At the Top of the Chart: A Composite Counterstory of Black Students’ Mathematical Success

Joslyn N. Richardson

University of Missouri-St. Louis, joslynrichardson@umsl.edu

Follow this and additional works at: https://irl.umsl.edu/dissertation

Part of the Science and Mathematics Education Commons

Recommended Citation


https://irl.umsl.edu/dissertation/1042

This Dissertation is brought to you for free and open access by the UMSL Graduate Works at IRL @ UMSL. It has been accepted for inclusion in Dissertations by an authorized administrator of IRL @ UMSL. For more information, please contact marvinh@umsl.edu.
At the Top of the Chart: A Composite Counterstory of Black Students’ Mathematical Success

Joslyn N. Richardson
M.A. Elementary Education, Truman State University, 2009
B.S. Psychology, Truman State University, 2008

A Dissertation Submitted to The Graduate School at the University of Missouri-St. Louis
in partial fulfillment of the requirements for the degree
Doctor of Education with an emphasis in Educational Practice

May 2021

Advisory Committee
Thomasina Hassler, Ph.D, Chairperson
Cheryl Osby, Ph.D
Shawn Woodhouse, Ph.D

© Copyright by Joslyn Richardson
All Rights Reserved 2021
Abstract

Mathematics as a discipline has ignored the experiences of African American students, making it difficult for them to develop strong mathematical identities and racial identities in relation to math. Black children and their academic achievements are often framed negatively, and underachievement and failure are often emphasized over their brilliance and resilience. This qualitative study adds to the limited body of knowledge by examining student perspectives and socialization factors that contribute to positive math identity and achievement in middle school students. Using a Critical Race Theory framework, data was collected through semi-structured interviews and math autobiographies that were structured around the following questions: 1) What perceptions do Black middle school students have on contributors to positive math identity and success? 2) What teacher practices do Black middle school students feel contribute to their success? And 3) How do Black middle school students author themselves into the narrative of mathematics? The participants were middle school students from a small school district in the Midwest. Themes derived from interviews, math autobiographies, and professional and personal experience were used to create a composite counterstory.
Dedication

Whoever humbles himself like this child is the greatest in the kingdom of heaven. - Matthew 18:4

Train up a child in the way he should go: and when he is old, he will not depart from it. - Proverbs 22:6

I want to dedicate this to the students who I have had the pleasure of teaching over the years. I have learned tremendously from you and you are the inspiration behind my pursuit of doctoral studies and this dissertation.
Acknowledgments

First and foremost, without God, none of this would have been possible. So I thank Him for equipping me with the drive, zeal, knowledge, wisdom, and courage to pursue this degree.

Thank you to Dr. Grace Lee and Dr. Hardin-Bartley for allowing me to do my research in the district. You two are exemplars of educators who go to bat for equity and racial justice.

To the family member and friends who have supported me in this journey, thank you. Thank you for your care, humor, and motivating words. To mom and dad, thank you for supporting me spiritually and your encouragement. To Jaz, your drive motivates me to do more.

I would like to express gratitude to my cohort members. Your wisdom and perspectives have been valuable over the years. I always learn something new from you and in turn I have pushed myself and evolved as an educator.

To Tamika, God put you in my life for a reason. I am in awe of your courage, perseverance, and heart. Thank you for being like a sister and supporting me over the years. I am so proud of you and can’t wait to see how God continues to elevate you.

To my program advisor, Dr. Hassler, I’d like to express my gratitude for your support and perspective. I have learned a great deal from you and during this program. Thank you for consistently reminding us that it’s all about the work that we do after the Ed.D. Thank you to my committee team members, Dr. Osby and Dr. Woodhouse.
Finally, thank you to Dr. Davis, who encouraged me to pursue this degree, when I had every excuse not to. You are truly missed. In love, study, and struggle.
# TABLE OF CONTENTS

## CHAPTER ONE- INTRODUCTION

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Background</td>
<td>1</td>
</tr>
<tr>
<td>Problem Statement</td>
<td>5</td>
</tr>
<tr>
<td>Purpose Statement</td>
<td>6</td>
</tr>
<tr>
<td>Research Questions</td>
<td>8</td>
</tr>
<tr>
<td>Theoretical Frameworks</td>
<td>8</td>
</tr>
<tr>
<td>Definition of Terms</td>
<td>11</td>
</tr>
<tr>
<td>Summary</td>
<td>13</td>
</tr>
</tbody>
</table>

## CHAPTER TWO- REVIEW OF LITERATURE

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>14</td>
</tr>
<tr>
<td>A History of Ineffective Reforms</td>
<td>16</td>
</tr>
<tr>
<td>Math as a Racialized Institution</td>
<td>20</td>
</tr>
<tr>
<td>Discourses</td>
<td>23</td>
</tr>
<tr>
<td>Discourse of Deficiency</td>
<td>24</td>
</tr>
<tr>
<td>Discourse of Achievement</td>
<td>32</td>
</tr>
<tr>
<td>The Role of Identity</td>
<td>33</td>
</tr>
<tr>
<td>Counterstorytelling</td>
<td>41</td>
</tr>
<tr>
<td>Summary</td>
<td>43</td>
</tr>
</tbody>
</table>

## CHAPTER THREE- METHODOLOGY

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>44</td>
</tr>
<tr>
<td>Research Methodology</td>
<td>45</td>
</tr>
<tr>
<td>Research Design</td>
<td>45</td>
</tr>
</tbody>
</table>
CHAPTER FOUR - FINDINGS

Introduction .................................................................56

How to read the composite counterstory ......................57

Composite Counterstory: Three Piece Special ...................58

Analysis .................................................................62

Theme 1 ........................................................................62

Theme 2 ........................................................................65

Theme 3 ........................................................................66

Theme 4 ........................................................................67

Theme 5 ........................................................................68

Theme 6 ........................................................................69
Summary........................................................................................................70

CHAPTER FIVE - DISCUSSION

Introduction ..................................................................................................74

Interpretation of Findings ..........................................................................75

Implications for Practice and Policy .........................................................82

Limitations and Suggestions for Future Research ....................................85

Final Thoughts .............................................................................................86

REFERENCES .............................................................................................88

APPENDIX A-1: Permission to Conduct Research ......................................106

APPENDIX A-2: IRB Approval Letter .........................................................108

APPENDIX A-3: Study recruitment flyer ..................................................110

APPENDIX A-4: Interested participant information form ..........................111

APPENDIX B-1: Informed Consent ..............................................................113

APPENDIX B-2: Student Assent form .........................................................117

APPENDIX C: Interview Protocol ..............................................................119

APPENDIX D: Math Autobiography .........................................................121

APPENDIX E: Data Summary Tables .........................................................122
CHAPTER ONE
INTRODUCTION

Background

In 2017, after 8 years of teaching and working in PreK-2, I started teaching fourth grade in an urban public school in the Midwest. My first fourth grade class consisted of mostly Black students, and four Hispanic students, one White, and one Chinese student. In addition to familiarizing myself with fourth grade content standards, I was eager to share my love of math with my new students. However, within a few weeks of the school year’s start, I became alarmed by the attitude of defeat that many of my Black students displayed in the area of math. It was as if some of these students had given up even before we even began. Furthermore, I often observed that when students struggled with certain concepts, many of them deferred to my Chinese student, Angelina, who was quick at calculations and always expressed glee when it was time to transition to math. Although it was not explicitly stated by me, in addition to lacking confidence and positive mindset in mathematics, the students seemed to have a pre-existing belief that their Asian classmate was better at math.

This type of belief is consistent with findings that children are sensitive to academic stereotypes as early as second grade (Cvencek et al., 2011), and become more aware of stereotypes about Asians and math in our society as they enter adolescence. Consequently, children are more likely to internalize these stereotypes as their personal beliefs (Cvencek et al., 2015). My teaching experiences that year drove my inquiry into how teachers and other stakeholders in the schooling of Black students reinforced or
reduced these harmful stereotypes. I spent much of that year helping my students change their mindset about math and their abilities as mathematicians. Unbeknownst to us all, my students’ internalization that children who look like Angelina always perform well in math was actually attributed to what Martin (2009) describes as a *racial hierarchy of mathematical ability*. This hierarchy positions Asians and Whites at the top of academic performance and intelligence and Latinos and African Americans are the bottom. It is this type of thinking that is threaded throughout research on the racial achievement gap (e.g., Payne, 2005; Thernstrom & Thernstrom, 2003).

The achievement gap has been the focus of discussion, research and controversy for more than 40 years. It has been well documented with numerical facts, particularly the mathematics achievement gap (NAEP, 2015; Mussu-Gillete et. al., 2017; Vanneman et al., 2019). The causes of the achievement gap have been long debated. Many achievement gap reforms and debates have not adequately addressed the underlying problems of systemic and institutional racism and inequity and thus continue to fail the very students they intend to help. In fact, in many explanations of the racial achievement gap, fingers are often pointed at Black students and their families as the sole culprit for academic underachievement. This type of deficit thinking positions that families are at fault because 1) students enter school without the normative cultural knowledge and skills and 2) parents undervalue and do not support their child’s education (Yosso, 2005).

While a student’s family life is a contributor to their overall well-being, other factors need to be considered. Putting the blame on parents without looking at the history of how Black communities have been subjected to acts of violence, disenfranchisement, mass
incarceration, and extreme poverty and the impact on the Black family structure as a result is counterproductive.

Still other researchers argue that a focus on the achievement gap is misplaced. “The historical, economic, sociopolitical, and moral decisions and policies that characterize our society have created an education debt that has accumulated over time” (Ladson-Billings, 2006). In order for the racial achievement gap to be addressed, educators, administrators, policymakers must be educated about its origins, which are rooted in racism. Stakeholders must be willing to examine how this racism has shaped the public education landscape and the trickle-down effects at the school and classroom level. Love (2019) describes black students and their families as sharecroppers, who are never able to make up the cost or close the gap because they are trapped in a perpetual state of educational debt, with no end in sight. Without attention to the education debt, policymakers have and still will create policy that ignores the underlying causes of the problem.

Explanations of the racial achievement gap tend to ignore the historical role that denial of access, racial beliefs, and what Darby and Rury (2018) refer to as The Color of Mind have played in maintaining unequal schooling for blacks and whites. The Color of Mind perpetuates the belief that Blacks are inferior in intelligence and morally corrupt, thus they are only fit to do menial, labor intensive tasks. The racial hierarchy of mathematical ability is a by-product of the Color of Mind. This racial hierarchy is often upheld by math educators and researchers and in turn is used to oppress and privilege students. The constant messages of underperforming Black, Latino, and Indigenous students shape how teachers see these students and their innate ability to achieve in math.
This often leads to poor quality of instruction and less rigorous math tasks, less referrals to gifted and talented programs, and reinforces a standard of whiteness in math education.

Historically, white students have had superior schools and resources, along with curricula designed to ensure white advantage, thus it was predictable that a black-white achievement gap would emerge (Darby & Rury, 2018). Before Brown v. Board of Education, not only did Jim Crow laws enforce segregated schooling, in many places schooling was not offered to African American children at all. Recent research has shown that many schools have remained as segregated as they were prior to Brown, due to racial gaps in wealth and employment as well as residential segregation. Reardon, Grewal, Kalogrides, Greenberg (2012) found that although court-ordered desegregation plans are effective in reducing racial school segregation, the effects of these plans minimize over time in the absence of continued court oversight. A National Analysis of Racial School Segregation sponsored by the Center for American Progress (Harris, 2006) suggests that African Americans and Hispanics learn more in integrated schools and that minorities attending integrated schools also perform better in college attendance and employment. Due to reports such as this, one prospective solution that has been offered to bridge the racial achievement gap involves the belief that schools should revisit integration efforts. However, recent research shows that this alone is insufficient because a substantial portion of the racial achievement gap still occurs within integrated schools. For example, affluent Black males perform worse than their white male counterparts on standardized tests which also signifies that gender and class have no bearing on achievement differences (Vaneman et al., 2009). Additionally, Minor (2016) found in her study with African American advanced mathematics students that despite having
similar course taking and background characteristics, these students left high school with less proficiency at solving problems and intermediate and advanced mathematics skills than their White peers.

**Problem statement**

Many of the reforms developed for closing the gap have a core at which white supremacy and anti-blackness reside (Dumas, 2016; Parker, 2017). These color-blind, assimilation-oriented movements pervade much of the mathematics education research and reforms (Martin, 2009). Additionally, these policies are a form of interest convergence, which serve the interests of Whites and maintain a hierarchy that upholds the racial narrative of who can and cannot succeed in mathematics. Racial narratives paint pictures of certain character and behavioral traits possessed by members of a race. These narratives sustain a deficit thinking model that has existed in the United States throughout history with the purpose of stigmatizing African Americans and limiting and denial of resources, education, and property. In much of the existing achievement gap research, Black children and their academic achievements continue to be framed in a negative light, where failure and underachievement have been emphasized over success and resilience (Martin, 2012). With this in mind, it is no wonder many African Americans have internalized this deficit and somewhat fixed mindset of their ability to achieve and mathematical identity.

In education research, there historically has been a general lack of examining the specific mathematics schooling experiences of racialized students. Additionally, achievement gap closing programs and math reforms are problematic because they don’t pay attention to these students specifically. Mathematics as a discipline has ignored the
experiences of African American students and this has made it difficult to develop strong mathematical identities and racial identities in relation to math. In recent years, there has been a renaissance of research on the mathematics learning of Black students, particularly focusing on how mathematical identity and socialization affect their math performance (Nasir, 2002; Gholson & Martin, 2014; McGee & Martin, 2011). Susperreguy et al. (2018) conducted a longitudinal study in which they examined the relationship between self-concept and achievement in adolescents. Findings from the study, which used multiple longitudinal data sets, showed that children’s perceptions of their abilities in math and reading were predictors of later academic performance across low, average, and high performing students.

Through the aforementioned research, I began to find the answers to my questions about why my fourth-grade students struggled with positive mathematical identity development. The questions that buzzed in my brain throughout that year were what can be done to change Black students’ self-concept of math ability before they reach middle school? How may the (in)actions and language of teachers, as well as the world outside of school, have communicated to students that they would never be mathematically competent? In what ways can we ensure that Black students build positive identity and self-concept in mathematics?

**Purpose Statement**

The purpose of this qualitative study was to counter the deficit narratives that are so pervasive about mathematics achievement among African American students through lifting the voices of high achieving students on their perceptions of impactful factors for mathematical success. I believe the achievement gap rhetoric to be a polarizing
explanation steeped in the deficit thinking that is used order to avoid centering and capitalizing on the unique experiences and cultural wealth (Yosso, 2005) that African American learners bring to the school, particularly in the math education setting. African American students enter the classroom with their own set of personal strengths and resources. They bring with them forms of cultural capital that the dominant groups within society often do not value and as a result, their voices are often absent in the literature on influences on their success in schools. Despite the education debt that has accumulated over time, Black students still fight, hope, dream, and believe (Love, 2019).

One of the lenses that I will use to evaluate my findings from this study is Critical Race Theory (CRT). CRT centers research, pedagogy, and policy lens on communities of color and calls into question White middle-class values as the standard which all others are judged (Yosso, 2015). One widely used tenet of critical race theorists is the call for the focus on counterstorytelling and counternarratives to share the lived experiences to challenge the dominant view of marginalized people. There is a growing body of necessary research that expands on counternarratives about the brilliance of Black students who, despite the role oppression has played in schooling, and math in particular, maintain a positive identity about their mathematical ability and experience success (Martin, 2013; McGhee, 2013; Wasserburg, 2017). However, many of these studies are in the secondary setting. As noted with the opening vignette, students begin to perceive racial and math identity well before they reach middle school (Cvencek, et.al., 2011).

For this reason, I was drawn to the perspectives of those Black students at the elementary and middle school level who enjoy and experience success in math. It is my
hope that this study will add to this limited body of knowledge by examining student perspectives and socialization factors that contribute to positive math identity and achievement in middle school students. Additionally, I hope that findings from this study will contribute to the design and restructure of racially equitable mathematics classrooms. The study involved interviewing Black students who have achieved success in the area of math through interviews. Additional data was collected through artifacts, in the form of a math autobiography from participants. Common themes were extracted from the qualitative data and used to create counternarratives featuring composite characters to describe the students’ lived experiences. The following research questions guided my study and interview framework.

1. What perceptions do Black middle school students have on contributors to positive math identity and success?
2. What teacher practices do Black middle school students feel contribute to their success?
3. How do Black middle school students author themselves into the narrative of mathematics?

Theoretical Frameworks

In this section I will discuss the theoretical framings that guided my study.

Critical Race Theory

Critical race theory, with its beginnings in the legal scholarship of Derrick Bell (1987), has been used to theorize the role that race and racism play in education and schooling. CRT will be used as a framework in my study to examine persistent racial inequities in education, qualitative research methods, pedagogy and practice, the
schooling experiences of marginalized students of color, and the efficacy of race-conscious education policy (Lynn & Parker, 2006, p. 257). Critical race theorists began this work with the notion that race was under theorized in education. Several assumptions of CRT scholarship guide my study, specifically that a) racism is endemic and deeply ingrained in American life b) race is a structural problem as opposed to just the actions of a select few and c) how the discursive frames around black students further disadvantage them in education d) it is necessary to use storytelling, narratives, and personal accounts to capture the voices of those positioned at the bottom of the racial hierarchy (Ladson-Billings & Tate, 1995; Dixson & Anderson, 2005). Through the use of a modified version of the CRT tenet of counterstorytelling, I use composite characters to speak against the master narrative about Black children in U.S. society (Cook & Dixson, 2013).

