four themes: "(1) having an epiphany about the importance of higher education; (2) having access to the resources needed to attend and persist in an institution of higher education; (3) having a mentor; and (4) being resilient when faced with obstacles" (p. 59).

The work of Tucker (1996) presents effective college mathematics programs at Predominantly White Institutions (PWIs) and HBCUs alike. The cases reported in his research had the following characteristics: programs attracted high school students to pursue mathematics as a major; programs offered experiences both in and out of class to attract students to mathematics; programs effectively prepared students for mathematics work beyond the undergraduate level; and programs were designed to recruit and retain minority students in mathematics, to name a few.

Cooper (2000) examined the procedures of a mathematics department that influenced a large population of African American mathematics graduate students at the University of Maryland. The mathematics department at this university is one the largest mathematics departments in the United States and has a track record of mathematical productivity and research. Cooper learned that one person can make a huge difference (i.e., Raymond Johnson); an African American presence within mathematics faculty members, staff, and students themselves lends itself to attracting students to a program; academic as well as social support are needed for students to be successful in a

mathematics doctoral program; and mentorship is a valuable aspect needed prior to and during graduate school to assist with the progress toward the doctoral degree.

Such mathematics efforts as those proposed by Fullilove and Treisman (1990), Tucker (1994), and Cooper (2000), I believe, should be implemented to get students excited about becoming high-achievers in mathematics and ultimately becoming mathematics majors, particularly African American male students. Preparing African American male students for work beyond the undergraduate mathematics degree, providing mathematical experiences in and out of the classroom, providing exposure to African American mathematicians, and creating environments that foster mathematics achievement among African American male students are all needed in higher education institutions. Moreover, the work of scholars outside the field of mathematics such as Warde (2008) provides insights to the education community regarding the participation of African American male students in higher education. Therefore, borrowing from intellectual traditions outside of mathematics might serve beneficial in our understanding of the experiences of African American male students.

Summary

The state of African American men in higher education appears to be under-researched (Cuyjet, 2006). While efforts are being made to research African American male college students, more research should be done in this area, especially research focusing on the success stories. Surprisingly, African American male undergraduate students are under-researched, especially considering the societal, economic, and political challenges that they face (Bonner & Bailey, 2006). Even colleges and universities with higher numbers of African American male students are experiencing difficulties with

retaining this group (Brown, 2006). This phenomenon presents a major problem considering the fact that only a small percentage of African American male students enroll in college (Hood, 1992). Therefore, higher education institutions must continually assess the retention and graduation rates of African American male students (Brown, 2006). HBCUs, however, have experienced much success in graduating African American college students. Next, I offer a synopsis of the role that HBCUs have played in producing African American collegians.

The Role of HBCUs

Introduction

In this section of the literature review, I stress the unique role that HBCUs have had in providing access to higher education for African Americans and producing African American college graduates. On the other hand, I do not engage in the scrutiny that HBCUs have come under in recent years (Gasman, 2007; Wenglinsky, 1996). Neither am I constructing a dichotomy between HBCUs and PWIs regarding achievement rates, test scores, and the like, nor am I attempting to discuss the quality of education received at either type of institution (Allen, 1992; Kimbrough & Harper, 2006; Wenglinsky, 1996). Investigating these issues is beyond the scope of this dissertation.

Because all four of the participants in my study attended HBCUs for their undergraduate education, I felt it incumbent upon me to tap into the research literature regarding the role that HBCUs have played in producing African American college graduates, especially African American male students. Furthermore, the success of HBCUs in attracting African American students and assisting with their development as scholars within an African context cannot be ignored (Copeland, 2006).

HBCUs have provided access to higher education for several generations of African American college students (Allen, 1992; Copeland, 2006). Since their inception in the late 1800s and early 1900s, HBCUs have not only provided an education for its alumni, but also they have opened up the doors to leadership opportunities as well as better living conditions for African Americans (Copeland, 2006). Moreover, Williams and Ashley (2005) report, "when historically black colleges and universities were opened in the United States, they continued the tradition of scholarship and higher education begun in Africa" (p. 10). As such, HBCUs are also contributing to the historical legacy of educational excellence among Africana people.

As aforementioned, HBCUs were established as an accessible entity to students who were not admitted to other universities based solely on race (Copeland, 2006). Currently, HBCUs seek to continue to provide racial equality with regards to access to higher education (Copeland, 2006). As such, HBCUs are vehicles of hope regarding equity and access for African American students (Brown & Davis, 2001). The mission of HBCUs is to provide a college education to African Americans in a society engrained with racial discrimination (Brown & Davis, 2001).

The Goals and Mission of HBCUs

The goals and mission of HBCUs are unique and specifically designed to produce African American intellectuals who will hold leadership positions and provide service to the African American community (Roebuck & Murty, 1993). According to R. Walters (as cited in Roebuck & Murty, 1993), there are six goals for HBCUs. These goals include: (1) to continue the historical and cultural tradition of teaching and research about the Black condition, (2) to serve the Black community in various leadership roles, (3) to

supply an economic function in the Black community, (4) to provide Black role models who examine social, political, and economic issues endemic to the Black community, (5) to produce graduates who engage in tackling race related issues in society, and (6) to produce Black scholars who disseminate scholarly research and teaching to the Black community.

In addition to the one-of-a-kind goals, HBCUs also have a founding mission, which is to uplift the race (Spence, 2004). This uplifting of the race also impacts the Black community. As a part of their mission, Copeland (2006) adds that all HBCUs stress

> the importance of developing the whole person, intellectually, morally, ethically, and spiritually. Emphasis has been and continues to be on developing the mind, heart, and soul and a strong work ethic, along with social and civic responsibility. An examination of some of these institutions' mission statements reveals that, in addition to developing the mind, they are concerned with cultural values, ethics, character development, civic responsibility, leadership, and service to the community. (p. 53)

In conjunction with developing scholars, HBCUs are also concerned with other cultural dimensions that develop the whole person. These dimensions include moral and ethical responsibilities to the Black community as well as spiritual development. Copeland also expressed: "The type of milieu in which students learn and develop can greatly influence retention and graduation rates" (p. 59). These supportive environments along with the goals and mission of HBCUs embody unique characteristics that aid in the successful production of African American collegians.

Added to the unprecedented goals and mission of HBCUs, these schools have other features that are endemic to the African American experience. An important aspect concerning HBCUs is that they teach "students how to fight oppression and to represent the African American community" (Wenglinsky, 1996, p. 93). That is to say, "if these

schools are seen as extensions of the African American community, then students are likely to attend them for reasons having to do with the curricula or mission of the schools" (p. 94). Because of their unique extension to the African American community, their mission regarding the fight against oppression, and their goals concerning the development of African American students, HBCUs assist with the intellectual, moral, ethical, and spiritual development of African American students and attract African American students to these institutions (Copeland, 2006; Wenglinsky, 1996). In this study, my participants embraced spirituality and expressed that HBCUs provided them with access to unique experiences (see chapter 5). I now turn my discussion to spirituality and HBCUs as vehicles of access.

Spirituality

Herndon (2003) employed a grounded theory methodological approach to 13 African American male college students at PWIs and found that African American male college students at PWIs needed academic, emotional, social, and financial support to succeed in college. He also added the spiritual support mechanism as another form of support for the success of African American college students. Additionally, he found that spirituality bolsters resistance, brings about a sense of purpose, and is used (i.e., religious institutions) to support African American men.

Replicating Herndon's study, Riggins, McNeal, and Herndon (2008) examined the role of spirituality among 13 African American male college students at an HBCU in the southern region of the United States. The following three themes emerged from their data: (1) prayer was used for guidance and to cope with difficult circumstances, (2) spirituality was used in a social context among the African American men, and (3) social

support was acquired from religious institutions. Religion was also emphasized, more specifically the role of the church, among the African American college students as being critical to the mathematics and science success with the participants in Hrabowski et al.'s (1998) study.

Watson (2006) conducted a study at three private HBCUs examining spirituality and religion in the lives of 97 freshmen and sophomore African American male students. He distributed a 23-item Likert scale questionnaire and three open-ended essay questions. He found that spirituality was valuable in the lives of these African American men as they struggled to persist in college and reach their academic goals: "Yet, as this study reveals, the ability to affirm his spirituality is an essential part of the African American man's identity development" (p. 124). As such, spirituality is used as a motivator to assist some African American male students in their undergraduate studies.

HBCUs as Vehicles of Access

HBCUs serve as vehicles of access for African American students in the realm of graduate and professional school opportunities: "At either the graduate or undergraduate level, HBCUs have educated some 75% of all African American Ph.D.s" (Wilson, 2007, p. 12). Wenglinsky (1996) found that African American students who attend HBCUs for their undergraduate studies are more likely to pursue advanced studies in graduate and professional schools. Further, HBCUs provide access to other cultural opportunities that are unique to the African American experience (Roebuck & Murty, 1993; Spence, 2004; Wenglinsky, 1996).

African Americans enrolled in HBCUs have access to other African American mentors. Both the formal and informal mentoring structures that have been established

within HBCUs have been instrumental in their overall success (Spence, 2004). Faculty mentors and peer mentorship have proven to maintain, support, and propel several African American students at HBCUs.

With regards to access, Brown and Davis (2001) characterize HBCUs as a means of social contract, social capital, and as a social equalizer. After the Civil War, they argue HBCUs were an expression of America's social contract with free African Americans. They also argue that HBCUs provided social capital for African Americans, using their "particular social and legal position in the higher education landscape to advance the interest of African Americans" (p. 41). Furthermore, they posit that HBCUs are agents of social equality, thereby, providing agency for African Americans to participate in society.

Summary

In this literature review, I have stressed the unique role that HBCUs have had on producing African American college graduates. I am not suggesting that all African American students should attend HBCUs, nor am I suggesting that attending an HBCU will provide access to a better life for all African American students. What I am suggesting, however, is that because of the mission and goals of HBCUs, they have been successful in promoting access to higher education and impacting college graduation rates for African American students. Copeland (2006) emphasizes the point by arguing: "It is apparent that many Black institutions provide a different milieu, an environment that promotes access and fosters retention and graduation" (p. 55). In the case of my study, all four African American men completed their undergraduate mathematics degrees in HBCU environments that were conducive to promoting access to mathematics

and fostering success with a mathematics degree. (For a more in-depth discussion of the role of HBCUs in my participants' lives, see chapter 5.)

Furthermore, HBCUs and their role as vehicles of access have produced a significant number of African American college graduates, especially in the field of mathematics. Brown and Davis (2001) argue that "HBCUs provide a unique educational function that cannot be replaced" (p. 47). I concur with Brown and Davis that HBCUs serve a special purpose of attracting African American students to the higher educational landscape that cannot be duplicated. Additionally, HBCUs are valuable with regards to the social, ethical, moral, and spiritual development of African American students, especially African American male students (Copeland, 2006). Therefore, the accomplishments of HBCUs in providing access to higher education and producing African American college graduates should be valued, appreciated, and acknowledged in the academy.

Conclusion

After reviewing the literature, I have found that there is a dearth of literature dealing with success among African American male students in mathematics, especially in higher education. Inspiring mathematics stories of African American mathematicians are also conspicuously absent from the research literature. Moreover, there is a shortage of literature regarding the experiences of African American students at HBCUs in general. Although some studies focus on SME/STEM majors, the literature dealing with mathematics, specifically, at the college level is limited. Therefore, my study is needed to fill a gap in the existing literature, especially with regards to acknowledging the historical mathematical contributions of African people, to offering a deeper understanding of

success in college mathematics, and to providing insights to the mathematics education community about mathematically successful African American male students in higher education. In the next chapter, I discuss the theoretical lens through which I conducted my dissertation research.

CHAPTER 3

THEORETICAL FRAMEWORK

This chapter provides a discussion of the theoretical "lens" through which this study of successful African American men in college mathematics is viewed: critical race theory (CRT). I begin the chapter by providing a brief historical discussion regarding CRT. Within the discussion, I address the four basic tenets of CRT, which are the hallmarks driving the theoretical perspective. I follow with a discussion of the theoretical and methodological appropriateness of CRT within education research. I also provide explicit examples of research that bring race to the forefront within an African American context. I then offer examples of CRT's expansion to other under-served populations (i.e., TribalCrit and LatCrit). I conclude the chapter by offering CRT as a viable theoretical lens for my work in particular with African American male students in mathematics.

A Short History of Critical Race Theory

Race has been used as an unjust construct in U.S. and World history.[6] As West (2001) says, "It goes without saying that a profound hatred of African people (as seen in slavery, lynching, segregation, and second-class citizenship) sits at the center of American civilization" (p. 106). Woodson (1933/2000) argued that the Negro was

[6] The Executive Board of the American Anthropological Association endorsed a statement on race that seeks to deconstruct race as a construct that inequitably categories different racial groups (American Anthropological Association, 1998). The Executive Board argued that racial inequalities exist not because of biological (scientific) reasoning but due to historical and modernized institutionalized "racial" practices.
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dismissed as if he was “a nonentity” (p. 2). Since slavery, African Americans in the United States have experienced this hierarchical race system that places Europeans at the top and people of color at the bottom (Du Bois, 1903/2003). Hilliard (2001) argues that race is a political construct and that race in education is designed “to teach African inferiority and European superiority” (p. 25). These arguments demonstrate how race has been used both historically and currently to dismiss and marginalize people of African descent as well as other people of color.

The legal system is one in which laws are supposedly designed to ensure that constructs like racism do not continue to permeate our society (Delgado & Stefancic, 2001). In actuality, the historical development of CRT has its genesis in critical legal studies (CLS) (Delgado & Stefancic, 2001). CLS is a movement that critiques formalism and objectivism (Tate, 1997). This critique consisted of many areas in law including “the bar, legal reasoning, doctrine, hierarchy, [and] meritocracy” (p. 208). While CLS offered valid critiques of these injustices in law, it failed to bring matters of race to the forefront in its critiques of the law (Tate, 1997). As a response to CLS’s limitation in addressing issues of race, CRT sprung up to fill this void.

CRT began as a phenomenon in law during the mid-1970s when law scholars at Harvard started to speak out about the lack of diversity amongst the faculty members as well as the marginalization of students of color from the law school’s curriculum (Carbado, 2002). CRT developed from the work of legal scholars such as Alan Freeman, Richard Delgado, and Derrick Bell, an African American law professor, who is considered the father of CRT (Delgado & Stefancic, 2001).

Additionally, CRT is rooted in the legal studies movement of the 1970s whose mission was to liberate, provide economic empowerment, and seek justice (Tate, 1997). The CRT movement also developed because law professors and others were distressed that the civil rights gains that were made in the 1960s seemed to be headed in the opposite direction (Delgado & Stefancic, 2000). Seeking to develop new theoretical approaches to deal with the subtle racism that was evading in the field of law, CRT emerged (Delgado & Stefancic, 2000). This movement consisted of various activists and scholars interested in investigating and transforming the injustices that were brought about because of issues of race, racism, and power in our society (Delgado & Stefancic, 2001).

As stated, CRT builds on the insights of CLS as well as radical feminism, and it investigates issues of race from a broader perspective considering economics, history, context, group interest, and individual interest (Delgado & Stefancic, 2001). Intertwining these issues, CRT seeks to "transform the relationship among race, racism, and power" (p. 144). CRT borrows from several other traditions including liberalism, feminism, and Marxism (Lynn & Adams, 2002). Although CRT began in legal studies, it has expanded to other disciplines, including education. Solórzano and Yosso (2002) argue that CRT in education

> advances a strategy to foreground and account for the role of race and racism in education and works toward the elimination of racism as part of a larger goal of opposing or eliminating other forms of subordination based on gender, class, sexual orientation, language, and natural origin. (p. 25)

Additionally, CRT has crossed epistemological boundaries; this includes African American epistemology, which Gordon (1990) defines as "the study or theory of the

knowledge generated out of the African-American existential condition, that is, of the knowledge and cultural artifacts produced by African-Americans based on African-American cultural, social, economic, historical, and political experience" (p. 90). In my study, I allowed my participants to create their own African American epistemology with regards to college mathematics by drawing on their cultural knowledge and artifacts, which I address in the next chapter (see chapter 5).

As such, CRT was situated to establish and investigate intersections between race/racism and other inequalities including, but not limited to, sexism, classism, sexuality, and spirituality (Lynn & Adams, 2002; Solórzano & Yosso, 2002). In addition to working as an advantage for African Americans to critique injustices, CRT has also been employed by other under-served populations to examine various injustices (e.g., Latino/as Critical Race Theory [LatCrit] and Tribal Critical Race Theory [TribalCrit]). I include examples of these theoretical perspectives later in this chapter. In seeking to understand CRT in any discipline, whether it is in education, law, and so forth, it is important to understand the basic tenets of CRT, which I outline in the next section.

Basic Tenets of CRT

CRT builds off of four basic principles. Some scholars have added different tenets to these four principles while others have tweaked these tenets to reflect their own culture (see, e.g., Brayboy, 2005; DeCuir & Dixson, 2004; Solórzano & Yosso, 2002). Nonetheless, these four principles are consistently noted within most versions of CRT. As such, I now turn my discussion to the philosophical underpinnings of these principles, providing the epistemological foundation for CRT.

First, critical race theorists contest “that racism is normal, not aberrant, in American society” (Delgado & Stefancic, 2000, p. xvi). Because the United States has historical structures, institutional structures, schooling practices, and so forth that perpetuate racism, racism seems normal to people in our society. Formal laws and other equal opportunity initiatives attempt to cease the most extreme and obvious forms of racism, but these initiatives can do little about the subtle racism that students (and people) of color experience every day (Delgado & Stefancic, 2000). Bell (1992) argues, “discrimination today is covert, harder to prove, its ill effects easier to blame on its black victims” (p. 104). This argument can be further extended to include other people of color. To this end, CRT analyzes and challenges racist notions in society while simultaneously understanding the privileged construction of race (Lynn & Adams, 2002).

Second, CRT does not follow the regular traditions of scholarship because it allows researchers to employ storytelling to “analyze the myths, presuppositions, and received wisdoms that make up the common culture about race and that invariably render blacks and other minorities one-down” (Delgado & Stefancic, 2000, p. xvii). Critical race theorists have the presumption that a group of people or “culture constructs its own social reality in ways that promote its own self-interest” (p. xvii). With this belief in mind, critical race theorists construct their own realties, which are different from prevailing realities that are offered by the dominant culture. Through writing and storytelling, critical race theorists seek to speak out on rules and processes that continue to give power to European Americans and allow racism to thrive in this society with the hope of contributing to social justice by breaking down (some of) these racist barriers.

Third, CRT asserts a critique on liberalism (Ladson-Billings, 1999). In

articulating a definition of liberalism, I embrace Delgado and Stefancic's (2001) definition of liberalism, which defines liberalism as a "political philosophy that holds that the purpose of government is to maximize liberty…the view that law should enforce formal equality in treatment" (p. 150). Critical race theorists critique this philosophy by arguing that the dominant culture does not fully understand what liberty and equality are. Under the notion of liberalism, critical race theorists have also critiqued "colorblindness, the neutrality of the law, and incremental change" (DeCuir & Dixson, 2004, p. 29).

Finally, the fourth tenet of CRT argues that Whites, particularly White women, have been the major beneficiaries of affirmative action and civil rights legislation (Ladson-Billings, 1999). This paradigm of thought also closely aligns with interest convergence theory.[7] In essence, this alignment reifies that Whites will accept and/or encourage advances for people of color only when these advances can also help Whites advance themselves. Critical race theorists critique the motives behind Whites supporting such policies and question whether the policies were designed to benefit people of color in the first place (Delgado & Stefancic, 2001).

Theoretical Appropriateness of CRT

Ladson-Billings and Tate (1995) argue that while race issues seem to be prevalent in society, race has been untheorized, especially in the field of education. Through this statement, Ladson-Billings and Tate are not suggesting that scholars have not explored race or even considered race when examining social inequality; instead, they are arguing that this theorizing had not been systematically employed when analyzing educational inequality. In an attempt to address the shortage of research looking through a critical

[7] Derrick Bell coined interest convergence theory (Delgado & Stefanic, 2001). Delgado and Stefanic define interest convergence theory as a theory that the majority group tolerates advances for racial injustice only when it suits its interest to do so.

race lens, they propose that (education) researchers employ CRT to investigate race and racism in education.

Solórzano and Yosso (2002) further argue that “substantive discussions of racism are missing from critical discourse in education” (p. 37). As Hilliard (2001) argues, what can be done about the way that we deal with race in education, particularly in education research? All of these issues emphasize the importance of including the construct of race in educational research. In the case of my study, I brought the construct of race to the forefront in the mathematics education experiences of my participants.

Gordon (1990) also poses thought-provoking questions to assist with the education of students of color. Gordon asks: “For what purpose might people of color be educated? How might education assist people of color in challenging the societal structures that maintain and reproduce inequality?” (p. 88). Additionally, what purpose does research seek to fulfill in investigating the experiences of students of color, especially with methods and theories that do not coincide with the experiences of students of color (Smith, 2001)?

CRT can be viewed “as a way to link theory and understanding about race from critical perspectives to actual practice and actions going on in education for activist social justice and change” (Parker & Lynn, 2002, p. 18). CRT allows researchers to critically analyze historical and current racial concerns through a critical race lens (Parker, 1998). Solórzano (1998) argues, CRT “in education challenges the dominant discourse on race and racism as they relate to education by examining how educational theory, policy, and practice are used to subordinate certain racial and ethnic groups” (p. 122). In the case of

my study, I sought to examine how the discipline of mathematics was used (or not) to subordinate African American male students.

CRT is employed theoretically because it seeks to reveal the institutional and ideological racism behind the color-blind myth (Parker, 1998). Through historical evidence and current institutional structures, it can be documented that individuals do indeed see color. Whether or not they choose to acknowledge, value, and/or respect the color or even culture of students of color is another issue. Employing CRT, theoretically, also allows (education) researchers to explore the culture of K–16 institutions, explore the nature of racist acts, behaviors, and/or utterances to students of color, and examine the disciplinary acts (if any) of students who engage in these racial undertakings (DeCuir & Dixson, 2004). This theoretical framework served useful in my study given that I explored the culture of my participants' undergraduate institutions as well as how they negotiated their race and/or racism as African American men in a society entrenched with racism.

Traditionally, by not addressing the concerns of students of color, depending on genetic and/or biological rationales to explain complex educational phenomena, and not fully taking into account issues of race and culture when investigating the issues students of color face in schools, educational research has not adequately examined the educational complexities students of color confront theoretically (Parker & Lynn, 2002; Solórzano, 1998; Valenzuela, 1999). While efforts such as multiculturalism, diversity programs and courses, and/or cross cultural studies seem to give this issue lip service (Gordon, 1990), dominant scholarship still seems to be leading the field with little improvement efforts in the education of students of color. Ladson-Billings (2000) posed

the following question: “Where is ‘race’ in the discourse of critical qualitative researchers?” (p. 272). As such, I incorporated race into the discourse regarding my participants’ experiences as successful African American men in mathematics.

Methodological Appropriateness of CRT

Methodologically, employing CRT as a theoretical framework contributes to the purpose of qualitative research (Parker, 1998). (I offer a further discussion of qualitative research in chapter 4.) Parker poses an exceptional methodological question:

> Rather than ask what can this theory do for qualitative studies in education, an alternative inquiry I would propose is what can qualitative research in education do to illuminate and address the salient features of CRT with respect to race and racism in educational institutions and the larger society? (p. 46)

CRT adds to qualitative research in that it “offers the researcher an opportunity to stand in a different relationship to the research (and researched)” (Ladson-Billings, 2000, p. 268). Employing CRT in my study was also methodologically appropriate because of the (scientific) methods that CRT employs.

One of the main methodological tenets of CRT is voice (Dixson & Rousseau, 2005). With voice, there is “the assertion and acknowledgement of the importance of the personal and community experiences of people of colour as sources of knowledge” (p. 10). Borrowing from this tradition, critical race theorists believe in and use personal narratives and personal stories as forms of (scientific) knowledge to document inequity, injustice, and/or discrimination (Dixson & Rousseau, 2005). With using the term voice, it is important not to essentialize[8] or think that one person’s voice speaks for the entire

[8] Leistyna, Woodrum, & Sherblom (1996) defined essentialism as a fundamental nature or biological determinism to human rights through attitudes about identity, experience, knowledge, and cognitive development. Within this view, categories such as race and gender become gross generalizations, and single-course explanations about individual character.

group or culture (Dixson & Rousseau, 2005). Also, attempting to essentialize students of color is an erroneous practice that some scholars in the dominant culture continue to make (Ladson-Billings, 2000). As such, I did not assume that one African American male participant was representative of and speaking for all African American male students. While African American male students as well as other students of color may experience racism during their educational experiences, the extent and the individual scenarios of the racist acts are entirely different.

Delgado (1989) asserts that many who have been telling stories, especially in CLS, are those "whose voice and perspective—whose consciousness—has been suppressed, devalued, and abnormalized" (p. 2412). Allowing their voices to be heard through the usage of personal stories, narratives, counterstories, autoethnographies, and so on, critical race theorists seek to offer a different perspective than the negative views and beliefs that seem to be circulating throughout the dominant culture about marginalized groups. Furthermore, Taylor (1999) offers:

> One powerful way to challenge the dominant mind-set of society—the shared stereotypes, beliefs, and understandings—is through telling stories. Stories can both challenge the status quo and help build consciousness by creating a shared, communal understanding…CRT scholars often engage and contest negative stereotyping through storytelling/narrative/autobiography/personal history. This strategy uses the experiences of people negatively affected by racism to confront the beliefs held *about* them by whites. (p. 184)

Borrowing from Taylor, I employed storytelling through interviews as a scientific method of data collection to withstand the negative stereotypes concerning African American male students.

In addition, Delgado (1989) contends, "Members of the majority race should also listen to stories, of all sorts, in order to enrich their own reality" (p. 2439). He further

argues, "Listening to the stories of outgroups can avoid intellectual apartheid" (p. 2440). Possibly, this act of listening to stories of people of color might result in laws that seek to eliminate racial inequality to be implemented instead of undermined (Tate, 1996). Hopefully, the dominant culture will realize that some of their views are distorted and that they can be cured of their "dysconscious racism"[9] (King, 1991, p. 133). The dominant culture might also understand that scholars of color have also been doing research for many years. To validate this point, Smith (2001) offers the following concerning "common" people who conduct research:

> They are referred to as project workers, community activists or consultants, anything but "researchers." They search and record, they select and interpret, they organize and re-present, they make claims on the basis of what they assemble. This is research. The processes they use can also be called methodologies. The specific tools they use to gain information can also be called methods. Everything they are trying to do is informed by a theory, regardless of whether they can talk about that theory explicitly. (p. 17)

As such, community people have been conducting research employing critical race perspectives before CRT's genesis, especially within the context of African American communities.

In sum, the use of voice and storytelling allow people of color to express their racist experiences and discriminatory acts against them as a way to create (scientific) knowledge in this area (Bernal, 2002; Dixson & Rousseau, 2005). This creation of knowledge consists of African American epistemology proposed by Gordon (1990) as well as epistemology of other students of color (Bernal, 2002; Brayboy, 2005). As such,

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[9] King (1991) coined the concept "dysconscious racism." She defines the term as the limited and distorted understandings preservice teachers have about inequity and cultural diversity, which make it difficult for them to act in favor of truly equitable education.

we, education researchers, must apply these race-oriented epistemologies to educational research, knowledge creation, and the pedagogy of students of color (Villalpando, 2003).

