

ABSTRACT

Title of Dissertation: PLACE VALUE: A QUALITATIVE STUDY
OF BEING A BLACK GIRL IN URBAN
MATHEMATICS CLASSROOMS

Camille Fair, Doctor of Philosophy, 2020

Dissertation directed by: Associate Professor, Dr. Lawrence Clark,
Teaching, Learning, Policy and Leadership

This qualitative study documents and examines what it is like being in a Black girl body while learning math in urban schools. The ten participants in this study self-identified as Black and female, and they graduated from three high schools in an urban school district in the Northeast between 2017 and 2019. Despite demonstrating excellence in and out of school, participants' stories were burdened by experiences of exclusion, marginalization and oppression in their K-12 math learning.

Drawing on Critical Race Feminism (CRF), a framework used to theorize interlocking oppressional forces, I designed this qualitative study after conducting a pilot program to improve Black girls' math experiences. Preliminary findings from the pilot study suggest that Black girls' math experiences and performance outcomes are largely shaped by the extent to which they are given or denied social place and intellectual value in math classrooms. I appropriate the math concept of place value, and I use it as a metaphor in a framework I developed called Human Place Value.

This study examines three questions to understand Black girls' lived experiences in urban math classrooms: 1) How do Black girls face exclusion, marginalization, and other forms of oppression in math classes? 2) How do Black girls identify and recognize negative attitudes and beliefs about their identity in math classes? 3) How do Black girls respond to and navigate their experiences in math classes?

I collected personal data about my participants through background questionnaires and one-on-one semi-structured interviews. I analyzed the data using tenets of CRF and classroom interaction frameworks to distill three themes across social place and intellectual value: visibility, positionality and knowledge production. Key findings from the study suggest that being in a Black girl body renders students particularly vulnerable to math marginalization in the form of hostility, maltreatment and instructional neglect. The data collected from the ten participants tell a collective story that warrant consideration for the role Human Place Value plays in teaching and learning that yields disparate mathematical outcomes. This study concludes with a presentation of counternarratives from two participants and cross-case insights that detail implications for theory and practice.

PLACE VALUE:
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CLASSROOMS

by

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Dedication

With love, reverence and humility, I dedicate this to

God

my great-grandmothers, Elizabeth Jackson and Essie Fair

my grandmother, Carolyn Fair

my mother, Cheryl Fair

my four beautiful, brilliant daughters, Fatimah, Nasirah, Georgi and Soleil

my daughters from other mothers

Jillian, Olivia, Ashley, Kendall, Maxxie, Cam, Tiona, Indya, Cecile and Paloma

and all the women and girls who consistently showed up for me

before, during and after this process.

I also dedicate this to Harriet. Her legacy gave me strength for the journey.

Thank you for such unwavering love and encouragement.

I am forever grateful.

With this, I go to prepare a place for you.

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To my family

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Chapter 1: Introduction

Orienting the Reader

About the Researcher

Over the past eighteen years, I have been fortunate enough to have innumerable experiences as a K-12 educator. The expertise that I have acquired through personal and professional exposure to teaching and learning in urban schools equips me to enter the scholarly conversation on exclusion and marginalization in mathematics¹. I have been an urban educator, mathematics educator, and teacher educator. I hold licenses in special education, bilingual education, and bilingual special education. I have served schools in New York, Chicago, the District of Columbia, and Los Angeles as a classroom teacher and instructional leader. I have had the privilege of observing instruction and preparing teachers across public, charter, private, and parochial settings. I have prepared and supervised both alternative route and traditionally trained teachers, and in doing so, I have conducted countless classroom observations. In just one year as a new teacher mentor, I conducted more than five hundred observations across elementary, middle, and high school classrooms. These experiences along with being a Black² woman, researcher, and mother of four Black daughters who attend urban public schools equip me

¹ I use the terms mathematics and math interchangeably throughout this dissertation. Some scholars refrain from using the term “math” because there can be negative ideas associated with it.

² I use the term Black as a cultural referent describe those who identify as and have membership in communities of African descent and primarily in America and across the diaspora. Henry Louis Gates argues that there is no one way to be Black, and that if there are X number of Black people living, there are X number of ways to be Black. This study uses the term as an all-encompassing descriptor to discuss individual and collective experiences, but it does not essentialize Blackness to a singular truth or experience.

with an incredibly unique perspective to this work. My professional background, higher education, and lived experiences have afforded me the opportunity to see, hear, and experience what I believe few other educators and researchers have, at least not from the same vantage point.

In my professional and personal experiences, when discussing Black children and their mathematics education in urban schools, it is not uncommon for one of the following terms to be referenced: at-risk, disadvantaged, underachieving, minority, underrepresented, poor, low, and, shockingly still, inner-city. As recently as December 2019, I attended a summit on the state of public education in Nevada, and I was disturbed to see researchers from esteemed and trusted institutions frame the subjects and context of their study as “non-white, low-income, low-performing, disadvantaged, and under-resourced.” While some would argue that these descriptors are accurate, the beliefs inherent in these characterizations are often misinformed, incomplete or untrue.

I am not only extremely uncomfortable with discourse grounded in assumptions that are casually and carelessly tossed around about children and families, but I am troubled by the survival of this rhetoric and its common use in the education enterprise. Unbeknownst to many, “those kids” and “those families” are my children and my family. I live in Ward 7, one of the most economically marginalized neighborhoods in the nation’s capital. I have been a witness to and deeply affected by the suffering that exists East of the River³, just a gaze away from the disheartening reality of the new condominiums being erected beside the District of Columbia jail. My daughter, Fatimah

³ Residents in the District of Columbia use this phrase to refer to neighborhoods that geographically exist east of the Anacostia River. With the exception of areas that have been gentrified, neighborhoods in ward 7 and 8 remain segregated, impoverished and underserved.