Racial Hierarchy of Mathematical Ability

Who is good at math? Who is not? These are questions that have often been used to categorize students in mathematics education research. Martin (2009) emphasizes that education researchers must deconstruct the racial hierarchy of mathematical ability that positions Black, Native American, and Latino/a students at the bottom and Whites and Asians at the top. Math race hierarchies contribute to the view that Asians are good in math or African Americans perform poorly in math. In many mathematics classrooms, teachers and students participate in a range of practices in which they develop, contest, and internalize beliefs about who is proficient in math and what mathematical proficiency looks like, further contributing to the classroom as a racialized environment (Martin, 2000; 2009). In this space and in the
research, Black students and their math performance are in constant comparison to other ethnicities in a negative way and are always viewed as needing to be “fixed”. This study challenges math race hierarchy through the use of composite counterstorytelling.
Definition of terms

The following terms are defined to help the reader understand the context of each term in this study.

*Whiteness:*

1. Whiteness is the ideology that maintains White supremacy, valuing one racial group over others, which produces privilege  (Battey & Levya, 2016).
2. Frankenberg (1993) defines Whiteness as multidimensional: ‘‘Whiteness is a location of structural advantage, of race privilege. Second, it is a ‘standpoint,’ a place from which White people look at ourselves, at others, and at society. Third, ‘whiteness’ refers to a set of cultural practices that are usually unmarked and unnamed’’ (p.1).
3. Whiteness can move from being a passive characteristic as an aspect of identity to an active entity that - like other types of property - is used to fulfill the will and to exercise power. (Harris, 1993).

*Racial Achievement gap:* A thoroughly researched and well-documented achievement gap that exists between disadvantaged and minority students and their white counterparts.

*Brown v. Board of Education (1954):* The pivotal landmark decision made by the U.S. Supreme Court that ended legal segregation.

*Cultural Capital/Wealth:* Communities of Color nurture cultural wealth through at least 6 forms of capital such as aspirational, navigational, social, linguistic, familial, and resistant capital (Yosso, 2005).
Antiblackness: Dumas and Ross (2016) state that “antiblackness is not simply racism against Black people. Rather, antiblackness refers to a broader antagonistic relationship between blackness and (the possibility of) humanity’ (p. 429).

Racial narrative: Existing beliefs of a member of a racial group, largely based on stereotypes and majoritarian viewpoints.

Racial remediation: Bell (1976) explains “spurred by the need to confront a political or economic danger as a whole, serious racial injustice is acknowledged and enjoined, but necessary remedies are not implemented once the economic or political irritant is removed.”

Interest convergence: Coined by Derrick Bell (1980), interest convergence stresses that equality and equity for marginalized groups will only be pursued and advanced when they converge with the interests and expectations of whites.

Minoritized: Gillborn (2010) uses the term minoritized instead of ‘minority ethnic’ because “the former draws attention to the social processes by which particular groups are defined as lesser or outside the mainstream.”

Racialization/Racialized: “Racialization is the very complex and contradictory process through which groups come to be designated as being of a particular "race" and on that basis subjected to differential and/or unequal treatment. Put simply, “racialization [is] the process of manufacturing and utilizing the notion of race in any capacity” (Dalal, 2002, p. 27). While white people are also racialized, this process is often rendered invisible or normative to those designated as white. As a result, white people may not see themselves as part of a race but still maintain the authority to name and racialize "others."
Summary

This study examined student perceptions of contributors to their mathematical success and positive math identity, and how they navigate these in a system that has been structured historically to ignore or harm them. This chapter offered an introduction to the purpose and significance of the present study and its relevance to existing literature. Furthermore, it has provided definitions of key terms seen throughout this study.

There are four more chapters. In Chapter Two, a comprehensive review of existing reforms, ideologies, and research on Black students and math performance is shared. In Chapter Three, the research methodology and design, as well as specific details on how the study was conducted are presented. In Chapter Four, the results are presented and in Chapter Five, an interpretation of the findings and implications for practice are given.
CHAPTER TWO
REVIEW OF LITERATURE

Introduction

The primary goal of this review of literature is to advance some recurring discourses, theories, and findings that have been presented in the extant research on the relationship between mathematics achievement, identity, and African American students. I will first discuss the state of mathematics education for minoritized learners as well as why studies like this are important. I will then give a brief overview of mathematics education reforms and their contribution to the field as well as how these students have been affected. The literature review will then be organized into both positive and negative prevailing discourses and theories in math achievement for African American students. I will further outline what has not worked and what has worked in cultivating math achievement and positive identity construction in Black students. Finally, I will briefly discuss the research context and summarize the main points of this chapter.

Mathematics is connected to our larger society, and replicates patterns of disparity in economic, political, and cultural power (Berry, 2018). Many researchers argue that high-level mathematics courses function as a gatekeeper to the working class and leading class and careers (Berry, Ellis, and Hughes, 2014; Cobb & Hodge, 2002) and economic capital and independence (Battey, 2013). Mathematical literacy is given precedence because it has “socioeconomic utility for those who already possess economic capital” (Apple, 1992). The gatekeeping nature of math has been used to sort and rank students by race, class, and gender starting in elementary school (NCSM and TODOS, 2016) and it plays a role in both disrupting and reproducing these inequities. Additionally, Black,
Latino, and Indigenous students have disproportionately low representation in fields of science, technology, engineering, and math (STEM) education compared to their population representation in the United States and only comprise about 16% of the STEM workforce (National Science Foundation, 2019).

Mathematics has usually been presented as a set of objective and universal facts and rules that is free from being inclined toward one particular culture. Many researchers, policy makers, and educators do not consider math as being socially and culturally constructed. Race, racism, social justice, contexts, identities, conditions, are often relegated as issues not appropriate for math education when in fact they are central to the learning and teaching of mathematics (Berry, 2018, p. 15). In fact, Martin (2009) argues that race has been undertheorized in math and that the de-silencing of race in mathematics is needed to examine the ways in which the social construction of race produces racial inequalities. Racial inequalities for students on the margins are reinforced by the flattening of social diversity into binaries, dividing racialized groups into artificial hierarchies (Funk et al., p.67, 2018). One consequence of the lack of examination of race in mathematics education has been the perpetuation of a widely accepted racial hierarchy of mathematical ability: students who are identified as African American, Native American, and Latino are assigned to the bottom while students identified as White and Asian are assigned to the top. Rather than interrogating this racial hierarchy, many educators, researchers, and policymakers buy into this belief and use the assumption of mathematical illiteracy as a starting point for addressing the learning of students at the bottom of the hierarchy.
A History of Ineffective Reforms

When examining the history of math education for minoritized students, attention needs to be paid to the intentional policies that were designed to keep them undereducated. For example, during slavery, there were many laws prohibiting teaching Black people to read and write and strict consequences were enforced for those who didn’t heed this warning. Even when finally allowed to receive an education, many schools that served Black students were substandard and ill-equipped. Furthermore, much like the denial of right to read during to slavery, schooling for Black children became a means to control and ‘civilize’, so that they could assimilate to the what the dominant society deemed acceptable. Before discussing the literature on barriers and promoters of achievement and positive identity in math for African American students, it is useful to give an overview of how mathematics education has evolved in the past thirty years in the United States.

There have been numerous documents published that indicate that mathematics education policy has been shaped by concerns about maintaining America’s economic privilege in a global market, technological interests, and threats to national security. One such case is after the launch of Sputnik in 1957, when America was concerned about lagging behind Russia in the areas of mathematics in science. This led to the new math reforms of the 1950s and the Back-to-Basics Movement, which were targeted primarily at white males. The invisibility of Black children in these early forms may demonstrate deficit discourses of the time about the limited capability of black students to learn.

The Standards Movement
Since then, there has been a call in mathematics education for students to engage in the process of mathematical thinking over memorizing formulas and applying procedures (Ladson-Billings, 1997). Reform efforts that promote “mathematics for all” (NCTM, 1989, 2000; RAND Mathematics Study Panel, 2003) as equitable solutions to disparities in math education. “Mathematics for all” and concern for educational equity became a cornerstone in math education in the United States during the 1980s and 1990s. In 1989, the National Council of Teachers of Mathematics (NCTM) published Curriculum and Evaluation Standards for School Mathematics (CESSM) which addressed a new’ opportunity for all’ goal for schools:

The social injustices of past schooling practices can no longer be tolerated. Current statistics indicate that those who study advanced mathematics are most often white males. Women and most minorities study less Mathematics and are seriously underrepresented in careers using science and technology. . . . We cannot afford to have the majority of our population mathematically illiterate: Equity has become an economic necessity. (p. 4)

The mathematics for all rhetoric is what Apple (1992) calls a slogan system. Slogan systems must: a) have a degree of vagueness that appeals to many different groups (those who are powerful and those without power for example) but b)they must be specific enough to seem that something is being done here and now and c) they must be able to charm us into imaginative possibility.

In 2000, the NCTM revised its standards document through the release of the Principles and Standards for School Mathematics (PSSM). The authors of PSSM highlighted equity as the first of its six principles for school mathematics. The PSSM state that “equity does not mean that every student should receive identical instruction;
instead, it demands that reasonable and appropriate accommodations be made as needed to promote access and attainment for all students" (NCTM 2000, p. 12). However, Martin (2003) offers a critique that blanket statements about all students are counterproductive. He highlights that there is an unwillingness to explore how the intersection of race, minority/marginalized status, differential treatment, underachievement is experienced by Black learners in deference to the assumption that teaching, curriculum, learning, and assessment are all that matters. In 2009, the Common Core State Standards for Mathematics (CCSSM) were established to promote standardization across the country and prepare all students for college and careers after high school. While the CCSSM at the core was designed to ensure that students would have consistent learning from state to state, the implementation of these standards in many districts has been less than ideal and problematic. When poor planning and implementation is coupled with a hyper focus on standardized testing, in which race becomes salient, Black students who are most often receive the brunt. Additionally, in the CCSSM there is no mention of the inequities that exist between student educational outcomes. The CCSSM, as with its precursors, are another colorblind, race-neutral, one size fits all racial remedy (Bullock, 2019; Martin, 2009; Martin, 2019). Although mathematics for all seems to be an inclusive phrase that should appeal to everyone, it does not take into account the social and structural inequities and violence experienced by Black children.

The underlying trend in reform in mathematics education reforms shows that the needs and interests of the larger dominant society are addressed, often at the expense of and ignoring the needs and interests of minoritized learners. Berry (2018) used a hybrid
policy analysis-critical race theory lens to contend that policies and reforms in math education are often designed and enacted to protect the interests of those in power in the larger society. This is a form of the CRT principle of interest-convergence, in which math education policies, such as the slogan system ‘mathematics/opportunity for all’ claim to benefit all with the assumption that the benefits would trickle down. However, history has shown us time and time again that these policies really only serve the interests of those with the most wealth, not the interests of marginalized people. In addition, efforts and discussions ad nauseam have centered around the kind of mathematics in which White, middle class students have access. Consequently, after over 30 years of reform efforts premised on ‘mathematics for all’ critics argue that gaps in educational outcomes persist with Black learners and that they still experiencing the lowest levels of success in school mathematics (Allexsaht-Snider & Hart, 2001, Martin, 2003, 2019; Berry, Ellis, Hughes, 2014; Berry, 2018).

Many reform efforts have focused on addressing four basic concerns: content – what mathematics children should learn?; pedagogy – how students should be taught mathematics?; assessment- how will we know students are learning?; and quality – who is qualified to teach mathematics (Allexsaht-Snider & Hart, 2001; Berry et al., 2014;). Critics argue that a focus on these variables alone will not produce the equitable conditions that African American students need to succeed and does little to offer meaningful insight into the variables that impact mathematics teaching and learning for Black children (Berry et al., 2014). Informed by the scholarship of Derrick Bell, Bullock (2019) asserts that these discourses also serve as racial remediation strategies that have continued to fall short. African American students have instead continued to experience
oppression in mathematics because these discourses insinuate that they are intellectually inferior or mathematically illiterate instead of looking at the ways that white supremacy and privilege are upheld.

Mathematics as a Racialized Institution

There has been recent research that exposes how whiteness may be at the center of educational reforms. The ideology of whiteness, a social construct, maintains a system of White supremacy, which produces advantages for White students. White institutional spaces can be characterized by the:

1. exclusion of non-whites from positions of power in various institutions, which results in the accumulation of white economic and political power,
2. the development of a white frame that organizes the logic of these institutions and normalizes white racial superiority,
3. the historical construction of a curricular model based on the thinking of white elites, and
4. the assertion of knowledge and knowledge production as a neutral and unconnected to power relations.

(Moore, 2008)

Simply put, white institutional spaces constrain or afford differential access to people, resources, and work (Batey & Levy, 2016). Furthermore, it oppresses blackness through deficit thinking, unfair treatment, and lower quality of instruction for those who are outside the boundary of White (Battey & Levy, 2016). Current and past reforms and policies in mathematics that fall under standardization and equity discourses serve as a means of maintaining math as a White institutional space (Bullock, 2019; Martin, 2015, Batey, 2018). Math is considered a racialized institution due to the fact that participation in mathematics education research, practice, and policy is largely White and heavily influenced by whiteness and anti-blackness (Bullock, 2019; Martin, 2013, 2015). Furthermore, critical race theorists with a focus in mathematics education propose that in schools Black students pay a “racial tax” in regard to math learning due to inadequate
mathematics instruction and differential teacher quality (Anderson, 2019). Anderson
asserts that poor quality of instruction in math doesn’t just impact current students, it has
intergenerational costs. I would further add that the nature of whiteness in mathematics
often supports racial compensation and accumulation (Anderson, 2019) for white
students and racial costs for Black students, contributing to the education debt owed
(Ladson-Billings, 2006).

Until recently, the ways in which whiteness shows up was mostly only discussed
in broader education literature (Martin, 2009; Battey & Levya, 2016). The past fifteen
years have produced a handful of researchers describing the implications of whiteness in
science and mathematics. Matias (2017) uses critical whiteness studies as a lens to
postulate a theory on how whiteness operates in science education and what aspects of it
perpetuate whiteness and racism. She refers to whiteness as a “hegemonic stronghold”
that recycles itself. Matias explores racism and whiteness in science through the avenues
of safe multiculturalism, science culture, and science teacher education. She offers four
suggestions for White science educators to engage in so that they are not complicit in
perpetuating whiteness: 1) Recognize that there are different forms of racism besides
everyday, explicit examples 2) Unpack and examine whiteness 3) Reject dominant racial
ideologies such as colorblindness, deficit thinking, and essentialism and 4) Reimagine
what science spaces could look like. I propose that these suggestions should be
generalized to every content area.

Similarly, Battey and Levya (2016) detail a theoretical framework that can be
used as a tool to deconstruct whiteness in mathematics by attending to the advantages and
disadvantages it reproduces. The authors use extant research to thoroughly discuss how
whiteness and white supremacy operate. They use three lenses for their framework: institutional, labor, and identity to discuss how whiteness is enacted through ideologies, physical space, interactions, and students’ agency and resistance. Both Battey and Levya (2016) and Matias (2017) ascertain that because of the masking or invisibility of whiteness in math and science education, the success of students of color is hindered.

Whiteness has received a lack of attention in mainstream mathematics research and Martin (2009) and others (Battey & Levya, 2016; Bullock, 2019) call for a systematic study of whiteness in mathematics education. Racial hierarchies have been developed in a field that privileges whiteness and offers unearned benefits due to race to those at the top of the hierarchy.

In order to make meaningful gains in educational policy, we must continue to interrogate the ways in which whiteness shows up in math education and work on decentralizing it to disrupt its power and privilege. When we decentralize whiteness in mathematics, we create space and opportunities to consider the roles that histories, contexts, and experiences play in the development of reforms and policies in the field (Berry, 2018).

According to the Black Liberation Collective (2017), anti-blackness describes ‘an interlocking paradigm of institutions, attitudes, practices and behaviors that work to dehumanize and oppress Black people in order to benefit non-Black people, and specifically, to benefit and maintain white supremacy’. Therefore, like racism, antiblackness is endemic and woven into the fabric of our global society (Dumas & Ross, 2016; Black Liberation Collective, 2017; Martin, Moore & Price, 2019). As a result, antiblackness is a driving force behind the school discipline, policy, and education that
continue to harm and disadvantage Black students. Martin et al. (2019) suggest that mathematics and other areas of education are inherently anti-Black spaces that have contributed to different forms of systemic violence. They discuss three forms of systemic violence—symbolic, epistemological, and physical, that inflict injury and trauma on Black students in math education. Violence is systemic when it is directed at members of a group simply because they are members of that group” (Young, 2018, p. 58).

**Discourses**

Stinson (2006) reviews the existing literature surrounding the achievement gap and the schooling of African American students, with emphasis on Black males. His work is organized in three discourse clusters: the discourse of deficiency, the discourse of rejection, and the discourse of achievement. He calls for mathematics education researchers to attend to theoretical perspectives present in the fields of anthropology, sociology, and social psychology when examining the performance of Black students. In this literature review, guided by the work of Martin et al. (2019) in the area of systemic violence, the epistemological and symbolic violence that Black students experience in education will be discussed, vis-à-vis the existing discourses of deficiency (Stinson, 2006). Stinson insists that researchers move away from the discourse of deficiency and rejection and focus on the stories of mathematically successful African American students. After reviewing the discourse of deficiency, I will highlight meaningful research that supports the achievement and counternarratives of African American students who have experienced success in mathematics.
Discourse of Deficiency

Epistemological Violence

The discourse of deficiency positions African American students as being deficit, underachievers, and inferior and positions White and Asian students as the standard for achievement in mathematics (Berry, Thunder, & McClain, 2011). Martin (2009a) recognized that Black students have characterized their experiences in mathematics as highly racialized. He concluded that there exists a racialized hierarchy of mathematical ability. This hierarchy is interesting because Asians generally outperform white students in math, but this is never mentioned. Instead, white students’ performance is used as a measure to determine whether Black, Indigenous, and Latino students are achieving (Davis & Martin, 2018; Berry, 2019). In mathematics, the assumption is that in order for Black students to be mathematically literate, they must conform to that of white students. This racial hierarchy of mathematical ability contributes to what Stanley (2007) describes as a master narrative, which often presents contrasts between groups of people by giving advantages to dominant groups and disadvantaging members of minoritized groups such as women and people of color. Master narratives drive the discussion in mathematics literature by focusing on the achievement gap and standardized test scores to compare groups of students (Berry et al., 2011) and is one of the tools used to justify symbolic and epistemological violence against Black students in mathematics.