Further, employing CRT methodologically might yield what Solórzano and Yosso (2002) call a critical race methodology (CRM). CRM is a theoretically and methodologically grounded approach to research in education that brings race and racism to the research process; challenges traditional and prevailing paradigms and theories that attempt to explain the experiences of students of color; provides a liberatory and transformative agenda to counteract race (gender, class, and sexism); and utilizes interdisciplinary studies to gain a better understanding of the racial experiences of students of color (Solórzano & Yosso, 2002). By conducting my study on successful African American male students in mathematics, I am contributing to the interdisciplinary practice of gaining an understanding concerning the racial experiences of African American male students.

Examples of CRT within an African American Context

As previously stated, CRT has been used as a theoretical lens in many disciplines (Solórzano & Yosso, 2002). In this section, I highlight some of the research literature employing CRT as a theoretical framework in various fields as it pertains to the experiences of African Americans. Although all of the scholars cited in this section do not list CRT explicitly as a theoretical framework used to investigate their research, all of the African American scholars cited bring issues of race and racism to the forefront of their analysis.

The work of legal scholar Derrick Bell (1992) has been heavily cited among scholars who seek to bring race to the forefront of their analysis. In his book, *Faces at the*

Bottom of the Well, Bell used fictional and historical accounts to prove how our legal system has systematically shown favor to Whites. He even extended his arguments to law schools, explaining how these institutions "exclude disproportionately blacks and other people of color whose approach, voice, or conclusions may depart radically from the usual forms" (p 140). As such, Bell charged scholars to employ a critical race theoretical perspective. He wrote: "With what some of us are calling critical race theory, we are attempting to sing a new scholarly song—even if to some listeners our style is strange, our lyrics unseemly" (p. 144). I, too, am seeking to sing a new scholarly song in mathematics education research regarding African American male students even though some scholars might not embrace my theoretical approach.

Tatum (2003) analyzed various racial conversations and experiences that occur among children and adults alike in her book, *"Why Are All the Black Kids Sitting Together in the Cafeteria?": And Other Conversations about Race*. Employing a psychological theoretical lens, Tatum examined racial identity development and offered strategies for engaging in healthy conversations related to race and/or racism. Drawing from her many years of teaching and researching about race, she seeks "to help students explore the psychological impact of racism on both Whites and people of color" (p. xiii). Tatum's discussion helped bring about understanding as it pertains to the interactions among students and colleagues with individuals of different racial groups. Her explanation of the framework of racial identity development contributed to the understandings about how constructions are made concerning being White or a person of color and how race and/or racism operates in society.

While Cleveland (2004) was completing his doctoral studies in education at a predominantly White research university, Cleveland realized that he was being judged because of his race as opposed to his scholastic abilities. He shared his thoughts and feelings concerning the racism that he was experiencing, which caused some tensions among his cohort and faculty members alike. As an African American male doctoral student who was not afraid to write about and speak out concerning the racial injustices practiced at the institution, Cleveland employed a critical race approach by using his "voice" through speaking out and writing narratives to document racial injustices (Dixson & Rousseau, 2005).

The scholarship of Carter (2008) addressed the manifestation of a critical race achievement ideology among nine high-achieving Black students. Her participants were academically successful and maintained a positive racial identity in a predominantly, White suburban public high school. Carter argued: "These students embody a critical race achievement ideology that allows them to both view themselves as achieving within the context of being black and also overcome perceived racism in their school environment" (p. 477). As such, these nine Black students' achievement in school intertwined a positive sense of self with an understanding of racism and a mindset to resist racism. Carter also found that these students were cultural negotiators. In other words, they were able to employ multiple strategies to adapt to various cultural and ethnic groups as well as their African American peers.

With regards to mathematics education research, Martin (2009) brought race to the forefront of his analysis. Seeking to change the way that race is used as a means to place students in various data categories in mathematics education research, he proposed

that race be understood as a “sociopolitical, historically contingent construct” (p. 298). Further, his analysis included (re)conceptualizing the mathematics education goals of marginalized groups such as African Americans, Latino/as, and Native Americans to adequately reflect race. By doing so, Martin called for a deconstruction of the racial hierarchy of mathematical ability that places Asian and White students at the top and African American, Latino/a, and Native American students at the bottom. Martin’s research article is unique in that it is an example of employing a critical race theoretical lens in mathematics education research.

Because my study focused on the experiences of four African American men in college mathematics employing a critical race theoretical stance, I included the aforementioned instances in which race was brought to the forefront in the context of African American scholarship. In chapter two, I have provided literature as it pertains to scholars conducting research in the context of African Americans who have included racial analyses in their work (e.g., Agwu & Nkwanta, 1997; Joseph, 1990; Kenschaft, 2005; McGee, 2005; Stinson, 2004, 2008; Zaslavsky, 1999). Also, CRT seeks to give voice to those marginalized groups whose perspectives have been minimized (Delgado, 1989). These groups of people include African Americans, Chicanos, Latino/as, Asian Americans, and so on. I provide examples of how other marginalized groups have used and expanded the work of CRT in the next section.

Examples of CRT Focused on Other Under-Served Populations

Usually, race in the United States is thought of as a dichotomy of Black and White paradigms. Scholars have critiqued that this view of race is too narrow and does not include the experiences of other students of color (Brayboy, 2005; Solórzano, 1998).

As a result, CRT has also been used with other students of color. With regards to extending CRT to other marginalized groups, some scholars argue LatCrit includes the population of Chicano/a people (Bernal, 2002; Villalpando, 2003). Other scholars argue, however, that Latino/a, Chicano/a, and Mexican are distinct groups (Solórzano, 1998). As such, I highlight aspects of both TribalCrit and LatCrit. Finally, I provide an example of CRT with Chicano/a students and one example with Mexican students because each population has its own autonomy.

TribalCrit addresses more thoroughly the issues of Indigenous Peoples in the United States (Brayboy, 2005). While CRT emphasizes that racism is endemic in society, TribalCrit places emphasis on the fact that colonization is endemic to society. (For a thorough account of the nine tenets of TribalCrit, see Brayboy, 2005.) Additionally, some Indigenous scholars do not view theory merely as an abstract thought, but they view theory as a roadmap for the continuous survival of their community in a society where European thought seems to be the dominant discourse (Brayboy, 2005; Smith, 2001).

An example of a research study employing TribalCrit was conducted at a predominately White research I university; Castagno and Lee (2007) examined a university's policies dealing with racial diversity. These scholars were concerned with two issues: (1) interest convergence and Indian mascot policies and (2) interest convergence and ethnic fraud policies. The first issue dealt with the university, which did not have a Native mascot, but had a policy allowing a sister institution to continue to use a Native mascot even after Indigenous people expressed discontents because they felt that it was a misrepresentation of their cultural symbol and that these symbols were used to portray or stereotype Indigenous people as "bloodthirsty savages" (p. 5). Indigenous

people argued that the university's policy used weak language that discouraged rather than banning the use of Native mascots. Moreover, the university's policy went on to say that "the Athletic Board will not schedule games with teams that have Indian mascots unless the team is a traditional rival or a conference member" (p. 7). Again, Indigenous people argued that this clause still served in the interest of the institution leaving Indigenous people to feel like their voices were not being heard and that the institution was not concerned about the interests of Indigenous people. In other words, the White institution was more concerned about its own interest.

The second issue Castagno and Lee (2007) investigated was concerning ethnic fraud policies. Ethnic fraud occurs when students, faculty, and/or staff identify themselves as a member of a particular ethnic group for personal gains (e.g., scholarships, jobs, special programs, and other economic incentives), but who are not "really" a part of the ethnic group. The participants in this study went to the university proposing that they implement a policy similar to the policy at the University of Oklahoma, which has a formal verification policy. This proposed policy would potentially cause many cases of ethnic fraud to cease and appropriately distribute these gains to the worthy constituents. Because the university refused to incorporate such a policy citing high costs for implementation as its reason, Castagno and Lee (2007) argued that the university and other universities with similar policies embrace policies that replicate a superficial approach to achieving diversity, equity, and the like. These researchers used TribalCrit to understand how these two policies are a contributor to the longstanding legacy of racism and colonization.

Another type of theory has come about since the inception of CRT is LatCrit. LatCrit examines the positioning of Latinos/as, especially those in the United States with the hopes of better positioning Latinos/as in U.S. society (Fernández, 2002). LatCrit draws on the tents of CRT, but LatCrit also encompasses unique issues directly related to the Latino/a community including immigration, language, and phenotype (Bernal, 2002).

Fernández (2002), a doctoral student, conducted a study with Latino/a high school students who experienced racial injustices. Fernández interviewed high school students and college students who attended the same high school, which had a 90% population of Latino/a students. Although most students articulated some of the same "problems" with this particular high school, one student, Pablo, was used as a case for the given study because he was successful at the high school and was currently enrolled in college. Pablo mentioned that even though he was successful in high school and placed in the higher track while in high school, he was not adequately prepared for college.

Pablo explained how the English as a second language (ESL) classes were not challenging (Fernández, 2002). Pablo stated that teachers seemed to be more concerned about discipline and about students being on time as opposed to their learning. Also, students at the high school cut school on a regular basis; this was done most often because students did not feel that they were missing anything by not being at school. Additionally, the school seemed to be focused on a vocational track instead of a college preparatory track. The school did, however, offer advanced courses to students.

Fernández (2002) reported and Pablo also raised the same question: if Pablo was enrolled in advanced courses in high school, then what type of education did his classmates receive who were in lower level courses? Fernández wondered about other

Latino/a students who attended the high school with such low standards. In response to the reflection, Fernández posed the following questions:

> What of those young people who don't "succeed"? The ones who didn't go to college or who didn't even graduate, or the ones who did graduate but are barely literate? Where are they and what have their lives been like since they left high school? What are their prospects for the future? (p. 60)

Moreover, she maintained that such research, which draws upon the stories of marginalized groups, could offer insights to LatCrit and to the educational research community at large.

Villalpando (2003) followed a cohort of approximately 200 Chicano/as students and approximately 200 White students from 40 different institutions over a period of 9 years. He was interested in racial balkanization, which is when students of color divide themselves from the majority culture. Attempting to debunk the myth that racial balkanization has a negative effect on the post-college educational, social, and behavioral outcomes of students of color, he used LatCrit to investigate this phenomenon. Villalpando found that when Chicano/a college students associated with other Chicano/a college students, their socially conscious values and beliefs are strengthened, their willingness to seek out careers that cater to their community increased, and their active participation in community service activities after college increased.

Interestingly, Villalpando (2003) found that when White college students interacted with Chicana/o college students, they (White students) too obtained some of the benefits as Chicano/as. Additionally, Villalpando found that when White college students interacted mainly with other White college students, they do not obtain the same benefits as those who interacted with Chicana/o college students. To bring his point home, Villalpando included a counterstory of Chicana/o faculty member as well as two

undergraduate Chicana/o students. In the counterstory, several “central cultural practices, beliefs, and norms of the peer group that function as empowering and nourishing cultural responses for Chicano/a students” were cited (p. 639). These included a strong Chicano/a cultural consciousness, a connection to their spirituality, a strong commitment to their community, and a strong influence from their family. A LatCrit lens allowed Villalpando to use race-oriented epistemologies to validate that these Chicana/o students were engaging in a self-preservation as opposed to a self-segregation to debunk the “racist and white supremacist ideologies that frame and promote deficit-based beliefs about students of color in higher education” (p. 640).

In another study, Solórzano (1998) examined the racial and gender microaggressions that affected the career paths of Chicano/a doctoral fellows. Because the doctoral degree gives individuals access to becoming a university professor, Solórzano wanted to examine how race and gender played out in the doctoral experiences of Chicano/a students. (Because I am more concerned about the racial implications of this study, I only highlight the racial experiences here.) In this study, Solórzano found that these scholars felt out of place in the university setting (both undergraduate and graduate) because of their race, believed that their professors had lower expectations for them, and experienced racist attitudes and behaviors from both their professors and their fellow students. Solórzano concluded that even at heightened educational levels where conditions might seem to be free from racism such as a doctoral program, the forms of racism might be a little more subtle. Also, these students’ experiences reinforce the idea that students of other racial groups’ experiences are critical to understanding the experiences of all students of color.

Valenzuela (1999) examined the experiences of Mexican youth in a high school struggling to gain access to an equal educational opportunity. Although she addressed the schooling experiences of Mexican students and did not mention CRT in her analysis, she examined these experiences through a critical race lens. In her book, *Subtractive Schooling: U.S.-Mexican Youth and the Politics of Caring,* Valenzuela reported that Mexican students were judged based on their attire, were viewed with negative beliefs because of their bilingualism, did not have books for some classes, and walked out of class to protest against the injustices that they experienced while at the school. The most disturbing racial phenomenon that was discussed dealt with reciprocal relationships. Because teachers did not exhibit reciprocal relationships, the Mexican students viewed this practice as a rejection of their culture. This example, too, brings issue of race and culture to the forefront of its analysis.

Conclusion

CRT is a theoretically and methodologically sound framework that allows us, as researchers, to bring race to the forefront of our analysis in various interdisciplinary, educational research studies. If the goal of educational institutions is to recruit and retain students of color, then these students must be recognized as “holders and creators of knowledge” (Bernal, 2002, p. 106) even though their knowledge might not reflect the beliefs held by the dominant population. CRT maintains that the “histories, experiences, cultures, and languages” (p. 121) of students of color are acknowledged and respected.

As the examples cited in this chapter demonstrate, students of color, whether they are African American, Latino/a, Chicano/a, Native American, Asian, or representative of any other marginalized group, have in common the experience of constructing a

racialized identity (Ladson-Billings, 2000). Also, these marginalized groups have to confront racism on different fronts (Bernal, 2002; Solórzano, 1998). With regards to race in education, I believe Hilliard (2001) said it best when we he stated:

> So we have two major concerns. First, there is the need to access and to dismantle a tremendous array of aggressive negative beliefs, behaviors, and strategies. Second, there is the need to construct normal nurturing. There is no mystery about how to provide a high quality of teaching to people of African ancestry or to anyone else. There is only the matter of will. (pp. 25–26)

Although Hilliard was speaking in regards to the will to educate people of African descent, I extend his argument to race and/or racism. Theoretical perspectives such as CRT are designed to frame research embedded in a racial context. The question is do we, as education researchers, have the will to employ these theoretical frameworks, which often make some groups of people uncomfortable.

Moreover, the new question regarding theoretical frameworks for students of color "would ask how these traditional interests and cultural artifacts serve as vehicles to limit and bind the educational opportunities of students of color" (Tate, 1997, p. 234). New and different theoretical frameworks are needed to better address the needs of students of color, especially with regards to African American male students. These frameworks must allow researchers to examine and act upon racial change in order to eradicate (as much as possible) racial inequalities and injustices, and provide access to equitable schooling practices, especially in (undergraduate) mathematics (Parker & Stovall, 2004). Such scholarship in education is long overdue (Gordon, 1990).

Furthermore, these theoretical frameworks are also needed to contribute to knowledge production. Ladson-Billings (2000) asks, "But how can the full range of scholarship be explored if whole groups of people are systematically excluded from

participating in the process of knowledge production?" (p. 271). Similarly, I am seeking to employ CRT because it does not contribute to the marginalization of African American male students, but it provides a space for them to contribute to knowledge production (Parker & Stovall, 2004). Researchers should be more willing to listen to scholars of color and to seek to understand the meaning(s) behind the stories. This paradigm reinforces what I want to do with my participants; that is, listen to their stories of how being African American and male played out in their educational experiences, especially with regards to college mathematics. In the next chapter, I elaborate on how I carried out the investigation methodologically to capture the stories of four African American men who were high-achieving mathematics college students.

CHAPTER 4

METHODOLOGY

This chapter explores the methodological approach used to conduct my dissertation study. I begin the chapter with a brief description of the purpose of my project. I then provide a description of qualitative, case study, and multiple case study research methodologies, respectively. In the following section, I provide a discussion about my pilot study elaborating on what I learned from the pilot study that assisted me with the project. Next, I describe how the participants were selected, explaining the difficulties I experienced in finding participants, as well as the research setting. I discuss data collection, data management, data analysis, and data interpretation. I then address my subjectivity and issues related to validity, reliability, and ethics. I conclude the chapter with a brief overview of my methodological approach.

Purpose of the Study

The purpose of my study was to investigate the mathematics educational experiences of African American men who negotiated the mathematics pipeline at their respective undergraduate colleges and universities. Coupling qualitative research methodology with critical race theory (CRT), I chronicled the experiences of four mathematically successful African American men who are currently graduate students in mathematics or mathematics education. The study allowed these four African American men to explore how they gained access to college mathematics, how they attained an undergraduate degree in college mathematics, and how their race and/or racism affected

(or not) their performance in college mathematics and throughout their lives as African American men. The following research questions were used to guide the investigation:

1. To what factors and/or experiences do mathematically successful African American men attribute their success with mathematics as a major in college?
2. What did these mathematically successful African American men do inside and/or outside of the college mathematics classroom to warrant success as college mathematics majors?
3. How did these mathematically successful African American men negotiate their race and/or racism during their mathematics experiences and as African American men in general?

Qualitative Research

Qualitative research methodology was employed during this dissertation study. While doing qualitative research, researchers open themselves up to consider different terminology as well as different methodologies in completing the research process (Bogdan & Biklen, 2007). With qualitative research, “the researcher’s primary goal is to add to knowledge, not to pass judgment on a setting” (p. 38). As such, my dissertation study adds to the knowledge base concerning the successful schooling experiences of African American men, particularly in college mathematics.

As I began to fine-tune my research agenda and craft this dissertation research, I knew that it would be beneficial for me to employ a methodological framework that was consistent with the study’s aim. Being trained in quantitative methods, I was conditioned to think of a quantitative strategy as an avenue to pursue my research study. I knew, however, that I had to employ a methodological framework that would allow me to

gather a descriptive account of how African American men make meaning of their (mathematics) schooling experiences (Bogdan & Biklen, 2007). Qualitative research has provided me with this sense of meaning making and given me a different vocabulary and methodological procedure to employ regarding conducting this research investigation.

In addition, qualitative research is consistent with my theoretical framework, CRT. The use of voice through narratives, storytelling, and so on is common among both critical race theorists as well as qualitative researchers (Bogdan & Biklen, 2007; Parker, 1998). These narratives challenge existing notions of race and promote social change (Parker, 1998). The stories told in this study regarding my participants' experiences in mathematics as African American men sought to bring issues of race and/or racism to the forefront. Having provided information about qualitative research and its consistency with CRT, I now address my chosen methodological subset of qualitative research: case study research.

Case Study Research

Under the umbrella of qualitative research, I conducted a case study. As qualitative researchers, we seek to describe and understand the specific cases that we study (Bogdan & Biklen, 2007). Case study research "is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 2003, p. 13). Further, case study researchers investigate existing problems or cases for the purpose of explaining, understanding, and making the public aware about the cases (Hays, 2004). The goal of case study research is not to generalize; rather, it stresses the uniqueness of each case (Hays, 2004). Schram (2006) argues, "Its strategic value lies in its ability to

draw attention to what can be learned from the single case" (p. 107). Additionally, case study research allowed me to investigate my participants' mathematics (educational) experiences by providing thick descriptions of each case (Merriam, 1998).

Merriam (1998) purports that case study research possesses the following three characteristics: particularistic, descriptive, and heuristic. The first tenet, particularistic, focuses on a particular situation. In this study, the shortage of mathematics success stories of African American men regarding their educational experiences is considered the particularistic aspect. Second, case studies are descriptive, meaning that they provide rich descriptions of the case. I have provided rich descriptions of my participants in distinct cases (for each participants' case study, please refer to chapter 5). Third, case studies are heuristic, meaning that they improve the reader's understanding of the topic. This study has addressed the heuristic tenet by adding to the reader's knowledge base concerning the experiences of African American men in undergraduate mathematics.

Multiple Case Study Research

With describing each case, I employed the multiple case study approach. Multiple case studies are also referred to as multicase studies or collective case studies (Bogdan & Biklen, 2007; Merriam, 1998). A multiple case study is done when researchers carry out a case study in which more than one case is involved (Merriam, 1998). Because I had four participants for this study, I reported four case studies in the findings section of the next chapter (chapter 5). Merriam (1998) asserts, "The more cases included in a study, and the greater the variation across the cases, the more compelling an interpretation is likely to be" (p. 40). Additionally, the inclusion of multiple cases in my dissertation study was a methodological approach to validate my findings across cases (Merriam, 1998).

Although I sought neither to discover common themes among my participants nor generalize my findings to the entire population of successful African American men in college mathematics, the common themes that I identified across the four participants' cases in the data were reported.

When conducting multiple case studies, Bogdan and Biklen (2007) suggest that researchers not conduct multiple case studies simultaneously. They argue that doing so might confuse the researcher. As such, I took heed to Bogdan and Biklen's advice and collected as much data as possible for each case before moving on to subsequent cases. Because I conducted a pilot study during the spring semester of 2007, I knew firsthand the amount of time and energy that I needed to devote to each case. I now turn to what I learned from conducting my pilot study.

Pilot Study

During the spring semester of 2007, I conducted a pilot study; this pilot study was a single case study of an African American male Master's student in mathematics who reflected on his undergraduate mathematics experiences. Three brief interviews, ranging from 20 to 30 minutes each, were conducted, audio-taped, transcribed, analyzed, and coded. In addition, I observed the participant three times during the pilot study.

The search for a participant for my pilot study was not as exhaustive as it was for my dissertation study, which I discuss in the next section. The first possible participant who I approached regarding participation in my pilot study worked in the mathematics laboratory at a local university; however, he did not agree to participate in the pilot study. I was confused as to why he did not elect to complete the study. As I reflected on his refusal to my invitation, I realized that I was asking much from him and not

compensating him in any shape, form, or fashion. Another thing that I learned from that experience was that I needed to “sell” my research and present it so that any African American male graduate student in mathematics or mathematics education would be willing to participate.

With my pilot participant, I attempted to observe him practicing everyday mathematics. I observed him in a couple of mathematical settings (i.e., teaching his mathematics class and taking an advanced mathematics graduate course). I learned that observations were not extremely useful as it pertained to this study. Also, I found the observations did not add thick descriptions to the case. Therefore, I chose not to observe participants for my dissertation research. As a result, I added the dimension of artifacts as a supplement for collecting data, which I discuss in more detail in the data collection section. In addition to the realizations expressed above, I also learned from my pilot study that it would take a considerable amount of time to transcribe, analyze, and report my findings while conducting my dissertation research. The pilot study allowed me to “experiment” with qualitative research methodology. Throughout my pilot investigation, I learned these valuable lessons, which led to my becoming a more competent qualitative researcher with regards to my dissertation research.

Participant Selection

Four participants were selected for this dissertation study. The three criteria for participant selection for the study included: (1) self-identify as an African American man, (2) have majored in mathematics as an undergraduate student, and (3) be currently pursuing a graduate degree in mathematics or mathematics education. By selecting African American men who were pursuing advanced degrees in mathematics or

mathematics education, I sought to select African American men who were continuing in the mathematics pipeline, thereby, strengthening my argument that they were successful in college mathematics.

Some researchers suggest that qualitative researchers select participants with whom they have little or no prior experiences (Bogdan & Biklen, 2007; Glesne, 2006). With this study, I had little to no prior relationships with all four of my participants. Glesne adds that if researchers conduct research with participants whom they have prior relationships, then this might cause researchers not to notice unique aspects about the participants. Drawing from this reasoning, I elected not to select African American male participants who were mathematics education graduate students at Georgia State University (GSU) in the Department of Middle-Secondary and Instructional Technology (MSIT) (i.e., my department) who fit my study's criteria.

To make initial contact regarding my study, I invited participants by posting flyers, sending emails with my recruitment letter (see Appendix A) to department chairs and graduate students, and telling others about my study (i.e., word of mouth). I contacted an African American Graduate Student Center at a local university and attended a meeting with another university's mathematics club to find a participant. I initially sought five participants as I indicated in my dissertation proposal. After these means did not yield five participants (much to my surprise), I had to go back to the drawing board.

Being frustrated that I did not find five African American men to fit my study's criteria, I began to search various colleges' and universities' websites. I made telephone calls and sent emails to faculty members in mathematics and mathematics education

departments about my research. I mentioned my study again to my doctoral colleagues in an attempt to find participants, especially given that a few of them were directly related to some of the colleges and universities in which I sent out initial requests. I received countless emails from mathematics and mathematics education department chairs, faculty members, and graduate students alike from these institutions echoing the same message: that they could not locate a single African American male graduate student in their program that fit the descriptors for my study. I even began to search the websites of various school districts to locate high school mathematics teachers who were African American men who might fit my study's criteria.

While the historically Black college and university (HBCU) that I contacted did not have an African American male graduate student in their mathematics program (the mathematics department had just graduated two African American men during the spring semester), I played phone tag with a faculty member in the mathematics education department who might have possibly had a few African American men. Nonetheless, I found my lack of eligible participants to be disheartening considering the fact that I contacted approximately ten higher education institutions within a sixty mile radius of GSU. What are the implications of the shortage of African American men enrolled in these graduate programs on the field/practices of mathematics and mathematics education if there is such a shortage of African American male graduate students in mathematics and mathematics education in a city that has both several higher education institutions available for students to pursue graduate degrees and several college-educated African American men?

I must admit that I became somewhat discouraged when I could not find participants for my study. Two of my doctoral colleagues, who were also at the data collection stage, were using former students as participants for their studies. I questioned whether I had thought through this participant aspect thoroughly. I also began to wonder about graduation; how would I graduate without conducting a dissertation study? Furthermore, I wondered if my dissertation topic should have been changed altogether.

After a tedious and rather exhaustive search (and much prayer), I finally had four African American men who agreed to participate in my study. These African American men made recommendations of other African American men who met the criteria for my study, to no avail. Nevertheless, the four African American men who were selected as participants for this study were Antonio, Rico, Dedrick, and Roger. Luckily, all four men completed the study from the beginning of the study until its completion. I report how I came in contact with the four participants and present their case studies in the next chapter.

Research Setting

Because my participants completed their undergraduate studies in mathematics at various HBCUs, I did not have a single research site for this study. Over the period of 7 months, I met my participants at their proposed locations, which were locations most convenient for them. The research setting for data collection included my office at GSU, GSU's library, and two local universities. By allowing the participants to choose the research site, the participants were more comfortable sharing their experiences at their specified research settings (Glesne, 2006).

Researchers recommend that qualitative researchers conduct research in settings in which they are not familiar (Bogdan & Biklen, 2007; Glesne, 2006). Conducting research in a setting in which you are familiar, commonly referred to as doing research in your backyard, might be beneficial if you are attempting to save time and have easy access to participants (Glesne, 2006). Doing research in your own backyard might not necessarily be beneficial, however, because the researcher might be too familiar with the setting (Glesne, 2006). Hence, I chose not to research in my own backyard by selecting African American men who are currently enrolled in GSU's doctoral program in mathematics education with me (as previously noted). As Glesne points out, "When everything is different, you are more open to new understandings" (p. 31). In the case of my research, everything was different. These different dimensions included the participants themselves, their undergraduate institutions, their experiences in and with mathematics, and their experiences with race and/or racism. Additionally, I aimed to be open to new understandings by selecting participants with whom I had little to no prior relationships.

Data Collection

At the outset, I gained permission from my participants for the study by obtaining their signatures on the consent from approved by GSU's Institutional Review Board (IRB). (For a copy of the consent form, please refer to Appendix B.) To initiate the data collection process, I met informally with two participants and spoke with two participants over the telephone regarding the specifics of my study. By making contact with my participants prior to the study, I was able to explain that participation in the study was voluntary and what data would be solicited from them. This contact also served as a

vehicle to establish rapport with my participants. After that initial contact, I began data collection during June of 2008 and continued until December of 2008.

Because case study research draws upon different sources for data collection, this methodological approach validated my utilization of surveys, interviews, and artifacts as data collection methods (Merriam, 1998). A survey was given to my participants prior to their first interview detailing information pertaining to their demographics, family, education, and so on. The survey instrument used for this dissertation study is located in Appendix C.

Along with completing the survey, each participant completed three structured interviews. The research studies conducted by Herzing (2002) and Stinson (2004, 2008) strongly influenced my development of my interview questions (see Appendix D for sample interview questions). Nonetheless, three interviews were conducted, and each interview lasted between 35 minutes and 1 hour. I audio-taped and transcribed each interview before conducting the next interview. I chose interviewing as a data collection method because interviews allowed me to hear the participants' "voices." The usage of voice also aligned with CRT, which seeks to give voice through storytelling of those in marginalized groups whose voices have been silenced (Delgado, 1998; Dixson & Rousseau, 2005; Taylor, 1999). Additionally, interviews petitioned my participants to reflect and (re)construct their mathematics and racial experiences in their own words.

For the first interview, I developed questions after reviewing the participants' initial surveys and selected other questions from my initial interview list of questions. (For a list of my initial interview questions, please refer to Appendix D.) The first interview consisted of information regarding their K–12 educational experiences as well

as college experiences in school in general and in mathematics in particular. The first interview also required the participants to express definitions of mathematics, success, and success in mathematics in their own words.

The second interview delved deeper, soliciting details about some of the issues that arose during the first interview. As a result, I read and reflected on each interview before conducting the subsequent interview. In addition, I requested that my participants bring some artifacts to the second interview as a catalyst for discussion. I suggested that they bring approximately three artifacts, and I specified that I would like for at least one artifact to be indicative of their undergraduate mathematics experience. After discussing the artifacts, the second interview delved into specific details about their undergraduate mathematics experiences and chronicled why the participants decided to pursue an advanced degree in mathematics or mathematics education. At the conclusion of the second interview, I provided my participants with a research article and urged them to read the article before we conducted the third and final interview.

Merriam (1998) supports that case study researchers can provide vivid materials (e.g., quotations, newspaper articles, journal articles, and so on) to illustrate the complexities of a case. I gave my participants the research article written by Duncan (2002) titled, “Beyond Love: A Critical Race Ethnography of the Schooling of Adolescent Black Males.” In this article, Duncan investigated the academic as well as social lives of Black male students at City High School, a racially integrated, competitive magnet academy. He examined the stories of teachers, administrators, and students to pinpoint how Black male students were excluded from City High School. He also sought to ascertain what contributed to the attrition and retention rates of Black male students at

the school. Duncan used the term "*différend*" to refer to "a conflict between two parties that cannot be equitably resolved for lack of terms to which all parties can agree" (p. 134). Applying this concept to his research, he found that members of the dominant culture did not understand the ramifications of events expressed by Black male students. Furthermore, members of the dominant culture perceived the events as "happenstances" of an equitable system.

Duncan (2002) proposed that Black male students were *beyond love*, a concept that signifies how these students are "excluded from society's economy and networks of care and thus expelled from useful participation in social life" (p. 140). Duncan addressed the complexities concerning Black male students having access to a quality education. Similarly, my research sought to understand how African American male students gained access to mathematics. In addition, Duncan pointed out that while Black males students might have access to a school like City High School, the structures within the school that are used to sustain oppression must be examined. Furthermore, he charged researchers and practitioners alike to listen to what Black male students have to say about their schooling experiences.

In this study, I presented the Duncan (2002) article to my participants because it employed a critical race theoretical perspective, which is the lens through which I situate my epistemological stance and the theoretical framework used for my study. Another reason for including this particular article was that it dealt specifically with the schooling experiences of Black male students. And most important, the reason I included the article was that it utilized "voice." In other words, the Black male students in the article were able to "tell it the way it is." For these reasons, the Duncan article was used to elicit

responses regarding issues surrounding race to further engage my participants in the study and to link (or not) the racial issues highlighted in the article to their own experiences.

For the third interview, I began by collecting my participants' thoughts on the research article written by Duncan (2002), allowing the article to serve as a catalyst to bring issues surrounding race to the forefront. I did not pose any questions to the participants about the article. I wanted to ascertain what they gathered from the reading. After listening to their thoughts on the article, I asked them about their own experiences with race and/or racism in school and society in general and in mathematics in particular.

While collecting data, I simultaneously wrote notes in my researcher's notebook. Bogdan and Biklen (2007) suggest that qualitative researchers reflect and write memos as soon as they have finished collecting data. Furthermore, Hays (2004) suggests that researchers review information as soon as possible and keep a written diary expressing their feelings. These reflective writings are designed to make the research process more rewarding for the researcher (Bogdan & Biklen, 2007). I did, indeed, take the advice of Hays and Bogdan and Biklen and kept detailed notes about the research process, which aided in the data management stage.

Data Management Plan

The data collected for this dissertation study were maintained in digital form (i.e., digital recorder and Microsoft word documents) and paper form (i.e., IRB consent forms, surveys, and interview transcripts). Electronic files of all the data were stored on my computer. Also, hard copies of the data were stored in a file cabinet. Glesne (2006) suggests that qualitative researchers keep analytic files as they collect data. Borrowing

from Glesne, I kept a folder on each participant with hard copies of their IRB consent form, initial survey, interview transcripts, and my written notes. These hard copies of their documents were placed into each participant's file. Also, pseudonyms were used to label the participants' files in order to ensure confidentiality (Bogdan & Biklen, 2007; Glesne, 2006; Merriam, 1998).

Bogdan and Biklen (2007) suggest that qualitative researchers not procrastinate when managing data. I learned first-hand from my pilot study that getting right to the task of transcribing interviews and managing the data is a must. Moreover, getting right to the task of managing the data produced greater recall of the details pertaining to the research process (Bogdan & Biklen, 2007).

Data Analysis

After I collected and managed the data, then I began to formally analyze my data. With analyzing data, qualitative researchers have to provide descriptions of the research study, search for patterns (if any) in the data, articulate explanations for different phenomena, create hypotheses, and sometimes cultivate theories (Glesne, 2006). While analyzing the data, I first provided rich descriptions of each case study. Then, I searched for similarities and dissimilarities within each case. Next, I sought to explain why different phenomena were present in my research. As of yet, I have not cultivated any theories from my data. As mentioned previously, I wrote notes in my researcher's notebook while I collected and managed the data. These notes also assisted me in the data analysis stage. I believe they helped me to develop a better understanding and make sense of each case (Merriam, 1998). Further, the notes also assisted me in articulating what I understood about each case.

Additionally, I used analytic coding to help analyze my data (Glesne, 2006). With coding, qualitative researchers must develop coding categories and a means to sort through them (Bogdan & Biklen, 2007). Silverman (2001) mentions that small numbers of texts may be coded and analyzed very differently. While conducting my pilot study, I realized that coding can become extremely difficult (i.e., some codes may overlap, some codes can be open to several interpretations, etc.). I found the coding process to be difficult with my dissertation data as well. Nevertheless, Silverman reminds qualitative researchers that we should not expect to place everything in a perfect category: "the idea of 'completeness' may itself be an illusion. Surely, there cannot be totally complete data" (p. 830). I learned firsthand from coding my data that there was no idea of completeness; rather, the data were coded and categorized according to my analytical lens at the time of the coding process.

With analyzing my data, I also triangulated the data. I adopted Bogdan and Biklen's (2007) definition of triangulation to refer to "the use of multi-data sources or theoretical perspectives" (p. 275) in order to gain a better understanding of the experiences of African American men in college mathematics. For this study, I used surveys, interviews, and artifacts as methodological procedures to triangulate the data.

There are two stages of data analysis with the multiple case study approach, and they are within-case analysis and cross-case analysis (Merriam, 1998). For the within-case analysis, I analyzed each case separately. I completed the within-case analysis stage first with my data and member checked my interpretations with my participants before I began the second stage. The second stage, cross-case analysis, entailed building and strengthening arguments across cases. Using cross-case analysis, I developed more

descriptions, understandings, and explanations across the four cases. With analyzing data, Merriam (1998) purports, “the real learning can only take place in the doing” (p. 156). I found that my real understanding of analyzing data came in analyzing data in and of itself. I followed the suggestions offered in the research literature, but I did not fully comprehend how to analyze data until I was presented with the task of doing it. I adopted this same philosophy from Merriam when interpreting my data also.

Data Interpretation

As forestated, I conducted three interviews with my participants as well as gave them a survey and requested for them to bring artifacts to the second interview. I realized that I was the sole interpreter of the data (Merriam, 1998). In order to ensure that I adequately interpreted my participants’ comments, stories, and experiences, I validated my interpretations of the findings by member checking. (To view my member checking letter, please refer to Appendix E.) When there was a dispute with my participants when it came to my interpretations of the data, it was important for me to remember: “one voice or narrative is not privileged over another. In cases of disagreement as to the interpretation of what is occurring in a research study, researchers’ and participants’ narratives are both presented as point and counterpoint or narrative and counter-narrative” (Milner, 2007, p. 396). As such, I had to go back to my data and accurately represent my participants’ voices in times of disagreements.

In addition to member checking the interview data, I also member checked about my interpretations of the survey and artifacts. Merriam (1998) suggests that case study researchers continuously member check throughout their entire research study, and I member checked all of the data before I move to the next stage in the research process

(i.e., submitting my findings to my doctoral colleagues, my major professor, to my committee members, and so on). Glesne (2006) recommends that qualitative researchers share drafts with their participants and that sharing drafts results in growth of both the researcher and the researched about the phenomenon being investigated. In order to achieve this goal, I shared each participant's case study with him. I also shared other information with regards to my dissertation with my participants to contribute to their growth as well as my growth concerning the experiences of African American men in mathematics.

Along with seeking assistance from my participants, I also sought assistance from my doctoral colleagues in interpreting my findings by encouraging them to read and comment on drafts of my analysis (Glesne, 2006). I shared drafts of the analyzed data with members of my Saturday writing group. This process offered me a different perspective on interpreting the data and provided a space for me to address questions pertaining to my data. It also allowed me to discuss my findings, which aided in my interpretations of the findings.

Glesne (2006) reminds qualitative researchers that when we notice something, we do not notice something else. While seeking to interpret my findings, I had to ensure that I accounted for as many aspects or angles of the data as possible. Glesne (2006) also reminds qualitative researchers to reflect on why we did indeed notice what we noticed. In reflecting on my own experiences as a successful African American male student in college mathematics, I had to think about the implications of my experiences on my own research. In other words, how did my past experiences or subjectivity play out in terms of

noticing what I noticed in my data analysis? I now address how my subjectivity influenced my research study.

Subjectivity

I managed a portion of my subjectivity by including the foreword chapter in my dissertation chronicling my story as a successful African American man in college mathematics (see foreword). This methodological approach is also consistent with CRT, which seeks to value voice as a source of knowledge (Dixson & Rousseau, 2005). In the foreword, I presented my own voice by reflecting on and articulating my beliefs, stereotypes, and presuppositions. I also chronicled and explored some of my own experiences with the discipline of mathematics, with college, and with race/racism.

The reason why I included the foreword was because my study of successful African American male students in mathematics mirrors my own schooling experiences; therefore, my subjectivity unfolded during the research process. Glesne (2006) argues that subjectivity can contribute to research. Not only did my subjectivity contribute to my research, but also my subjectivity informed my decision to engage in this particular research project itself. Ladson-Billings (2000) adds, “this discursive turn is not merely a narcissism; rather, it is a concern for situating myself as a researcher—who I am, what I believe, what experiences I have had—because it affects what, how, and why I research” (p. 268). I argue that my discursive turn occurred throughout my doctoral studies of educational research, and this turn influenced why I have decided to undertake this research study on successful African American men in college mathematics.

Milner (2007) argues: “Researchers in the process of conducting research pose racially and culturally grounded questions about themselves. Engaging in these questions

can bring to researchers' awareness and consciousness known (seen), unknown (unseen), and unanticipated (unforeseen) issues, perspectives, epistemologies, and positions" (p. 395). He goes on to argue, "Researchers' engaging in this process of reflection regardless of their particular study could bring to their consciousness explicit, hidden, or unexpected matters, which can have a bearing on an entire research study" (p. 395). I concur with Milner's arguments and strived to be reflective throughout the research process, especially when I discussed my subjectivity.

Addressing my subjectivity, I embraced Peshkin's (1988) advice that researchers should "systematically identify their subjectivity throughout the course of their research" (p. 17). From the beginning of this research project, during my data collection, and during my writing up of the results, I was constantly aware of the fact that my own experiences as a successful African American male student in college mathematics took form during the research process. Moreover, my own academic experiences in a predominantly White elementary school, a predominantly African American junior high school, a predominantly African American mathematics and science high school, and an HBCU shaped how I interpreted my research findings. In addition, my graduate school experiences in mathematics at an HBCU, my doctoral studies in mathematics education at a racially diverse research institution, and my religious upbringing in the Church of God in Christ (COGIC) have shaped how I have constructed meanings of my data.

As such, I had to be sure to manage my subjectivity. By doing so, I had to make certain that I was not trying to make my participants' stories resemble my own. Even though we have all experienced success in college mathematics as African American men, I understand that everyone's stories and experiences were uniquely different. In

addition, I set out not to proselytize during this research process. My goal in conducting this research was not to "brainwash" my participants or get them to say what I wanted them to say. Rather, I engaged in this dissertation study to learn from these mathematically successful African American men, especially with regards to their experiences with race and/or racism. In order to manage my subjectivity, I had to be sure to continuously watch for clues that demonstrated my subjectivity during the research process (Glesne, 2006). I concur with Peshkin's (1988) explanation that subjectivity

> should result from a formal, systematic monitoring of self. Speaking personally—but meant generally—I see this monitoring as a necessary exercise, a workout, a tuning up of my subjectivity to get it into shape. It is a rehearsal for keeping the lines of my subjectivity open—and straight. And it is a warning to myself so that I may avoid the trap of perceiving just that which my own untamed sentiments have sought out and served up as data. (p. 20)

For example, if I was interviewing a participant and he said something that I did not particularly agree with, I had to be sure not to do the following: look as if he was wrong in his thinking, not consider his perspective, or discredit his voice from my data. Therefore, I had to be certain that I monitored myself throughout the research process.

Validity, Reliability, and Ethics

Every qualitative researcher is presented with issues regarding validity, reliability, and ethics (Merriam, 1998). Further, "All research is concerned with producing valid and reliable knowledge in an ethical manner" (p. 198). I, too, sought to provide valid and reliable knowledge in my work. In this section, I offer a brief synopsis of what each domain (i.e., validity, reliability, and ethics) entails. Then, I discuss how I addressed each in my dissertation research.

Validity refers to the question of whether the research findings match what really happened (Merriam, 1998). Other issues surrounding validity include but are not limited to the following: whether it is worthy to accept someone's interpretation of someone else's interpretation as research, whether the researcher is a valid instrument, and whether the participants have lied to the researcher. With regards to this study, I employed different methodological approaches to address validity. I member checked with my participants to ensure that my results were valid (Merriam, 1998). Even though I member checked, I was and still am fully aware of the fact that the stories in this dissertation are my interpretations of my participants' interpretations. Also, I employed peer examination as well, requesting for my colleagues to comment on my findings. Additionally, I presented my worldview and exposed my theoretical lens in the subjectivity section of this chapter and by including the foreword to my dissertation.

To address validity issues, I also triangulated the data to validate my findings. With triangulation, research findings are usually viewed as more trust-worthy. Merriam (1998) mentions, "Especially in terms of using multiple methods of data collection and analysis, triangulation strengthens reliability as well as internal validity" (p. 207). Therefore, triangulating my data with surveys, interviews, and artifacts corroborated the data findings and aided in addressing both validity and reliability.

Reliability refers to the question of whether research findings can be replicated (Merriam, 1998). Rather than obtaining the same results if the study were conducted by another researcher, reliability also refers to whether the results from the obtained data make sense. In other words, reliability pertains to "whether the results are consistent with

the data collected" (p. 206). According to Yin (2003), "The goal of reliability is to minimize the errors and biases in a study" (p. 37).

Merriam (1998) asserts that case study researchers should explain the theoretical orientation of the study, the criteria and descriptions of the participants, and "the context from which data were collected" (p. 207) to address issues related to reliability. I followed Merriam's advice and explained the theoretical framework that was used to guide this dissertation study, CRT. I also included my foreword of my mathematics story to position how I arrived at this theoretical orientation.

Embracing Merriam's (1998) recommendation, I established the criteria for which I selected participants for this study. The three criteria used for participant selection for this study were: (1) self-identify as an African American man, (2) have majored in mathematics as an undergraduate student, and (3) be currently pursuing a graduate degree in mathematics or mathematics education. I provide a description of each participant in their individual case study in the next chapter. Further, I described the context in which the data were collected for this study (see the research setting section of this chapter). By providing information about the context and specific data from the interview, I sought to validate that the results were consistent with the data collected. As I mentioned above, I also triangulated the data to address reliability issues.

Ethics refers to whether or not the research was conducted in an ethical manner (Merriam, 1998). With regards to qualitative research, these issues include "the protection of subjects from harm, the right to privacy, the notion of informed consent, and the issue of deception" (p. 213). Merriam reminds case study researchers that ethical issues also surface while collecting data.

Although I did not foresee any potential harms with regards to my study, I addressed this ethical standpoint by making my participants aware of possible harms (or lack thereof) associated with the study. I also ensured that my participants' identities were not disclosed by assigning pseudonyms to them, their institutions, and other specific names revealed during data collection. In addition, I did not attempt to deceive my participants. In other words, I did not lead them to believe something contrary to what was written in my IRB consent form as it pertained to what was required for this study. Merriam (1998) reminds qualitative researchers: "All possibilities cannot be anticipated, nor can a researcher's own responses" (p. 218). In the case of my study, all the ethical possibilities were not presented, but if and when these ethical issues surface, I will turn my attention to more seasoned qualitative researcher and scholars concerning issues of validity, reliability, and ethics.

Conclusion

In this methodological chapter, I have discussed how I have used qualitative analysis through the multiple case study approach to investigate the experiences of four successful African American men in college mathematics. I administered a survey, conducted three structured interviews, and solicited artifacts from my participants. In addition, I wrote reflective notes in my researcher's notebook. These methodological procedures were employed to further understand the mathematical, educational, and racial experiences of four African American men.

Also, the participants were important in the analysis process. Through their member checks, I was able to better interpret their experiences through their contexts during the within-case analysis. This stage aided in my cross-case analysis to strengthen

my descriptions, understandings, and explanations across the four cases. In the next chapter, I present the mathematics stories of four successful African American men in college mathematics by reporting and discussing the findings from my data.

CHAPTER 5

FINDINGS & DISCUSSIONS

The purpose of this study was to understand how four African American men gained access to college mathematics and were high achievers in mathematics employing a qualitative research methodology coupled with a critical race theoretical framework. Additionally, I sought to investigate the ways in which these four African American men continued in the mathematics pipeline beyond the mathematics undergraduate degree. This chapter, grounded in data, examines the experiences of four mathematically successful African American men.

Borrowing from Merriam's (1998) analysis of multiple case study research, I first provide within case analyses of each participant. In other words, I present each participant, Antonio, Rico, Dedrick, and Roger, as their own case study in the findings section. Each case study is divided into the following seven categories: introductory vignette, K–12 educational experiences, the journey to mathematics, college experiences, artifacts, critical race reflections, and closing vignette. I draw on the participants' "voices" regularly (i.e., direct quotes) to capture the "essence" of what they are saying. I then offer a cross-case analysis discussion, which examines the data across cases and aligns the data with relevant research literature.

Antonio's Case Study

Antonio's Introductory Vignette

Antonio is a mathematics teacher in a school system in the southeast region of the United States. I met Antonio a couple of years back while tutoring a student who went to the school where he was employed. He was interested in coming to the university where I was completing my doctoral studies to work on his certification in mathematics. He decided, however, to complete his certification and master's through another alternative preparation program.

Antonio was reared in a middle-class household. While his mother has been a real estate loan officer for the past decade, his father was in the U.S. Army and is currently employed by the United States Department of Agriculture (USDA), which he has done for the past 20 years. As an African American male scholar in his mid-twenties, he has a ten-year-old sister and considers himself a role model to her. Throughout his K–12 educational experiences, Antonio remained on the principal's list. He credits himself with always being a "stellar" student in mathematics and says that he has always loved mathematics throughout his schooling experiences. He attended an all-male HBCU in the southeast where he finished a few years ago. In college, Antonio participated in the marching band, concert band, intervarsity, and the rotaract club, where he served as vice-president. Additionally, he participated in a mentoring program while in college.

Currently, Antonio is working on his certification in mathematics, which will lead to a master's degree. In addition, Antonio is taking pre-requisite classes as a post-baccalaureate to enter dental school. He plans to teach mathematics at the high school level until 2010. In August of 2010, he plans to attend dental school full-time. His future

goals include earning a master's degree in mathematics education and becoming a dentist. I now present the mathematics story of Antonio.

K–12 Educational Experiences

Antonio's elementary and middle school experiences were completed in predominantly African American settings. In elementary and middle school, he remained an "A" student. Antonio acknowledged that he has always been at the top of his class in mathematics from as early as he can remember. He credited his parents with instilling educational values in him as a young child. Antonio shared the following regarding his educational experiences as a child:

> And first of all in my household, education is very, very, very important. (He laughs.) It's funny, my mom she did well in high school. My dad, not so well, but at the same time, both of them came to the understanding and conclusion that hey, education is important, and hey, our kids are going to need it. So they stressed it, stressed it, stressed it a lot in our house…When it came to test scores, like I said before, my math was above average. My reading was below average. So I was like, hey, well, I figured by the time I got in the fifth grade, well fourth and fifth grade, I was like I'm a little behind with this reading thing, but my math scores were high. I could still make some opportunity for myself, so let me continue studying this math. Let me continue, you know what I'm saying, mastering math. Even as a young kid, I would take things like tic-tac-toe and SOS and pretty much figure out all the combinations for them, you know what I'm saying? (Interview 3)

Antonio emphasized that his parents stressed education in his household. In addition, Antonio cited instances of finding the number of ways that he could manipulate games. As a child, he engaged in mathematical practices that captured his curiosity.

In the eleventh grade, Antonio revealed that he had the opportunity to attend an SAT preparatory class at a research university. The course, which was held for 4 hours on a Saturday afternoon, focused on the tricks and the trade of the SAT. As a result of this one session, he contended that his mathematics score on the SAT increased by 120 points

and that he learned problem-solving techniques that helped him in high school mathematics. He also noticed mathematical patterns outside of the mathematics classroom, and he cited his AP Chemistry class as an example in which he found these mathematical patterns.

With such a strong foundation in mathematics, Antonio had mathematical confidence. He explained that his mathematical confidence really started in elementary school and continued until he got to college. Speaking about his confidence, Antonio said:

> So my confidence when I step into the math classroom was already high. I already knew I was gonna' get an A. You know, right off the bat. Or I knew that I was gonna' stand out. Now did I study the material? That's where the hard part came in. I already knew that I could step into the classroom and understand everything that the professor puts up on the board. Did I memorize it? Probably not, no. I understand it. There was nothing never over my head. So my confidence in walking into my math classrooms, even in college, but especially in high school, I was already overconfident. (Interview 3)

Because of his previous successful experiences with mathematics, Antonio had become overconfident with regards to mathematics by the time he reached high school. At this point, he knew that he was on a journey to mathematics.

The Journey to Mathematics

Antonio's journey to mathematics began as a young child. He recalled learning mathematics even before he entered school, and he noticed his "gift" in mathematics when he was in the third grade. He stated: "Math just made logical sense to me, so I just stuck with it" (Interview 1). He felt that he was influenced to pursue a major in mathematics because his high school teachers had planted that seed in him. They

encouraged him in mathematics because they saw the special talent that he had with the discipline. Thinking back to his high school days, he communicated:

> So by the time high school came along, my teachers were like you should think about majoring in engineering or math or something. They never said math; they always said engineering. I guess because at that time engineers were making a lot of money or what not or whatever. (Interview 3)

He brought attention to the fact that his teachers did not suggest mathematics per se. His teachers suggested engineering, which is mathematics in nature. He believed that his teachers suggested engineering because of the monetary gains in that field.

When questioned about how he would define mathematics, Antonio offered the following definition of mathematics:

> Uh, I would define math as (pause) the process of thinking logically. Cause, uh, I see it as a lot of times in math, though we use symbols and numbers, it's actually the logic behind it that actually drives it. So I believe that, uh, if you can do math, then you have the ability to think logically, which opens a lot of doors like to like research and things of that nature. (Interview 1)

With this definition, he described mathematics as a process of logical thinking. He also recognized the opportunities that mathematics can provide. In other words, mathematics is the key to the gate of the world of opportunities.

Validating his point that mathematics is the foundation for other fields, Antonio explained this pyramid that he carved out to support his hypothesis. In this pyramid, he placed mathematics as the foundation of all other disciplines. He summed up the pyramid with the following synopsis:

> My thing is if you can understand math, then you have the basic foundation that you can understand anything that operates on this Earth. The only difference I say between math and English is that English is probably, is a subject that's based upon communication. Okay, but there's still logic behind English. Okay your verb goes here, your subject goes

> here, predicate and whatever. So there's still logic behind it. So what is math? Math is just logic. That's all it is. So if you can understand math, you can understand anything. (Interview 3)

College Experiences

Antonio said that he knew that he would go to college ever since he was in the first grade. Because he had done so well in mathematics in school, he figured that he might as well pursue a degree in mathematics. In his upper-level mathematics classes, there were small groups of students, ranging from ten to fifteen students per class. He shared the following reflection about his experience:

> It's funny, uh, cause the classrooms were so small, everyone knew each other. And this is the class where it's pretty much 100% African American males. So it was very easy to relate to those guys. And then being at Delmont it was already dug into your head that this was a brotherhood. So you really feel…it's easy to ask questions to your neighbors next to you. (Interview 1)

He mentioned that there was also a brotherhood at his college. This paradigm was shared among his fellow classmates. Because he could relate to his classmates, he felt comfortable asking his neighbor questions regarding mathematics.

Although Antonio studied primarily with the mathematics majors, he did much studying on his own. He continued to make exceptional grades in mathematics even in college. As far as getting good grades in college mathematics courses, Antonio asserted:

> If you learn a topic, if you keep going back and working out problems at home, and if you did not understand what you were doing, as far as asking the professor and then also reading ahead to know what's ahead and how you would link the last topic or section to the next one. So uh, I believe math has this spiral of learning. And if you miss something, it leaves a gap. And then you have to go back and try to fill in that gap, to make that connection as well. (Interview 1)

He pointed out that mathematics is similar to a spiral. In other words, students must have the center of foundational mathematics knowledge in order for the spiral to persist. If

students want to continue their mathematics spiral, Antonio proposed that students do some independent work, seek out help from professors, read ahead in the text, and make the connections to other concepts in mathematics.