Epistemological violence is defined as “a way to identify interpretations [of data] that construct the ‘Other’ as problematic or inferior, with implicit or explicit negative consequences for the ‘Other’ even when empirical results allow for meaningful, equally compelling, alternative interpretations” (Teo 2008, p. 47). Teo argues that interpretations
of empirical data that have implicit or explicit negative consequences for the Other should be perceived as a violent act. In this study, the Other refers to Black learners. Knowledge production in the field of mathematics is a form of epistemological violence against Black learners in that the literature typically discusses how they differ in ability from their White and Asian peers (Martin, 2009; Martin et al., 2019). These analyses and subsequent discourses are usually fueled by statistics and data, or numbers. They serve as a means of encoding antiblackness into statistical master narratives that continue to uphold white superiority (Martin et al., 2019) and ignore the alternative narratives and stories of brilliance of Black learners. The practice of not presenting alternatives to these master narratives that construct the Black students as inferior or problematic and lead to violence is identified as epistemological violence (Ruge, 2018). Martin (2009) even contends that equity discourses, which draw on statistics that show Black underachievement, become a vehicle of perpetuating antiblackness and epistemological violence.

Mathematical and reading illiteracy is not an innate trait of Black children but has become widely accepted as a signifier for Blackness (Martin, 2019). Throughout U.S. history, the subordination of and violence against Blacks has been built on theories posited by scientists, each of which depends on racial stereotypes about Blacks that makes the conditions appear appropriate” (Ladson-Billings, 1999, p. 23). Martin et al. (2019) argues that systemic oppression and violence against Black children’s minds and bodies are fostered by a belief of the expendability of Black children, and that they are the cause of this violence.

We were drenched from West African shores and brought to America as slaves. According to the white man, we were subhumans, having no culture,
language, history and, of course, no scientific skills. From the Crusades to the present, the white man had to continually create “scientific” myths about how much of a superior being he was/is and how savage and uncivilized nonwhites were/are.

(Anderson, p. 20, 1970)

The scientific community has long debated and validated the notion that when compared to whites, members of the African diaspora are inferior (Darby, 2018; Batey, 2019; Bullock, 2019; Davis & Martin, 2008). The scientific community participated in validating Black intelligence and culture inferiority (Darby & Rury, 2018). This is what formed the basis of scientific racism, which is when scientific methods are used to support and validate racist beliefs about the Other that supports white supremacy. These conjectures were used to support state and local policies that segregated students and gave inadequate resources for black children’s education. Although today we know that there is no credible scientific evidence that racial differences have no bearing on human intelligence and are not grounded in genetics, the Color of Mind (Darby & Rury) was and is paramount in the formation of racial hierarchies, naming achievement gaps, and the systemic violence people of color experience.

Scientific racism and the Color of Mind have informed education policy, curricular decisions, and remains present in education research (Bullock, 2019; Darby & Rury, 2018; Martin 2013, 2019; Battey & Levy, 2016) Policies and reforms often portray minoritized learners as needing to be fixed and deprived (Berry, 2018) and lacking the knowledge and experiences as the dominant group (NCTM and TODOS, 2016). For example, there have been many studies that show that poor children, code for Black, enter school with limited mathematical knowledge, gaps, and are unable to mathematize
their daily experiences (Siegler, 2009; Hughes, 2003; Quinn, 2015; Wang, 2009; Klein et al., 2008). This type of research tends to ignore, dismiss, or cast as barriers mathematical knowledge and experiences children engage with outside of school every day (NCTM and TODOS, 2016) and problematizes so-called achievement differences from the beginning, setting the stage early for the negative framing of marginalized students.

The achievement gap discourses stem from results of standardized testing. Tate (1993) argues that standardized tests are scientifically structured to prepare poor African American students to replicate their parents’ status in society and so that they don’t receive the same instruction in mathematics as middle- and upper-class members of society. Additionally, he argues that standardized test scores are used as a way to rank and sort students, and not to improve their educational experiences in math. As a result, many schools serving African American students receive substandard math education and again, white and Asian students are used as the standard. Schools with an environment of high stakes testing caused by accountability measures of The No Child Left Behind Act (NCLB) often strive for satisfactory outcomes on state assessments at the expense of authentic learning and development for students (Davis & Martin, 2008). This accountability is supposed to be race-neutral but it “operates discursively to justify and institutionalize curriculum and instruction that disadvantages students of color” (Anderson, p. 27, 2019).

Gloria Ladson-Billings (2006) describes the achievement gap as an educational debt that is owed to African Americans for unequal schooling opportunities that continues to be inherited generationally. Moreover, inequitable schooling experiences for African Americans, endemic poverty of many African American communities, lack of
jobs and residential segregation constitute an opportunity gap. Many policies and practices in schools do not give proper attention to the role the educational debt and opportunity gap play in schooling experiences for minoritized students and Ladson-Billings urges us to consider these when thinking about ways to close the so-called achievement gap. In our schools today, while some districts are making efforts, reforms that simply focus on teaching practices and teaching students to take standardized tests are not enough. The racial achievement gap is just a symptom of the opportunity gap. Martin (2009, p. 298) states that:

Goals that are motivated by a singular focus on closing the racial achievement gap carry with them assumptions about the inferiority of African American, Latino, and Native American students. Also implicit in these goals is the suggestion that if these students are to become more “proficient” and “high achievers,” they must become less African American, Native American, and Latino, and more like White and Asian students in terms of their dispositions and values.

The prevailing achievement gap discourses (Farkas, 2004; are fueled by differences in scores between Black students and White students and inflict harm on the dignity of black students through tracking, gross disparities in educational resources and facilities, teacher quality, coursework and extracurricular opportunities. Darby and Rury (2018) constitute this as a dignitary injustice to Black students. I will now turn to symbolic violence to discuss how dignitary harm is further perpetuated on children through symbolic systemic violence.
Symbolic Violence

French Sociologist Pierre Bourdieu (2001, p. 1) describes symbolic violence as “a gentle violence, imperceptible and invisible even to its victims, exerted through the most part by the purely symbolic channels of communication and cognition (more precisely, misrecognition), recognition, or even feeling”. Symbolic violence is a form of non-physical violence that is invisible and not recognized. Due to its imperceptibility, those who are most affected by symbolic violence unknowingly consent to it. “Through symbolic violence, individuals learn to consider unjust conditions as natural and even come to value customs and ideas that are oppressive” (Boehnert & Onafuwa, p. 1, 2016).

In this section I will describe how symbolic violence is enacted on Black students in math education through a hyperfocus on black-white achievement gaps and math racial narratives.

Gap Gazing Fetish.

One way that symbolic violence is experienced by Black students is what Gutierrez (2008) calls an achievement gap-gazing fetish in mathematics education. The gap has been thoroughly cited using K-12 standardized scores on the National Assessment for Educational Progress (NAEP), also known as the Nation’s Report Card, through grades, college admission and completion rates, high school graduation and drop-out rates, and performance on college admission tests.

Gutierrez (2008) clarifies different forms of gap-gazing in the achievement gap literature: research the merely documents the gap and research focused on trying to reduce the gap and how both can be detrimental to the cause and further promote antiblackness. She likens focus on the achievement gap as a theoretical lens through
which educators and researchers view mathematical ability. In addition, this lens sends messages that student identity is static, that minoritized are not worth studying on their own and have to be compared with another group and in turn places groups in opposition with each other, and functions as a seemingly neutral way to discuss groups without explicitly naming them. Martin (2009) explores how this hyper focus naturalizes students of color place in the racial hierarchy of mathematical ability. Both Martin and Parks suggest further research on advancement, excellence, and gains within marginalized communities. Focus on the achievement gap as a way of explaining and understanding the persistent inequality in schools leads to short-term solutions that rarely address the underlying problems and further promotes a majoritarian narrative that devalues knowledge bases of communities of color (Ladson-Billings, 2006, 2007; Gutierrez, 2008; Parks, 2009; Martin, 2009).

**Racialized Math Narratives, Stereotypes, and Stereotype Threat.**

According to Shah (2017), racial stereotypes are a type of racial narrative that he defines as stories that circulate about the supposed traits and behaviors of particular racial groups. Cvencek et al. (2014) investigate the prevailing racial stereotype that Asians are good at math using implicit and explicit measures. They found that endorsement of these stereotypes was stronger in middle school than in elementary age students. They contend that this may be caused by the increased exposure to racial stereotypes and discussions around racial group academic performance as they age. This often causes students to internalize these stereotypes and invoke a racial narrative which then may affect self-efficacy, racial and academic identity, and academic performance (Cvencek et al., 2014; McGee, 2013; McGee & Martin, 2011; Steele, 1997).
Stereotype threat is a type of confirmation bias where one enters a situation in which a negative stereotype is invoked and they fear being judged by doing something that would confirm this stereotype (McGee, 2013; Steele & Aronson, 1995). There has been much written on how stereotypes can negatively affect academic performance, even in high achieving African American students. (Steele, 1997; Steele, Spencer, & Aronson, 2002; Wasserburg, 2014, 2017). Negative math race stereotypes, narratives, and stereotype threat act as invisible forms of symbolic violence against Black children in schools. In fact, much of the stereotype literature has found that when high achieving Black students are confronted with negative racialized experiences and stereotypes, they often exhibit a loss of racial pride and motivation, and increased stress and anxiety and decreased test performance (McGee, 2013; McGee & Martin, 2011). On the other hand, there are some studies that show that some students challenge widespread cultural assumptions by using their success in school as a form of resistance to stereotypes about their group (Berry, Thunder, McClain, 2011; McGee & Martin, 2011; McGee, 2013; Stinson, 2011, 2013). McGee and Martin attribute this to what they call stereotype management, the strategies in which high achieving STEM students use to invoke their agency and reduce the impact of demeaning stereotypes. Furthermore, in their studies with high achieving African American, Latino, and Asian undergraduate and graduate students and African American high school students, although students experienced success despite negative stereotypes, they also were constantly aware of the negative perceptions of their racial groups in these contexts. This acts as a form of antiblackness that further harms students because of the perpetual perception of being perceived as intellectually inferior. In math classrooms, these perceptions become self-fulfilling...
prophecies as far as how Black and Latin students are treated, the forms of instruction available to them, the courses schools should provide. This impoverishes forms of instruction through reduced funding, lack of support, teacher perceptions and practices, and tracking, thus legitimizing the stereotypical narrative that these students are inherently poor math learners (Levya & Batey, 2006).

**Discourse of Achievement**

As mentioned in the Introduction, in response to the discourse of deficiency that has prevailed in math education about Black learners, there have been a number of studies that examine the brilliance of Black students in math with the aims of changing the narrative. Frustrated by discovering that his daughter’s middle school didn’t offer any algebra classes, former math teacher Robert P. Moses was prompted to form The Algebra Project in 1982. Guided by his experience in the civil rights movement and the technological revolution of the 1980’s, the civil rights activist aimed to create a culture where every child was expected to get ready for and do algebra in the eighth grade under the premise that all children can learn algebra. The Project is a response to the problems surrounding math education in the United States and the increasing requirements of math and science literacy as prerequisites for full participation and citizenship (Silva et al., 1990) and is specifically targeted towards Black students and students living in poverty. Moses identifies algebra as the gatekeeper not only to further mathematical study but also to continuing education beyond Grade 12, challenging careers, and economic opportunities in a global knowledge economy (Hunt, 2010). The Project used student-centered teaching methods and everyday language and experiences
to help students gain an understanding of abstract math concepts. Additionally, the Project aims to empower students through math.

Grant, Crompton, and Ford (2015) state that the primary goal for the Algebra Project was to transform urban and rural students’ perceptions of themselves from adopting mathematical identities (e.g., at risk students) given to them by others to math literate learners. In their study, the authors examine the mathematics identity of six male African American high school students over the course of a 4-year Algebra Project Cohort Model (APCM) initiative. The authors defined mathematics identity as participation through interactions and positioning of self and others. The authors observed the boys over the study time period and agency and work practices in relation to math identity. They found that APCM students’ confidence in self and peers increased over the study period, they consistently chose to engage in mathematics, and their reliance on knowledgeable peers lessened (Grant et al., 2015). The proof is in the pudding. The program was very successful in increasing the number of students who graduated from middle school and moved to honors classes at the high school level, and these students did not need to take remedial math in high school. Almost four decades after its inception, the APCM continues to help increase math participation, positive identity, and achievement and has reached over 200 middle schools in marginalized communities across the nation.

**The Role of Identity and Self-Efficacy in Mathematics Learning**

For many African American students, race and racial stereotypes remain a salient component of their identity and academic development. Although identity development is a heterogeneous process (Cross, 1991), William Cross (2001) first introduced the Black
Racial Identity Model (or the Nigrescence model) in 1971, as an outline for racial identity that focuses on the stages Black Americans typically go through on their journey towards becoming Blacker. At the time he believed that a Black person was considered more psychologically healthy and would consequently do better academically if they accepted their Black heritage and culture. On the other hand, Blacks who centered whiteness were considered to suffer from self-hatred and low self-concept (Cross, 1971). This is demonstrated by one of the earliest widely known research studies on Black children’s racial identity. In the 1940s, psychologists Kenneth and Mamie Clark created and conducted a series of experiments known as the Doll Tests (Clark & Clark, 1950) to study the awareness of racial differences and segregation and how they psychologically affected Black children’s development. In the test, the Clarks looked at 253 black children between the ages of three to seven years old. Each child was shown four dolls: two with white skin and yellow hair, and two with brown skin and black hair. Each student was asked to identify the race of the doll and which one they preferred. The majority of the black students preferred the white doll and associated it with positive traits and ignored the brown doll and associated it with negative traits. The Clarks concluded that Black children form a racial identity by the age of three and attach negative traits to their own identity. At the time, this was exacerbated by segregation and prejudice. To put it another way, children as young as three are aware of and may unknowingly embrace antiblackness.

In a world shaped by antiblackness, Black students experience racism and are often denied affirmations and statements of worth, which contributes to the development of self-efficacy and racial identity (Wong et al., 2003). Self-efficacy can be defined as an
individual's perception of his or her capacity to learn or perform a task in a given domain (Schunk & Pajares, 2005). Self-efficacy and racial identity are constructed over time, through historical, institutional, and cultural experiences. Black students who do not have a high self-efficacy, self-concept, or positive or healthy racial identity may succumb to math race stereotypes and struggle to experience academic success (Batey & Levya, 2006; Cvencek et al., 2015; Grantham & Ford, 2003; Martin, 2009; McGee & Martin, 2011; Wong et al., 2003). Simply said, children’s self-concept of ability may be one of the strongest predictors of academic achievement (Wigfield & Eccles, 2000).

Still, other studies show that racial identity may be indirectly related to academic achievement and may in fact denote a curvilinear relationship (Grantham & Ford, 2003). Schweinle and Mims (2009) examined mathematics self-efficacy within the racial context of the classroom from the perspective of both the theory of stereotype threat and resilience. In the study, Black students reported similar levels of self-efficacy as white students, which contradicts stereotype threat. Their results supported the notion of resilience in Black students and that they may be less affected by stereotype threat and more reliant on ethnic identity. These authors, along with Wong & Eccles (2003) suggest that ethnic identity acts as a protective factor that when emphasized, can improve efficacy. Another example of racial identity as a protective factor can be seen in the research of David Stinson (2004; 2008; 2010; 2013). In these studies, young, African American men read, reflected on, and responded to Fordham & Ogbu’s (1986) “burden of acting White theory’. Using poststructural theory, critical race theory, and critical theory, analysis revealed that the participants successfully negotiated the burden of acting
White and other negative discourse surrounding black Americans and had acquired a positive mathematics identity.

During adolescence, African American children are beginning to explore the personal meaning of their racial group membership, and the perceptions of this group depends on the meanings they ascribe to being a member of their racial group (Butler-Barnes et al., 2017). Due to this, there have been many studies that have focused on the contributors of positive racial identities and how they impact academic experiences. Emerging research in STEM education has also suggested that racial identities are co-constructed with students’ academic identities (Berry, 2011; Grantham & Ford, 2003; Martin, 2000, 2007; McGee, 2009; Nasir, 2007; Stinson, 2006, 2009, 2013).

Martin’s body of work (2000, 2006, 2007, 2009) has focused the conceptualization of race and learning in African American students. He, along with several others (Berry, 2011; McGee, 2013; Nasir, 2002), have sought to shed light on how Black students construct identities in the context of being Black and as doers of math. Some questions that he has attempted to answer are: What does it mean to be Black? What does it mean to be a Black math student? What identities do Black students develop as a result of racialized schooling experiences? Martin (2007) asserts that math and racial identities are not formed in isolation of each other and due to racialized math experiences, they are co-constructed. Martin (2006) analyzed the racialized experiences of success Black students, using math identity as a lens. He defines mathematics identity as:

[T]he dispositions and deeply held beliefs that individuals develop, within their overall self-concept, about their ability to participate and perform effectively in mathematical contexts and to use mathematics to change the conditions of their lives. A mathematics identity encompasses a person’s self-understanding of
himself or herself in the context of doing mathematics...It also encompasses how others “construct” us in relation to mathematics.

Martin (2006, p.26)

Martin’s (2000) study with middle school students showed that successful math students were able to overcome numerous obstacles, such as negative mathematical experiences, racial microaggressions and pressure from teachers to underperform by exercising a sense of agency. These students had developed a strong mathematical identity to manage oppositional forces and achieved success in math. While Martin was unable to pinpoint which factors contributed to strong mathematical identities and agency, he did acknowledge that school and community forces may have contributed.

Nasir (2002) also described how many African American males learned math through out-of-school experiences and how these experiences helped shape their identities, learning, and goals. She claimed that African American students do not have the freedom to go through this experience in school. Similarly, Berry (2008) examined how eight middle school boys gained access to upper-level mathematics in an environment of antiblackness. He discovered that the boys were able to develop alternative identities related to co-curricular, sports, and religious activities that helped them become resilient and deal with peer pressure in order to develop positive mathematical and academic identities and achievement.

Berry and McClain (2009) investigated the racial socialization practices of parents of Black boys. He found that these parents socialized their boys in a way that they believed would help them manage in a world of racism and discrimination. Additionally, the authors found three overlapping components that contributed to the boys' positive math identity: a) motivation to succeed; b) strong beliefs of self-efficacy in math; c) a
relationship with caring math teachers. Later, Berry, Thunder, and McClain (2011), investigated in a phenomenological study how middle school boys develop math and racial identity and how they interact with each other. They found that four factors contributed to positive math identities in the boys: a) Development of computational fluency by 3rd grade b) Extrinsic recognition c) Relational connections between teachers, family, out of school activities (consistent with findings in Berry (2008) and Nasir (2002) and d) engagement with the unique quality of math. Furthermore, in school racial identities were connected to the perception of other students' engagement in school. The interaction of the boys’ racial and mathematical identities helped them redefine their own racial and math identity. Based on previous studies, Nasir and Shah (2011) describe two narratives that represent African American students’ experiences in school. The first narrative contends that African Americans are not good at school or math, and the second contends that Asians are good at school and math. They argued that these narratives are the primary reason that math achievement and ability get linked to race, and that the narratives are particularly salient in schools and society, which supports the math race hierarchy (Martin, 2009). The above literature shows that adolescence is a crucial period in developing identity and self-concept. This is why it is important for researchers, teachers, policymakers, and administrators to understand the process involved in this vulnerable developmental time period and foster environments that nurture and provide interventions to support positive identity development.

Nasir (2002) and Nasir and Hand (2008) studied African American students’ participation in mathematics based activities outside of school as well as in school. The authors sought to understand how these students, who were successful with mathematics
related to out of school activities such as playing basketball and dominoes, could be unsuccessful in school mathematics. They examined how identity played a part in each of these settings. Nasir and Hand focused on identities in practice, or “identities that people come to take on, construct, and embrace that are linked to participation in particular social and cultural practices” (p.147). Nasir noticed that students were motivated to develop goals that allowed them to be apart of the dominoes and basketball player community and this helped them identify with the game. They were engaged in the game and could imagine themselves as members of the community. This led to a desire to learn more about the activity/game and continue to develop goals so that they could continue to participate in that community.

Stinson, Jett, and Williams (2013) discuss empirical findings from their three dissertations that examined young Black men and their success in school mathematics (K-16). In the chapter, each author gave an overview of their research and findings. In each of their studies, participants provided perspectives that challenged the discourse of deficiency. The goal of this article was to add to the existing discourse of achievement (Stinson, 2006) and the authors found three common factors that emerged within their studies pertaining to the role of mathematics teachers in the achievement and persistence of these students. Consistent with findings from Nasir and Hand (2008), teachers who 1) developed caring relationships beyond the mathematics classroom and set high expectations for success, 2) accessed and built on out-of-school experiences and community funds of knowledge during mathematics instruction and 3) challenged school mathematics as a white institutional space, were the most instrumental in the lives of
participants. The authors use these findings to provide a baseline description of an effective math teacher and recommendations to math teachers of Black children.

Yet another example of how educators and schools can positively impact students’ math identity and performance comes from Boaler and Staple’s research published in 2008. This five-year longitudinal, mixed-methods study was completed with three urban high schools in California. The researchers compared the three schools, two of which used tracking practices and placed freshman mathematics students into either college-bound or remedial classes, as well as using traditional teaching practices and curriculum. The third school, which they called Railside, de-tracked all freshman students and placed them in college bound classes, as well as using a reform-oriented approach to teaching. At the beginning of the study, the ninth-grade students at Railside were academically achieving at lower levels than the two other schools. The authors report that the students at Railside realized greater academic gains and positive mathematical identities.

Marginalized students need to feel a sense of belonging in the math classroom. Bartle (2011) suggests that to do this, teacher must develop relationships with students and get to know them well. This includes teachers sharing their own personal lives as they participate and value their students’ lives. Neal and Battey (2014) highlight examples of teachers engaging in positive relational interactions with African American and Latinx students during high quality math instruction, using culturally relevant pedagogical practices. These allow for multiple ways of being for students in the mathematics classroom.
Culturally relevant teaching has been a buzz word in education lately because more scholars and educators are examining how challenging mathematics as a white institutional space, building on students’ culture, and accessing community funds of knowledge may contribute to positive school experiences for minoritized students. Abdulrahim and Orosco (2019) synthesized the existing research (1993-2018) on Culturally Relevant Math Teaching (CRMT) on culturally and linguistically diverse students. They found that seven themes emerged: cultural identity, instructional engagement, educator reflection, high expectations, student critical thinking, social justice, and collaboration. The CRMT literature revealed that teachers who apply culturally and linguistically affirming practices can cultivate learning environments where learners are empowered to achieve mathematics excellence (Gutierrez, 2013). Federal, state, and local policy makers must ensure that teachers are provided with professional development on culturally responsive teaching. Teacher educator programs at universities should focus on fostering teacher disposition for CRMT and capitalize on learning by using the funds of knowledge and cultural capital that minoritized future teachers bring into the learning environment.

**Counterstorytelling**

Critical Race Theory places value on experiential knowledge of marginalized people through the use of counterstorytelling and personal narratives. CRT utilize personal narratives and stories as “‘evidence’ and thereby challenge a ‘numbers only’ approach to documenting inequity or discrimination that tends to certify discrimination from a quantitative rather than a qualitative perspective” (Dixson & Rousseau, 2005). Personal stories and narratives in CRT are used to counter or challenge prevalent master stories that uphold the racial hierarchy. According to Solórzano and Yosso (2002),
“within the histories and lives of people of color, there are numerous unheard counter-stories. Storytelling and counter-storytelling these experiences can help strengthen traditions of social, political, and cultural survival and resistance.” It is important to note that CRT does not essentialize the experiences of all people of color. CRT recognizes that the stories of individuals will differ, however, they share a common experience of racism and positioning of being outside the margins.

Although there is a growing body of literature that highlights the success of Black students in math education that seeks to counter deficit narratives, there are few mathematics researchers who have used CRT counterstories as a method to conduct research on black students in math education. Mathematics counterstories can be used to narrate the racialized and classed mathematical experiences of Black students” (Davis, 2019). Davis calls for more counterstorytelling in math education using the lens of CRT. Counterstorytelling in critical race theory can take on three forms: personal narratives, other people's narratives, and composite narratives. “Composite stories and narratives draw on various forms of “data” to recount the racialized, sexualized, and classed experiences of people of color” (Solórzano & Yosso, 2002, p.33). As with other forms of counternarratives, composite counterstories (CCS) have been used to counter dominant stories in education. One example, in a study of Black male elementary educators (Tafari, 2018), highlighted the experiences of participants in education and how otherfathering shapes their experiences as teachers through the use of composite counterstories. Cook and Dixson (2013) utilize CCS to examine black educators’ experiences in New Orleans during school reform efforts. Another study was completed by Berry, Thunder, and McClain (2011), who sought to investigate how the mathematics identity development
interacted with racial identity in high achieving Black, middle school boys. Using a qualitative phenomenological approach involving interviews, math autobiographies, documents, and observations, the authors found four themes that corresponded to each research question and used them to construct counter narratives.

In this study, data was collected through interviews and math autobiography artifacts from middle school students. The data was analyzed by extracting themes and used to create a counterstory involving composite, fictional characters. An important reason that I choose CCS over other forms of storytelling is that it allows anonymity of participants and provides an empirical space for me to recount the stories and experiences of students, who are in vulnerable positions. By creating a composite counterstory, the spotlight is off the individual and instead the focus is on their collective story.

**Summary**

This chapter discussed the negative discursive frames and reforms surrounding the mathematical performance and achievement of African American students and how they act as symbolic and epistemological violence and are rooted in racism and antiblackness. This chapter also discusses the research on how Black students often negotiate their identities and achievement despite these harmful frames. The literature review reveals the need for more studies involving how Black students maintain positive math identities and how that counters the racial hierarchy of math ability. In the next chapter, I will explain the methodology I used to examine student mathematical identity construction and math success through composite counterstorytelling.
CHAPTER THREE

METHODOLOGY

Introduction

As discussed in previous chapters, many education reforms, curricular changes, and pedagogical practices aimed at closing the black-white achievement gap have ignored the perspectives and lived experiences of Black students (Berry et al., 2014; Bullock, 2019; Martin, 2013). These reforms are built on the notion that Black students are intellectually inferior or mathematically illiterate (Martin, 2003). The purpose of this study was to highlight the experiences of mathematically successful African American students through the use of counternarratives, as well as examine their perceptions of what factors contribute to their success. The researcher believed that a better understanding of these students’ experiences can be used to inform policy, curriculum, instruction, and teacher training in the field of K-12 mathematics. In seeking to understand their experiences, the study addressed three research questions: a) What perceptions do Black middle school students have on contributors to positive math identity and success? b) What teacher practices do Black middle school students feel contribute to their success? c) How do Black middle school students author themselves into the narrative of mathematics?

This chapter describes the research methodology used and includes discussions on the rationale for research approach, description of the research sampling technique used and context of the participants, procedures, methods of data collection and analysis, ethical concerns, trustworthiness, and limitations and delimitations of the study. In addition, a brief summary concludes this chapter.
Research Methodology

The goal of the study was to explore and understand the meaning students ascribe to a social phenomenon by relying on their perception in a given situation (Creswell, 2014; Stake, 2010). While the researcher considered using a quantitative or mixed methods approach to obtain teacher perspectives, a qualitative research design was ultimately selected as the best way to learn about the problem from participants and to address the research to obtain that information. Those who engage in qualitative research “support a way of looking at research that honors an inductive style, a focus on individual meaning, and the importance of rendering the complexity of a situation” (Creswell, 2014, p. 69). Quantitative studies, which seeks to understand relationship between variables, can be restrictive due to relying on the use of tools such as surveys that are structured for participants to respond to rather than with the researcher (Kozleski, 2017). Qualitative research contributes to educational research in valuable ways including the study of significant problems of practice. These methods allow for new discoveries in the moment through the use of such designs such as case studies, interviews, and ethnography. Through the use of qualitative methods, the researcher was able to elicit the rich data needed to address the research questions and the problem.

Research Design

Because the researcher desired to capture the lived experiences of children, a qualitative phenomenological approach was adopted for this study. Phenomenology research serves to “investigate the meaning of the lived experience of people to identify the core essence of human experience or phenomena as described by the research participants” (Bloomberg & Volpe, 2019, p. 54). Phenomenology was also chosen
because of its assumption that there is some commonality in human experiences. The researcher desired to focus on the perspectives of the students using interviews and math autobiography data. The data was then used to craft composite characters and a mathematical counterstory to describe students’ experiences with success. Solórzano and Yosso (2002) determined that counterstories differ from fictional stories in that characters are grounded in real life experiences and contexts. They identified four functions of counterstorytelling:

1) Build community among those at the margins of society.
2) Challenge the perceived wisdom of those normally centered in our society.
3) Open the windows into the reality of those who are at the margins, offering a glimpse into the other side through lived experiences.
4) Combine elements from both the story and the current reality, allowing for the author to devise a rich, authentic experience for the reader.

Research Context

Population

The City of Bloomfield is located in a Midwestern state. It is known for being diverse, with a focus on the arts, blending suburban and urban housing and areas, and neighbors a renowned medical and research institution. The median household income is $64,500. There is a 15.5% poverty rate. The racial composition of Bloomfield is 54.27% White, 35.24% Black, 4.6% Asian, 4% Other. The school district was selected for this study due to its central location, rich history, and longtime traditions. Bloomfield School District is a small district (enrollment =2,600, 7 schools total). Average teacher experience in the district is 12.3 years. The district is 99% Free Reduced Lunch. The
high school 4-year graduation rate over the past three years has been slowly declining and was 88% in 2019. The demographics of the district are 83% Black, 10% White, 3% Hispanic, and 4% Other. The district neighbors an affluent, less diverse district with higher academic achievement test results. Bloomfield Middle School, serving 600 students from grades six through eight, was chosen because it is the only middle school in the district and the environment similar to those that serve Black children around the country. Bloomfield is a Title I school due to the large percentage of students who qualify for free and reduced lunch.

Sampling Methods and the Research Participants

Due to the positionality of the researcher, the study used purposive criterion sampling to select students. The purposive sampling technique, also called judgment sampling, is the deliberate choice of a participant due to the qualities the participant possesses and their proficiency with the phenomenon being studied. Unlike random sampling which aims to include a diverse group of participants, purposeful or judgement sampling focuses on participants with specific characteristics who will better be able to assist with the relevant research (Etikan et. al., 2016). The specific criteria were  a) The student must be African American b) The student must currently be enrolled in math courses c) The student must have scored advanced or proficient on the state standardized test OR shown significant academic achievement and/or positive math identity in school math courses.

Nine parents with students in grades 6, 7, or 8 who self-identified as Black or African American signed their child up for the study through the sign up link on the emailed flyer, however, only two returned the electronic Informed Consent form. Due to
limited time, the researcher proceeded with interviewing these two students, a sixth grader and an eighth grader from Bloomfield Middle School. All names in this study are pseudonyms.

**Researcher Positionality**

The researcher worked in the field of education for 12 years and holds a Bachelor of Science in Psychology and a Master of Arts in Education. The researcher has been trained in all the necessary skills to carry out the study and has training and experience in learning methods, mathematics teaching and design, and issues of social justice, racism, and equity. During the study, the researcher was employed as a classroom teacher in the district at another school and was able to work with the middle school principal and teachers to identify students who meet the criteria for the study. The researcher previously worked on a math curriculum writing team and state standardized test item writing team with one of the middle school math teachers. This provided another entry point for recruitment of students.

**Procedures**

First, the researcher received approval from the Bloomfield Superintendent to conduct the study in the district (see Appendix A-1). The researcher then applied for and received approval from the College of Education Institutional Review Board Committee (IRB). Once this approval was given, the researcher sought approval from the University of Missouri-St. Louis IRB (Appendix A-2). Once this approval was given, the researcher emailed the middle school principal to request distribution of the study background information and flyer to caregivers of potential participants (see Appendix A-3). The principal shared the flyer with families in a weekly newsletter. In addition, the advanced
math teacher and one of the seventh-grade teachers shared the flyer with the families of students in their courses. The flyer included a link to a Google Form that was a screener using demographic data, to be sure they met the selection criteria (see Appendix A-4). Families who signed up were then emailed a link to the Informed Consent form (see Appendix B-1). The researcher sent this form to families two more times, with the goal of getting more participants. Participants who completed both parts of the study received a $10 Amazon gift card.

**Data Collection**

The use of triangulation was used in an attempt to obtain an in-depth understanding of the phenomenon under study. This strategy also is used in qualitative research to test validity through the convergence of information from different sources in qualitative research (Carter et al., 2014). Interview questions, along with a math autobiography were designed in a way to elicit rich descriptions of the students’ experiences in and out of school. Throughout the process the researcher wrote memos as a way to keep record of decisions and revelations. Analytic memos assist with "future directions, unanswered questions, frustrations with the analysis, insightful connections." (Saldaña, 2016, p. 45)

**Phase 1: Interview**

Interviews were selected as the primary source for data collection in this study. The interview protocol used is a combination of semi-structured, open-ended questions (Appendix C) derived from the research questions and existing literature. Student participants were interviewed over the Zoom platform at scheduled times in the evening. Each interview was recorded. Students first completed the Student Assent form (see
Appendix B-2) that they viewed prior to the Zoom interview. I then gave an overview of the study and did not start recording until students consented with the proceeding. Interviews were not conducted without the written and verbal informed consent of the participant. Each interview session was between 30 and 60 minutes in length. Initial questions were the same for each student and follow up questions were asked throughout for elaboration purposes. At the end of the interview and frequently throughout the session, the researcher summarized responses for review by participants to check for accuracy and integrity on the part of the researcher. The audio from each interview was sent to a professional transcription service, Rev, and transcribed. After receiving the transcript, the researcher reviewed each to add in and delete unnecessary or incorrect transcriptions.

**Phase 2: Math Autobiography**

The math autobiography serves as an additional source of data in which the students recount important mathematical milestones (see Appendix D). Using a math autobiography protocol adapted from Berry (2003), participants were encouraged to use their voice to represent their experiences in math learning, classrooms, and promotive and corrosive factors that may have influenced their math identity or academic success. They were given two weeks after the study to complete the math autobiography. However, only one student was able to complete their math autobiography.

**Data Analysis and Data Reporting**

**Coding**

When interviews and the math autobiography were completed, the researcher listened to the audio recordings and reviewed the transcripts for phrases and words that
were threaded throughout participants' answers. The researcher took additional memos during this first review. Because the interview questions naturally align with the original research questions, common phrases and themes were coded to correspond with each research question. Some of the codes were predetermined. Coding connects the qualitative data collection phase with the data analysis phase of a study. Coding is an iterative process and is not a one-time, linear event (Rogers, 2018). It allowed the researcher to break down the transcripts into meaningful and manageable chunks of data. Codes were created manually by the researcher during the research process.

After the first review, the researcher read each transcript line by line and coded the data into broad categories, using repetitions were needed. A second cycle of coding included reorganizing, reanalyzing, and comparing new data to existing data. Also, during this stage, new codes were added and some codes were eliminated. This type of coding, known as selective coding, allowed the researcher to refine the categories into themes. During the coding process, the researcher organized information in a Data Summary Table (see Appendix E) to observe the frequency of themes and phrases from participants. After the coding process, the themes were organized by research question on a Google Jamboard document, and further refined, with attention to any alignment with Critical Race Theory and the racial hierarchy of math ability.