When mathematics problems and theories became difficult for Antonio to understand, he contextualized the problems to fit his own real world situations. He claimed:

> Well, for one, I sat down and actually worked out (the) application process to whatever theory we learned. Say, for instance, the probability of a certain event happening in a certain situation. Well, I actually worked out a situation that dealt with that theory. So with me, the more, the more I practice the applications that I can put into a theory, the better I'll understand it. (Interview 1)

Antonio made the mathematics relevant to him. He developed real world situations to apply to the mathematical theory that he was studying.

Antonio also spoke about the significance of conducting mathematics research to complete the requirements for his senior project. He presented the research project to his academic advisors as well as to his peers. His project was in the area of Numerical Analysis, and he favored this branch of mathematics because it was not heavily populated with proofs. He also chose Numerical Analysis because it analyzes numbers, which interests him.

At his undergraduate institution, Antonio mentioned that there was a mathematics club; however, he did not participate in the club. He attended one mathematics club meeting, and described it as being a tutoring session of some sort. As a result, he was not motivated to go to future meetings. When asked how he believed that a mathematics club should be structured in college, he replied:

> For the most part, it's a social club. Meaning that let's get together, some people having a common goal like getting a math degree or a math minor degree, or you know, something related to math. And then share thoughts and ideas. It actually keeps you motivated in your major… it brings a collective group of people together and then you guys can pretty much go out and see, you know, what's out there after undergrad, that's one thing, one benefit, visiting graduate schools. Another benefit is if you need help, there is someone there to help you. So I think anytime you put a group of people together, it brings some substance to the table. (Interview 2)

In college, Antonio's mathematics professors were described as exceptional. They were willing to help, even though he might not have been enrolled in their class. Several of his mathematics professors were African American men, and most of them were alumni of his college. As a matter of fact, he said that he knew firsthand that a few of them attended his alma mater.

Moreover, while in college, he cited mentoring and tutoring as his two areas of expertise, which he still exercises today. His college professor told him about a community service project they were doing and invited Antonio to join them in the work. He explained:

> It's where, uh, we took students out of the university area…We went out into the community around the university, and we mentored kids. And so I was in charge of the math SAT prep. And so I would basically work out problems with them and teach them little tricks and what not. And uh, also, I used to tutor algebra on the side, for a small fee. (We both laugh.) (Interview 1)

Because of his successful experiences with mathematics and his SAT mathematics preparatory course, he ended up taking the leadership role for the SAT mathematics tutoring. In addition, he tutored algebra to provide him with supplementary income while in college.

Artifacts

Antonio brought his mathematics degree as well as his shirt from the marching band as artifacts. The mathematics degree was the typical college degree with the college's name, student's major, and student's name. He cited the degree as being significant because it represented that he had overcome the challenge, as an African American man, of obtaining a college degree. The other artifact, his shirt, was a marching band shirt with the school's name and mascot on the front. Being in the marching band was extremely demanding with all the practices and football games, both home and away. Antonio played in the marching band all 4 years of college, and he served as the section leader for 2 years. He also played in the concert band, which was a band that practiced and performed primarily during the spring semester. He did all of this while maintaining full academic loads and a maintaining a high grade point average.

Antonio's experiences in the band were relevant to his field of study because he related mathematics to music. With regards to counting the notes in music and counting in mathematics, he commented:

> I see that most people who did music were actually pretty good at math. Because as far as music goes, you have to be able to count fractions. Because half of a whole note is a half note. Half of a half note is a quarter note. Half of a quarter note is an eighth note. Half of an eighth note is a sixteenth note. And it breaks down just like that. And being able to count beats and seconds; that's also math… Fractions, in music, if you don't know it, you'll be off beat every time. (Interview 2)

In this case, Antonio argued that knowing fractions (i.e., mathematics) resulted in being rhythmically acclimated to the music that was being produced. An erroneous understanding of fractions would have resulted in music that was off base.

Antonio expressed that he wished to bring his senior project as an artifact. He had difficulties, however, locating his hard copy of his senior project, but he felt extremely proud of the mathematics research that he had conducted for his senior project. Furthermore, he wished to show the deep levels of mathematical thinking that he exhibited while conducting research for the project.

Critical Race Reflections

Because Antonio's schooling experiences have been primarily in majority African American contexts, he believed that he had not had to deal with racism directly. He was, however, knowledgeable about the racism that is engrained in American society. His interaction with various extracurricular programs outside of school included diverse students, so he got a feel for race relations when interacting with that group. He remembered vividly a trip that he took during the summer with a diverse group of students. Out of approximately 35 students, there were about four African American students on the trip. He recalled, specifically, hanging out with the African American students during the trip instead of the students who were from other racial groups.

Even though he was one of the top students in his class throughout his schooling experiences, he felt that he was average compared to students nationally and globally. He drew attention to the fact that African Americans are at a disadvantage in this country. When I asked him to elaborate on this, he said:

> I watch a lot of PBS documentaries. I've always been interested in the Civil Rights Movement. Uh, you know, learned a lot about slavery and Blacks not being able to read or not just have education, you know. And I knew that me personally, I was in school; I was getting an education. I was making A's and B's. I was one of the top students, so as far as competition, I knew that I would probably be at the top of my race. You know what I mean? And sadly because of the disadvantages that we've been put in in this country, and take that, I guess nationally, globally, uh, I

> might be considered average. But I know why, because here, unfortunately, African Americans are, you know, disserved… And then, you know I understood why we were at a disadvantage. So when I do go out nationally and to my Whites and other races, it's like okay. I made it this far. I really wasn't supposed to cause when you think about our past, the past 400 years, we've been at a disadvantage. And we've struggled to get this far. So just the fact that I've gotten this far and the trials and struggles that I've gone through, are represented by my race and not necessarily me. (Interview 3)

Antonio attributed his making it to his race. In other words, because of our ancestors and the past African American scholars and activists, Antonio believed that he was able to make it in American society. Furthermore, he added: "And you know I thank God for the patriarchs and matriarchs that shaped and formed these opportunities for us" (Interview 3). This statement reified his appreciation for previous African Americans who paved the way for his success.

Reflecting on his experiences with race, he admitted that that he does not look at race. Currently, his two classmates, who are his best friends, are Vietnamese and White. He expressed that he views human beings holistically, rather than solely on race. With regards to the Duncan (2002) article, Antonio offered the following synopsis:

> So already, like, to me, this is what it (the article) says. Before a Black student steps into any arena or any institution or whatever, there's already, uh, a perception of them in the group's mind, and that's what I see here. It's like, okay, even if I'm not qualified to be at this school, quote on quote. It's public school, so how am I not qualified? You know what I mean?...Step two or like part two of that is like okay, okay even if I'm an African American male, and I step into this institution, it's like, you know, as a student, you know, there's your above average, there's your average, and there's your below average. They already think I'm at the bottom or almost average. They don't really think that I can compete. That's what it seems like…. And it's like okay, they already put that strike on me, so it's like you might as well not even be here. And I'm like, if this is a public school, then I have the right to be here because of my neighborhood. And also, what about the Whites that are average and below average? Are you guys saying that they don't belong there? Are you kicking them out? No. (Interview 3)

Antonio spoke passionately about this issue. He declared that racism is a major problem in this society. He credited Duncan for bringing issues like racism to the forefront. Relating the race issue to his personal life, Antonio voiced the following concern:

> See what I'm saying. Let's say they had an experience with an African American male, and I guess they just, you know out, uh, they pretty much play out that experience in their interaction with me. So it's like I can't win for losing, and I just walked into the building. I haven't even said anything yet. (Interview 3)

Antonio knew the consequences of a racialized ideology. He added more statements about the way that racism can show its face. He continued:

> As far as Black males, it's funny because we get it from both sides. It's like, okay you, you're blamed because they consider you inadequate. Say for instance, they consider you inadequate based off of what they see, but they really don't know you. But then when you come back to your own community, and you're trying to get ahead, it's like okay you're considered being quote on quote white. So it's like you're stuck in the middle. (Interview 3)

He expressed his disgust with the fact that African Americans get the negativity from either end of the totem pole. In other words, African American men are labeled negatively based off of society's prejudgments (i.e., they consider you inadequate), and African American men are labeled negatively if they are successful (i.e., quote on quote White).

His discussion regarding racial issues included the usage of Ebonics, which was brought up in Duncan's (2002) article. He noted: "Ebonics, like some Black sub language or whatever you want to call it. But really it's just street talk because we're (African Americans) not the only ones who use it" (Interview 3). He disclosed his frustration with Ebonics being represented in such a negative manner as some type of substandard language, especially when other racial groups use it and are not depicted negatively for

their usage of Ebonics. In addition to his argument about Ebonics, he also critiqued rap music. He argued that rap, as a powerful social tool, should be used to better the African American community. He claimed that Ebonics and rap were used, more often than not, as mechanisms to perpetuate the negative connotations that go along with being an African American in society.

Concluding Vignette

Antonio is an African American male scholar who was successful in college mathematics and who is continuing that success in life. He has a confidence in himself, and he says that the main reason for his strong confidence is due to the fact that he knows who he is as an African American man and knows his history. During our last interview, he had on a shirt representative of his cultural knowledge and ties. He disclosed the following information about his shirt:

> Take a look at my shirt; it's actually a shirt from college. It's the tribe of Kemet. Kemet is actually a tribe around Egypt. And we know that Egypt is very big on mathematics. Uh for me, I already had the confidence that I could do it because when I look back in history, here, especially in this country, math was, we had it down pat, you know, we were masters of it. (Interview 3)

With a knowledge base that traced mathematics back to Egypt, Antonio possessed the historical information regarding the Africana experience in mathematics.

Further, Antonio recognized that he is in a special position to encourage more African American male students to pursue mathematics as a high school mathematics teacher. With regards to encouraging more African American males to study mathematics in college, he remarked:

> Well, as a teacher, I was excited about math, which brought a different twist to the classroom. They saw a young guy doing mathematics, and so you see someone you can relate to, so it's like hey, maybe I can do it too. I

> think that personally what I would do I would go out and continue tutoring high school kids in math and continue to show them, hey, this is not hard as people make it out to be. It really isn't. There is a pattern behind everything, and once you learn the pattern, you can pretty much do anything. And one thing about math is that if you learn one aspect of math, then you can apply it to all of it. So I personally would just show them through tutoring and mentoring how easy it can be. I think that would help a lot of students to go into the sciences or do math or a math minor or something. (Interview 2)

Antonio believed that he was in a unique position to continue the mathematics tradition because of his excitement about mathematics as an African American male mathematics teacher in front of a primarily African American student population. He also referred back to two important attributes that he prides himself on and believes are instrumental in encouraging African American students, particularly African American male students: tutoring and mentoring. Assuredly, Antonio referred to mathematics as "the basics of all subjects" (Interview 3). After reflecting on his college experiences, Antonio acknowledged that he would have kept mathematics as his major, but he would have taken more pre-med classes as electives.

Rico's Case Study

Introductory Vignette

Rico is in his late 20's, and he is the middle child of three children. His older brother is a music producer while his younger sister is a college student. He described his family's socioeconomic status as middle-class. His mother's current occupation is that of a nurse, which she has done for approximately 25 years. Rico completed his undergraduate studies at an all-male HBCU in the southeast where he double majored in mathematics and computer science.

I went to Rico's department to inquire about African American male graduate students in mathematics. The mathematics department's secretary, an older African American woman, told me that he was the only African American male graduate student in the department that she knew of in mathematics. After listening to my research agenda, she assured me that Rico would be willing to help with my study. She also instructed me on where I could locate him.

Previously, Rico held a job in industry for a few years as a system engineer in the northwest region of the United States. He then moved back to the South and accepted a job as a network consultant for approximately 6 months. During this time, he participated in an internship with children at a charter school, which further affirmed his belief that he should pursue a career in mathematics education. During this internship, he worked as a mathematics enrichment teacher with children who needed additional help with basic mathematics skills such as multiplication facts and word problems. Participation in this internship ignited Rico's fire to teach mathematics, which led to his 1 year experience as a high school mathematics teacher. He realized that he had a desire to teach mathematics at the collegiate level, so he enrolled in graduate school.

Currently, Rico is a full-time graduate student working on his master's degree in mathematics with a concentration in scientific computing. In addition to being a full-time graduate student, he works in the university's mathematics lab and takes care of his grandmother periodically. He also tutors mathematics to both high school students and college students to supplement his income. I now present the mathematics story of Rico.

K–12 Educational Experiences

Rico grew up in a majority White town in the southeast and attended majority White elementary, middle, and high schools. He depicted his small town as one having animals, farms, and barns where everyone knew each other in the neighborhood. Rico's grandfather was a pastor; therefore, he spent a significant amount of time at his grandfather's church. He mentioned helping out with various church activities as well as singing in the choir and serving as an usher. In addition, he helped out with the treasury, which aided in developing his mathematics skills.

In the fourth grade, Rico remembered specifically that he earned an award for outstanding mathematics achievement. Although most of his elementary school teachers were White, he stressed that the teacher who gave him a mathematics award was an African American teacher. This African American woman was one of the first teachers to recognize and highlight his mathematical abilities. He received the award for his mathematics aptitude including stellar performances on long division problems, factor trees, problem-solving exercises, and the like.

Although he developed an interest in mathematics around the fourth grade, Rico said that he was not particularly interested in mathematics in middle school. In the following discussion, Rico described his middle school mathematics experience:

> In seventh grade, I struggled in transitional math. I got a B in that class. Uh, what stuck out? I want to say eighth grade; that kind of stuck out. I took Algebra I, and I actually started taking advanced classes in the seventh grade, seventh grade and up. In Algebra I, I excelled in and I started developing a passion, no not a passion, but I started to strive to do well in math because I was trying to keep up with another individual in the class. And I ended up liking the math at the same time, and I got an award as well for excellent mathematics. (Interview 1)

In this case, he equated struggling in mathematics with maintaining a B average. His ideological framework leads him to believe that struggling in mathematics resulted in a B average whereas others might equate a B average in mathematics as satisfactory. Despite his so-called struggles in seventh grade mathematics, he still developed an interest in mathematics. Note, however, that Rico was granted access to advanced mathematics courses in middle school.

In the aforementioned quote, Rico also mentioned that he tried to keep up with another student in the class. This trend continued while he was in high school as well. This young White girl was his competition in mathematics courses, and she pushed him to excel further in mathematics during his middle and high school years. She became the valedictorian of his graduating class, and he admitted that he kept in touch with her concerning her educational endeavors even while they were at two different higher education institutions.

The Journey to Mathematics

Although Rico had exceptional experiences with mathematics as a K–12 student, he admitted that he developed a passion for mathematics in high school. Rico reflected:

> I found myself doing more than I should have in the (mathematics) course. Like even though I wasn't supposed to do other math problems, I would go ahead and take the initiative and try one or I would make up more math problems during that time and see if I could solve it. And that's what I still do. I didn't know it at the time, but that's when I was starting to develop a passion for math. (Interview 1)

Rico described moments of doing mathematics problems above and beyond the exercises that were assigned by his teachers. This practice showed that he had a mathematics curiosity, which strengthened his mathematical abilities. Furthermore, he made up his own mathematics problems to determine whether he could solve them.

Rico thought about different aspects of the mathematical landscape. When asked to provide a definition of mathematics, Rico gave the following response:

> Math is the science of working with numbers, teaching you to think, the science developed to teach you problem-solving skills. Uh, a science that allows you to develop reasoning skills and deductive reasoning skills, developing problem-solving strategies. It's a science that allows you to develop problem-solving skills. (Interview 1)

Rico immediately rendered the idea of mathematics being a science involving manipulations or calculations with numbers. His definition emphasized the problem-solving aspect of mathematics.

Rico is definitely on a journey to mathematics as he seeks to begin a doctoral degree in mathematics within the next year. Although he is not knowledgeable about the historical legacy of African Americans in mathematics, he does know that African American mathematicians exist. In an effort to learn about the mathematical legacy of Africana people, Rico was going to assign the task of researching these mathematicians to his students, but he never found the time to incorporate the project.

College Experiences

Although mathematics was Rico's passion, he also studied computer science in college because he was attracted to the monetary rewards that computer scientists were expected to earn. He did not, however, see the same monetary gains with a degree in mathematics alone. Because of his expertise in both areas, Rico tutored fellow college students in mathematics and in computer programming while he was in college.

Although he did not participate in the mathematics club in college, Rico participated in the computer science club and choir. He also completed missionary work with his grandfather's church. In college, Rico mentioned that his mathematics classes

were small, reminiscent of the size of high school classes. Rico went to several research symposia offered by his mathematics department as a college student. Even though he confessed that the seminars did not relate to his interests, he did cite them as being beneficial. They were beneficial in that they provided him with the outlet of conducting research in mathematics. In other words, he realized that mathematicians can do more than teach mathematics at a higher education institution. He also mentioned being fascinated by some of the theories and ideas that were being discovered by the real world mathematicians.

Rico made exceptional grades in college mathematics courses during his college matriculation. With regards to preparing for mathematics tests in college and studying mathematics in general, Rico stated:

> I would make up my own tests and pull problems from each section that the teacher would possibly put on a quiz or test. And I would work them out and make sure I did them correctly by comparing my answers with the back of the book to see if I was on the right track. (Interview 1)

This practice of making up his own problems and implementing different strategies to solve them was a methodological approach that he first began in high school mathematics. In addition to his own studying technique, Rico attributed other things such as his mathematics professors and his undergraduate mathematics courses to his success in college mathematics. He described the usefulness of his undergraduate mathematics courses:

> I used what I learned when (in college math) I was teaching high school to uh, explain, well, explain. Well, I used those skills that I learned to apply them in high school, when I was teaching high school. And I use those skills today in my classes now in DE and partial DE. And especially in the lab, cause I work in the Math Lab, the tutorial lab, so when I'm explaining problems to them, I use those skills. So I'm grateful for the professors I had in undergrad. (Interview 1)

As indicated, Rico believed that his undergraduate mathematics courses were useful. He believed that they assisted with his teaching of high school mathematics by providing him with a knowledge base concerning mathematics. Further, he believed that his undergraduate mathematics courses helped prepare him for rigorous graduate mathematics courses such as Differential Equations and Partial Differential Equations.

Overall, Rico's mathematics professors were willing to help with mathematics work and provide advice about going to various graduate schools in mathematics. He recalled instances of professors recommending their graduate institutions for him to attend. Out of all of his undergraduate mathematics professors, he had two African American male mathematics professors. He cited one of his African American male mathematics professors as serving as a father figure to him. Describing this professor, Rico articulated:

> Rico: Because he would chew us out when he would hear some type of bad news go on on campus about a student acting up or being foolish or broke into a car. And he would crack down on us like you shouldn't do things like this; I don't know why ya'll don't do this, this, and this. At the same time, he would work out a problem for us and help us along the way. So at the same time, he was like a counselor/teacher in the classroom. And I appreciate him for that.
>
> Chris: Uh-hum.
>
> Rico: Even though we lost class time during his lectures, we lost class time because he wanted to talk about certain things like that, but it was okay. I learned at the same time still. I did well in his class, which I was very appreciative of because I learned in his class at the same time along with the little inspirational talks. (Interview 2)

Rico benefited from the motivational speeches that were given by his African American male mathematics professor. Although he realized that the inspirational talks took away from mathematics instruction, he considered them valuable and relevant to his overall

educational progress. The fact that Rico referred to his African American male mathematics professor as a father figure speaks volumes regarding the importance of providing African American male scholars as role models in the mathematics classroom.

In addition to probing his professors in their offices concerning mathematics problems, he also drew on the knowledge base of some of his peers who he described as having higher order thinking skills. Rico said: “I picked the individual’s brain so I could understand how they were understanding the concept” (Interview 1). He described mathematics study sessions where he would pick the brains of his classmates to understand how they arrived at different complex mathematical processes.

Reflecting on his overall college mathematics experience, Rico thought about his success in college mathematics. He stated:

> I think the things that helped me become better at math was going to see my professors; asking them questions on how to solve a particular problem. Just going back and reworking out the problems. And being able to connect a problem with an analogy or something that’s relevant. Sometimes I would create an analogy like, (pause) but I can’t think of one right now; well I’m trying to think of one.
>
> (We both laugh.)
>
> But uh, another thing that contributed was being encouraged by people who were around me. That also played a factor. If you have individuals around you who encourage you to keep going forward and not giving up and to not stop what you’re doing, that was another thing that kind of kept me going. (Interview 2)

Rico sought to connect the mathematics that he was learning to something relevant to him. He used analogies and other strategies to help him retain mathematical concepts. Moreover, he stressed the importance of the support network that he received from individuals around him.

In discussing what led Rico to pursue a master's degree in mathematics, he said that he was seeking to study mathematics that was a little more challenging than the typical mathematics concepts that are taught in high schools. Even though he mentioned that he worked well with youth, he stressed that he worked better with adults. In other words, he pursued an advanced mathematics degree to pursue more challenging mathematics and to work with individuals who were more mature regarding mathematical endeavors.

Artifacts

As an artifact, Rico brought a trophy from his middle school years highlighting his accomplishments in school in general and in mathematics in particular. The trophy was awarded to students who earned all A's and B's throughout their middle school years. The trophy was significant to him, and he cited it as being one of the greatest accomplishments in his schooling experiences. He also brought a poster from his summer internship that he completed at a research university in the western part of the United States during college. This project was of interest to Rico because it intertwined mathematics algorithms with computer applications. During our interview, he explained the mathematics concepts on the poster thoroughly, as if he were presenting his poster at a research conference. He also revealed that he completed this research project as a participant in the SCHOLARS Program.

The SCHOLARS Program consisted of students from diverse backgrounds. Rico pointed out that the program was designed to provide students who were interested in attending graduate school in mathematics and science with the necessary research skills to be successful in graduate school. Also, the program was intended to present that

particular research institution as a viable option for students to apply for their graduate work. Rico acknowledged that he learned to successfully use Matrix Laboratory (MATLAB) while in the program. In addition, he learned about mathematics research from his assigned professor with whom he worked on his research project. When I asked Rico if he applied to the institution for graduate school, he communicated that he did not because he did not feel that the school was diverse enough.

Critical Race Reflections

For his K–12 schooling experiences, Rico went to predominantly White schools. When questioned about his personal experiences with racism rather blatant or subtle, he mentioned that he was so busy in his own little happy world that if he was a victim of racism, then he was not aware of it. On the other hand, because he went to an HBCU, he pointed out that he did not experience any racism among the majority African American student population. He did, however, give two accounts of racism that he has experienced since college.

The first example that he gave of experiencing racism was with his White male administrator while he was a high school mathematics teacher. During the incident, Rico was being hounded by the administrator. He recalled instances of being called into the administrator's office before the school day to discuss miscellaneous items. This trend continued until Rico eventually told the administrator that he would have to wait until after school to meet with him because the early morning meetings were interrupting with his morning prep time for the school day. His administrator, however, kept insisting that they meet in the mornings. After Rico refused to meet with him in the mornings, the administrator threatened to write him up.

Rico explained that the administrator disregarded his requests to meet after school. Further, Rico expressed that these meetings were not relevant to the school day and could have easily waited until the school day was over. He felt that had he been a White male teacher, then this hounding from the administrator would not have occurred. Therefore, he believed that this administrator used his race as a power dynamic to attempt to control him.

The second racial experience occurred indirectly. Rico said that he might have assumed that it was racism. He spoke about this form of racism during his tutoring experiences:

> And I've noticed that sometimes when I would tutor people not of my race and show them how to do problems, they would be kind of surprised. And their eyes would get really, really big sometimes when I explain math problems to them. And at the same time, they would be grateful, and they would be stunned at the same time. Uh, and I guess that kind of helps them to break the barrier that minorities are just horrible people, and they don't do anything with their lives and they don't want to give back to their communities and to the education field. (Interview 3)

In this scenario, Rico stated that his tutees were stunned at his mathematical abilities. He equated their surprise elements with the fact that he was an African American man who was gifted in mathematics. He recounted his experience indicating that these students were not accustomed to competent mathematics tutors of African descent, especially African American men.

Concluding Vignette

Rico strongly believes that we need to encourage African American male students to achieve in mathematics and any subject in general. He offered the following suggestions for increasing the African American male pool of mathematicians:

> Just start by little things. When you see them in classrooms, you can motivate them to come up to the board and solve a problem. And if they get it wrong, you don't bash them out and say oh, you did it wrong, go sit down. You say, you did a good try, we were almost there, but if you did that step here, you can do it. Encourage them and motivate that person and let them know they can do it; then a lot of things are possible to go forth in that particular area or subject. (Interview 3)

Rico mentioned that mathematicians/mathematics educators should encourage African American male students to solve problems on the board. In other words, students should become involved and engaged in the mathematics process. Rico spoke of encouragement and motivation as key aspects in promoting mathematics achievement among African American male students.

Rico also offered the following advice with regards to attracting more African American male students in mathematics:

> They should have some type of mentorship program that would be very helpful to a lot of scholars. If you really strong on wanting to get individuals involved in math, you want to develop a good repertoire with the students and find out what their interests are in math and then run with that interest. And then you can probably develop a research project that they're interested in. And that would probably help increase more people involved in math. If the faculty comes together and have some type of mentoring program for the student, and always encourage them to go further and not stop just at the research or just stop at the undergraduate program or the graduate program. Because I think the key of having relationships with professors and students are very, very important. And it plays a very important role when you want to increase mathematics teachers or mathematics professors throughout collegiate schools. (Interview 3)

First, he mentioned that there should be mentoring programs. Secondly, Rico maintained that research agendas should be developed, which speak to the interests of students. In addition, Rico stressed the relationships among professors and students, indicating that those mathematical enterprises should continue on even when students have finished a degree program.

In the future, Rico wishes to pursue a mathematics career in higher education as a mathematics professor. In addition to becoming a mathematics professor, he hopes to establish his own tutoring center, designed to help students specifically with mathematics. Rico was particularly enthusiastic about mathematics in our many conversations about the discipline itself. In his closing statement, he voiced jovially: "Yeah math, math is fun. Me, personally, I could do it all day. Math is just a fascinating subject. I'm not sure what else to say behind that one, but go math!" (Interview 3).

Dedrick's Case Study

Introductory Vignette

As an African American man in his early 30's, Dedrick described his family's socioeconomic status as middle class. His mother retired from working for the federal government, and his father has been a train engineer for over 20 years. Dedrick's undergraduate situation is unique in that he completed 2years of college at an out-of-state HBCU seeking to major in engineering and then transferred to an in-state HBCU where he graduated with a mathematics degree with an engineering emphasis. Both HBCUs, however, were located in the southeastern part of the United States. He completed his master's degree in mathematics education at the same HBCU that awarded him his undergraduate degree.

Dedrick was introduced to me by a close friend who went to college with me. He and Dedrick are employed at the same school. When I mentioned to my friend the nature of my dissertation study and that I was in need of a research participant, he mentioned that Dedrick was also at the dissertation stage of his doctorate and arranged for me to

contact him directly about my study. Upon listening to the description of my study, Dedrick agreed immediately to participate in my study.