Counterstorytelling

This research study is a form of narrative inquiry. In narrative research, “the researcher studies the lives of individuals and asks one or more individuals to provide stories about their lives. This information is then often retold or storied by the researcher into a narrative chronology” (Creswell, 2014, p. 94). While extracting themes
from the data, I created a narrative story of each participant. This was done so that I could capture the essence of both participants and ensure that their individual experiences were captured (Cook & Dixson, 2013). I then looked for overlapping and complimentary themes in the data. Students’ individual intersecting stories were then used to create composite characters. Next, I conceptualized how their story could unfold, the setting of the counterstory, and what the dialogue would entail (Hicks, 2018). Using the CRT methodological framework, I used existing literature to develop counterstories from the interview dialogue, math autobiographies, and professional and personal experience (Solórzano & Yosso, 2002). These counterstories feature three composite characters and serve as anti-deficit narratives of Black student performance in mathematics.

**Trustworthiness**

In qualitative research, trustworthiness is one way researchers can persuade themselves and readers that their research findings are worthy of attention (Lincoln & Guba, 1985). As qualitative researchers conduct their research, they must continue to seek to control for potential biases that might be present in the design, implementation, and analysis of the study. Lincoln and Guba (1985) posit that trustworthiness involves establishing credibility, dependability, transferability, and confirmability.

Transferability shows that the findings have applicability in other contexts. Though generalizability was not the intended goal of this study, due to the risk of essentialization of Black students’ experiences, the researcher attempted to establish transferability by way of thick, rich description of the participants experiences in elementary and middle school math classrooms; with math teachers; positive math identity; and engagement with math. Lincoln and Guba (1985) suggest a number of techniques to address credibility including activities such as prolonged engagement,
persistent observation, peer debriefing, member checking, and triangulation. In this study, the researcher employed member checking when giving participants the notes and summary of their interview to check for accuracy and integrity on the part of the researcher. In addition, using both interviews and math autobiography allowed for data triangulation.

Confirmability refers to the extent to which the findings of a study are shaped by the respondents and not researcher bias, motivation, or interest (Lincoln & Guba, 1985). In this study, an audit trail was used to demonstrate dependability, credibility, and transferability. This audit trail included ongoing reflection and journaling through memoing, field notes, and transcripts. Using a transcription service to transcribe interviews, and manual coding of themes by the researcher ensured that the participant intent was captured and minimized bias.

**Ethical Concerns**

Ethical issues and the protection of participants are concerns in any research study. The researcher maintained ethics throughout the study to protect the identity and responses of participants. Students were read the student assent form prior to their interview (see Appendix B-2). The risks to participants in this study were minimal. Pseudonyms were used in the transcripts for all names of participants, school districts, and cities. Using pseudonyms alone will not allow them the protection they deserve in fully sharing their experiences (Cook & Dixson, 2013). Composite counterstorytelling allows anonymity of participants and provides an empirical space for me to recount the stories and experiences of students, who are in vulnerable positions. By creating a composite counterstory, the spotlight is off the individual and instead the focus is on their
collective story. The transcripts will remain in the possession of the researcher only. All audio recordings, video recordings, and consent forms were kept on a secure external hard drive. Recordings will be destroyed upon conclusion of the dissertation.

**Limitations and Delimitations**

I will discuss three limitations of this study. First, the study occurred during a pandemic. This caused the IRB process and recruitment to be pushed back, which ultimately affected the amount of time the researcher had to recruit and retain participants. Secondly, due to the pandemic, the students attended virtual school and to ensure social distancing, interviews were conducted through video conferencing. During these conferences, there were challenges with participant Internet connections, making it difficult to decipher some responses. In addition, video conference etiquette makes it difficult to interpret and capture expressions, tone, and gestures. A final limitation is that one participant did not complete the math autobiography.

A major delimitation of the study was that the research sample was restricted to Black middle school students in one school district. A critique of this research might be the lack of generalizability to other groups of Black students. The goal of this study was to capture the voices and experiences of a group of students who are often overlooked and underrepresented educational research. Thus, another delimitation is that participants chosen had to have been successful in mathematics, which again affects generalizability.
Summary

In summary, this chapter outlined the research method used to answer the research questions. A phenomenological method was employed to illustrate the contributors to mathematical success in Black middle school students. The participants were two middle schoolers who were in advanced mathematics and scored proficient on standardized tests. Two data collection methods were employed, individual interviews and a math autobiography. This data was then coded and analyzed using a review of literature and the corresponding tenets of CRT. The goal of Chapter Four is to provide the results of this study and demonstrate that the methodology described in this chapter was followed.
CHAPTER FOUR

FINDINGS

Introduction

This study investigated the experiences of African American students who have been successful in mathematics and how they develop positive math identities. This study’s research questions, interview protocol, and data analysis was framed by Critical Race Theory (CRT). CRT centers research, pedagogy, and policy lens on communities of color and calls into question White middle-class values as the standard which all others are judged (Yosso, 2015). In this study, I interviewed two Black middle school students who have experienced success in math throughout their time as students, as indicated by standardized test scores, class performance, and advanced math class placement. In addition, both students were presented with a math autobiography in Phase 2 of the study, however, only one student was able to complete the artifact. I then used the analysis of these interviews and math autobiography to craft a composite counterstory (CCS), framed by CRT. “The counterstory is also a tool for exposing, analyzing, and challenging the majoritarian stories of racial privilege” (Solórzano & Yosso, 2002, p. 32). This chapter is presented in three sections. In section one, I present how one should approach reading the composite counterstory. In section two, I present the CCS using the voices of each participant, based on the existing literature, interviews, and math autobiography from this study. Finally in section three, I provide an analysis of the CCS based on the themes derived from the following questions:

1) What perceptions do Black middle school students have on contributors to positive math identity and success?
2) What teacher practices do Black middle school students feel contribute to their success?

3) How do Black middle school students author themselves into the narrative of mathematics?

**How to Read the Composite Counterstory**

Cook and Dixson (2013) identified three points that should guide one’s reading of the composite counterstory:

1) the dialogue, setting, and thoughts of the composite characters come directly from the interviews, field notes, and other data sources but are edited to maintain the flow of the narrative;

(2) the analysis of the counterstories appears later in the paper; and

(3) footnotes provide background and factual information for clarity.

As you read the counterstory, it is important to remember that although they are fiction, these narratives are based on data (interviews, field notes, artifacts, etc.) and both qualitative and quantitative research, as well professional experiences. Crafting the CCS involves artistically weaving together these sources into a coherent narrative that captures the essence of the study participants through composite characters. The “composite” characters developed are “grounded in real-life experiences and actual empirical data and are contextualized in social situations that are also grounded in real life” (Solórzano & Yosso, 2002, p.36) . The purpose of this composite counterstory is to “dislocate comfortable majoritarian myths and narratives” (Smith et al., 2007) and
amplify the voices of students of color, rather than further marginalize them. The setting of this CCS is Bloomfield Middle School. I now present you with a mathematical CCS, featuring the composite characters Brook, Henry, and Devin.

**Three Piece Special**

**Devin**
Devin sighed and gazed out the library window, unfazed by the heavy rain that had started to fall immediately after the buses of students left for the day. Next to him was his cousin Brook and her friend Henry. He couldn’t believe he had let her drag him to this after school math club. He peered around the brightly lit room. Seated in a circle were about ten other Black kids of different grade levels from Bloomfield Middle School. In his eyes, they all looked like nerds. Although they were some of the top performing kids in BMS, these were the kinds of kids he tended to stay away from. He was on the football team and as a transfer student to the district at the beginning of the year, who was also a lowly sixth grader, he had a reputation to keep. His math teacher, Mrs. Young, who was also over the club, was quietly talking with another teacher near the front of the library.

“You alright man?”, asked Henry with a concerned look on his face.

“He’s a-l-ight. I can’t believe you still mad at me-” Brook started.

“YEP. You just had to go tell the teacher that I like math! I do NOT belong here,” Devin said, with extra emphasis.

Before Brook could respond, Mrs. Young took a seat in the circle and cleared her throat. She smiled widely, beaming at each student.

“Welcome to Math Club young mathematicians! Most of you know me from Advanced Math, but for those who are new, this is our second year at Bloomfield. And we have a good time.” She grinned as she said the word, good, as if withholding some ancient math secret that only past club members were privy to. Devin liked Mrs. Young. In her class they got to work together in groups and have fun competitions often. Devin liked competing and working with other students. He learned math best by communicating his ideas and listening to the thinking of other students. She also often called on students to share how they got their answers, even when they were clearly wrong.

She went on. “The goal of this group is to provide a space for you to be affirmed, acknowledged, and challenged. I will push you, because I expect nothing less than your best. You will struggle at times, but I will teach you how to come out victorious. We keep it honest and real here-”

Devin couldn’t even listen to the rest of what she was saying. Struggle? Push? Challenge? Nah. He wasn’t ready for that. Not after what happened at his last school. Not when his year was going so well. He looked over at Brook and shook his head. Unbelievable, he thought. She knew how his fifth grade year at Downton Elementary School had been.

He stood abruptly, gathering his backpack and started towards the door. He heard Brook tell him to wait but he was determined. He had to get out of there.
Brook

As she watched Devin leave, Brook immediately felt guilty. Why had she listened to her mom when she told her to convince Devin to come to Math Club? She was always sticking her nose in everyone else’s business! It often got her in trouble, even though she had good intentions. Most of the time.

“It’ll help him. You love that club. I am sure Dev will too,” her mom had said last week while dropping her off at school.

Brook shook her head slowly. “Ma, I don’t know. He had a pretty bad experience with his fifth grade teacher at Downton. He never wants to talk about math stuff anymore.”

“Just try. It will be good for him, baby. Plus, he’ll have you and Henry there.”

So, Brook set out to convince Devin. Devin was her favorite cousin. The two had been inseparable since his family moved to the mid-sized city of Rivertown when he was eight. Although he attended a different school and lived in a different area than Brook’s family, the two bonded over their curiosity of the world around them and love for math and science over the years. Both students had a mostly positive experience with math in elementary school and were teachers’ favorites. That is, until fifth grade.

Miraculously, Mrs. Young was able to get Devin to come back into the library. Brook was curious. What did she say to him? she thought incredulously. Wordlessly, he sat back in his seat next to Brook. He still looked a bit upset, so she decided to let him cool off before she spoke to him again.

“Today we are going to do something different. Something we haven’t done before in math club. Today will be the day you all tell your math story.” Mrs. Young said, again beaming at each of the students.

Brook smiled back at her. Mrs. Young was her favorite teacher. She was lucky enough to have her for all three years of Advanced Math at Bloomfield Middle. Mrs. Young was funny, caring, strict, and fair. She knew how to relate to the students and made math class engaging. She trusted her students and would let them know if they violated that trust by something they said or did. Brook often left her class with a new challenge to turn over in her head or some question to ponder. Math was just like that. There was always some puzzle to solve, which often was related to another pattern or sequence or puzzle. She absolutely loved it.

Mrs. Young explained that everyone there that day would create an autobiography, on math. They had the opportunity to tell their life experiences with math from elementary school all the way up to the point that they were now. Mrs. Young wanted them to use words and visuals. They had the option of doing a digital presentation, poster, video, recording, and numerous other ways to present their story.

Brook was excited. Although she couldn’t remember every experience with math in elementary school, she remembered her third grade teacher Ms. Fields. Brook struggled tremendously with math in 1st and 2nd grade. In third grade, Ms. Fields would take time with Brook on her recess and lunch break, as well as after school to help her with math. Ms. Fields, who was young, became a mentor to Brook. Ms. Fields
communicated with Brook’s mom often and was even allowed to take Brook home at times. Brook wanted to impress Ms. Fields, and Ms. Fields made her believe she could do anything. Brook felt they had a bond. Brook’s confidence in math grew as a result of that year, as did her performance in math.

In a way, Mrs. Young reminded her of Ms. Fields. Mrs. Young always had high expectations of Brook, allowed her to peer tutor in class, and gushed over her (and any other student’s) math discoveries. Brook always felt at home with Mrs. Young.

******

Henry

Henry was just finishing up his math autobiography. He looked around the library. The other 12 students were scattered around, some on the floor drawing on poster boards. Others on the computer making presentations. A couple of others were surrounded by balls of paper, discarded ideas, as they perfected their final piece. Henry was the only other seventh grader in the math club. His dad had insisted that he come to this club. Henry wasn’t in Advanced Math like most of the other students but he knew Mrs. Young personally because she kept trying to get him to take her class. Henry just wasn’t interested at the time. However, he enjoyed math. He especially liked the shortcuts and tricks. He’d always been really good at math and never needed to ask questions. When asked by his teachers how he arrived at his answer, he always said, “I just know it in my head.” He almost always just knew the answers. That’s how he knew he was good in math.

Henry knew the importance of math. His dad and aunt always talked to him about the math in the world. He knew it would be something that he would use often. His dad made sure of this, making him give him estimations of the cost of groceries when they went shopping, making Henry pay with cash and change, instead of just swiping his card, and having him calculate the percentage off during a sale. His aunt made him cook with her sometimes and had him convert measurements for ingredients such as ounces to cups and pounds. Henry had grown to like cooking. Being constantly bombarded with math could be exhausting at times, but Henry enjoyed it.

His dad and aunt had also warned him about how the world saw Black children, specifically because he was male. He knew that he would often be seen as not only a threat, but not smart, just because of the color of his skin. His dad made sure to remind him that he must prove them wrong. Henry knew that he needed his own set of tools to disprove the naysayers and take care of himself. Henry preferred to work alone and didn’t really believe in asking questions in math class. He liked being independent and relying on himself. The only reason he was joining math club this year was because of Brook. They lived on the same bus route and she had been friendly to him last year when he was a sixth grader and she was a seventh grader. He couldn’t understand why. He was skinny with big glasses and nappy fro at the time. Brook was an honor student, and everyone loved her. But since then, he had developed a huge crush on her. They didn’t have much in common except math, so there he was.

Ten minutes later, the math club gathered in their circle again. Mrs. Young asked students to volunteer to tell their story. Henry was surprised when Devin stood up first, holding a large sheet of white posterboard. He walked over to a nearby wall and taped his poster up. Henry couldn’t believe it. Devin was an amazing artist! His poster was divided into three sections labeled: school, home, and football. In each section, Henry had drawn
pictures that showed how he used math in each area, as well as captions and thought bubbles. The pictures were detailed and clean and each section gave a clear picture of Devin’s math story.

When Devin began to describe the elementary part of his school section, he looked uncomfortable for a bit.

“It’s okay Devin. Tell your story,” Mrs. Young urged.

Devin looked uneasy but continued. “So as I was saying, I thought I was good in math until fifth grade. That year I had this racist teacher. No matter what I did, it was never right. I was a really good student. I did good in math. I was always answering questions right. But this man, this white teacher, he just ignored me. I was the only Black kid there. He just didn’t like me. I felt it.”

Devin looked around the room at the curious faces. Henry was concerned that Devin might cry or something. This thing must have really affected him.

Devin went on. “Every teacher had a clip chart for behavior. In this dude’s class, I could never get clipped up to the highest color. Everyone in that class did that year. ‘Cept me. And this white guy—another student—always used to mess with me. And one day I just yelled at him to stop. I was fed up about it. I think he bothered me because I was Black but I don’t know for real. So I got in um...trouble and when I told the teacher how that dude always messed me, he never did anything. None of the times I told him. So, even though I liked math and did well in it, I stopped caring after a while. And they kinda hurt because math was my FAVORITE subject from first grade to fifth grade. I hope they fired that man.”

Henry wasn’t surprised at Devin’s experience. He had something similar happen to him when he was in sixth grade at Bloomfield. His science teacher would call the Black kids words like “dumb”, “retarded”, and cursed at them occasionally. Henry wasn’t having that. His dad had always taught him that he always had a responsibility to speak up and use his voice to cause change to happen. He set up a meeting with the sixth grade principal and told him what happened in science class every day. When he told the principal, he didn’t know if they would do anything about the teacher, who was an elderly white woman nearing retirement. She was old and crabby, but still that wasn’t an excuse for how she talked to the Black kids at BMS. The other students started calling him Henry X, after Malcolm X, after the incident and he became one of the most popular kids in the school. That science teacher didn’t return to Bloomfield the next year.

After everyone shared their math autobiography, including Henry, the club members felt a little more like a community.

Mrs. Young clapped her hands to get their attention. “Okay students before we leave, I just want to thank you for being vulnerable and honest about what you have experienced. I know that it wasn’t easy for some of you. I am glad you choose to be brave every single day and show up for math. She glanced around the circle.

She continued. “So, in this math club we will learn not only math tools and compete in the yearly competition, but we will learn about the accomplishments of other Black and Brown mathematicians. Our society tends to try to limit what African Americans can do and doesn’t recognize who you are. I want to empower you. But you just remember one thing. You are mathematically brilliant. And no one can take that away from you.”

“Now quick, why do plants hate math?”, she asked.
“No one, no one? Because it gives them square roots!”, Mrs. Young laughed as the students groaned in protest at the corny joke.

Henry chuckled. He felt, what’s the word Mrs. Young used? Empowered. He felt empowered after sharing. Like even though bad things might happen, he could overcome it. He was digging this math club.

“This was alright. Much better than I thought it would be,” Devin said smirking, taking a seat across from him on the after school club bus.

“Yeah man, I’m sorry that you had to go through that in fifth grade. That sucks,” Henry said.

Devin shook his head. “Yeah, I am, too. That year I felt down all the time. Like no matter what I did, the white kids would always be on the top. And then there I was, always at the bottom. I wish more teachers were like Mrs. Young. She really believes in us and seems to care and want us to do good. It feels good to finally be at the top of the clip chart again.”

Analysis

In this section I will present the analysis of the data and Composite counterstory. First, I will present the Findings in the form of Tables, organized by theme and research question. These tables will include a sample of relevant quotations of student voices that were used to determine themes and create the CCS. Following each theme table, I will give an explanation of how their words and descriptions are conveyed in the CCS. When coding, several of the themes overlapped significantly, and were combined or collapsed in the final coding stage. Five broad themes contributing to mathematical success and identity emerged from the analysis of the data: 1) Teacher dispositions and practices 2) Early experiences in math 3) Extrinsic recognition of achievement 4) Family support and involvement 5) The unique nature of math and connection to the real world. The last table will discuss the third research question, how students envision and author themselves in the narrative of mathematics.

<table>
<thead>
<tr>
<th>Theme 1. Teacher Practices and Dispositions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Question: What teacher practices do Black middle school students feel contribute to their success?</td>
</tr>
</tbody>
</table>

1 Each table was adapted from Bloomberg, L. D. (2011). Understanding qualitative inquiry: Content and process (Part III). Unpublished manuscript
OVERVIEW

This question was used to investigate how student beliefs are related to teacher interactions. According to Purdue University online, teachers must demonstrate the professional attitudes and conduct that facilitate student learning. These attitudes and modes of conduct are known as professional dispositions. These are the values, actions, attitudes, and beliefs of educators as they interact with students, families, community members, and professional colleagues.

FINDINGS

A. Students appreciate teachers who show students they trust them by giving them responsibility and independence, as well as relying on them to help in class with other students.
B. Teachers who allowed students to share their work and take ownership, in front of others, were highly regarded.
C. Extrinsic motivation from teachers such as praise, competition, and rewards were useful in students wanting to engage in math and having positive math identity.
D. Teachers who were helpful, caring, had high expectations, dependable, relatable, and humorous were highly regarded.
   o Teachers who checked on students outside of school were seen as caring and relatable.
   o Teachers who worked one-on-one with students were seen as caring.
   o Teachers who used positive language were instrumental in fostering positive identity.
E. Teachers with negative dispositions and racially aversive classroom climates had a negative effect on student self-concept but this helped foster resilience and agency in students.

PARTICIPANT PERSPECTIVES

a) “My teachers rely on me more than other students. They were allowing me to help other students and share what I know to other students, because maybe some students don’t know as much as I know.”
   o “He was funnier and gave us more trust and independence. He was sarcastic and more relatable.”

b) “My teachers always told me I was good in math and that I was just smart in general. They also let me share my math findings with the school on stage on some Fridays.”

c) “…my teacher sends me these little note cards of how good I’m doing.”
   o “She always asks me how I’m doing. She says good morning every time I come into class.”

d) “They made it [math] fun by having us do sprints and racing each other to get to the top and move on to the next set of multiplication charts and stuff like that…and just having competition is fun.”
   o “She always cracks these math puns and stuff, for the entire class and everything. She’s funny and stuff and she just talks to us.”

e) “I didn’t think my teacher really liked me a lot. She was really mean to me and I think she was racist. There was this white guy who would pick on me for no reason and when I just reacted to him, she got mad at me and then didn’t do anything about him and then she would always find a way for me to get at the bottom of the clip chart.”

The findings from this theme are represented throughout each of the three children’s perspectives in the counterstory. Findings A, B, C, D were all demonstrated by Mrs. Young and Ms. Fields in the story. In Devin’s narrative at the beginning of the CCS,
Mrs. Young informs the children that they will be affirmed, acknowledged, challenged, and expected to do their best to succeed. This shows that she was caring and believed in the math abilities of her students. In Devin’s narrative, we also learn about the environment of Mrs. Young’s math class. This reflects the study participant’s perception that having math competitions and extrinsic rewards contributed to positive math identity and their success in math. In addition, Devin’s narrative tells how he enjoys competition in Mrs. Young’s class, which showed up in participants’ responses throughout the research study. Participants from the study also enjoyed teachers who used humor and were relatable. This is shown in the CCS by Mrs. Young making a math joke about plants, as well as her down to earth tone and way of speaking to the children.

During Brook’s narrative, we learn about the math autobiography assignment of the day, which made Brook excited because she was eager to share her story about her experiences with Ms. Fields, her third-grade teacher. Brook’s relationship with Ms. Fields reflects the study participants’ expression that one-on-one time with the teacher and teachers showing they care about the student’s life outside of school. In Henry’s narrative, we learn why Devin was so upset and prepared to leave the math club meeting. His early experiences with math were positive until his fifth-grade year. During that year, Devin had a teacher who he felt was racist, overlooked his abilities, and wasn’t encouraging. Devin repeatedly tried to earn his name at the top of the behavior clip chart, but his fifth-grade teacher seemed oblivious to this. He left that year feeling dejected, with a lowered self-concept about math. This reflects the study Finding E, how teaches with negative dispositions and classroom practices affected their math identity. Finally,
Brook’s experiences with Ms. Fields and Devin’s experience with his fifth grade teacher also reflect another theme, early experiences in math, which will be discussed next.

<table>
<thead>
<tr>
<th>Theme 2. Early Math Experiences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Question: What teacher practices do Black middle school students feel contribute to their success?</td>
</tr>
</tbody>
</table>

**OVERVIEW**

This theme describes the early experiences that influenced student math identity and learning.

**FINDINGS**

The students shared that both positive and negative experiences affect student math identity, disposition, and self-concept.

A. Elementary teachers who were affirming and took time to meet with students one on one and build a relationship influenced students positively by contributing to self-efficacy.

B. Negative interactions and classroom environment influenced students negatively.

**PARTICIPANT PERSPECTIVES**

a) “They were really nice and they helped us if we had any trouble and they were also strict so we wouldn’t fall behind or anything.”

   a. “My teacher really helped me…If I could get some independent (free) time for recess, he’d help me with math and stuff. It really made an impact on my math.”

   b. “I could rely on him and ask him questions and stuff, and then he can rely on me…And I feel like it was just like a bond.”

   c. “It helped me be successful by, it helped me exceed on my math. It took me to a farther step, because at first I wasn’t really doing good in math, but now I feel like I’m doing great. I’m doing great in math now.”

b) “She would always find a way for me to get at the bottom of the clip chart. And I never got to outstanding. [I felt like this experience affected my performance in math because] I was constantly trying to get to the top of the clip charts and she just wouldn’t let me, even though I was a really good student.”

   a. “She was like ‘You might want to try to do that [get to the top of the clip chart] before the year is over.’ And I was trying and it didn’t work out.”

In the CCS, both Brook and Devin have elementary experiences that contribute to their beliefs about themselves as doers of mathematics. In Brook’s narrative, we learn that Brook struggled in math prior to her third grade year. Her third grade teacher, Ms. Fields, supported Brook in various ways and this fostered a positive math identity and was a catalyst for Brook to embrace math. From the CCS,

Brook wanting to impress Ms. Fields, and Ms. Fields made her believe she could do anything. Brook felt they had a bond. Brook’s confidence in math grew as a result of that year, as did her performance in math.

On the contrary, we also learn about Devin’s experience as a fifth grader. In the CCS Devin remarks
“So as I was saying, I thought I was good in math until fifth grade. That year I had this racist teacher. No matter what I did, it was never right. I was a really good student. I did good in math. I was always answering questions right. But this man, this white teacher, he just ignored me. I was the only Black kid there. He just didn’t like me. I felt it…So, even though I liked math and did well in it, I stopped caring after a while. And they kinda hurt because math was my FAVORITE subject from first grade to fifth grade. I hope they fired that man.”

Although he had positive experiences with teachers and math prior to fifth grade, this one experience was enough to change the trajectory of Devin’s relationship with math.

Theme 2 reflects consistency among participants on the impactful way their early experiences with math shaped their math identity and performance.

**Theme 3. Extrinsic Motivation and Recognition of Achievement**

Research Question: What perceptions do Black middle school students have on contributors to positive math identity and success?

**OVERVIEW**
Extrinsic motivation and recognition refer to the ways that students are motivated to perform well in math in order to obtain a reward.

**FINDINGS**
Extrinsic recognition of math achievement and performance were indicators that students felt successful in math and contributed to positive self-efficacy and self-concept in math.

- A. Students identified correct answers and high scores on tests as indicators that they were good in math and motivators.
- B. Feedback from teachers was shown to be ways students know they were successful in math.

**PARTICIPANT PERSPECTIVES**

a) “[I know I am successful in math] when I get good scores on a test or something, or I get all my answers correct, or I can do things myself and not have to ask questions and stuff.”
   
   a. “We have this group of teams and we try to work out this group of five math problems and whoever does most of the questions right, they get candy. So that was fun.”
   
   b. They can give out candy. In third grade, my teacher…She would choose two students who were doing really well and get them a sandwich from Jimmy John’s for lunch.”

b) “And my teacher sent me a little note card in the mail that said I was doing really good. And I'm also getting advanced test scores on the big tests and stuff.”
The theme of extrinsic recognition of achievement being a motivator for students to perform well in math were illustrated in both Brook’s and Henry’s narrative in the CCS.

From Brook’s narrative,

Mrs. Young always had high expectations of Brook, allowed her to peer tutor in class, and gushed over her (and any other student’s) math discoveries. Brook always felt at home with Mrs. Young.

From Henry’s narrative,

But you just remember one thing. You are mathematically brilliant. And no one can take that away from you.”

Mrs. Young ensured that her students knew they were mathematically brilliant and always would be.

| Theme 4. Family Involvement |
| Research Questions: What perceptions do Black middle school students have on contributors to positive math identity and success? |
| **OVERVIEW** |
| Family involvement includes ways that family members support students in understanding math, such as applying and seeing math in their world, and practicing math skills. Family involvement includes family members teaching students the importance of math and making connections. |
| **FINDINGS** |
| A. Families who involved math in student lives helped contribute to student math identity and understanding of math and their world outside of school. |
| **PARTICIPANT PERSPECTIVES**
| a) “I think it [being Black] could have played a big factor into it [doing well in math] because I’m pushed by my mom and dad. They’re both really smart. My mom’s a teacher and my dad’s an engineer and they both pushed me really hard and I think part of it is because I’m Black and a girl.”
| a. “Math comes in handy with cooking and stuff and my mom says I have to learn how to cook. And my dad, he also does some things, like the tape measure thing. And my grandma also does that with candies and stuff. So, we all use math a lot and so I need to know lots of math.” |

The theme of family involvement and support in math was included throughout the entire CCS. The first mention of family support in math comes during Devin’s
narrative, when he talks about how his cousin Brook, convinced him to come to this math club. We later learn during Brook’s narrative the two cousins are close, due to bonding over their love of math. We also see Brook’s mother encouraging her to invite Devin to math club, in hopes of helping him get back to liking it. Her mother says, “It’ll be good for him,” and “It will help him.” This shows her support for the two participating in math club. In Henry’s narrative, we learn how his dad and aunt made him engage with math on a regular basis. For example, his father made him pay with cash and change when they went shopping or estimate the cost of groceries. Although it could be tiresome, Henry enjoyed using math in the real world. We also learn how Henry’s dad, much like Mrs. Young, discussed with Henry that the world isn’t always so kind to Black children, even when they show aptitude for math. His dad’s influence is what caused Henry to speak up about a problematic science teacher that he had his sixth grade year, leading to her removal. In the research study, involvement showed have a positive influence on student’s identity in math and other subjects.

<table>
<thead>
<tr>
<th>Theme 5. Unique Nature of Math</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Question:</strong> What perceptions do Black middle school students have on contributors to positive math identity and success?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>OVERVIEW</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>The unique nature of mathematics involves the patterns and relationships seen between mathematical concepts and the world outside of the classroom.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>FINDINGS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Participants commented on specific math properties and qualities that make it enjoyable to them.</td>
</tr>
<tr>
<td>B. Students commented on the real-world applications of math and gave examples.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>PARTICIPANT PERSPECTIVES</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>a) like the systems and tricks you can use, the rules and functions. I also like the simplicity and how you use it in real life.”</td>
</tr>
<tr>
<td>o “He has so many cool math tricks that make it so easy.”</td>
</tr>
<tr>
<td>o “I like that it has formulas and always a trick that you can use to get the answer faster. I like all the sequences and stuff.:</td>
</tr>
<tr>
<td>o “And then proofs are really fun”</td>
</tr>
</tbody>
</table>
b) When I’m cooking and when I’m measuring things with my tape measure. I used to have a shop class and he taught us math in there a lot. “
   o “…math comes in handy with cooking and stuff and my mom says I have to learn how to cook. And my dad, he also does some things, like the tape measure think I told you about and my grandma also does that with candies and stuff. So we all use math a lot so I need to know lots of math.”
   o “You get a lot of real-world math problem. Like say, if you ain’t know how to count, but the basics of math, how would you know how much money you have or how much to give the cashier when you need to go somewhere? Or how much change you’re supposed to get back”

Theme four is represented in the CCS first through Brook’s explanation of why she liked her teacher, Mrs. Young and math class. From the CCS,

Brook often left her class with a new challenge to turn over in her head or some question to ponder. Math was just like that. There was always some puzzle to solve, which often was related to another pattern or sequence or puzzle. She absolutely loved it.

Furthermore, in Henry’s narrative, we learn that although Henry isn’t interested in Advanced Math Class, he enjoyed the shortcuts and tricks you use in math. Participants in the study commented on enjoying tricks, shortcuts, patterns, and easy ways to solve math problems.

Henry’s account of how his father helps him engage with math in an everyday context, which speaks to the unique nature of math, was discussed in the previous theme. In addition, his aunt makes him convert measurements when cooking with her in the kitchen. These examples display how study participants understand how and apply math in their home and community environments.

In the next section, I will review how students author themselves into the narrative of mathematics. Attention was paid to how students succeed, despite schooling
in racialized institutions and being seen as members of the lower level of racial hierarchy of mathematical ability by some teachers. I also detail students’ perceptions of what a mathematician is and whether they saw themselves as one.

**Research Question:** How do Black middle school students author themselves into the narrative of mathematics?

**OVERVIEW**
The third Research Question has the goal of finding out how do Black students, who have historically been framed in a negative light and whose accomplishments are often ignored, show themselves as math learners and doers.

**FINDINGS**

A. Study participants reported using various tools of success for math learning.
   a. Students indicated traditional methods of doing well in math such as paying attention and having a desire to learn the subject.
   b. Study participants indicated that self-reliance and independence were important in succeeding in math.

B. Study participants gave answers that corresponded to using their agency and advocacy in some situations.

C. The data indicated knowledge of stereotypes and how to navigate to be successful in school, which could be a highly racialized environment.

**PARTICIPANT PERSPECTIVES**

"...Because the world could have preconceived notions that I'm not good in math so I need to have my own set of tools to prove them wrong and to take care of myself."

"I was constantly trying to get to the top of the clip charts and she just wouldn’t let me...And I was trying and it didn’t work out."

"My third grade teacher helped me during recess"

"I think it’s because [why I do well in math] I actually pay attention…"

When asked if they considered themselves a mathematician and what is a mathematician

“Not all the way [a mathematician] because there’s still some stuff I need to learn, but almost.”

“[A]Mathematician is someone who is really good at math and they're advanced in it and they can do most problems with ease and they just really like math and they try really hard at it.”

Study participants gave overwhelming evidence that they saw themselves as mathematicians. One study participant said that being good in math meant that they really enjoyed math and worked hard to do well in it. They saw themselves as a mathematician because they did precisely this in math class. Another study participant saw themselves as successful in math and having a positive identity in math but did not consider themselves a mathematician because they still needed to learn things in math. This indicates that the student believes that a mathematician is someone who knows all math. However, the
participant said they were “almost” a mathematician and this reveals that they believed learning math was a process, by their definition of a mathematician.

Students also showed advocacy and resilience and using their “tools” to be successful in math, such as paying attention. One study participant commented on how their family helped them realize that the world has preconceived notions of what Black people could accomplish in math, so they have to be ready with their own set of strategies and tools to overcome challenges and do well in math. Both study participants commented on relying on self was important in doing well in math. In the CCS, Henry discusses how he prefers to work independently and rely on himself and doesn’t like to ask questions in math. He believes that as a Black boy, this shows that he is smart in math and doesn’t need any help. Brook advocates for herself and shows agency by going to her third grade teacher, Ms. Fields, during her recess and after school to receive additional math support. This pays off for her in the long term, much like for participants in the study.

Summary

In this study, I investigated student perceptions of contributors to their success in mathematics. Students were required to reflect on their experiences in elementary school up until their current year in school. The interview and math autobiography questions were formulated with a Critical Race Theory framework in mind. The data was analyzed with predetermined codes (see Appendix) and new codes were included to create themes from student responses. Students’ lived experiences were told through a composite counterstory, *Three Piece Special.*
Students attributed and experienced mathematical success and positive math identity in several ways. One way was through interactions with teachers who had positive dispositions, classroom environments, and student affirming and centered teaching practices. These teachers were regarded as safe, trusting and trustworthy, relatable, and caring. Students emphasized the importance of having teachers that cared about them outside of the math class and brought the real world into the classroom. Research shows that teacher student interactions can have a promotive or corrosive role in motivating students and enhancing achievement (Diemer et al., 2016). Another theme was the effect of early experiences on the identity of students. Again, teachers who were affirming, gave frequent praise, and spent one-on-one time with students were regarded as effective in shaping students’ positive math identity. Teachers who were verbally abusive and dismissive affected student academic disposition negatively. However, this fostered resiliency in some students, which would help them in their math learning after elementary school.

Students also expressed the importance of external rewards and feedback through praise, sharing with the class, recognition by the school, food, and candy. These were motivators for continuing to do well in math, as was teamwork and competition for prizes. Family support and involvement also was important to students and helped shaped their math identity before middle school. Students who had parents that discussed the role racial stereotypes with them saw that as an opportunity to develop tools to ensure success in school. Students also enjoyed engaging with the unique nature of math in school and at home. They saw math as relevant to their lives outside of school and engaged in some of the examples they gave on a daily basis. The final research question
involved having students share the ways in which they see themselves as mathematicians and doers of mathematics. One student shared that they saw learning math as a process and there was more to learn. Another student felt that they already conceptualized a mathematician due to excelling in math, enjoying math, and persevering in learning math concepts. This also points to resiliency in learning math.