Currently, Dedrick is working on his doctorate in mathematics education at a research university in the southeast part of the United States. He is employed as a high school mathematics teacher, and he has been teaching mathematics for approximately 12 years. He has taught mathematics at various high schools in three different states. In addition to working at a high school, Dedrick teaches an Intermediate Algebra class at a local community college twice a week and a College Algebra class at a local college one night per week. I now present the mathematics story of Dedrick.

K–12 Educational Experiences

Reflecting on his educational experiences, Dedrick affirmed that his schooling experiences were exceptional. His elementary school was a magnet school and was located in a White neighborhood. He was a product of the busing system in that he was bused from his neighborhood to the magnet school. At the magnet school, they were a grade level ahead. Describing the schooling experience, he recounted:

> So of course it was an academic program and everything was a grade level above. And the thing is how I figured it out was that I didn't do a transfer to go to the magnet middle school. I thought it was automatic. But I had to go to the neighborhood school for 3 weeks. In those three weeks, although I was in a fifth/sixth grade class split, the sixth grade work I had already done. I had already done the work or what have you. That's how I figured that the elementary school I had attended was already a grade level ahead. (Interview 1)

Interestingly, Dedrick really did not notice that he was a grade level ahead until he attended his neighborhood school. For Dedrick to notice the grade level distinction was a remarkable discovery for a child at that age.

Dedrick's middle school was also an academic magnet school. As a matter of

fact, his elementary school served as the feeder school for his middle school. At the time, Algebra I was being offered to students at the other magnet school. Dedrick wanted to take Algebra I in the eighth grade as well, but his school did not offer Algebra I to eighth grade students at the time. Despite this lack of exposure to Algebra I in eighth grade, Dedrick was still able to compete mathematically with the other students and in his high school. This same spirit of academic excellence continued at his high school. To be admitted into his high school, Dedrick took a placement test, which he did exceptionally well on, as well as submitted an application for entry into the school. Notably, his high school was and still is ranked among the top five academic high schools in the state.

Dedrick recalled several instances in which he experienced meaningful mathematics during his K–12 educational experiences. He mentioned an elementary mathematics example where they used pizzas to learn fractions. This practice of experiencing meaningful mathematics continued throughout his high school experiences. He spoke with enthusiasm and excitement when he spoke about a string art project that he completed as a high school student:

> It was a string art project. Actually, I do a part of it now when I do. I ask the question, can a curve be drawn, can you draw a curve from using straight lines? And I guess you can because you use angles. And you would number each side of the angle and then from there, you would just connect them. So once you start connecting them, (pause) so once you start connecting them, you get your curve. And it was curve-stitching and also, this came from the 70s. Because a lot of them, I remember my aunts and uncles they were doing projects where they would create pictures, and it was from string art. And when I had to do the string art project in high school, I was like I remember seeing this, so it was like they used to have those in the houses back in the 70s and so on and so forth. And I think I'm going to have to bring that back out. Bring that back out and enhance it. Yeah, string art; that was the one I remember the most, and I had the most fun with that one. (Interview 1)

As Dedrick reflected on the mathematics project, he realized that the string art project had been around for quite some time. He also related the mathematics project to his home environment. Dedrick even conveyed that he will use the project with his current high school mathematics students.

The Journey to Mathematics

Dedrick mentioned that he had his "aha" moment of his mathematical gift while he was a sophomore in high school. This realization came when he was faced with the decision to enroll in two advanced mathematics classes simultaneously. When asked about his realization concerning his gift in mathematics, Dedrick communicated:

> It was sophomore year; let me tell you how I know. Because they gave us the option to double up in math. We could take Geometry and Algebra II at the same time. And I said, you know what, I took Algebra I honors, you know, and I came out okay in there. And then Algebra II and Geometry at the same time, that's when I really started to hone in on those math skills. And I realized I was really, really sharp. And I ended up taking, after Geometry and Algebra II, I ended up taking Trig and Analysis and then AP Calculus. (Interview 1)

As indicated, Dedrick was granted access to advanced mathematics courses as an African American male student. Remarkably, he took two advanced mathematics courses concurrently. Due to his mathematics success in these two advanced mathematics courses, he elected to take more advanced mathematics during his junior and senior years.

In regards to my questioning Dedrick concerning his definition of mathematics, he shared the following statements:

> I would define mathematics as the world; the world as waiting to be solved. Because you have to have it wherever you look, you have to have those math skills. It's not so much that people are like I'm going to sit here and write this problem and solve it or whatever. You use logic and problem-solving skills everyday in every thing that you do. I mean you

> don't sit there and say I'm going to do the five steps of problem solving. You hone in on those problem solving skills. Just like you make a decision on whether or not you're going to buy gas or groceries. Yeah, process of elimination. (I laugh.) (Interview 1)

Dedrick defined mathematics as the utilization of logic and problem-solving skills to make intelligent decisions in life. While he argued that one might not equate using mathematics with solving an everyday problem like purchasing gas or groceries, he admitted that one use mathematics skills daily to analyze these situations such as these.

College Experiences

Even though Dedrick started as an engineering major in college, he changed his major to mathematics. He completed his undergraduate degree in mathematics, and he attended two HBCUs during his undergraduate matriculation. When asked why he chose to attend an HBCU, he replied:

> But the thing was it started with "A Different World," you know the TV show. I was like okay, I'm going to a Black college; that's it because I fell in love with the glitz, the glamour, the fame, the step shows, the Greek life, the homecoming activities, the marching band, and the football team, the whole nine. So that was, I chose an HBCU for the glitz and the glamour. (Interview 3)

As indicated, he decided to attend an HBCU because he saw people who looked like him having fun in a collegiate setting. Also, he could relate to the African American television characters on *A Different World*.

As aforementioned, Dedrick completed 2 years of college at one HBCU and then transferred to an HBCU in his home state. Describing his first HBCU, Dedrick shared:

> I had probably one of the best times of my life at that university. I was in the band; I was an engineering major. And a lot of people was like how do you do it, knowing that the band practices all night and go to every game, home games as well as away games. But I think I was pretty good with time management. And you know, I was taught study skills early on. But it wasn't, these are the skills you need to hone in on to develop good study

> habits. So what I would do is, you know, pretty much learn the materials and the concepts in class so that when I got home, and I had to do homework or outside assignments or what have you, it was fairly easy to me because I did most of my studying and honing in, in class or what not. But other than that, I loved it. Out of state tuition was kicking butt, and financial aid just wasn't cutting it, and after a while I realized that I'm going to be bored in corporate America as an engineer. And I said I can't do it. So I transferred. Became a regular math major, and I thought I was going to go back and pick it (engineering) up. That's why my degree is mathematics pre-engineering because I could have done those last years in engineering and got a dual degree. (Interview 1)

At his first HBCU, he expressed that had an exceptional time. Being in the band and studying engineering were two demanding tasks, and he balanced the two time-consuming tasks with ease. He reported that he had good study skills and time management skills, which contributed to his success with managing both of these tasks. He also indicated that the out-of-state tuition costs were becoming insurmountable. This financial difficulty coupled with his lack of interest in engineering led him to transfer and change his major to mathematics.

When he transferred to another HBCU, the university required that all students take a prescribed set of core courses. Included in this set of courses was College Algebra and Pre-Calculus. Because Dedrick had taken the Calculus sequence at his previous institution, he figured that he would not be required to take the College Algebra course. Surprisingly, the university officials required him to take the lower-level mathematics classes as part of the university's requirements. Dedrick expressed his frustration with the policy:

> I was pissed because I had to go back. And hey had this thing called university college where everybody who comes in has to do at least 30 hours in university college. So I had to go back and take College Algebra and Pre-Calculus. Yeah, I was pissed. I was mad as hell. I was like, you know, I've taken Calculus I, II, III, and IV. You all don't even offer Calculus IV, and they made me go back and to take College Algebra and

> Pre-Cal. So what I do? I went in and I slept the entire semester in both classes and aced them both. I remember going to my final in College Algebra in my pajamas. The final was from 8 to 10. I got there about 8:45. At 9:30, I was back in bed. To this day, that professor was like how did you do it, and I didn't tell him to the end, and he was like why did they even make you take that class. So, but yeah, that was my thing. (Interview 1)

Dedrick's frustration with this university requirement is understandable. He had taken mathematics courses that were more advanced than the mathematics courses required. It seemed logical that he would be able to substitute those mathematics courses or test out of them, to no avail. What are the implications of such policies that are inadvertently used to impede African American college students from reaching their educational goals?

Nevertheless, at Rayford State University, Dedrick's upper-level mathematics classes were small in number, ranging from six to approximately fifteen students in each mathematics class. He spoke of a strong bond that the mathematics majors created among themselves as well as the one-on-one attention given to him by his mathematics professors. His most challenging mathematics course was Differential Equations. When I asked him how he overcame the mathematics course, he offered the following remarks:

> I stayed up in the professor's face and his office during office hours. I was like look, you've got to get me out of here alive; I'm not taking this class over. So I guess he felt sorry for me and had mercy on me, and let me out alive. That was the only way that I could, I couldn't even do this on my own. I couldn't even fake it. Even my classmates, I think it was eight of us in that class, I'll never forget I had a cousin in that same class, we were both math majors. He sat in front of me, and he would turn around and he was like dude, don't even do it. Don't even do it. (We both laugh.) (Interview 1)

Dedrick went to his professor's office to seek help with his mathematics problems. He expressed that he was adamant about not repeating the mathematics course. Because of his stance, he would voice his frustrations with the material when it was not registering

with him in class. Moreover, his first-cousin, a fellow mathematics major, would have to keep Dedrick under control often concerning his battle with Differential Equations.

Overall, Dedrick had positive relationships with his mathematics professors in college, but he had one professor with whom he had a rocky relationship, Dr. Chow. This mathematics professor assigned him a C in his Senior Seminar course. Dedrick reached out to his African American male Geometry professor to help with his senior project because as Dedrick commented: “With Dr. Chow, it was just like no hope” (Interview 3). Dedrick also had similar grievances with the same mathematics professor while he was working on his master’s degree. He felt that Dr. Chow treated him harsher during the graduate mathematics course because he was seeking revenge on him for being difficult in the senior seminar course.

On the other hand, the college mathematics curriculum did not necessarily relate to Dedrick, but he could relate to his African American male mathematics professors. Dedrick declared:

> I mean there was no connection for me as far as the curriculum, and, uh, I take that back. I was, I guess, with my Black professors, I’ll put them in the mix, the Black professors that I had in math, they were strong, sharp individuals. And you know, for one thing, I could relate to them, and I respected them. Because I was like hey, I have a Black man in front of me teaching this class versus a foreign professor where people are like I can’t understand him or like I don’t know what he’s writing; I don’t know what he’s saying, so from that aspect, that was a great connection for me. (Interview 3)

Dedrick emphasized the importance of the positive cultural image of an African American male mathematics professor leading the class. He experienced a greater connection with an African American male mathematics professor as opposed to a mathematics professor of another ethnicity. Similarly, Dedrick previously noted the

cultural connection to “A Different World.” From these experiences, he was able to relate to and understand the African American experience.

With this cultural connection, it is not surprising that Dedrick is someone who is knowledgeable regarding the legacy of African Americans in mathematics and science. As a matter of fact, he has his high school students complete assignments that highlight the contributions of people of African descent to mathematics. When discussing African American inventors, he uttered:

> And even with that, the thing that pops in my head is the African American inventors. I want students to see ingenuity and the mathematics behind the light bulb, the traffic light. You know, Madame C.J. Walker when she was mixing up chemicals or what not for hair care products and so on and so forth. So with that, I try to get students to see the ingenuity as well as the creativity and the mathematics as well as science behind it all. (Interview 3)

Dedrick drew attention to the fact that African Americans were indeed clever and creative in their inventions. He makes it a point to stress this to his high school mathematics students, which are primarily African American students.

Instinctively, Dedrick has continued his mathematical cultivation beyond an undergraduate degree program. He explained why he did not study Pure Mathematics in graduate school. He said: “For one, I wanted to keep math, and I didn’t want to do Pure Math. I didn’t want to do Pure Math because I was like I want a life, and I don’t want to fry my brain” (Interview 2). He joked about Pure Mathematics frying his brain to indicate that he sought something more than just proving theorems over and over again. Besides, it worked in his favor to seek a master’s degree in mathematics education given that he had landed a job teaching high school mathematics. Because his master’s work was enjoyable, he decided to pursue his Ph.D. in mathematics education. Although he initially

sought to complete his doctoral studies at an HBCU, he ended up applying to various research universities due to the fact that he did not find any doctoral programs at HBCUs at that time suitable to his needs.

Artifacts

Dedrick had several artifacts to choose from to help chronicle his experiences as a scholar in mathematics education as well as an African American man. He had tons and tons of pictures in several envelopes as well as news articles and a photo album full of academic certificates. He mentioned that he would have brought his trophies. Unfortunately, they were all at his mother's house in another state. Nonetheless, I went through all of his artifacts for approximately one hour before we began the second interview. He asked me to choose which ones I wanted him to talk about for the interview. I declined and insisted that he choose artifacts that were personally meaningful to him.

For his artifacts, Dedrick selected a news article, a program from his undergraduate convocation, and pictures from his trip to Africa. The news story happened as a result of his students' mathematics history presentations. The event, sponsored by the National Council of Teachers of Mathematics (NCTM), was designed to expose students to famous mathematicians. Dedrick's students presented their work both orally and visually, and some of his students were also interviewed. The event culminated with a group photo of Dedrick and his students, which was printed in the local newspaper.

The next artifact was a program from his undergraduate institution's annual convocation. The convocation program that he selected was held on his birthday that year, which made it special to him. He also received an honors certificate as well as a

letter from the president congratulating him on his scholastic achievements. Although his parents were not able to attend, the event was also set aside as parents' day.

His last artifact included pictures of his trip to Africa. He was being watched by various people, and he was approached about participating in the teacher exchange program. There were eight teachers from Africa and eight teachers (four mathematics teachers and four science teachers) from the United States who participated. Dedrick found it to be an exciting learning experience to go to Africa; the fact that all of the expenses were paid was an added bonus. The pictures from his trip included various culturally grounded portraits including a tribe, the sunset of Zambezi, and Giant's Playground. These pictures really showed his commitment, passion, and connection to Africa.

Critical Race Reflections

Dedrick developed a critical race eye as early as second grade. Because his schooling experiences were located in predominantly White contexts, he was race conscious even as a child. He cited instances of noticing racial differences in regards to school buildings, neighborhood living conditions, and the like. Dedrick brought attention to the fact that he has experienced several critical race moments as an adult. He pointed out one experience when he went to his doctoral institution. I share this experience below.

> I've had several experiences, and it was a real eye-opener when I went to Rayford State. Because in some classes, one, I thought I was going to be the only African American student. Then, there were others, African American students in the math ed. program as well. But it was an eye-opener when I was the only Black male in the class, the only Black person in the class and I think I was the only American in the class. Everybody else was from Turkey, India, Bangladesh, China, you name it, so it's like anything came up dealing with race, it's like everybody got quiet, and all

> eyes were on me. So of course, I had to stand up and represent. I feel like I had to represent for every single Black person in the world in that class.
>
> (I laugh.)
>
> But at the same time, well at first, they looked at me kind of crazy. They looked at me kind of crazy, so I knew then…First, they started looking at me crazy. You know, we did introductions like where are you from, blah, blah, blah. Then I was like I went to Rayford State University. Then immediately everybody was like you went to Rayford, the University of Rayford. I was like no; I went to Rayford State University. They were like, oh. And then from there it's like, they kind of questioned my credentials, you know without saying anything, but giving me these crazy looks. So from there, when I opened my mouth I had to represent. I had to represent for everybody. I had to let them know that, yes, I graduated from an HBCU with my bachelor's and my master's, and I am well-prepared. (Interview 3)

In the first segment of Dedrick's response, he voiced concerns about being the only African American student in the class. He felt as though everyone viewed him as the expert when it came to matters of race. As a result, Dedrick acknowledged that he had to "represent" and make an intellectual argument on behalf of all African American people. Failure to do so, he believed, would result in maintaining negative stereotypes concerning the intellectual capabilities of African Americans by his colleagues.

In the aforementioned scenario, Dedrick imagined that students would consider him competent because he had an undergraduate degree in mathematics and a master's degree in mathematics education regardless of where he earned the degrees. The looks from his classmates, however, signified that the PWI carried more intellectual weight than the HBCU. He also felt that he needed to convince his colleagues that he was prepared to be in the doctoral program even though he had previously studied at an HBCU.

Dedrick also described another critical race moment when he reflected about the White woman in his mathematics class who doubted his credentials in mathematics. He disclosed:

> Even with some of the classmates, even some of my White counterparts in the program, I would never forget it; I was sitting there with one of my best friends Christina. And this one girl was like you guys have master's. And at that time, I had been in the program like 2 years; I was like my master's got dust on it almost. My master's is like 2 years old, and Christina was like, yeah, my master's is like 5 years old. And so the girl was like amazed. She was like, oh my God, you guys have master's. I'm like, yeah, we're in the Ph.D. program. And the thing was something that was just natural to us. We were like yeah, we got it. We have our credentials in order; we're in the Ph.D. program. I think she was in the master's program, and she was going to transition into the Ph.D. program, but that was one of those moments as well. We were like okay, what, you didn't think we had our stuff together? (Interview 3)

Because both master's and doctoral students were enrolled in the mathematics class, the student assumed that Dedrick and his friend were master's students. The woman in his class was stunned that they, as African American students, had already obtained master's degrees. This example highlighted the skewed belief that some White students hold concerning the educational attainment of African American students.

In another reflection on his racial experiences in his doctoral program in mathematics education, Dedrick shared a critical race moment that he experienced through an education course he had taken. He described his mathematics education professor and her hang-ups with African American students as follows:

> And then too, there was a professor, Dr. Garcia, and she was of Hispanic descent, and I want to say she came from poor humble beginnings with her parents or what not. But at the same time, we felt, you know, she was a hard ass; she was a hard ass. And I guess she was bringing the true graduate school experience to us. Because we forever had like six articles to read, and they were like 30 pages long on any given night, four textbooks, supplements here and there, and the thing was we kind of felt as she was, I wouldn't say that she looked down on African American

> students, but she would, I felt that was a little harder on us. And we don't know why, if it was out of spite, or if she was trying to prove a point in the department because she was new, so we, you know, we had to flip the script on her and let her know. Look, we're not lazy students. And you know, we do what we have to do in grad school, but at the same time, we have lives outside of this, and some of us work full-time. But you know she wasn't trying to hear that. So we had to flip the script on her and let her know, look we know what we're talking about. We're sharp individuals and basically we know our shit so to speak, so we had to flip the script on her and let her know that, uh, we're not lazy students. So that was the gist of that. (Interview 3)

Dedrick believed that his Hispanic professor had an idea engrained into her head that African American students were lazy. Dedrick had taken courses in which he was assigned several readings; however, he believed that this experience was an infringement on him as well as his African American colleagues as intellectuals. He was not necessarily concerned about all of the readings to prepare for the course, but he felt that this professor was assigning a lot of unnecessary work to prove a point. He believed that she was doing this to prove that African American students were lazy and not intellectually capable of engaging in rigorous coursework. As a result, she left an "unfavorable" impression in Dedrick's mind.

He also recounted issues with another Black person. He cited the incident as not necessarily being related to race but more of a class issue:

> I didn't have any racial experiences in undergrad so to speak, but in high school, it was more so a class thing. Because I went to a high school as to where students, you know, you had the mayor's son went there, the mayor's granddaughter, and then you had councilmen and women, and their kids went to the high school. And of course, you know we had a lot of affluent Black doctors and lawyers, so their kids went there as well. And a lot of those students there were in Jack and Jill, which is a, I guess a middle-class, upper-class. So you know it's like the upper-middle class, the upper-Blacks. But anyway, I had this one lady. She was the secretary or the administrative assistant or whatever at the school. And you know, she was, well, the girl I was dating in high school at the time, her father was a pediatrician, well-known throughout the city. And her mother was a

> teacher. And she (the administrative assistant) looked at me as if I was nothing. And she was like why are you dating him, why are you with him, and blah, blah, blah. And I was like okay, you know, is she like looking down on me. And that was a real shocker to hear that coming from her. You know, that was discrimination from one of our own, but at the same time, it was more so a class, class discrimination. (Interview 3)

Although he classified this experience as a class issue, I decided to include this example to showcase the complexities of race.

Concluding Vignette

Dedrick is an exceptional mathematics educator. The fact that he was chosen to participate in a teacher exchange program within the context of African schooling validates his outstanding teaching abilities. Although he says he has strong algebraic skills, he has a unique love for Geometry. Furthermore, he has a strong desire to see African American students, particularly African American male students, pursue majors in mathematics or mathematics education. During our last interview, he offered the following closing argument:

> Ending with this historic election, every African American male needs to up their game and get their life together. And as far as from a mathematical perspective, I would like to see more African American males or those college students that are torn between, you know, who may be strong math students, and may want to venture out into other areas. I would like to see them as math majors or math education majors. (Interview 3)

Citing the historic victory of President Barack Obama, Dedrick verbalized that African American male students should live better lives and set higher goals in life, especially with the first African American male President serving as a positive role model to African American male students.

Even though Dedrick would like to work in higher education and conduct research on the teaching and learning of mathematics employing an Afrocentric

methodological approach, he currently remains a high school mathematics teacher. He cited the significant decrease in financial compensation as one of the primary reasons why he has not secured a position in higher education.

Roger's Case Study

Introductory Vignette

Roger grew up as an only child in the South. He described his family's socioeconomic status as middle-class. Although his mother has a high school education, she has been a service provider for over 20 years. During his college experience, Roger attended an HBCU in the southeast part of the United States. In addition to being a mathematics major in college, he also played on the football team.

Roger is an assistant professor in the Mathematics Department at an HBCU in the southeast region of the United States. In addition to teaching College Algebra, Trigonometry, and the Calculus sequence, Roger has also taught mathematics courses above the 3000 level (i.e., Real Analysis, Probability and Statistics, and Senior Seminar, to name a few). His teaching of advanced mathematics courses proves that he is extremely knowledgeable about the different facets of mathematics. Moreover, he holds a master's degree in mathematics and a master's in electrical and computer engineering. Added to his strong mathematics content knowledge, Roger is currently working on his doctorate in mathematics at a university that offers both on-line and face-to-face delivery methods. As an African American scholar in his late 20s, his future goal is to become an academic dean.

Although I was able to meet the other three participants face-to-face regarding participation in my dissertation study, I contacted Roger via email. His email was

provided to me by a professor at a local university who suggested that I contact Roger about my study. During our first phone call, Roger asked to speak to Dr. Jett. (Needless to say, I liked him from the beginning.) Nonetheless, I believe that Roger added a different dimension to my research and that uniqueness will be revealed in his case study. I now present the mathematics story of Roger.

K–12 Educational Experiences

Reflecting on his educational experiences, Roger declared that he had exceptional schooling experiences. He stated that most of his elementary school teachers knew his parents; therefore, he was expected to act and perform well in school. Although he remembered serving as the president of the student council in the eighth grade, he maintained that most of his elementary and middle school educational memories were vague. While he spoke rather positively about his schooling experiences in general, he did not cite any educative experiences related to mathematics specifically.

As a high school student, Roger stated that he was not interested in mathematics. He actually found mathematics to be somewhat difficult. Below is a transcription of the interview regarding Roger's struggle with mathematics in high school:

Chris: What about your high school experience?

Roger: In high school, I didn't like math. I struggled in math the first couple of years. I believe because I was more focused on athletics than my education because I played football, and athletics in the environment of high school, I really wasn't focused that much. Math wasn't my strong point. But in high school, I really wasn't focused on school. It was basically social. But I made it through.

Chris: And why is it that you didn't like math in high school?

Roger: Basically, I just wasn't focused. Actually, I had to take a math class in summer school. I remember my summer school class very well. I really enjoyed it. I don't know if it was the teacher, but

> since I think about it now, I believe it was because I didn't have that many distractions. Summer school in math, I did pretty good.
>
> Chris: Were you in summer school because you failed (math)?
>
> Roger: Yeah, I failed.
>
> (We both laugh.) (Interview 1)

The fact that Roger failed mathematics in high school validates his disdain for mathematics in high school. Furthermore, his disgust with mathematics continued on for an abbreviated time period into his college experience. Interestingly, he failed mathematics in high school because he was more concerned about football, not because of a lack of mathematics abilities. Despite his hang-ups with mathematics, he was still able to successfully complete a degree in mathematics. Even so much so that he is working on a doctorate in mathematics.

The Journey to Mathematics

Roger entered college initially pursuing a degree in computer science. He spent a year studying computer science before switching his major to mathematics. To stress his dislike with computer science, Roger stated, "Staying in the computer lab for 3 or 4 hours because of a semicolon, that wasn't for me" (Interview 1). Roger stressed how minor errors such as a semicolon contributed to his frustration with computer science as a major.

In addition to his frustrations with the miscellaneous details concerning computer programming, Roger also acknowledged that the computer science faculty members were not concerned about his educational progress. He remarked:

> Well, after awhile I felt that computer science wasn't where I was supposed to be. And basically, the faculty members in the computer science department wasn't, basically, the computer science department, I

> don't believe that the faculty members were, uh motivational, and really kept my attention….and the lectures were dry. And they didn't really emphasize how important computer science is and what you can get good out of computer science or what you can contribute if you get it under your belt and things of that nature. It was just that faculty members were trying to get a paycheck basically. (Interview 1)

Roger believed that the computer science faculty members at his undergraduate institution were not excited about their field of study. Moreover, they did not highlight the important contributions that the field of computer science has to offer. For these reasons, Roger was not satisfied with his computer science studies.

As stated, Roger eventually changed his major to mathematics. He expressed that mathematics and computer science are connected. Discussing the connection between mathematics and computer science, Roger explained:

> Math and computer science are cousins of each other, and then, actually, I was really struggling. And I had a teacher, he was a math teacher, he really took me under his wings and stuff. I mean I was trying to do good and work hard at it and stuff. Stuff wasn't clicking, but after he got with me and showed me how to do things, the ins and outs and stuff like that. Actually, it was gray to me. And then basically, he just worked with me, and it was easy. (Interview 1)

As indicated, Roger's interest in mathematics was peeked by his African American male mathematics professor who noticed his gift in mathematics through working with him one-on-one. It is important to note that student and faculty interactions are extremely instrumental in attracting students to study mathematics.

Seeking to obtain more information about Roger's decision to switch from computer science to mathematics, I questioned him again during the second interview regarding his decision to change his major. Reflecting on his transition from mathematics to computer science, Roger added:

> Basically….this is what I was called to do. I didn't choose math. I believe it chose me. But I just got to a point where, I was at a point where I was basically, wanting to do good, but I didn't have no answers of how to get the math. Basically, I was a hard worker inside, but everything was gray to me. But I feel like the Lord put somebody in position to help me. So I feel like this is where I'm supposed to be or this is what I'm supposed to do. (Interview 2)

During this account, Roger mentioned a spiritual aspect for his decision to pursue a degree in mathematics. He believed that he was called to do mathematics. He did not choose mathematics per se; rather, it was a spiritual connection that drew him to the discipline.