In the final chapter, Chapter Five, I will delve deeper into the meaning of the findings and connect them to previous research studies. The chapter will culminate with implications of these findings, limitations and suggestions for future research, and final concluding thoughts.
CHAPTER FIVE
DISCUSSION

Several researchers call for a deconstruction of the racial hierarchy of mathematical ability that positions Black, Native American, and Latino/a students at the bottom and Whites and Asians at the top. Math race hierarchies contribute to the view that “Asians are good in math” or “African Americans perform poorly in math” (Martin, 2009). Mathematics as a discipline has ignored the experiences of African American students and their academic achievements continue to be framed in a negative light, where failure and underachievement have been emphasized over success and resilience (Martin, 2012). This has had a trickle-down effect has often made it difficult for these students to develop strong mathematical identities and racial identities in relation to math.

In many mathematics classrooms, teachers and students participate in range of practices in which they develop, contest, and internalize beliefs about who is proficient in math and what mathematical proficiency looks like (Martin, 2000, 2009).

The purpose of this qualitative study was to counter the deficit narratives that are so pervasive about mathematics achievement among African American students through highlighting the voices of high achieving students on their perceptions of impactful factors for mathematical success. In addition, the existing literature on composite counterstorytelling with Black middle school students is limited. Through the use of counterstory, the researcher examined contributors of positive math identity and academic success as told by composite characters. In seeking to understand their experiences, the study addressed three research questions: a) What perceptions do Black
middle school students have on contributors to positive math identity and success? b) What teacher practices do Black middle school students feel contribute to their success? c) How do Black middle school students author themselves into the narrative of mathematics?

This chapter includes an interpretation of the findings organized by theme and their relation to the major findings in the literature on African American student math achievement and identity. The chapter concludes with implications for future practice and policy, limitations and suggestions for future research, and concluding thoughts. Six factors in the math autobiographies and interviews were identified that relate to study participants academic achievement, identity, and engagement in math: 1) Teacher dispositions and practices 2) Early experiences in math 3) Extrinsic recognition of achievement 4) Family support and involvement 5) The unique nature of math and connection to the real world and 6) How students author themselves into the narrative of mathematics. The themes are not mutually exclusive, as there is overlap between many of the findings.

**Interpretation of the Findings**

It is important to note that students’ experiences are not monolithic. Each individual’s journey of success is unique. That being said, each of the six themes were prominent factors in their mathematical stories. Each theme is described in detail in the following sections.

**Teacher Practices and Dispositions**

Teacher practices and dispositions refer to the professional attitude and conduct that facilitate student learning. These also include beliefs, values, and actions that
educators hold as they interact with students, families, and the community (Purdue University Online, 2021).

Participants in this study overwhelmingly reported how their relationships with teachers affected their math performance and self-concept. First, teachers who spent individual time with students and showed care for students in the math classroom as well as out of school were highly regarded by students. This is consistent with findings in the research on how relational connections with teachers contribute to positive math identity and achievement (Berry et al., 2011, Berry & McClain, 2009; Nasir & Hand, 2008). Students indicated that when teachers are intentional in acknowledging students’ cultural background and assets, they felt cared for. This is a form of Culturally Responsive Teaching (Gutiérrez, 2013).

In addition, other contributors were teachers who provided challenging content, had high expectations, were dependable, relatable, and humorous. Similarly, Nasir and Hand (2008) and Abdulrahim & Orosco (2019) also found that teachers who had high expectations and challenging environments empowered learners to achieve academic excellence. Many Black students experience impoverished forms of instruction, which are often tied to teachers negative attitudes about them. From the CCS, Mrs. Young states, “The goal of this group is to provide a space for you to be affirmed, acknowledged, and challenged. I will push you, because I expect nothing less than your best. You will struggle at times, but I will teach you how to come out victorious.” This communicates to students that although math could be challenging, their teacher knew that with perseverance, they could succeed. Consistent with findings in Boaler and Staple (2008), when students know that they have teachers who care and have high expectations
and challenging coursework, they rise to the occasion. These practices are also forms of culturally responsive math teaching that enrich math learning spaces.

Students also expressed who teachers with negative dispositions and racially aversive classrooms had a negative influence on their self-concept and academic performance. This confirmed the many studies that found that when high achieving Black students are confronted with negative racialized experiences and stereotypes, they often exhibit a loss of racial pride and motivation, and increased stress and anxiety and decreased test performance (McGee, 2013; McGee & Martin, 2011). The study’s situation in the stereotype threat literature will be discussed more thoroughly in the last theme section.

**Early Academic Experiences**

There is an identified relationship between students’ early childhood and elementary experiences and math identity construction and achievement (Berry, 2008, 2011; Cvencek et al., 2014). The findings from this study supports that notion. Due to the large influence that educators have in student identity development, this theme overlapped with teacher practices and dispositions. Elementary teachers who took the time out to meet with students individually, were affirming to students, and built relationships with students out of school were remembered fondly by students and attributed to their academic success. One student attributed their relationship with their third grade teacher as a “bond” with mutual trust, respect, and support. Through this relationship, this student, who previously struggled in math, was able to succeed in math and has been excelling ever since. In the CCS, this was represented with Brook’s discussion of her third grade teacher, Ms. Fields. Ms. Fields was a role model and
positive influence for Brook and as a result, Brook was now in Advanced Math Classes and middle school.

On the other hand, in the CCS Devin’s experience with his fifth grade teacher who ignored his contributions and framed his behavior as problematic. The character Devin felt that even though he did well in school, no matter what he did, his fifth grade teacher never acknowledged his hard work and seemed to be racist and showed favoritism. This led to Devin’s led to decreased motivation, motivation, and self-concept. However, through having Mrs. Young as a teacher and participating in the after school math club, we see Devin regain some of his confidence in math. This agrees with Martin’s (2006) notion that math identities are always under construction.

**Extrinsic Recognition**

Extrinsic motivation and recognition refer to the ways that students are motivated to perform well in math in order to obtain a reward. In this study, students referred to various ways that extrinsic recognition of their math achievement and performance influenced their self-efficacy and performance in math class. Similar to Berry’s findings (2011), students were motivated by receiving correct answers and high scores on tests. Students saw these as indicators that they were “good in math”. Specific feedback from teachers was also a contributor to positive identity. One student comments on how their teacher sends note cards to let students know how well they are doing in math class. Students were also motivated by competition in teams and receiving food and candy for math performance. Students also remarked that this is a strategy that teachers can use to motivate low-achieving math students.
Teachers who allowed students to share their mathematical thinking with the class or peer tutor also were seen as supportive in students positive math identity development. Boaler (2006) documents teachers that highlight the intellectual value of and ask students to share their mathematical thinking. These actions communicate to students that they are mathematically competent and disrupts notions of fixed ability that is often attributed to minoritized students (Battey et al., 2016). This contributes to students developing productive dispositions in mathematics.

**Familial Support and Involvement**

When families provide support to students in understanding math and applying math in their world outside of school, students felt more confident in their math identity. Students remarked how families affirmed them in mathematics and this was strengthened when they engaged the student in math in a real world context. In the counterstory, we see the biggest influence of family in Henry’s narrative as he talks about the influence his father has had on his engagement with math. This agrees with findings from Hughes (2003) study, that suggest that racial socialization is an important mechanism that parents use to transmit to children their understanding of what it means to be a member of their ethnic group. Families often have a significant impact on students seeing themselves as successful in mathematics.

**The Unique Nature of Math**

The unique nature of math as defined by participant responses in this study involves the patterns and relationships seen between mathematical concepts, as well the application to the world outside of the classroom. In this study, the middle school students commented on the characteristics of math that made it enjoyable, thus leading to
engagement. Students stated qualities such as “cool math tricks” that make doing math easier, proofs and sequences, “the rules and functions” and how you “use it in real life”. Students discussed applications of math in cooking, measurement, and purchasing items at the store. This is consistent with findings in Berry, Thunder, and McClain (2011) that show that students’ engagement with the unique quality of math contributed to positive math identity. When students can connect math to their world authentically, they see math as relevant instead of disconnected. This is also a great way to integrate math into other disciplines to create cross-curricular connections.

**Writing Oneself into the Narrative of a Mathematician**

The intent of the third research question was to draw out ways that study participants show themselves as math learners and doers. Much of the existing literature shows Black students as passive learners and mathematically incompetent. Achievement gap research positions Black students at bottom of a racial hierarchy of who performs well in math, and often only points to deficiencies. This study examined the ways in which participants negotiated and navigated their math identity and learning in schools, which are historically racialized institutions. Study participants reported using various tools of success for maintaining positive math identity and high academic achievement.

To begin, students expressed that traditional methods of doing well in math such as paying attention and having a desire to learn the subject contribute to their performance in math. One study participant saw themselves as a mathematician because they are advanced in math, answering problems comes easily, and they persisted in math. Another participant said that they believed they weren’t a mathematician yet because there were still concepts to be learned but they were almost there. These responses show
that students have a desire to preserve in math, unlike many research findings, and have a growth mindset about their ability, identity, and achievement in math.

Students’ responses also indicate that students have learned how to advocate for themselves and use agency in learning mathematics. For example, in the CCS, we learn that Brook sought additional help in math from her third grade teacher. This reflected study participants similar experience. Students who consider themselves math doers and learners advocate for themselves and are key agents in their own learning. Furthermore, Larnell (2019) contends that when students see themselves as genuine contributors to mathematics, and not simply doers or users, they become living counternarratives to majoritarian deficit narratives. Study participants also showed agency and advocacy when they had negative experiences with teachers. For example, one participant’s experience with teachers who had a negative disposition towards the student took actions that demonstrated a form of resistance in negative racial environments and ultimately led to resiliency.

The themes of self-reliance and independence were threaded throughout the data as ways students navigated to be successful in math. One student remarked that how society has preconceived notions about the intelligence of Black students and as a result, they must prove them wrong and depend on themselves. This is yet another example of students resisting societal expectations and stereotypes and taking their learning into their own hands. This also demonstrates that although students are aware of stereotypes, contrary to findings in Cvencek et al., 2015, not all students internalize these stereotypes as their personal beliefs. This student, like others in existing literature, challenge widespread cultural assumptions by using their success in school as a form of resistance
to stereotypes about their group (Berry, Thunder, McClain, 2011; McGee & Martin, 2011; McGee, 2013; Stinson, 2011, 2013). When Black students are less affected by stereotype threat and are more reliant on ethnic identity, this is a form of stereotype management (Schweinle & Sims, 2009; McGee & Martin, 2011). McGee & Martin (2011) introduced stereotype management to explain academic resilience (traditionally valued high achievement in spite of negative intellectual and societal based stereotypes and other forms of racial bias) among Black mathematics and engineering students. As shown in the study and the CCS, racial stereotypes are powerful, but they are not deterministic (McGee & Martin, 2011).

**Implications for Practice, Policy and Theory**

Federal, local, and state policymakers, teacher educators, district administrators, and educators must examine their policies and the research showing that traditional math instruction is not working for Black students. The results from this study lend to several implications for practice, policy, and theory in the mathematics education and school of Black and other learners of color.

1) Gloria Ladson-Billings (1997) how school math is presented in ways that are divorced from the experiences of most students, not just Black students. She states that Black students in urban schools often received a pedagogy of poverty, which doesn’t allow for individuality, critical thinking, or creativity. Many schools and districts are beginning to see the importance of a practice that many educators of color have used with African American students since the beginning of schooling in this country. Teachers who use Culturally Responsive Pedagogy value and
incorporate culture, language, heritage and home/community experiences into mathematics instruction (Abdulrahim & Orosco, 2019). Policymakers and teacher education programs must make policies and provide courses that demonstrate effective practices of Culturally Responsive Math Teaching (CRMT) such as a focus on cultural identity, instructional engagement, educator reflection, communicating high expectations, engaging students in critical thinking, social justice, and collaboration. CRMT must be viewed as a pedagogical tool, and not just an add on. Thus, practitioners need plan all math instruction with a CRMT lens.

2) Jett (2019) calls for mathematics teacher educators should address issues of race and racism in their instructional practice through the use of critical race counterstories. These can be taught in conjunction with mathematics standards. Black students need to see other examples of brilliance in mathematics. They need to hear the authentic voices of students who they identify with.

3) In the study, students indicated that procedural fluency, that is, getting the answers correct and quickly, as well as not needing teacher support or asking questions contributed to their positive identity and engagement in math. As a practitioner who has studied math instruction and student learning immensely, I know that it is important that all students, regardless of performance or proficiency, see themselves as learners and doers of mathematics. Students must understand that speed and memorization aren’t the only ways of demonstrating math understanding. The results
from this study demonstrate that teachers need to redefine what mathematical success is and communicate this to students. The focus needs to be on the process over the product. Questions that can guide this include the following: In what ways can we restructure math classes at the elementary and middle school level to account for multiple ways of being (Neal & Batey, 2016) and learning in math? What messages have been communicated to students about what a mathematician is? In what ways are teachers giving specific feedback on student achievement?

4) Family involvement and support in mathematics learning had a large influence on student math identity. However, there are some caregivers who, due to their negative experiences with math in school, may find it difficult to support their child in math outside of school. Districts can find ways to support families with helping their child see math in out of school contexts that they participate in daily. Students need to see that math is not disconnected from their daily lives and that they can engage with it in numerous ways outside of the classroom.

5) A final recommendation is for math educators, math education researchers, and policymakers to interrogate the architecture of mathematics education and mathematics proficiency. Math functions as a gatekeeper that restricts access and disproportionately affects Black and Latinx learners. We must create equitable and liberatory mathematical communities so that students are able to thrive and author themselves into the narrative of mathematics.
Limitations and Suggestions for Future Research

This study was limited to two participants due to time constraints and communication difficulties due to the pandemic. Having the original intended sample size of 6 to 8 students would have contributed to the transferability of this study. I recommend repeating the study with a larger sample, across multiple schools. In addition, there are little to no existing studies using the critical race theory tenet of counterstorytelling in a mixed method research design. Combining quantitative and qualitative data would provide richer data that may lend to better transferability. A mixed methods approach could include student surveys from the larger population, randomly selecting a sample group, then doing focus groups or interviews. Students could also do math autobiographies. The researcher could present this information in the form of personal narrative counterstories or composite counterstories, as shown in this study.

Another suggestion for future research to advance the understanding of Black students learning in math is for more mathematical counterstories. Proponents of Critical Race Theory in Mathematics Education (CRTME) contend that mathematical counterstories should be used to tell stories of Black adults’ and children’s mathematical experiences “through the use of research data, math education literature, and the researcher’s personal and professional experience” (Davis, 2019, p. 194). In addition, counterstories could be used by practitioners as a pedagogical tool to implement culturally responsive math practices. One particular finding in this study showed how one student negotiated stereotype threat through stereotype management. It would be useful to provide more counterstories of similar students and compare and contrast their
strategies for negotiating their academic, racial, and math identity in the presence of stereotypes.

A final research recommendation would be to be for researchers to consider studies with elementary students in grades 3 to 5. Students are aware of stereotypes and differential treatment at an early age and although they are able to articulate their experiences more clearly at the middle and high school level, these children have important stories to tell. It would be useful to include parents’ perceptions in these studies, to form triangulation of the data and increasing trustworthiness.

**Final Thoughts**

The voices of young Black learners who have successful negotiated STEM are often absent from the discourse of achievement and persistence outcomes (McGee & Martin, 2011). Through this dissertation, I examined the perspectives of Black students who have experienced success in mathematics and maintain positive math identities. My study was guided by the following questions:

1) What perceptions do Black middle school students have on contributors to positive math identity and success?

2) What teacher practices do Black middle school students feel contribute to their success?

3) How do Black middle school students author themselves into the narrative of mathematics?

Through composite characters in fictional counterstories, I restoried the experiences of my study participants to reflect themes extracted from the interview and the autobiography data. Throughout this study, I endeavored to maintain participant
dignity and frame them in a positive light in an effort to counter deficit narratives that exist about Black children in the mathematics education literature. The clip chart in this study is an analogy to the racial hierarchy of math ability (Martin, 2009). On the classroom clip chart, students are clipped up and down based on their behavior. It acts as a behavior hierarchy and can cause anxiety in students, stereotypes about their classmates, and unnecessary comparisons. One of the characters in the counterstory shared that they had a classroom experience where they constantly strove to get clipped up, but their teacher never gave them the opportunity. In the racial hierarchy of math ability, Black students are always at the bottom of the chart. This is because math race hierarchies are informed by achievement gap research. Students and teachers internalize these beliefs and it often leads to a fixed mindset of their ability to achieve and negative mathematical identity. This study challenges math race hierarchy through the use of composite counterstorytelling. It allows the reader to step into the life of Black students who disrupt and dismantle the hierarchy from the top.
REFERENCES


Berry, R.Q. (2018). Disrupting policies and reforms in mathematics education to address the needs of marginalized learners. In Bartell, T.G.(Ed.) *Toward Equity and Social Justice in Mathematics Education*, Research in Mathematics Education.


http://www.blackliberationcollective.org/ourbeliefs/

https://doi.org/10.1207/s15430421tip4501_6


https://doi.org/10.1177/0095798416683170


doi:10.5951/jresematheduc.44.1.0316


https://doi.org/10.1080/13613324.2019.1592833


https://doi.org/10.1080/00220973.2013.876224
[https://doi.org/10.1006/ceps.1999.1015](https://doi.org/10.1006/ceps.1999.1015).

[https://doi.org/10.1007/s11256-007-0067-5](https://doi.org/10.1007/s11256-007-0067-5).


APPENDIX A-1: PERMISSION TO CONDUCT RESEARCH

Dr. Hardin-Bartley
Superintendent of Schools
University City School District

July 22, 2020

Dear Dr. Hardin-Bartley,

I am writing to request permission to conduct a research with students from Brittany Woods Middle School in the University School District. I am currently enrolled in the Doctor of Education-Educational Practice, Social Justice Emphasis at the University of Missouri- St. Louis and am in the process of writing my dissertation. The study is entitled A Composite Counterstory Examination of Contributors to Black Students’ Success in Math. The purpose of this study is to highlight Black students who are excelling in math and their perceptions of what factors contribute to their success, through the use of composite counterstories.

The research questions that will guide my study are:

1. What are 6th through 8th grade Black student perceptions of contributors to positive math identity and success?
2. What teacher practices do 6th through 8th grade Black students feel contribute to their success?
3. How do 6th through 8th grade Black students author themselves into the narrative of mathematics?

I hope that the school administration will allow me to recruit 6 to 8 students total from grades 6, 7, and 8 to interview with questions pertaining to the study. For this study, I am recruiting students who meet the following criteria:

- Identify as Black or African American
- Enrolled in math courses
- Have scored Advanced or Proficient on state math exam or shown significant academic achievement in school math courses

I will need the district or school assessment office to identify students who meet this criteria. From the population of students who meet this criteria, I will use a method called stratified random sampling to get three (6th, 7th, and 8th grade) sample groups. Finally, I plan to select a random sample from each grade level.

I will be conducting Zoom interviews in the study and I hope to obtain consent from student guardians. Students who are chosen to participate, will be given a consent form that explains the study, to be signed by their parent or guardian and an assent form to be returned to the primary researcher at the beginning of the interview process.

If approval is granted, student participants will complete two interviews, one in September 2020 and another in October 2020, through Zoom. The interview process should take no longer than 50 minutes for each participant for a total of 100 minutes. The individual results of this study will remain absolutely confidential and anonymous. Should this study be published, only the counterstories with names as pseudonyms will be published. No costs will be incurred by either your school or the individual participants.
Your approval to conduct this study will be greatly appreciated. I would be happy to answer any questions or concerns that you may have at that time. You may contact me at my email address: jnrcn7@umsl.edu.

If you agree, kindly sign below and I can pick up the form from the Administration Building, it can be mailed to me, or you can scan and email the PDF to me. Alternatively, kindly submit a signed letter of permission on your institution’s letterhead acknowledging your consent and permission for me to conduct this study at your institution.

Sincerely,
Joslyn Richardson
Doctoral Candidate
University of Missouri-St. Louis
(314) 562-0206
Advisor: Dr. Matthew Davis

Print your name and title here

[Signature]

Please Sign

Date 1-24-2020
APPENDIX A-2: UMSL IRB APPROVAL

December 09, 2020

Principal Investigator: Joslyn Richardson (UMSL-Student)
Department:

Your Amendment Form to project entitled A Composite Counterstory Examination of Black Students’ Success in Math was reviewed and approved by the UMSL Institutional Review Board according to the terms and conditions described below:

IRB Project Number ................................................. 2027046
IRB Review Number ............................................. 290044
Initial Application Approval Date .................. October 15, 2020
Approval Date .................................................. December 09, 2020
IRB Expiration Date .............................................. October 15, 2021
Level of Review .................................................. Expedited
Application Status ............................................... Approved
Project Status ..................................................... Active - Open to Enrollment
Risk Level ......................................................... Greater Than Minimal Risk
Type of Consent ................................................ Child Assent
........................ Parental Consent (One Parent)
Approved Documents .......................................... Recruitment flyer for families Link to Google Form to collect addresses

The principal investigator (PI) is responsible for all aspects and conduct of this study. The PI must comply with the following conditions of the approval:

1. Enrollment and study related procedures must remain in compliance with the University of Missouri regulations related to interaction with human participants following guidance at http://www.umsl.edu/reec/compliance/umsl-guidance-covid19-restart-6.28.2020.pdf
2. No subjects may be involved in any study procedure prior to the IRB approval date or after the expiration date.
3. All unanticipated problems must be reported to the IRB on the Event Report within 5 business days of becoming aware of the problem. Unanticipated problems are defined as events that are unexpected, related or possibly related to the research, and suggests the research places subjects or others at a greater risk of harm than was previously known or recognized. If the unanticipated problem was a death, this is reportable to the IRB within 24 hours on the Death Report.
4. On-site deaths that are not unanticipated problems must be reported within 5 days of awareness on the Death Report, unless the study is such that you have no way of knowing a
death has occurred, or an individual dies more than 30 days after s/he has stopped or completed all study procedures/interventions and required follow-up.

5. All deviations (non-compliance) must be reported to the IRB on the Event Report within 5 business days of becoming aware of the deviation.

6. All changes must be IRB approved prior to implementation unless they are intended to reduce immediate risk. All changes must be submitted on the Amendment Form.

7. All recruitment materials and methods must be approved by the IRB prior to being used.

8. The project-generated annual report must be submitted to the IRB for review and approval at least 30 days prior to the project expiration date. If the study is complete, the Completion/Withdrawal Form may be submitted in lieu of the annual report.

9. Securely maintain all research records for a period of seven years from the project completion date or longer depending on the sponsor’s record keeping requirements.

10. Utilize the IRB stamped consent documents and other approved research documents located within the document storage section of eCompliance. These documents are highlighted green.

If you are offering subject payments and would like more information about research participant payments, please click here to view the UM Policy: https://www.umsystem.edu/uma/policies/finance/payments_to_research_study_participants

If you have any questions, please contact the IRB Office at 314-516-6489 or irb@umsl.edu.

Thank you,
UMSL Institutional Review Board
ARE YOU A STUDENT WHO ENJOYS MATH?

STUDENT PARTICIPANTS NEEDED FOR RESEARCH STUDY

Joslyn Richardson, an UMSL doctoral student, is seeking to interview African-American middle school students who have experienced success in the area of math throughout school. The purpose of this study is highlight the experiences of students who are excelling in math and their perceptions of factors that contribute to their success.

Who Can Participate?

You might qualify if you meet the following criteria:
1) Identify as Black or African American
2) Currently enrolled in middle school math courses
3) Have scored advanced or proficient on the district or state math exams

Participation

Participation includes one 30–60 minute interview and completing a math autobiography. These two sessions will take place on separate dates. Interested? Please fill out the consent form.

Last chance! Please complete the Jotform by February 3rd to take advantage of this opportunity!!

https://form.jotform.com/210188118879

A $10 gift card is provided to students who complete both sessions for time and effort.

For more information please contact Joslyn Richardson at (314) 339-8184 or joslynrichardson@umsl.edu.
Black Students' Success in Math Research Study

Welcome!

This form is for those students and families interested in the math research study conducted by Joslyn Richardson, doctoral student at the University of Missouri-St. Louis. If you are interested and would like to receive more information about the study and consent paperwork, please fill out this Google form. Interviews will take place in January and February 2021 for eligible participants.

Thank you.

* Required

Please provide your name and relationship to the student. *

Your answer

What is the students name? *

Your answer

Is the student currently a BWMS student? *

- Yes
- No
In what grade is the student currently enrolled? *

- Sixth Grade
- Seventh Grade
- Eighth Grade

Is the student currently enrolled in math courses? *

- Yes
- No

Has the student achieved Proficient or Advanced on the district Galileo Math Test or the math portion of the MAP test within the past two years? *

- Yes
- No
- I’m not sure.

Will the child be able to commit to both Zoom sessions for this study (given on two days) in December? *

- Yes
- No

Where can I send the parent consent and student assent forms? *

- Email
- Home address
- Both

Please provide your contact information below. If you would prefer to receive the consent forms through email, please provide your email address. If you prefer to receive through mail, please provide your mailing address. *

Your answer

Please list any questions or concerns here.

Your answer
APPENDIX B-1: INFORMED CONSENT FORMS

Research Consent Form

Parent Consent for Child Participation in Research Activities

A Composite Counterstory Examination of Contributors to Black Students’ Success in Math

Joslyn Richardson

Primary Investigator

Hello,

Thank you for completing the research study intake form. I hope that your student is having a good year.

The next step is for you to read Study Overview in the Parent Consent form. You may print this form for your records if needed. When you are done, please sign the form at the bottom of this page giving your consent for your child to participate in the two interviews.

From there, I will contact you again to schedule the two Zoom sessions with your child. If you have any questions about anything, don’t hesitate to email me at this email or at my UMSL email joslynrichardson@umsl.edu. Again, thank you so much and I look forward to hearing from you soon.

Joslyn Richardson

☐ I have read this consent form and have been given the opportunity to ask questions. I hereby consent to my child’s participation in the research described above.

Participant Information

Child’s Name

First Name

Last Name

Age

ex: 23

Gender

☐ Male

☐ Female
Running head: AT THE TOP OF THE CHART MATH COUNTERSTORY

Parent’s Name
First Name
Last Name

Parent Phone Number
Area Code
Phone Number

Parent Email
example@example.com

Parent Signature

Date Signed
mm-dd-yyyy
Date

University of Missouri-St. Louis
College of Education
One University Boulevard
St. Louis, Missouri 63121
Telephone: 314-516-5937
E-mail: joslynrichardson@umsl.edu
Informed Consent for Participation in Research Activities
A Composite Counterstory Examination of Contributors to Black Students’ Success in Math

HSC Approval Number: 290044
Principal Investigator: Joslyn N. Richardson  PI’s Phone Number: (314) 339-8184

Summary of the Study
This research study seeks to examine the specific mathematics schooling experiences of African American students who have experienced success. Participation in the study is voluntary. This research will be completed over two Zoom sessions in the month of December and/or January with the Principal Investigator.

1. Your child is invited to participate in a research study conducted by Joslyn Richardson, Doctoral Candidate and elementary educator and Dr. Matthew Davis, Faculty Advisor. The purpose of this research is to highlight the experiences of Black students who are excelling in math and their perceptions of what factors contribute to their success.

2. a) Your child’s participation will involve:
   - Your child will engage in two Zoom sessions. The sessions will be recorded. In the first session, they will complete a math autobiography with the researcher, detailing their experiences as a math student in elementary and middle school. In the second session, students will be interviewed about their perceptions and experiences in math. Questions that will guide both the autobiography and interview include: Tell me your experiences with elementary and middle school. Have you experienced any stereotypes (will be defined) as a Black math student in school? How do you feel your teacher helps you be successful in math?
   - The amount of time involved in your child’s participation will be one hour for each of the two sessions for a combined total of no longer than two hours. Your child will receive a $5 Amazon gift card for each session completed for a maximum total of $10.

   Approximately 8-10 students may be involved in this research at the University of Missouri-St. Louis.

3. There are minimal risks associated with this study as a student may experience some emotional distress due to interviewing. This risk will be minimized by the researcher. Students experiencing any distress will be provided with emotional support or be encouraged to journal their feelings. In addition, the researcher will debrief students after the interview. As with all studies, there is a risk of loss of confidentiality. Please see item 7 for how this will be minimized.
4. There are no direct benefits for you participating in this study. This study may benefit educational researchers and educators who would like to learn more about helping African American students succeed in the area of mathematics.

6. Your participation is voluntary, and your child may choose not to participate in this research study, or you may withdraw your consent at any time. Your child will NOT be penalized in any way should you choose not to participate or withdraw.

7. We will do everything we can to protect your privacy. The recorded Zooms will be kept in a locked electronic folder on an external hard drive. This hard drive will be kept in a locked safe. The safe, hard drive, and locked folder are only accessible by the Principal Investigator. As part of this effort, your identity will not be revealed in any publication that may result from this study. In rare instances, a researcher’s study must undergo an audit or program evaluation by an oversight agency (such as the Office for Human Research Protection) that would lead to disclosure of your data as well as any other information collected by the researcher.

8. If you have any questions or concerns regarding this study, or if any problems arise, you may call the Investigator, Ms. Joslyn Richardson at (314) 339-8184 or faculty advisor, Dr. Thomasina Hassler at (314) 516-5181. You may also ask questions or state concerns regarding your rights as a research participant to the Office of Research, at 516-5897.
APPENDIX B-2: STUDENT ASSENT FORM

Student Assent Form

Student Assent for Participation in Research Activities

A Composite Counterstory Examination of Contributors to Black Students’ Success in Math

Hello,

My name is Ms. Joslyn Richardson and I am a doctoral student at the University of Missouri-St. Louis. I am also an elementary teacher in University City School District.

1. I am asking you to take part in a research study because we are trying to learn more about things that help students who are similar to you when it comes to math achievement.

2. If you agree to be in this study, you will be interviewed two times. In one session, you will work with me to complete an autobiography of your own math experiences from Pre-K to present. You will get to share some of the things that helped you become successful and enjoy learning in math. In another interview, you will share more about your experiences but this time I will be writing and you will only answer questions. We will keep all of your answers private and will not show them to your teacher or parents(s)/guardian. Only the researcher working on the study will see them.

3. We don’t think that any big problems will happen to you as part of this study, but you might you might feel sad when we ask about bad things that happen at school.

4. You will receive $5 for participating in both parts of this study for a total of $10. My name is Ms. Joslyn Richardson.

5. There are no risks from you participating in this research. Your participation will be confidential.
6. If you choose to participate in both parts of the study, when it is over you will receive an Amazon gift card of $10.00.

7. Please talk this over with your parents before you decide whether to participate. Even if your parents say "yes," you still can decide not to do this.

8. If you don't want to be in this study, you don't have to participate. Remember, being in this study is up to you, and no one will be upset if you don't want to participate or if you change your mind later and want to stop.

9. You can ask any questions that you have about the study. If you have a question later that you didn't think of now, you can call me at (314) 339-8184 or ask me next time.

10. Signing your name at the bottom means that you agree to be in this study. You and your parents will be given a copy of this form after you have signed it.

Thank you.

☐ I have read this consent form and have been given the opportunity to ask questions. I will participate in this study.
APPENDIX C: INTERVIEW PROTOCOL

Hello, I am Joslyn Richardson and I am a Doctor of Education student at the University of Missouri- St. Louis. I also teach in the district at an elementary school. You are here today because I am doing research on what type of things contribute to math achievement and success in African American students. The name of my study is ________________.

For the first part of our session, we will do an interview. The last part of our next session will be you writing your own math autobiography. For the interview, I have about 15 questions for you but I may not need to ask them all depending on your answers. So just a reminder that this will be recorded, but just know that this doesn’t go anywhere. Basically, what I do is I go back and I type out everything that you said. I’ve got your name, but I don’t use your name when I type, , I just use your names to organize my data, but then I just make you student 1, student 2, student 3. So no one knows your name except me. Before we start, I want to go over the assent form with you and have you sign it before we begin. I am going to email it to you again and then we will get started. E Do you have any questions before we start? Remember, I want you to be honest about your opinions and experiences. Remember, no one at your school will see this. Try to think about your experiences from when you were in elementary school and your time in sixth grade. If you don’t understand something, you can say, can you ask that in another way.

1. What do you like best about math?
2. What do you dislike about math?
3. What are some ways that you know you are good in math?
4. Do you consider yourself a mathematician?  Probe: Why do you feel that way?
    What is a mathematician to you?

Ok let’s move on to some different questions.

5. How do you feel your teachers in math helped you in elementary school? What about in middle school?
6. Do you feel that your teacher values how you contribute to math class? What about now? Probe: Can you give me some examples of how you know?
7. Do you feel it is important to show your teacher that you are good in math? Probe: Why or why not?
8. Is there a particular teacher that you had or have a positive relationship with and this relationship has helped you improve your math performance? Please don’t name the teacher. Probe:
   a. Describe the positive relationship that you have/had with this teacher.
   b. How has this relationship helped you be successful in math?

I would like to move on to our last set of questions

9. Do you feel that math is relevant to your life outside of school? How so?
10. Do you believe that because you are Black, you do well in math?
11. Do you feel there are issues with race at your school? Explain.
12. Have you experienced any stereotypes, comments or questions at school or in math class that you feel are insulting due to you being Black?
a. How do they make you feel? How do you deal with them?
13. What do other kids think about you? Do they think you are good in math?
14. In your opinion, what are some of the reasons why students struggle with math?
15. What do you think are ways that teachers could help other Black students be more successful in math in elementary school? What about middle school?

Before we end this interview, I’d like to ask you if there is anything else you would like to share about your experiences being a Black student in math class.

Debrief.
APPENDIX D: MATH AUTOBIOGRAPHY

The purpose of this autobiography is to have you reflect on your experiences with Mathematics. You have one week from the date received to complete the questions below. Your response to each question should be typed and single-spaced. Please number each of your responses according to the question that you are answering. For example, Response #1 would correspond to “Identify and write about significant…”). Try to think about this like you are writing a story about your life, but in this case, you are focusing only on your experiences with mathematics. It can be as long as you want but really try to give as much details as possible.

1. Identify and write about significant moments you have had with mathematics from kindergarten to your current grade. Please include both positive and negative experiences. The experiences can be either in-school or out of school.
   a. When were you first drawn to mathematics?
   b. What is it that drew you toward mathematics?

2. When did you first realize you were “good at math?”
   a. Describe and elaborate on this memory.
   b. How did you feel when you made this realization?
   c. Who helped you realize you were “good at math?”
   d. Do you feel the same way about your abilities now?

3. Describe the best mathematics teacher you had?
   a. What was it like to be in this teacher’s class?
   b. What qualities or characteristics influenced your thoughts about this teacher?
   c. How was this teacher different from other teachers?
### APPENDIX E: DATA SUMMARY TABLE

**R1: What are Black students perceptions of contributors to positive math identity and success?**

<table>
<thead>
<tr>
<th></th>
<th>Unique nature of math</th>
<th>Family involvement</th>
<th>Math achievement/Good performance</th>
<th>Peer perception</th>
<th>Positive Early experiences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student 1</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Student 2</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

**R2: What teacher practices do Black students feel contribute to their success in math?**

<table>
<thead>
<tr>
<th></th>
<th><strong>Teacher Practices</strong></th>
<th><strong>Teacher Dispositions</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>One on one time with students</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Build relationship with student (positive teacher language, praise)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trust and Rely on students</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Give students independence</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Share student work</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Extrinsic motivation from teacher (competition, praise, rewards)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Helpful</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Caring</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dependable</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Relatable</td>
<td></td>
</tr>
<tr>
<td>S1</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>S2</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

**R3: How do Black middle school students author themselves into the narrative of mathematics?**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>S2</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>x</td>
</tr>
</tbody>
</table>