College Experiences

Roger described a typical mathematics class session during his college matriculation as taking notes, going home and working problems, and completing tests. As it relates to a mathematics club, he was not familiar with a mathematics club at his undergraduate institution if it existed. Because he was so involved with football, he acknowledged that it could have existed without his knowledge. Although he was not involved in a mathematics club, he cited several instances of working with other mathematics majors on various assignments. Additionally, he did several mathematics presentations in college, which he credits with helping him strengthen his teaching skills. He joked: "I'm teaching, so I give presentations everyday" (Interview 2), stressing the importance of those mathematics presentations in undergraduate school to his current occupation as an assistant professor of mathematics. In addition, he kept the majority of his lecture notes from his college mathematics and draws upon those lecture notes to prepare mathematics lectures for his students.

Roger credits his HBCU with producing the most African American mathematics majors, even more than all of the well-known research universities in the state. He credits this production of African American mathematics majors to a strong mathematics department along with strong faculty and a strong department chair. He used the word strong to refer to their sternness with regards to mathematics and their ability to help him and other students prepare for the next level.

Once Roger declared mathematics as a major, he really did not have many major challenges with the discipline itself. When questioned about his most difficult mathematics course in college, he identified Calculus as the course that posed the most problems for him. Recounting his time in Calculus, he noted:

> Uh, basically, I wasn't putting enough time into it. And basically as a young person, it was kind of overwhelming the material and stuff. But after the, basically I had to understand that if I don't know these rules, then I'm not going to get it. I didn't really; it wasn't just clicking that I need to know these rules. I was just, basically, pictured calculus as being intimidating. And after you're intimidated, that's it. I believe I fell in that bracket for a little bit. (Interview 2)

Surprisingly, Roger claimed that he was intimidated by Calculus. Later on in the interview, he mentioned that he had to take Calculus again in summer school because he failed to master it the first time he took it. He failed Calculus because he did not invest a sufficient amount of time needed to be a success in the course. After mastering Calculus, however, Roger found that his remaining mathematics courses built off of the Calculus foundational knowledge.

As a result, he experienced much success with the remainder of his mathematics courses as well as his mathematics major. Interestingly, Roger has been an A student in

mathematics ever since. In college, he was bestowed respect from his peers because of his intellectual capabilities to pursue mathematics as a major:

> I mean that's the major to pursue because after you tell them you're a math major, you're looked at different. And people ask you questions like how'd you do it, so basically, the bottom line is I believe we carry the most weight than anything that you can do. (Interview 2)

Roger believes that people see mathematics majors in a different light than other majors. In his experience, people regarded him as being intelligent because he was pursuing a mathematics degree. This paradigm may have caused him to excel further in mathematics. During his graduate school years in mathematics and engineering and in his doctoral work in mathematics, Roger says that he has not had a challenging mathematics course because he obtained the mathematics training while working on his undergraduate degree to achieve in advanced theoretical mathematics graduate courses.

While in college, Roger affirmed that there were about five African American male mathematics professors at his institution. In describing them, he said: "They knew their subject matter. They knew their material. They were good. They weren't good; they were excellent. And basically they tried to pour that into you" (Interview 2). When asked about the importance of having those five African American male mathematics professors and what he took away from that experience, Roger responded: "Uh, basically so I can do the same thing they did for me. Help other African American young men that's coming along, so then they can help other African American males that's coming along" (Interview 2).

Also, Roger used the mathematics that he was learning in college to connect it to real world applications. Roger conveyed:

> Basically, with taking an Abstract Algebra class. Basically in that class, they showed us like dihedral groups, basically shapes and stuff. And I know with that type of stuff if you look at people's rims on their cars, that has dihedral groups like shapes and stuff. So we learned that in Abstract Algebra. Well at SINE with Statistics, they do a lot of Linear Regression. That's in Calculus also and also in Statistics. Uh, SINE, they use probability models like Poisson distribution or binomial distributions or things like that to see what's the probability of a package being late. So they use things like that. I learned about that in undergrad and grad school. (Interview 2)

Roger explained that his mathematics professors showed them how advanced mathematical concepts were used in everyday life. He also applied mathematical concepts to his work while he was employed for SINE while he was a college student and during his graduate program.

Artifacts

For his artifacts, Roger brought his championship ring from college football, a CD from his graduate mathematics course, and the folder that accompanied that graduate mathematics course, which included lecture notes, tests, and quizzes. The football ring was for the Central Intercollegiate Athletic Association (CIAA) championship. His college's football team had won the championship during his last year of college. He considered this a significant accomplishment given that his team was not so good during his freshman year. He related the football team winning the championship to his experiences in mathematics, believing that if you work hard, you will see the results of your hard work whether it's in mathematics, football, or any other facet of life.

The CD packet had all of the lecture notes and other supplementary materials. Roger's purpose in bringing the CD packet was two-fold. First, he wanted to highlight his many A's on mathematics tests, quizzes, and so on as a result of interfacing with the CD. Secondly, he wanted to pinpoint the direction where mathematics instruction is headed.

He played a portion of the CD, which was a mixture of both CD and DVD footage. On the computer screen, there was a mathematics professor lecturing in a lecture classroom. He shared an experience of being presented with the opportunity to teach an on-line mathematics course as an adjunct instructor at a local college to validate his hypothesis.

Critical Race Reflections

Roger was questioned about his experiences with race/racism as an African American male student in mathematics. Because he went to an HBCU with mostly African American students, he did not think that the race question dealt with his undergraduate experiences. He indicated that his mathematics curriculum in college did not relate to him as an African American man. He did, however, reflect on his experiences as a graduate teaching assistant (GTA) at a research university while working on his master's degree. He recounted:

> But I was a professor also. But once I told them that I'm a professor, they look at me, they see I'm Black and I'm young. They try to stereotype me looking at me like I ain't supposed to be no professor. But they couldn't do nothing to me because I knew my stuff. But that's what I picked up. (Interview 3)

Roger believed that his students questioned his mathematical abilities because he was an African American male instructor.

Roger was also questioned about his experiences with race/racism as an African American man in society in general. There seemed to be a contrariety regarding his experiences with racism. He affirmed:

> To be honest with you, I really haven't dealt with racism, but I have. It was just that it wasn't, it was more behind the scenes instead of out in the open. They did things behind my back. For example, I worked for SINE. Basically, I had more degrees than everybody in the company. This was in another state. Basically, what happened is I applied for a supervisor's position, and you got to send a package to Smallville. The package never

> get to Smallville and things like that. So they do little stuff like that behind your back. (Interview 3)

Prompting Roger to reflect more deeply about his experience with racism, I probed him further about that experience. I offer the following portion of the interview at length to get at the essence of his argument:

> Chris: When your packet got lost, how did…?
>
> Roger: The process is you have to do all the paperwork. Get the paperwork to your supervisor. And then they send it to Smallville. Then Smallville contacts you and set up a schedule for you to do a management test.
>
> Chris: Uh-hum.
>
> Roger: Basically, I turned the packet in every year. I didn't get any contact on when I'd get to take the exam or anything like that. Then I know for a fact that I gave the packet to the district manager one time.
>
> Chris: And you still didn't get picked?
>
> Roger: No.
>
> Chris: And how did that make you feel?
>
> Roger: Uh, frustrated. Uh, the bottom line is basically I was frustrated because basically I had really wanted a career in SINE. But I see right now that's not in God's plans for me to do. So at that point in time I was kind of frustrated, but right now I'm glad that it didn't go through. So I don't have a problem with it because they cut throat. When it comes to hiring up in the company, they cutthroat. And as a Black man, I already know I'd a got cut. (Interview 3)

Roger's packet for a supervisor's position was mysteriously lost for 2 consecutive years. For the subsequent year, he gave the application to the district manager thinking that would result in hearing from the company. To his dismay, he still was not contacted. Because he was qualified for the job and possessed a degree in mathematics, he believed that this was directly related to the fact that he was an African American male applicant.

Furthermore, as he reflected on this experience, he realized that he might not have survived in the company as an African American male supervisor. Therefore, he believed that God did not allow him to secure the position.

Concluding Vignette

Roger possessed limited knowledge about the historical legacy of African Americans in mathematics. He mentioned Benjamin Banneker and Marjorie Brown specifically as groundbreakers in the field. He made it clear, however, that he, as an assistant professor in a mathematics department at an HBCU, is in a position to attract more African American male students in the mathematics pipeline. I felt it was important to share the following segment of the interview to better understand Roger's sentiments:

> Chris: What can we do as college professors to attract more African American males in mathematics?
>
> Roger: We've gotta' go out there and get 'em.
>
> Chris: Uh-hum.
>
> Roger: They ain't gone come to us. I mean if we're serious about it, we've gotta' go get 'em.
>
> (I laugh.)
>
> Roger: We have to get them.
>
> Chris: Uh-hum.
>
> Roger: But I feel we can get them though. I mean they're out there, we just gotta' go and get them. I mean we need to do something like start like a team, young Black men and just go to high schools. Because if you think about it, it's more young Black men teaching math in high schools, they don't know that it's young brothers like me and you on the college level, so we need to network and get them in. (Interview 3)

Roger spoke with passion about going to get African American male mathematics majors. He believes that we, as African American men in mathematics, should collaborate to bring this vision into fruition. This collaboration should also be inclusive of African American male mathematics high school teachers.

During our last interview, Roger made it a point to emphasize that our work as African American men in mathematics has just begun. His closing argument really captured the earnestness that he has for his experiences with mathematics. Again, I am compelled to share the interview at length to give voice to his testimony:

> Chris: Are there any other thoughts that you would like to share about being a successful African American male in college mathematics?
>
> Roger: Well, to be honest with you. It's all a blessing. We're all called to something in life, and if you can stay on track and stay on a straight track and don't get off on any exits and get to the point where you need to be at in life. It's all a process for you to try to give back. Well, basically I feel that teachers are good people with good hearts and willing to give. And basically that's why we're in the position we are, to give back. We're hard workers, so we'll go the extra mile to tutor and help individuals who are not at the point where they need to be in life. Keep mentoring because basically I feel like you and me together, we're at a point in our life where, well, I don't know you feel, but I didn't think I was gone get this far. But it's all a blessing though, but I'm glad I did.
>
> Chris: Uh-hum.
>
> Roger: As a person that's been lost before, don't understand things, been immature and couldn't see the forest before the trees; that makes me a lot want to help people and help them turn the light on and get to where they supposed to be. (Interview 3)

Roger mentioned that he and I are working on our doctorates because of our willingness to give back. (I agreed to speak to two of his mathematics classes about my research agenda in mathematics education and my experiences in mathematics.) In other words, he feels that we are blessed because we are a blessing to others. He even reflected on the fact

that he was lost. In other words, he was not really focused on school; rather, he was going with the flow of traffic as a lost driver on the road. He now, however, has a clear vision of his future.

Roger's vision includes becoming the mathematics department chair. He definitely has a passion to help students, particularly in mathematics. As a result of this dissertation study, he admitted that he feels even more motivation to help African American male students, especially those who are seeking to pursue careers in the mathematics pipeline. And to think, he never even thought that he would be pursuing a doctorate in mathematics.

Discussions

My work attempted to capture the undergraduate mathematical experiences of four mathematically successful African American men in their own voices. In so doing, I set out to write their mathematics stories through examining their educational trajectories. Investigating their mathematical experiences through the multiple case study approach and using a critical race lens led to rich data concerning their experiences as African American men. My participants, as indicated in the findings section, are graduate students in mathematics and mathematics education who were successful with mathematics as a major in college. Antonio and Dedrick are master's and doctoral students in mathematics education, respectively while Rico and Roger are master's and doctoral students in mathematics, respectively (see Table 2).

Table 2

Profile of Participants

Participant	Graduate Level	Discipline	Current Occupation
Antonio	Master's	Mathematics Education	High School Mathematics Teacher
Rico	Master's	Mathematics	Full-time Graduate Student
Dedrick	Ph.D.	Mathematics Education	High School Mathematics Teacher; Part-time Adjunct Instructor
Roger	Ph.D.	Mathematics	College Instructor

Through this research investigation, I identified four themes that were common across all four of the participants' experiences. The first theme was that all participants believed they possessed internal characteristics that helped them succeed in mathematics. The second was that they had resisted racial injustices during their lives as African American men. Third, all four of the participants matriculated through HBCUs for their college mathematics experiences, which provided them with access to numerous African American male mathematics professors. Lastly, all four African American men expressed an optimism concerning the plight of African American men in general and African American male students in mathematics in particular. Below I explore each of these themes.

Internal Characteristics

The first theme from the data was concerning the internal characteristics that the four African American men possessed, which contributed to their success with mathematics as a major in college. These internal characteristics that were resonant across all four of the participants' cases included the following characteristics: a

mathematics identity, a cultural understanding, a persistent attitude, and a spiritual connection.

One internal characteristic among the participants was their ability to develop and employ their mathematics identity. In borrowing from Martin (2000), I am using mathematics identity to refer to these four African American men's beliefs about "(a) their ability to perform in mathematical contexts, (b) the instrumental importance of mathematical knowledge, (c) constraints and opportunities in mathematical contexts, and (d) the resulting motivations and strategies used to obtain mathematics knowledge" (p. 19).

The four African American men in this study exemplified Martin's (2000) mathematics identity. They all had internalized beliefs that they were mathematically talented and thus able to perform in mathematics, especially college mathematics. Also, they understood the importance of mathematics knowledge as an asset to other forms of knowledge. Furthermore, they recognized and took advantage of mathematical opportunities. In high school, Antonio took advantage of an SAT preparatory course at a research university while Dedrick enrolled in two advanced mathematics courses simultaneously. Rico elected to take advanced mathematics courses during his educational experiences. Roger, too, had opportunities to participate in advanced mathematics, but he did not due to his focus on his athletic opportunities. Nonetheless, these examples demonstrate the mathematical opportunities that the participants were provided access to in order to strengthen their mathematics identity.

With regards to their strategies employed to acquire mathematical understanding, the participants pointed out various tactics for strengthening their mathematics

knowledge. The participants' practices included: attempting more challenging and more complex mathematics problems than the ones assigned for coursework and/or homework, learning more than one strategy to solve mathematics problems, and being above average in mathematics in grade school. The concept of being a grade level ahead is cited in Hrawbowski et al.'s (1998) study, which found that African American male students who were completing work that was a grade level ahead in mathematics and science were likely to be successful in school in later years in these subjects.

These practices continued in college mathematics, and the participants cited the following approaches to succeeding with mathematics as a major: developing their own mathematics tests, attempting to think like their mathematics professors when studying for their mathematics exams, working together with their fellow mathematics majors to handle advanced mathematics topics, and seeking help from their mathematics professors when they encountered problems in which they needed assistance. These mathematical behaviors cited by the participants align with Martin's (2000) concept of mathematics identity. The participants understood the importance of acquiring mathematics knowledge and thus employed various approaches to attain mathematics knowledge.

The next internal characteristic was a cultural understanding that the participants shared. It is interesting to note that this cultural understanding was tied to the African American culture, and each participant displayed a distinct dimension of their cultural knowledge. With regards to this study, a cultural understanding refers to their African American culture being connected to their mathematics teaching and learning. This paradigm was informed by their experiences of being African American men and being successful in mathematics.

The mathematical practice of incorporating cultural referents in order to produce meaningful mathematics is consistent with Berry's (2003) and Ladson-Billings's (1994) work. "Although African Americans share common cultural, historical, and social experiences, not all cultural characteristics uniformly apply to all African Americans" (Berry, 2003, p. 246). As such, all mathematical exercises that are cultural in nature may not be applicable to all African American students. African American students, however, must be able to draw on their daily experiences to relate mathematics to their everyday lives (Berry, 2003).

With regards to this research study, Dedrick mentioned several instances in which his African American culture linked to his mathematics education. For example, Dedrick's string arts project allowed him to use mathematics creatively, and it also allowed him to make a direct cultural link to his family's African American cultural knowledge base (Berry, 2003). Additionally, as a part of a teacher exchange program, Dedrick went to Africa to teach mathematics, which he conveyed opened his eyes to more cultural aspects of mathematics.

Antonio and Rico disclosed that they made mathematics relevant to their own lives as African American male mathematics students. Antonio told stories of how he applied the mathematical theories of Probability and Statistics to his own real world "cultural" scenarios to help him understand these complex theories in college mathematics. In like manner, Rico told of how he would think of weird analogies to help him retain mathematical information. Rico also told of playing around with mathematical concepts and thinking of his own sample mathematics problems to help him contextualize mathematics. Further, he mentioned his firsthand account of keeping the treasury at his

grandfather's church, which strengthened his skills in mathematics. Roger, with the assistance of his Abstract Algebra professor, told of how they examined the rims of a car while studying dihedral groups. All of these were the participants' expressed representations of how mathematics was connected to their African American culture and thus to their everyday lives.

Also, the participants' cultural understanding was inclusive of knowledge regarding the presence of people of African descent in mathematics. While Rico and Roger had limited knowledge of the contributions of people of African descent to mathematics, Antonio and Dedrick had an extended knowledge base regarding the mathematics contributions of people of African descent. In my last interview with Antonio, he wore a shirt from his college mathematics experience that traced mathematics back to Egypt (see, e.g., Zaslavsky, 1999). Dedrick also possessed unprecedented historical knowledge concerning the historical legacy of people of African descent in mathematics. Dedrick's trip to Africa to teach mathematics later in life (i.e, after his college mathematics experience) added to his cultural understanding. As such, the participants' various internal ties to the African American culture further influenced their mathematics identity as African American male mathematics students and their ability to succeed in mathematics because they could identify with successful mathematicians who looked like them.

Another internal characteristic that these four African American had was that they had a persistent attitude with regards to their mathematical endeavors. I borrow from the *Webster's New Century Dictionary* (2001) definition of persistent and extend it to mathematics by using persistent to refer to my participants' ability to continue on with

mathematics as a major in college in spite of difficulties, oppositions, and so on. I am not suggesting that all it takes is effort or persistence in mathematics for African American male students to be successful in mathematics. In this study, however, all four of the participants shared how they worked hard or persisted in college mathematics even when they were faced with major obstacles. This theme was echoed in Warde's (2008) study with African American men with a baccalaureate degree. Warde found that African American male students possessed an internal drive that aided in their college completion when confronted with significant obstacles.

Antonio's difficulty came in managing his time with regards to balancing his demanding band schedule and his academic workload. Rico's dilemma was also with regards to time; balancing his demanding tutoring schedule along with being active in campus organizations including the choir contributed to him developing a persistent attitude. Dedrick's adversity came in the form of financial hardships. As a result of a lack of financial aid to cover out-of-state tuition costs, he had to transfer to another university. In addition to transferring to a new school, he also had to take introductory mathematics classes for which he was overqualified. Nevertheless, he still persisted with mathematics as a major in college. Roger's difficulty was with the discipline of mathematics itself. After struggling with mathematics and even failing his freshmen Calculus course in college, he persisted in college mathematics.

With regards to college mathematics, Roger stated: "If I had questions, I would go to my instructor. Or I'd seek out help and try to get some assistance or get it clear. So basically, I worked with a lot of the faculty members" (Interview 1). Collectively, all of the participants shared similar sentiments and noted that they sought help from their

mathematics professors when they were presented with abstract mathematics concepts. This routine is in stark contrast to the literature that purports that African American male college students work alone when presented with difficult circumstances (Treisman, 1992). In addition, each participant shared how he had to put a valuable amount of time, work, and energy into proving mathematical theorems and solving mathematics problems.

Interestingly, this persistent internal quality extended beyond my participants' mathematics work. Each participant likened the process of being persistent in mathematics to being persistent with other things. For example, Antonio and Dedrick related their persistent attitude and hard work ethic to their musical endeavors while in college. Rico related his persistent quality to his experiences with helping keep the treasury at his grandfather's church, which he claimed that this exercise increased his mathematical aptitude. Roger related his persistent quality to football:

> If you work hard, if you are true to football or true to our field, then you'll have a good outcome. And then not just, well, it's basically year-round. Basically with math, it's a, basically it's an ongoing, uh, ongoing field. (Roger, Interview 2)

Roger insinuated that working hard leads to favorable outcomes. He also implied that mathematics is an ongoing field. In other words, mathematics requires students to persist continually in order to be successful. In sum, each participant shared how they had to work hard and persist in mathematics as well as in other facets of life.

The last internal characteristic that was a commonality among the four African American male participants was that they were all spiritually grounded. I cite Watson's (2006) definition to clarify between spirituality and religion: "spirituality is a belief in some external, animating force, whereas religion is adherence to an established system of

beliefs and practices grounded in spirituality" (p. 113). Riggins, McNeal, and Herndon (2008) examined the role of spirituality among 13 African American male college students at an HBCU in the South and found that embracing their spirituality leads to continued college experiences for African American male college students. Religion was also emphasized, more specifically the role of the church, among African American college students as being critical to their success in mathematics and science in Hrabowski et al.'s (1998) study.

Although the four African American men in my study are spiritually grounded, they do not share the same religious affiliations. As a matter of fact, they all shared that they were affiliated with different denominations. They all, however, cited an internal connection or a personal relationship with a higher power (i.e., God), which helped with regards to their mathematics plans in college and their plans with life in general. I share a couple of the participants' statements below to exemplify their spiritual connectedness:

> My grandfather was a pastor. He, when I was younger, I would help him out with things he had to do. I also participated in the choir events that he had at his church. I'd help with the ushers; helping them count with the treasury and stuff like that. (Rico, Interview 1)

> I feel like this is what I was called to do. I didn't choose math. I believe it chose me. But I just got to a point where, I was at a point where I was basically, wanting to do good, but I didn't have no answers of how to get the math. Basically, I was a hard worker inside, but everything was gray to me. But I feel like the Lord put somebody in position to help me. So I feel like this is where I'm supposed to be or this is what I'm supposed to do. (Roger, Interview 1)

The above excerpts indicate that the participants were spiritually grounded. Antonio's comments also connect his spirituality to his cultural understandings. The participants, however, acknowledged an internal spirit man as key to their lived experiences. Moreover, the participants' spiritual connection was one of the driving

forces behind their success with mathematics as a major in college and with their success as African American men in general.

Racism

The second theme that I identified concerned issues of race and/or racism. The study's working definition of racism is borrowed from Delgado and Stefancic's (2001) scholarship, which defines racism as "any program or practice of discrimination, segregation, persecution, or mistreatment based on membership in a race or ethnic group" (p. 154). The African American men in this study cited instances in which they experienced discriminatory practices because of their race as African Americans. Their racial schooling experiences were distinct, and I have included a summary of their racialized schooling experiences in Table 3 to further situate each participant.

Table 3

Summary of the Racial Makeup of the Participants' Schooling Experiences

Participant	Elementary School	Middle School	High School	Undergraduate Institution	Graduate Institution
Antonio	African American	African American	African American	HBCU	PWI
Rico	White	White	White	HBCU	PWI
Dedrick	White	White	Diverse	HBCU	HBCU/PWI
Roger	Diverse	Diverse	Diverse	HBCU	PWI/Diverse

The study's theoretical lens, CRT's first tenet asserts that racism is normal in American society (Delgado & Stefancic, 2001). All four of the African American men in this study had a keen sense of the normalized practice of racism, and all four of these African American men pinpointed examples of racism in their personal lives. Moreover, they all expressed ideas parallel to that of racism being normal, especially with regards to African American men.

Second, CRT employs storytelling to “analyze the myths, presuppositions, and received wisdoms that make up the common culture about race and that invariably render blacks and other minorities one-down” (Delgado & Stefancic, 2000, p. xvii). I solicited my participants to tell their own stories in mathematics, especially with regards to race to construct their own realities pertaining to race and mathematics (education). Moreover, my participants’ racialized stories offered a different perspective from the realities offered from the dominant culture. By including my participants’ racial experiences in mathematics education, I sought to bring various racial issues to the forefront with the goal of exposing these issues to the dominant culture (as well as other cultures) with the hope of establishing mathematics practices that do not allow racism to thrive.

Third, CRT asserts a critique of liberalism (Ladson-Billings, 1999). For example, Rico’s case study highlighted the scenario with his White male principal who he believed hounded him because he was an African American man. Rico acknowledged that his principal’s meetings with him were not equitably distributed as compared to his White teacher colleagues. Even though Rico did not explicitly state that his principal did not know what liberty and equality were, he described practices enacted by his principal that were not equitable (Delgado & Stefancic, 2001). As such, this example serves as a critique of a liberal or equitable society.

Fourth, CRT argues that Whites have been the major beneficiaries of legislation (Ladson-Billings, 1999). Discussions concerning this fourth tenet were lacking from all four of the participants. This lack of critical consciousness concerning this last tenet might be contributed to their lack of knowledge regarding CRT as a theoretical framework. All of the participants, except for Dedrick, expressed that they had never

been exposed to CRT. Although Dedrick was exposed to CRT, he mentioned that he was not grounded in CRT. Nonetheless, the participants did not share any personal experiences that addressed the fourth tenet of CRT.

Tatum (2003) asserts, “Black boys also face a devalued status in the wider world. The all too familiar media image of a young Black man with his hands cuffed behind his back, arrested for a violent crime, has primed many to view young Black men with suspicion and fear” (pp. 57-58). Noguera (2008) adds, “For African American males, who are more likely than any other group to be subjected to negative forms of treatment in school, the message is clear: individuals of their race and gender may excel in sports, but not in math or history” (p. 31). Consequently, these examples portray some of the many racial messages that seem to come to the surface regarding African American male students. My participants were well aware of the racial undercurrents that pertain to African American male students. I recount some of their quotes below to unveil my participants’ racial sentiments:

> But, uh, I really haven’t been exposed to it, but I know that it’s been going on. I’m not ignorant to the fact of what’s going on. (Roger, Interview 3)

> Before a Black student steps into any arena or any institution or whatever, there’s already, uh, a perception of them in the group’s mind, and that’s what I see here. It’s like, okay, even if I’m not qualified to be at this school, quote on quote. It’s public school, so how am I not qualified? You know what I mean? (Antonio, Interview 3)

> Unfortunately, African Americans are, you know, disserved. So competition, I never worried about competition. And then, you know I understood why we were at a disadvantage. So when I do go out nationally and to my Whites and other races, it’s like okay. I made it this far. I really wasn’t supposed to cause when you think about our past, the past 400 years, we’ve been at a disadvantage. And we’ve struggled to get this far. So just the fact that I’ve gotten this far and the trials and struggles that I’ve gone through, are represented by my race and not necessarily me. (Antonio, Interview 3)

In the quote above, Antonio offered a different perspective, attributing his success in mathematics and life in general to his race of African American people. This quote was one illustration of an instance in which Antonio moved the issue of race to the forefront; the other three participants had personal experiences with racism and also had instances where they positioned race at the center of their analysis. I recount my participants' experiences with racism to demonstrate the racism that is endemic to society.

Rico experienced racism from his White male administrator. Rico believed that his administrator used his race as a White man to establish unnecessary meetings with him about pedagogical practices and used his race as a power dynamic to attempt to control him. Rico's paradigm is consistent with CRT's fourth tenet, which states that Whites seek to set up policies that seem to be an advantage for people of color but really seek to advance the interests of Whites themselves (Delgado & Stefancic, 2001). Applying this fourth tenet to Rico's experience, his White male administrator sought to set up meetings with Rico not to assist with his mathematics teaching but to push his own agenda, which Rico believed was to distract him from his planning and teaching time.

Dedrick cited an instance in which he had to resist both his mathematics education professor's as well as his colleagues' ideas about African American students being intellectually inferior. Dedrick recalled a moment where he found himself "educating" his classmates and his professor about the African American experience; he expressed that this was something that he had to do frequently when issues of race seemed to surface in the class. He expressed seeking to speak in an intelligent matter so that his classmates and professor would not (continue to) internalize negative messages

about African Americans. He felt pressured to defend himself and the African American community at large academically.

Another example of racism was Roger's experience as an employee at a company seeking a management position. He applied for the management position three times, and his packet was mysteriously lost the first 2 years that he applied. During the third year that he applied for the position, he hand delivered the management application to the district manager to no avail. Because Roger was well-qualified for the position being one of the few employees with a college degree and the only employee with a degree in mathematics, he linked the incident to racism. Roger's frustration made him feel as if he was "a nonentity" (Woodson, 1933/2000, p. 2) within the company. Roger's example, however, highlighted the racial discrimination that exists today that is subtle and more difficult to prove (Bell, 1992).

With regards to mathematics, Rico experienced subtle messages of racism from his tutees. While tutoring, his tutees seemed to portray an element of surprise that he, as an African American male mathematics student, possessed such profound mathematics knowledge. Similarly, Roger was viewed as being mathematically incapable of teaching an undergraduate mathematics course as an African American male graduate mathematics instructor in a predominantly White setting. Both Rico and Roger told of the fact that they were aware of the racial undertones that they perceived as a result of these messages.

Rico's and Roger's racial experiences are similar to the racial experiences of another African American male graduate student (see Cleveland, 2004). While working on his Ph.D. in education at a PWI, Cleveland realized that he was being judged because

of the color of his skin rather than because of his academic abilities. He shared his thoughts and feelings regarding the racism that was common in his doctoral program, which caused some conflicts among his cohort and faculty members. As an African American male doctoral student who was not afraid to write about and speak out concerning the racial injustices practiced at the institution, Cleveland refused to be treated as if he was a statistic. Rather, he sought to be treated with respect as an African American male scholar who was completing his doctoral studies at a well-respected research university. Likewise, Rico and Roger sought to be treated and viewed as competent mathematics scholars even though they were African American and male.

Antonio's case study was unique in that he did not cite any personal race instances directly. Rather, he spoke of the racism that African American men face in society in general. It is interesting to note Antonio's critical race eye as a student. When Antonio went on an overnight trip with a diverse group of high school students, he observed that he situated himself among the other African American students. Antonio's clustering with individuals of his same racial group symbolized his search for his personal identity as an adolescent African American (Tatum, 2003). During adolescence, Tatum posits that African American students begin to explore cultural issues related to being an African American young person. As such, "Black students turn to each other for the much needed support they are not likely to find anywhere else" (p. 60).

Antonio's clustering with other members of the African American population as an adolescent was also common among Dedrick and his clustering with other African American students in his doctoral program. Dedrick admitted that he was focused on making cultural connections during his doctoral studies; his dissertation research attempts

to make the cultural connection (i.e., Afrocentric) to mathematics. Nonetheless, Antonio and Dedrick were what Tatum (2003) described as immersing in their culture by "unlearning the internalized stereotypes about his or her own group and is redefining a positive sense of self, based on an affirmation of one's racial group identity" (p. 76). By clustering with other African Americans, Antonio and Dedrick were seeking "out opportunities to learn about one's own history and culture with the support of same-race peers" (p. 76).

Although I have noted the congregating of African Americans together, the concept of clustering with people of the same racial group can be extended to other marginalized groups as well. For example, Villalpando (2003) described the process of racial balkanization, which is when students of color disconnect themselves from the majority cultural group. His study with Chicano/a college students revealed that Chicano/a college students who associated with other Chicano/a college students strengthened their value and belief system, sought careers that catered to their community, and continued to actively participate in community activities after college. In this study, the participants, too, drew attention to the fact that fellowshipping with other African American students led to significant understandings about race/racism and strengthened their ties to the African American community.

Another interesting aspect of racism concerning Dedrick was his experience with an administrative person who was also an African American woman. Dating a young lady whose father was a well-known pediatrician in their city, Dedrick expressed that the administrative person was "looking down" on him as someone who was not "worthy" enough to be dating someone from such an upper class of African Americans. Dedrick's

“class” scenario is an example of a critique of CRT that it does not adequately address issues related to social class (Delgado & Stefancic, 2001). As it stands, CRT has not fully developed a comprehensive theory of class. Some scholars have begun to address issues related to race and class (see, e.g., Delgado & Stafancic, 2000; Shapiro, 2004). CRT, however, has not explicitly offered a critical stance that couples race and class.

The participants’ experiences with racism illuminated the racism that is normal in American society. Interestingly, they all expressed instances where they resisted racial injustices that would have otherwise discriminated against them. The participants’ excerpts and experiences discussed above demonstrate how four mathematically successful African American men understood racism and its consequences regarding the population of African American men holistically. They were, however, able to excel as African American men in their mathematics studies, in school in general, and in society-at-large in spite of racism.

Interestingly, the African American men in this study did not cite any racial experiences during their undergraduate studies due to the fact that all four of the African American men’s undergraduate studies in mathematics were completed at HBCUs, which I address in the next theme. Even though the four mathematically successful African American men did not make reference to any experiences with racism during their undergraduate mathematics experiences, their experiences with race/racism were prevalent during their experiences in which they were not in majority African American contexts.

HBCUs/African American Male Mathematics Professors

The third common characteristic among the four participants was that they all attended HBCUs during their college mathematics studies. More specifically, they all attended HBCUs in the southern part of the United States for their undergraduate studies. The African American male participants in this study expressed that their respective HBCUs served as institutions that provided positive racial environments. Their statements closely aligned with scholarship that purports that HBCUs provide a different milieu with regards to racial features for African American students (see, e.g., Copeland, 2006; Roebuck & Murty, 1993). With regards to HBCUs, Antonio noticed that the idea of milieu was inclusive of social aspects as well with his quote below:

> So I don't think there's a reason, I don't, performance, academic performance, man please. There are smart people in every culture and nationality; that's not the issue. The issue is can I come here and be, you know, socially comfortable? (Antonio, Interview 3)

Cooper (2000) also asserts: "Many black students find the most comfort and can relax, not fearing condescension or disrespect, in the company of other black students" (p. 185). As such, a unique feature concerning HBCUs is their potential for social and academic collaboration among a large pool of African American college students (Cooper, 2000; Kimbrough & Harper, 2006). Furthermore, "a key consideration for these students is being connected to peers who will provide them with critical feedback related not only to their academic progress, but also to their nonacademic progress" (Bonner & Bailey, 2006, p. 26). As mentioned previously, my participants' clustering with other African American students contributed to their peer academic support in college mathematics and with other facets of the African American experience as African American men.

With regards to HBCUs affording this feature of providing a large number of African American college students, this phenomenon rang true for Dedrick especially. Because Dedrick had witnessed many African American college students enjoying college life on the television show, *A Different World*, he cited this experience for being the chief reason why he decided to attend an HBCU. He expressed that he perceived the campus environments of HBCUs to provide supportive environments for African American college students. All four of my participants declared that they chose HBCUs for the supportive environment, especially the positive racial support they believed they needed as African American men.

Also, HBCUs train their students to provide service to the African American community (Roebuck & Murty, 1993). Because most HBCUs are located within predominantly African American communities, these institutions provide a unique service to African American students in the community who seek to enter college (Kimbrough & Harper, 2006). With my participants, Antonio worked with a program in which he taught mathematics SAT preparatory courses for community students while he was in college. Rico also did some mathematics tutoring to African American students in his college community. With his fraternal organization, Dedrick participated in community service projects. Although the projects were not mathematical in nature, he mentioned that the community initiatives promoted education for African American students.

All four of the participants, especially Rico and Roger, stressed that their mathematics departments at their HBCUs were getting them prepared for graduate work in mathematics. It is interesting to note that these two participants are also the individuals

who are pursuing graduate work in pure mathematics. Antonio emphasized how graduate representatives from various universities came to his college to recruit African American male mathematics students for their graduate programs in Mathematics and Statistics. This practice of preparing undergraduate mathematics students for graduate school work is consistent with Tucker's (1996) finding that effective undergraduate mathematics programs prepare students for advanced mathematics study. Although Tucker's study included case studies of mathematics departments from HBCUs and PWIs, the HBCUs possessed "especially nurturing atmospheres for students" (p. 1358). While these mathematical practices may occur at all higher education institutions, they were particularly meaningful for my participants at HBCUs because they expressed that this preparation came from someone of their own African American culture.

As expressed in chapter two, HBCUs provide access to higher education for African American students in a society permeated with racism (Brown & Davis, 2001). In the case of my four participants, HBCUs served as a vehicle to higher education as well as provided access to mathematics. In addition to providing my participants access to higher education and to mathematics, the data revealed that these four mathematically successful African American were also granted access to African American male mathematics professors at their respective HBCUs.

According to Roebuck and Murty (1993), one of the goals of HBCUs is to provide African American role models who examine issues relevant to the African American community. With regards to mathematics, McGlamery and Mitchell (2000) found that it was beneficial to bring in mathematics and science professionals from different racial and gender groups to encourage students to pursue careers in these fields.

More specifically, they sought to bring in more African American professionals to recruit and retain African American male high school students in mathematics. While completing their undergraduate studies in mathematics at HBCUs, all four of the African American men in this study cited an African American male mathematics professor as being an influential role model with regards to their mathematics education. I have noted this phenomenon as the secondary aspect of this theme because my participants were able to gain access and attain success in mathematics as a result of these interactions. I am not suggesting, however, that placing African American male students with African American male mathematics professors will ensure college mathematics success.

Consequently, what I found in the data were resounding messages of these African American male mathematics professors being instrumental in my participants' college mathematics experiences. Similarly, the African American male high school mathematics students in McGlamery and Mitchell's (2000) study were able to relate and connect to the professional African American mathematicians because the mathematicians "embodied their culture and attitudes" (p. 81). With regards to my study, the participants acknowledged that they were able to make the cultural connection to an African American male mathematics professor.

In the case of Antonio, he sought the help of an African American male mathematics professor to assist with his senior project in the area of Numerical Analysis. Although Antonio was not enrolled in this professor's course, he went to this professor to obtain mentoring in mathematics. Antonio also mentioned that he was able to relate to his African American male mathematics professor. Moreover, Rico cited an influential African American male mathematics professor who served as a father figure to him. Rico

discussed the personal advice concerning life as an African American male in this society that was provided to him by his African American mathematics professor. In like manner, Dedrick mentioned his fraternity brother who was also a mathematics professor at his HBCU. Dedrick told of how his mathematics professor was a positive influence with regards to mathematics and his work with the fraternity in the African American community. In addition, Roger was taken under his African American male mathematics professor's wings (so to speak) to understand the fundamental theorems and rules of mathematics. Roger cited his African American male mathematics professor as showing him "the ins and outs" (Interview 1) of mathematics and encouraging him to pursue a major in mathematics. I highlight some of my participants' statements below with regards to their experiences with African American mathematics professors.

> He was sort of like a father figure to me at the same time when he taught…I guess with African Americans, they normally see the opposite race (mathematics professors). But for me, what was so odd for me was that I was also motivated by people of opposite races to want to do things like pursue, go on to grad school. (Rico, Interview 2)

> You know, being on a Black college campus and in the math and science department, we had a lot of foreigners. So to see someone of African descent or an African American math teacher, it was like an added bonus, like a special added bonus because everyone else was foreign. (Dedrick, Interview 2)

> Uh, you know anyone that goes back to teach at their alma mater or anyone that has an alma mater, is always going to pump up their alma mater. So it's always going to be like hey, survive this class so you can join the ranks of the Delmont man… So it's (having African American male mathematics professors) very motivating. And so you see the example of a Delmont man sitting right in front of you, someone who actually sat in some of the same seats that you're sitting in or went through the same process that you went through. (Antonio, Interview 2)

Rico acknowledged that even though the African American male mathematics professor was influential, he was influenced by members of the dominant culture as well.

He mentioned that he considered it an oddity that he was influenced to pursue graduate studies by White faculty members. Dedrick mentioned that there was a large concentration of foreign professors in his mathematics and science department at his HBCU and that he considered it a bonus to have some African American professors in the mathematics and science department. This example also poignantly pinpoints an issue concerning the lack of African American mathematics and science professors at HBCUs and the influx of foreign mathematics and science professors at HBCUs. (For more information concerning this discussion, please refer to chapter 6.) With Antonio, he found it a motivating factor to have African American male mathematics professor instructing his mathematics courses, especially African American men who were alumni of his undergraduate institution. Yet, the fact remains that these four African American men were nonetheless influenced to persist in mathematics in college because of the efforts of an African American male mathematics professor.

After soliciting participants for my study in a major city in the southern part of the United States filled with college educated African Americans, my search resulted in four mathematically successful African American men who attended HBCUs for their undergraduate experiences. The participants expressed that they received encouragement and support from classmates, faculty, and staff members alike at these HBCUs. These support mechanisms promoted a positive racialized culture in a society that seeks to do otherwise. Also, an important observation confirmed by the data was that the participants were provided access to African American male mathematics professors at their HBCUs, which strengthened their identities as mathematics scholars. In part, because of their

positive experiences with college mathematics at HBCUs, they all seemed hopeful about the future of African American students in mathematics.

Positive Affirmations Concerning the Future of African American Men in Mathematics

As indicated, this study examined the experiences of four mathematically successful African American men in college mathematics. The four participants held positive beliefs concerning the "plight" of African American male students in general and in mathematics in particular. In other words, the participants possessed positive outlooks concerning the participation of African American male students in mathematics. I offer the participants' statements below to reveal their sentiments regarding the plight of African American students in mathematics and in school in general.

> Well, as a teacher, I am excited about math, which brought a different twist to the classroom. They saw a young guy doing mathematics, and so you see someone you can relate to, so it's like hey, maybe I can do it too. (Antonio, Interview 2)

> It is a shortage (of African Americans in mathematics), and it can be improved. But it mostly has to start from home where the kids are being taught in school, how teachers are teaching, how teachers are motivating kids to want to learn and be involved in math and be excited about math. If the teacher shows excitement about math, then maybe kids would want to do more with math… If they see the importance of how it plays, that will make it fascinating for the child, if they see the importance of it. (Rico, Interview 3)

> We all get grouped into this one category. And then, you know, with the images that you see on TV… We all don't have saggy pants, and gold teeth, and what not. At the same time, I even see it with my students. You can never judge a book by its cover; you can't group everybody into the same category together. So a lot of these students are known for trying to portray these images, but when you crack them open and really get to them on the inside, you know a lot of these guys are smart; they're smart geniuses or what not... And a lot of people do judge off of what they see before they actually get to know a person, before they get to know their intellect and so on and so forth. But I try to carry myself in a manner in which I can be a role model to somebody that's looking up to me even if I

> don't know them or whatever. So I try to portray a positive image from the outside as well as from the inside. (Dedrick, Interview 3)

Antonio and Rico spoke about the mathematical excitement that must be exhibited in order to attract students to mathematics. Dedrick's reference to his African American male students as geniuses speaks to his ideological framework concerning African American male students. Kunjufu (1995) noted: "What teachers *see* in the child is what they produce *out* of the child" (p. 47). Antonio, too, as an African American male high school mathematics teacher purported to have high mathematics expectations for his students as well as portray a positive image as an African American for his students.

The participants' high expectations were extended to African American male students in college mathematics. Again, I provide the participants' direct quotes below to pinpoint their beliefs pertaining to the participation of African American male students in college mathematics:

> Stay focused on your goal and even when it feels like it's time-consuming and it's pointless and a waste of time during your degree program, kind of look back on your purpose of why you joined the program and what was your purpose. Sometimes we get lost in all of the work that we do as a graduate student that we get away from the passion… This whole journey in the class or inside the graduate program is all part of the process. (Rico, Interview 3)

> If you really strong on wanting to get individuals involved in math, you want to develop a good repertoire with the students and find out what their interests are in math and then run with that interest. And then you can probably develop a research project that they're interested in… If the faculty comes together and have some type of mentoring program for the student, and always encourage them to go further and not stop just at the research or just stop at the undergraduate program or the graduate program. (Rico, Interview 3)

> Be true to your craft. Learn your craft. Study your craft. And never stop learning. (Dedrick, Interview 3)

> I'm right here at the foundation to meet them (African American male students) where they are in high school. And I think right now I can get them interested and show them the beauty of math and show them how all of the pieces of the puzzle fit together and how it works and apply math and to hone in on their thinking skills… So I think if I have those that they come with an inkling of interest or somewhat of a background in math, then I can get them, mold them and shape them, to go and fall in love with math and to go on and have a math major or a math education major. (Dedrick, Interview 3)

> At the present moment, I feel that the future is bright… I believe that we can influence a lot of Black young men to pursue math and science degrees. (Roger, Interview 3)

The participants' remarks demonstrated that they were passionate about mathematics being accessible to African American students, particularly African American male students. They shared various strategies and words of wisdom in regard to the participation of African American students in both mathematics and mathematics education. Furthermore, their personal success stories with mathematics influenced their optimistic claims with respect to African American male students in mathematics.

While Antonio, Rico, and Dedrick all formed relationships with mathematics during their K–12 schooling experiences, Roger did not. Roger was the only participant to tap into his mathematical gift during his undergraduate education. Roger's example is powerful in that it signifies how important it is for mathematicians and mathematics educators to realize the unrecognized potential in African American students, especially African American male students (Cooper, 2000, 2004). My participants all expressed interests in playing their part to recognize the mathematical intuition among African American students, especially African American male students. Roger, specifically, shared his drive to help prospective African American male students in mathematics:

> Basically so I can do the same thing they (African American male mathematics professors) did for me. Help other African American young

> men that's coming along. So then they can help other African American males that's coming along. (Roger, Interview 2)

Notably, each of these African American men accepted personal responsibility for doing their part to attract more African American male students to the mathematics pipeline. They all acknowledged that they are in unique positions to encourage more African American students, particularly African American male students to continue in the mathematics pipeline. As high school mathematics teachers in predominantly African American settings, Antonio and Dedrick believe that they are in prime positions to encourage more African American students to pursue a career in mathematics. Antonio mentioned that his excitement about mathematics as a young African American male mathematics teacher of freshmen high school students might be an added dimension because his students see an example of someone who is practicing mathematics that represents their culture.

The four participants articulated optimism regarding the participation of African American male students in mathematics. Although the participants knew about the racism and negative stereotypes that are used to burden African American male students, they did not allow these views shatter their images of the favorable outcomes they envisioned regarding African American male students in mathematics. Furthermore, despite the shortage of African American men in mathematics, all four participants offered optimistic thoughts and hopeful strategies to recruit and retain more African American male students in mathematics and mathematics education. They all shared positive affirmations regarding the plight of African American male mathematicians and mathematics educators.

Summary

In this chapter, I presented the case studies of Antonio's, Rico's, Dedrick's, and Roger's experiences as African American men in mathematics using a critical race theoretical perspective. I identified the following four themes from an analysis of the data: (1) the participants believed that they possessed internal characteristics that aided in their mathematics achievement, (2) the participants resisted racial injustices as African American men, (3) the participants all attended HBCUs for their undergraduate studies in mathematics and had access to African American male mathematics professors, and (4) the participants had positive outlooks concerning the participation of African American male students in college mathematics.

First, the participants' internal characteristics, which included a mathematics identity, a cultural understanding, a persistent attitude, and a spiritual connection contributed to their success with mathematics in college and their overall success as African American men in general. Although this theme was common across all four of the participants, an analysis of the data revealed that these African American men's individual lived experiences caused them to enact the theme in different ways.

Next, the participants' experiences with racism illuminated the racism that African American male students face in schools and in society-at-large. In addition, their experiences with racism were their own constructed realities and provided them with an understanding regarding the significance of race. As African American male students, Antonio, Rico, Dedrick, and Roger were able to reject the racism that could have potentially hindered them from succeeding in mathematics. Furthermore, they were able to ignore the racial undertones concerning African American male students.

Third, the participants all attended HBCUs for their undergraduate studies in mathematics. Their respective HBCUs allowed them to collaborate with several other African American college students, provided them the opportunity to engage in providing service to the African American community, and prepared them to engage in graduate mathematics coursework. Furthermore, by attending HBCUs, the participants were provided access to African American male mathematics professors, who were instrumental in their college mathematics success.

Finally, the study's participants' undergraduate experiences with mathematics were fruitful and thus they all expressed positive notions regarding the participation of African American male students in college mathematics. Their quotations listed in the previous section illuminate the vision that they possess regarding the participation of African American male students in college mathematics. Moreover, they offered positive affirmations regarding the success of African American men in general.

The findings of this research study demonstrate how four African American men were successful in college mathematics. As the participants' case studies attest, their experiences in mathematics and as African American men were unique. Furthermore, the data suggest that there are implications and suggestions for research, policy, and practice. In the next chapter, I conclude the dissertation, discuss the limitations and implications of the study, and offer suggestions for future research.

CHAPTER 6

CONCLUSIONS & RECOMMENDATIONS

In the final chapter, I conclude my study on the experiences of four successful African American men in college mathematics. I conclude by recapping the purpose of the study, the research questions, the methodological approach, and the theoretical framework. I make recommendations for those invested in the mathematics education of African American male students. I then discuss the limitations of the study and the implications for research, policy, and practice. Additionally, I offer suggestions for future research and provide an overview of the study as it pertains to the participation of African American male students in the mathematics pipeline.

Summary

The mathematics education of African American male students remains a complex topic of investigation for researchers. Research conducted at the undergraduate level concerning African American men's mathematics experiences emphasizes the difficulties that many of them face with mathematics (see, e.g., Fullilove & Treisman, 1990; Stage & Kloosterman, 1995; Treisman, 1992). In spite of these reported difficulties, there are some African American male students who achieve in college mathematics. While there are studies that focus on the successful mathematics experiences of African American students at the middle and secondary levels (see, e.g., Berry, 2008; Martin, 2000; Moody, 2000; Stinson, 2008; Walker, 2006), studies that

examine the successful schooling and mathematics experiences of African American students, particularly African American male students, at the college level are limited.

This study focused on the experiences of four mathematically successful African American men who studied mathematics in college and who are currently pursuing graduate degrees in mathematics or mathematics education. Through the multiple case study methodological approach embedded within a critical race theoretical perspective, I explored how they gained access to college mathematics, how they achieved in college mathematics, and how their race and/or racism affected their performance in college mathematics. The following research questions guided the study:

1. To what factors and/or experiences do mathematically successful African American men attribute their success with mathematics as a major in college?
2. What did these mathematically successful African American men do inside and/or outside of the college mathematics classroom to warrant success as college mathematics majors?
3. How did these mathematically successful African American men negotiate their race and/or racism during their mathematics experiences and as African American men in general?

As indicated, I employed the multiple case study methodological approach (Merriam, 1998). I utilized surveys, conducted three interviews, and solicited artifacts from my participants regarding their experiences in mathematics. I gave my participants a survey preceding the first interview. The artifacts served as a catalyst for discussion for the second interview, while the Duncan (2002) article was used to elicit responses concerning race and/or racism during the third interview. (For a synopsis of the Duncan

article, please refer to chapter 4.) Over a 7 month period, I met my participants at their proposed locations to conduct the three interviews to chronicle their experiences as successful African American men in mathematics. I reported the findings from the four case studies in the previous chapter (chapter 5). Additionally, I reflected upon and presented my own “mathematics story” (foreword) to address my subjectivity and to help the reader understand how I was led to this research inquiry.

Along with the multiple case study approach, I employed a critical race theoretical framework to investigate how race and/or racism might play out in my participants’ mathematics education experiences. Employing critical race theory (CRT) allowed me to explore the culture of my participants’ education institution, to examine the covert and overt instances of racism experienced, and to seek to understand how they negotiated their race and/or racism as African American men (DeCuir & Dixson, 2004). (For a discussion of their specific experiences with race and/or racism, please refer to chapter 5.) CRT also aligned with qualitative research in general and the multiple case study approach in particular because it drew upon my participants’ “voices” through storytelling to capture their experiences with race and/or racism as well as their experiences in mathematics (Dixson & Rousseau, 2005). By combining the multiple case study approach with CRT, I sought to offer a different perspective concerning the experiences of African American male students as it relates to race and/or racism and their access to college mathematics.

In this study, the four African American men provided thick descriptions when questioned about their experiences with (college) mathematics, with race and/or racism, and with race and/or racism in mathematics. They identified internal factors within

themselves as well as African American male mathematics professors as contributors to their college success with mathematics. Moreover, the participants cited their historically Black colleges and universities (HBCUs) as providing supportive racial and academic climates as it pertained to their undergraduate mathematics success. Further, the participants negotiated various racial dynamics and thus expressed positive affirmations concerning the plight of African American men, particularly in mathematics.

This study expands the public's understandings regarding the mathematics experiences of four successful African American men in college mathematics. Moreover, this study has attempted to offer a discourse of success as it pertains to the mathematics experiences of African American male students (Stinson, 2004, 2008). While this research has the potential to extend the public's view concerning the obstacles, especially racial ones, which African American male students face, my hope is that those invested in the mathematics education of African American male students will think of possible strategies to enact within their own domains to provide African American male students with access to mathematics. Furthermore, this study is significant because it adds to the limited knowledge base concerning the successful college mathematics experiences of African American male students.

Recommendations

As I conclude the project, I realize that the research investigation is ongoing. I am still in the process of thinking about the different angles in which I can dissect the data and the future directions in which I will pursue this work. I am also searching for new ways to bring race to the forefront of my analysis. Although I have posed these three research questions, I realize that I have only begun to scratch the surface concerning the

participation of successful African American men in mathematics. The issues regarding African American male students in mathematics are complex and will require further research and analysis to positively affect the mathematics achievement rates for African American male students.

As such, I am positing five recommendations for those invested in African American male students' access to mathematics. These recommendations are intended to be (re)starting points of reflection and action for those involved in the mathematics education of African American male students from P–16. While I am not arguing that employing these suggested recommendations will lead to mathematics success for all African American male students, I am, however, arguing that these recommendations might assist with the mathematics achievement of African American male students. I now turn my discussion to the following recommendations:

Recommendation #1: Engage in dialogue with African American male students about racism in society.

In keeping with the study's theoretical perspective, CRT, I recommend that issues of race and/or racism be brought to the foreground in regards to African American male students. I posit that all students should engage in conversations concerning race and/or racism, even in the mathematics classroom. At the undergraduate level, African American students should be exposed to literature employing CRT as a theoretical lens. By instituting this practice, we as mathematics educators are not allowing racism to thrive. Rather, we are seeking to expose racism and its effects on racialized students in hopes of breaking down some of the racial barriers that exist in mathematics and in society in general (Delgado & Stefancic, 2000). Such dialogue could bring understanding

about racism to marginalized groups and to the dominant culture as well (Delgado, 1989). My hope is that this dialogue will also contribute to the positive cultural identity of African American male students and to the mathematics success of African American male students.

Cooper (2000) asserts, “Many black students find the most comfort and can relax, not fearing condescension or disrespect, in the company of other black students” (p. 185). I extend this argument to the specific population of African American male students. In the company of other African American male students, African American male students might feel more comfortable talking about issues such as racism in “safe” spaces. At the undergraduate level, an implementation of a freshman seminar course designed specifically for African American men might be a step in reaching this goal. Antonio and Rico both attended an all-male HBCU and expressed that the atmosphere embraced a positive racial identity for the African American men.

As my four participants’ case studies attest, these four African American men are keenly aware of the negative stereotypes and racism that are commonly used to hinder African American male students. They shared examples of the many conversations they have had in their personal lives as it pertains to the racism that African American male students face. Sharing of some these stories along with stories in the research literature concerning African American men in school and society who have been successful negotiating the racial pipeline might serve beneficial to students, especially African American male students. Furthermore, I concur with Tatum (2003) that this racial dialogue should begin with children, especially African American male students in the early years. The inclusion of children’s literature that promotes anti-racist behaviors for

younger children must be included in the homes and mathematics classrooms of all students to aid in the fight against the racism that evades society—including the mathematics classroom (Martin, 2009).

Recommendation #2: Ensure that mathematics and higher education are accessible to African American male students.

My second recommendation is for providing African American male students access to mathematics that builds upon the African American male culture. Many scholars echo similar sentiments that mathematics should be connected to African American students' as well as other students of color cultural experiences (Berry, 2005; Ladson-Billings, 1994; Moses & Cobb, 2001; Tate, 2005). I propose that mathematics experiences be established to allow African American male students to make the connection of mathematics to their experiences as African American male students.

In recommending that mathematics be consistent with the African American male experience, I am not suggesting that certain cultural experiences are going to be representative and culturally relevant to all African American male students (Berry, 2005). For example, even though my participants are all African American men, they represent a diversity of backgrounds and interests and they experienced mathematics in distinct ways. Roger spoke about the connection that his mathematics professor assisted him in seeing the relationship between dihedral groups and the rims of cars. While this example served as a connector of mathematics to the real world, this example was unique to Roger. As such, mathematics educators must be in tune with their African American male students to develop nuances that speak to that particular African American male culture.

Moreover, African American male students should be provided access to higher education. Because HBCUs are a vehicle in which many African American male students are provided access to higher education with high retention rates, HBCUs should be presented as a viable option as well as predominantly White institutions (PWIs) for African American male students to pursue their undergraduate studies (Allen, 1992; Copeland, 2006; Kimbrough & Harper, 2006). With regards to HBCUs, Kimbrough and Harper (2006) recommend:

> Given that most HBCUs are nestled in the heart of Black neighborhoods or in close geographic proximity to large concentrations of African Americans, they are in a unique position to reinforce college-going messages to young boys and teenage males. After-school, summer, and special outreach programs should be created to nurture pools of prospective African American male college-goers. (p. 205)

Kimbrough and Harper's recommendation should be implemented given that several HBCUs are embedded within African American communities. This recommendation will serve powerful to young African American male students as well as the African American men who assist with such efforts. During their college years, Antonio, Rico, and Dedrick each articulated personal examples of how they reached out to African American children, via tutoring mathematics and/or community service initiatives, who lived near their respective HBCUs. By doing so, they were implicitly sending messages to those students to pursue higher education, especially African American male students.

<u>Recommendation #3: Expose African American male students to the mathematics contributions of people of African descent, to career opportunities that are available to them in mathematics, and to African American men in the mathematics pipeline.</u>

I recommend that African American students in general and African American male students in particular be exposed to the mathematical historiography of people of

African descent. I challenge those mathematics educators who are not familiar with the mathematics history of people of African descent as well as other marginalized groups to research, learn, share, and engage in dialogue about this history with all students, especially African American male students. If we as mathematics educators are serious about the mathematics education of African American male students, then we must make concerted efforts to seek out this knowledge. Such historical knowledge might influence African American male students to pursue advanced studies in mathematics, particularly at the collegiate level (Agwu & Nkwanta, 1997; Bonner & Bailey, 2006; Kenschaft, 2005). As Bonner and Bailey (2006) affirm: “Identifying the accomplishments of African Americans in the sciences, history, politics, and mathematics aids students in realizing the endless possibilities of their educational pursuits, and it can end off the onset of academic disengagement” (p. 32).

Additionally, I contend that African American male students should be exposed to the career opportunities that are available to them if they pursue mathematics as a major. My participants each shared that they held limited views about the career opportunities in mathematics. Also, they shared how they were encouraged to study engineering and computer science in college because of the “applications” of these disciplines and the nice financial compensation packages associated with these fields. All of the participants in this study, except for Antonio who declared mathematics as his major upon entering college, entered college seeking to pursue majors in various mathematics related disciplines. Rico and Roger initially sought to study computer science while Dedrick sought to study engineering. I argue that if African American male students can become attracted to majors in computer science and engineering, then mathematics, the driving

force behind these disciplines, should be equally paraded and attractively presented as a career option for African American male students.

I also posit that African American male students should have access to other African American men in the field of mathematics via mentors, professors, and so on. In this study, the four participants had access to several African American male mathematics professors at their respective HBCUs during their undergraduate mathematics experiences. In college, Dedrick mentioned that he felt fortunate to have African American mathematics professors given that his mathematics department was composed primarily of foreigner mathematics professors. Similarly, Rico mentioned that he was influenced by White faculty members to pursue graduate studies in mathematics mainly because there was a shortage of African American (male) mathematics professors to assist him. These two participants, however, still maintained that their exposure to other African American men in the mathematics pipeline strongly influenced their participation in mathematics. As such, I recommend that African American male students be exposed to African American men who have been successful negotiating the mathematics pipeline as African American men.

Recommendation #4: Recognize and build upon the mathematics potential in African American male students even at the collegiate level.

I am in agreement with Cooper's (2000, 2004) recommendation that we, as mathematics educators, recognize the mathematics potential in African American male students. I concur with Wilson (1992) that we need to awaken the natural genius in our Black children, especially our African American male students. Where would the field of mathematics/mathematics education be if we, as those invested in the mathematics

education of African American male students, considered the African American male students that we encounter as natural geniuses? My study included four African American men who I consider geniuses and had different trajectories as it relates to their participation in mathematics.

While Antonio, Rico, and Dedrick all formed positive relationships with mathematics during their educational experiences, Roger was the only participant who did not experience much success with mathematics initially. As indicated in Roger's case study, Roger failed mathematics in high school and in college, resulting in him having to take mathematics courses during the summer session. Roger could have been perceived as not having mathematics potential. Furthermore, given that he was a college student, it could have been perceived that it was "too late" for him to begin his mathematical journey. Roger, however, was able to achieve because his mathematics professors, in particular an African American male mathematics professor, recognized his mathematics potential. Roger's case study is powerful in that it signifies how important it is for mathematicians and mathematics educators to realize the unrecognized potential in African American students at all educational levels, especially African American male students (Cooper, 2000, 2004).

Recommendation #5: Engage African American male students in "challenging" mathematics by implementing various pedagogical practices and mathematics curricula that requires critical thinking in P–16.

With this recommendation, I challenge mathematics educators to seek out mathematics lessons, activities, projects, and so on that require students to think critically and to use mathematics to analyze various community, national, and international issues

(Gutstein & Peterson, 2006). Some examples of this practice include teaching mathematics for social justice and relating mathematics to students' local community experiences (Berry, 2003; Gutstein & Peterson, 2006; Ladson-Billings, 1994; Moses & Cobb, 2001). As forestated, Dedrick mentioned his cultural connection to the string arts project that he completed in high school. Also, Rico told how his abstract algebra professor used the rims of a car to help the students apply the concept of dihedral groups. When explaining these mathematics lessons to me during our interview, the participants showed a "new" excitement concerning mathematics. My hope is that more African American male students at all levels will experience similar engaging mathematics lessons that excite them about mathematics, connect mathematics to their experiences, and require them to think critically, especially at the undergraduate level.

Limitations of the Study

A limitation of the study was that my participants included four African American men who attended HBCUs in the southern part of the United States. One limitation of the study is that my participants were all reared and attended schools in the South. This phenomenon implies that the participants' experiences were viewed through a "southern" lens. Morris and Monroe (2009) highlight the South as an overlooked place for investigating the educational experiences of African American students, especially given the large concentrations of African American people in the South. Including African American male students who completed their undergraduate degrees in mathematics in other regions of the United States, however, might have provided additional insights as it pertains to the data in this project.

Although qualitative research methodology supports a sample size of four, the use of four participants is a limited number of participants for the investigation. Adding more participants to the sample size might have served valuable in an investigation such as this one to add to knowledge base concerning mathematically successful African American men's racial experiences. Further, including more success stories could have continued to build our understandings regarding the experiences of African American male students in mathematics, especially college mathematics. Also, the findings from the four participants in this study cannot be generalized to all African American male mathematics majors.

Another limitation was that I only included African American men in this study. As such, my study did not include African American women as well as other marginalized groups. Perhaps the inclusion of other marginalized groups employing a critical race perspective might have given "voice" to other marginalized populations as it pertains to their racial, mathematics experiences (Bernal, 2002; Dixson & Rousseau, 2005).

Implications

This study on successful African American men in college mathematics has implications for research, policy, and practice. With regards to research, research methodological and theoretical approaches that foreground race must be employed in mathematics education research. Also, the inclusion of African American male students' "voices" in research has significant implications for those conducting research concerning the plight of African American male students in mathematics. I address some courses of action as it pertains to future research in this area in the next section.

I posit that policymakers must move away from deficit theories as it relates to the mathematics achievement of students of color, especially African American male students. Policy makers must consider the perspective of research that situates African American male students as successful mathematics students (e.g., see Berry, 2005, 2008; Stinson, 2004, 2008; Thompson & Lewis, 2005). My hope is that my study will also be examined as it pertains to educational policy at the undergraduate level. These studies have to be given considerable attention when policymakers develop policies that affect the mathematics education of African American male students. Furthermore, policymakers must account for race in their established educational policies.

Policymakers and practitioners must recognize HBCUs as credible academic institutions. In the case of Dedrick, he believed that his doctoral cohort members and faculty members at his institution considered him less intelligent because he had received an undergraduate and Master's degree from an HBCU. As such, African American students from majority African American institutions at all levels must be considered scholars even if their institutions are inequitably funded.

Another implication is for mathematics education practitioners to recognize the mathematics potential in African American male students (Cooper, 2000, 2004). Yet, another implication is for mathematics educators to research the mathematical contributions of people of color and use that as a foundation for mathematics teaching and learning for all students (Kenschaft, 2005). In addition, practitioners must listen to their African American students' "voices" as it relates to their mathematics education. As mathematics educators, we must propose mathematics as a viable college major for all students, especially African American male students.

Suggestions for Future Research

After conducting this study, I have noted several directions for future research as it pertains to the mathematics achievement of African American men in higher education. I contend that these suggestions will also serve valuable for African American women, other marginalized groups, and the dominant culture. If employed, these research suggestions can provide insights to the mathematics education community, to researchers, and to policymakers.

First and foremost, I propose that future mathematics education research use CRT as a theoretical lens to analyze different phenomena. Dedrick mentioned that there was a large population of foreign mathematics professors at his HBCU. Future research should examine the hiring practices of mathematics faculty in mathematics departments at HBCUs employing a critical race lens. Furthermore, future research should consider the implications of having several foreign mathematics professors. On the other hand, all four of my participants expressed that they had access to African American male mathematics professors. Their African American male mathematics professors, however, were instrumental in their success with mathematics. Future research should also examine the affects of having African American male mathematics professors on the mathematics achievement levels of African American (male) students. For example, Abdulalim Shabazz experienced much success in motivating African American students to achieve in undergraduate mathematics and to go on to pursue graduate degrees in mathematics (Kenschaft, 2005). As such, researchers should initiate conversations with those scholars of African descent who have a legacy of producing African American mathematicians, especially African American male mathematicians employing CRT.

Next, I propose that future researchers tap into the academic networks and communities established at HBCUs. Researchers should examine the role and impact of HBCUs in producing African American mathematicians and mathematics educators. Because HBCUs abound in producing African American college graduates, the successful established (mathematics) practices at these institutions should be researched (Allen, 1992; Kimbrough & Harper, 2006). As forestated, future researchers investigating these complex issues regarding the participation of African American men in mathematics should employ a critical race perspective to bring issues of race and/or racism to the forefront. Future research should also examine the curricula and practices (i.e., community service projects, African American cultural events, and so on) at HBCUs to investigate the ways in which HBCUs are educating college students to become critical race thinkers and activists (if at all). What is being taught at HBCUs to continue the intellectual traditions established by our forefathers and foremothers? What are HBCUs doing to produce race conscious college graduates? And how do HBCUs ensure that African American male students in particular understand the ramifications of race consciousness? These are some examples of future research questions that could be examined employing a critical race lens.

An examination of the contributions of people of African descent to mathematics would be beneficial. Although some scholars have begun to conduct research in this area (see, e.g., Gerdes, 1994; Joseph, 1990; Kenschaft, 2005; Williams, 1997; Zaslavsky, 1999), there is much work to be done in this area. In the foreword, I noted that I have several books by African American authors; however, I also noted that I have a difficult time locating texts that recognize the contributions of people of African descent to

mathematics. I argue that more research is needed that situates the cultural context of mathematics in Africa. This linkage could serve as a powerful approach to help African American students connect to Africa and to mathematics.

As I mentioned in the limitations section, this study had four African American male students. Future research could examine the mathematics success stories of African American women as well as other marginalized groups (i.e., Latino/as, Chicano/as, Native Americans, and so on) using CRT, LatCrit, and TribalCrit. In addition, future research should continue to examine the relationship(s) between spirituality and academic achievement among African American students (Riggins, McNeal, & Herndon, 2008). Future research could examine the role of spirituality as it relates to mathematics achievement. As a developing scholar, I would like to engage in a future research study that aims to explain the interconnectedness of African American spirituality and mathematics employing a critical race theoretical perspective.

Also, I mentioned the South as a critical place for investigating the educational achievements of African American students given the South's African American population as well as rich African American history and culture (Morris & Monroe, 2009). Morris and Monroe point out that the South has been accidently "stumbled upon" in research studies as a region for examining the schooling experiences of African American students, not necessarily highlighting the geographical influences of the region. I, too, "stumbled upon" this phenomenon of the South as a critical region by highlighting the fact that my participants attended HBCUs in the South. I concur with Morris and Monroe that the South's unique region must be placed at the forefront of future educational research as opposed to being some sort of later "discovery."

With regards to mathematics teaching and learning, future research could examine the experiences of successful African American male mathematics teachers. For example, Dedrick has experienced much success in teaching mathematics to African American high school students. Future research could also examine the reasons attributed to why successful African American male mathematics teachers leave the teaching profession and bring issues of race to the forefront. Antonio has decided that he will leave teaching high school mathematics altogether and pursue a degree in dentistry. Rico decided to leave the teaching profession after one year of teaching despite his drive to teach mathematics. Future research should investigate these issues with the hopes of retaining African American men who have a passion to teach mathematics.

In addition, I recommend that critical race researchers establish a theoretical paradigm that analyzes class using a critical race lens (Delgado & Stefancic, 2001). In other words, I suggest that future research consider a theory that meshes race and class. One participant, Dedrick, mentioned how the administrative assistant at his high school "looked down" on him. He expressed that this African American woman viewed him negatively because he was not a member of the upper-middle class. This experience represents a coupling of discrimination on the account of both racism and classism. Future research could use CRT's developing theory as it relates to class to examine racial/class experiences from members of one's own racial group.

For this study, I invited four African American male graduate students to reflect on their undergraduate experiences in mathematics. Future research could examine the mathematical, educational, and racial experiences of African American male doctoral students in mathematics and/or mathematics education after they have successfully

completed their respective programs. With my own specific research, I could conduct a follow-up investigation with my four participants in the near future prompting them to reflect on their graduate experiences in mathematics, especially given that they are not pursuing graduate studies at institutions with a majority African American student population.

Conclusion

Through this research investigation, I have explored the mathematical, schooling, and racial experiences of four successful African American men in college mathematics. This investigation extended beyond their collegiate mathematics experiences tapping into their K–12 as well as their graduate school educational experiences. Their mathematical stories are both empowering and motivating. Added to that, their experiences with negotiating their race and the racism in society are noteworthy. For my participants to negotiate the racial dynamics used to deter African American male students, to attain mathematics success in a racialized society, and to continue in that success even as they pursue graduate degrees in diverse and predominantly White settings is also to be commended. As a result of their persistence in mathematics, they are indeed successful in mathematics and on their way to becoming “model scholars” as it pertains to the mathematics achievement among African American male students.

Further, my interest in this area of research was predicated upon my experiences in mathematics as expressed in my own mathematics story in the foreword. I recall my race consciousness at the age of six when I realized the preferential treatment that my White female first-grade teacher was giving to the White students. At the age of six, I also noticed that most of the African American students were in the “regular” classes

while most of the White students were in the “advanced” classes. In addition, my mother possesses a strong positionality on race. Therefore, when I began to read literature on CRT and research employing CRT as a theoretical lens, I could immediately identify with and understand the various race related experiences.

Moreover, my personal experience with Antonio, my tutee, reified my belief concerning the importance of connecting African American male students with African American male mathematics teachers with whom they can identify. My foreign, advanced calculus professor had little exposure to *our* method of doing mathematics as people of African descent. I am not suggesting that all mathematics foreign professors are not connecting with African American students and are not providing spaces for African American students to do mathematics. Rather, I am suggesting that based upon my experiences and the experiences of my four participants, we all had more rewarding and more empowering mathematics experiences when taught by African American mathematics professors at our respective HBCUs. These experiences closely align with research that purports that we as people of African descent have an elongated history of mathematics excellence (see, e.g., Hilliard, 2003; Zaslavsky, 1999). Because of my own experiences in mathematics coupled with the experiences of my four participants, I have offered the aforementioned recommendations to ensure that mathematics environments (continue to) welcome African American male students, especially at the collegiate level.

As I previously indicated, the recommendations made in this chapter are paramount. If we as educators, researchers, and policymakers are concerned about making mathematics accessible to African American male students, then we must act now to attract students to this field. The title of an important work regarding the

participation of African Americans in mathematics, *Changing the Faces of Mathematics: Perspectives on African Americans*, carries with it the notion that African Americans have the mathematical potential needed to diversify the mathematics faces that evade our image of how a "traditional mathematician" looks (Strutchens, Johnson, & Tate, 2000). With regards to expressing the seriousness of the participation of African American male students as well as other students of color in mathematics, I believe Kenschaft (2005) stated it best when she declared:

> It seems crucial that we provide the pleasure of mathematics to as many humans as possible, and that the mathematical communities become maximally diverse, reflecting the gender, sexual orientation, age, race, and ethnic composition of the outside community. Such diversity is vital for the health of the mathematical enterprises, the health of humankind, and the health of the larger global community of all living creatures (p. 209).

I concur with Kenschaft's position and emphasize the importance of providing African American male students with access to mathematics for the well-being of the mathematical enterprise. My participants were and still are provided access to mathematics, and they possessed a proud disposition concerning their status as African American men in society. They presented powerful stories about what it means to be African American and male as well as a mathematics scholar. They have indeed helped to change the faces of mathematics.

By conducting this study, I have developed a renewed interest regarding the participation of African American male students in mathematics, especially at the undergraduate level. I hope and trust that those who read this dissertation will increase their drive to encourage the participation of African American male students in mathematics, especially at higher education institutions. I also hope that HBCUs and PWIs alike will aid in ensuring that African American male students have access to and

are equitably mathematically equipped to journey through the mathematics pipeline. Whether or not African American male students choose to attend an HBCU, mathematics practices should be established where all African American male students can gain access and attain success in college mathematics.

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APPENDIXES

APPENDIX A

RECRUITMENT LETTER

To: Participant
From: Christopher C. Jett
Date: February 2008
Subject: Research participant for dissertation study at GSU

Greetings African American Scholar in Mathematics:

My name is Christopher Jett, and I am conducting a dissertation study on successful African American male in college mathematics. I am in need of five participants, and you were identified as an exemplary mathematics student. I am seeking to learn as much as I can from you concerning your college experiences as an African American male who successfully studied mathematics.

Your willingness to participate in this study will not only aid you and me, but it will also aid the future of African American men and women as well as all other students, especially students of color.

If you decide to participate in this research study, your involvement will include the following:

1. Completing an initial survey that will include basic information such as education, family, etc.
2. Participating in three audio-recorded interviews conducted by me.
3. Reading an article dealing with the proposed research topic.
4. Providing artifacts to highlight your schooling (mathematics) experiences.

Congratulations on your success thus far in mathematics, and I hope that you decide to participate in the study. Please feel free to contact me at any of the information provided below to further discuss this opportunity. Thank you in advance for your consideration.

Sincerely,

Christopher C. Jett
Doctoral Student-Mathematics Education
Cell: (678) 849-9079
cjett2@student.gsu.edu
c_jett@yahoo.com

APPENDIX B

CONSENT FORM

Georgia State University
Department of Middle Secondary and Instructional Technology (MSIT)
Informed Consent Form

Title: African American Male Students and Undergraduate Mathematics Success: Gaining Access and Obtaining Success

Principal Investigator: Dr. David Stinson, MSIT
Mr. Christopher Jett, MSIT

Purpose: You are invited to participate in a research study. The purpose of the study is to investigate what makes some African American men successful in college mathematics. You are invited to participate because you are a successful African American male in mathematics. Five participants will be recruited for this study. Participation will require you to complete a survey, participate in three interviews, read an article relating to the study, and share artifacts during May 2008 through November 2008.

Procedures: If you decide to participate, you will participate in three 45 minute interviews. The interviews will take place at a convenient place for you. This study is a voluntary research study, so you will incur any and all costs traveling to the interview site. All interviews will be audio-taped. The tapes will be used to transcribe the interviews. Your name will not appear on the written record of the interview. The records will be kept at the PI's apartment in a locked cabinet.

Risks and Benefits: In this study, you will not have any more risks than you would in a normal day of life. Participation in this study may not benefit you personally. Overall, we want to gain information about your success in hopes of helping other African American men to become successful like you.

Voluntary Participation and Withdrawal: Participation in this study is voluntary. You have the right not to be in this study. If you decide to be in the study and later change your mind, you have the right to drop out at any time. You may skip questions on the survey or during the interview at any time. Whatever you decide, you will not lose any benefits to which you are otherwise entitled.

Confidentiality: I will keep your records private to the extent allowed by law. I will use a psuedonym (false name) rather than your name on study records. Only Dr. Stinson and Mr. Jett will have access to the information you provide. It will be stored in a locked

cabinet at the PI's apartment. Your name and other facts that might point to you will not appear when I present this study or publish its results. You will not be identified personally.

Contact Persons: Call Dr. David Stinson at (404) 413-8409 or Mr. Christopher Jett at (404) 413-8475 if you have any questions about this study. If you have questions or concerns about your rights as a participant in this research study, you may contact Susan Vogtner in the Office of Research Integrity at (404) 413-3513 or svogtner1@gsu.edu.

We will give you a copy of this consent form to keep for your records.

If you are willing to volunteer for this research, please sign below.

_____ _____

Participant Date

_____ _____

Principal Investigator or Researcher Obtaining Consent Date

APPENDIX C

SURVEY INSTRUMENT

Basic Information

1. Name: _____

2. Address: _____

   _____

3. Phone Number(s): _____

4. Date of Birth: _____

5. Current Occupation: _____

6. What are your future goals? _____

_____

Family Information

1. Do you have any siblings? Yes No

2. If yes, how many siblings do you have? _____

3. What are their current ages? _____

4. Please list any other important information about your siblings. _____

_____

_____

5. What is your mother's or guardian's current profession? _____

6. How long has your mother or guardian been in that position? _____

7. What is your father's or guardian's current profession? _____

8. How long has your father or guardian been in that position? _____

9. Please list the highest educational attainment by your mother or guardian.

_____

10. Please list the highest educational attainment by your father or guardian.

_____

11. Please circle how you would describe your family's socioeconomic status (SES).

Upper class Upper-middle class Middle class Working class Lower class

12. Please list any other important information about your parents or guardians. _____

_____

_____

K–12 Schooling Information

1. What elementary school(s) did you attend? Please list the state, city, and county.

_____

_____

2. What special awards did you receive? _____

_____

_____

_____

3. Please any other important information about your elementary school(s). _____

_____

_____

_____

4. What middle school(s) did you attend? Please list the state, city, and county.

_____

_____

_____

5. What special awards did you receive? _____

_____

_____

_____

6. Please any other important information about your middle school(s). _____

_____

_____

_____

7. What high school(s) did you attend? Please list the state, city, and county.

_____

_____

8. What special awards did you receive? _____

_____

_____

_____

9. Please any other important information about your high school(s). _____

_____

_____

_____

College Information

1. What college/university did you attend? _____

2. When did you know that you would attend college? _____

_____

3. What mathematics courses did you take in college? List as many as you can recall.

_____

_____

_____

_____

4. What was your most challenging math course in college? _____

5. What awards did you receive in college? _____

_____

_____

_____

6. Please list the internships, if any, that you held while in college. _____

_____

_____

_____

7. Please list the mentoring programs, if any, that you participated in while in college.

_____

_____

_____

8. Please share any other important information about college. _____

_____

APPENDIX D

SAMPLE INTERVIEW QUESTIONS

Please tell me about yourself.

Please describe your mathematics experiences from elementary school to now.

When did you first notice your interest in mathematics?

What are your feelings about mathematics?

How would you define mathematics?

How would you define success in mathematics?

Do you feel that you are successful in mathematics? Explain.

Describe your college.

Describe a typical math class session at your college.

What did it take from you to get good grades in your college mathematics courses?

How did you study mathematics in college?

How do you best learn mathematics?

Did the mathematics department have colloquia, research seminars, etc. at your college? If so, how did activities in the mathematics department relate to your interests?

What were your relationships like with your mathematics professors in college?

How many African American male students were in your college (mathematics) graduating class?

What would you do to encourage more African American male students to study mathematics in college?

How did your race influence your mathematics college experiences?

If you could change anything about your mathematics college experience, what would you change?

APPENDIX E

MEMORANDUM TO PARTICIPANTS CONCERNING MEMBER CHECKING

To: Dissertation Study Participant
From: Christopher C. Jett
Date: February 6, 2009
Subject: Member Checking

Greetings African American Male Scholar in Mathematics:

Thank you for participating in my research study. The purpose of this letter is to member check my case studies. Member checking is a process in which the researcher (me) shares his information with the research members (you) to produce valid and accurate research findings.

I have written the four distinct cases for each individual participant. I have changed your names to ensure anonymity and confidentiality. Furthermore, I have changed the names of institutions mentioned, professors, teachers, companies, and so on. The goal is so that readers will not be able to pinpoint who you are.

Please read your case study and correct any errors that I have made. Also, if my interpretations of a given situation are incorrect, please correct me on that as well. Please either track your changes or highlight your changes in a particular color so that I can decipher the corrections. Once you have corrected your case study, email it back to me as soon as possible. If you find that my errors are too numerous and need further clarification, then please contact me directly via telephone.

After I receive each case study from you, then I will compare all the cases. At that point, I will look for common themes to emerge as well as dissimilarities amongst the four of you. Then, I will report all of this to my major professor who will give me clearance regarding moving forward with this process. The member checking is the last thing that I will need from you.

I sincerely thank each and every one of you for your time invested into this study. This dissertation process has been a rough journey for me, but I have persevered. Congratulations on all of your success thus far in mathematics and as an African American male in general. I am excited about this research endeavor as well as your future. I hope this is the beginning of many more collaborations to come.

Sincerely,

Christopher C. Jett
Doctoral Candidate-Mathematics Education
Georgia State University
P.O. Box 3978
Atlanta, GA 30302-3978
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