Fair, recently published an article in the Washington Post (2020) about the environmental injustices that remain ignored on our side of the river. As I read her commentary on the number of friends she lost during her senior year, I was in disbelief that there were 150 homicides in Washington, D.C., the year many of my participants graduated from high school. What does any of that have to do with mathematics teaching and learning?

The ways Black students experience mathematics in schools have been documented by dozens of scholars who examine pedagogy, socialization, and identity with methodological considerations for the constellation of social, cultural, historical, and geographic forces that shape those experiences (Boaler & Greeno, 2000; Gutierrez, 2013; Leonard, 2019; Martin, 2009; Martin & Larnell, 2013; Tate, 1994). Math education scholars continue to establish and evidence the salience of race, gender, culture and identity to the teaching and learning of math. Further, an overwhelming body of math education research illustrates Black children's mathematical brilliance, some of which documents the strategies that Black girls use to persist through and succeed in their P-20 math experiences, despite tacit and overt barriers to accessing mathematical knowledge (Joseph et. al, 2017). Martin (2009) asks the important question, "What should the study of African American children be the study of?" and he acknowledges the importance of research that examines the ways that Black students experience mathematics in school contexts. In his book *Mathematics Teaching, Learning and Liberation in the Lives of Black Children* (2009), Martin and a host of scholars give primacy to the stories that Black learners tell about themselves and the need for both culturally sensitive research approaches and narratives that counter dominant storylines of failure. which is echoed with the unfolding of each chapter in the book. This study is inspired, in part, by

Martin's call for more research that documents and examines the various lived experiences Black children have while learning math. I specifically draw on the stories of ten Black girls' who attended three different schools within a large urban district.

This study is also inspired by my understanding of intersectional identity, and the way Blackness and femininity can uniquely shape experiences, not to the exclusion of math learning. Thus, as a researcher, mother and teacher, I recognize the importance of a culturally aware, student-centered lens because as I tuned into Black girls' stories of what math is like for them on a day-to-day basis. I realized that there are insights uniquely associated with *being* a Black girl in K-12 mathematics that warrant greater examination and study. As critical math scholars acknowledge, the same injustices that historically underserved children experience in the world are reproduced inside of the mathematics classroom. Broad sweeping, deficits-based generalizations that attribute performance outcomes to racial or socioeconomic differences often distort the historical underpinnings of stratification, overlook the multiple realities of living as a person of color in the U.S., and neglect systemic issues and institutionalized barriers of racism, bias, and discrimination.

I know what it is like to be socially displaced and intellectually devalued in and out of school because of gendered racism. Scholars point to how this is particularly true in math classrooms. I examine experiences with exclusion and marginalization in the context of a math space. Despite efforts in the field to adopt more assets-based language and practices, many labels in the education enterprise that are frequently used in reference to students of color also continue to be often be used as default deficits-based descriptors of Blackness. With the exception of Black students who are distinguished as

high-achieving or academically excellent, far too often I hear that Black children are less capable or motivated than their white⁴ peers, and that their parents are less invested or involved than white middle-class parents. Historically, however, we know that this is not the case. We know that Black students and parents have relied on education for upward mobility despite strong opposition to opportunity and numerous barriers to success. Further, many families are resourceful and invested in their children's education, but that does not inoculate them from the cumulative consequences of ineffective instruction or ill-equipped teachers.

As a researcher, my goal is to advance scholarship that amplifies the voices of marginalized and underrepresented groups. In this study, I interrogate the false narrative of Black female incompetence in mathematics, and I illuminate stories that reveal the everyday experiences that create barriers to actualizing mathematical brilliance. It is my hope that the findings and framework that emerge from this study will be useful to enhance teaching and learning for members of all underrepresented and minoritized groups in mathematics and STEM education.

⁴ According to the 2020 US Census Bureau, a white person is an individual having origins in any of the native people of Europe, the Middle East or North Africa. This includes racial categories named German, Italian, Lebanese, Arab, Moroccan, or Caucasian.

About Turning to the Phenomena of Study

As my oldest twin daughters matriculated through advanced-level high school mathematics courses, I began to have more questions about math identity and socialization. Despite attending two different schools, they described experiences with notable similarities. They were both spending countless lunch periods and hours after-school with teachers to gain an understanding of the content. They often came home and reported instances of confusion and humiliation during their ninety-minute math classes, all before spending several more hours online to strengthen their mathematical knowledge. I arranged support from colleagues who are mathematics educators to help them access mathematical knowledge, I taught them how to advocate for themselves in class and how to effectively communicate their needs to teachers. Still, I felt helpless in my ability to protect them from these day-to-day encounters in math that left them feeling so demoralized. The more I talked to other Black girls in their friend group, the more I saw patterns across their experiences. Young women and their parents shared that a common response from mathematics teachers was, “They just need to work harder.” My experience with five out of the six math teachers that they had one mathematics teacher during their high school experiences was that they did not acknowledge that their pedagogical content knowledge or mathematical knowledge for teaching could be areas of growth in their practice. With my daughters and their friends, the assumption was often that they were just intellectually inadequate. Unfortunately, this assumption is congruent with portrayals of Black children as persistently underperforming compared to their white peers.

At the same time, I was taking four courses a semester and consuming a tremendous amount of educational research. I noticed, however, that what I was observing outside of class was not quite reflected in the math, urban or teacher education scholarship, at least not in ways that matched my experiential knowledge. It seemed to me that while the research provides essential theoretical and pedagogical insight for teaching and learning, the voices and experiences of Black girls were overwhelmingly absent, and practical applications to facilitate their success were much less defined in pedagogy. I arrived at my research interest in Black girls' mathematical experiences not only after being exposed to so many stories that seemed worthy of further analysis; but also after piloting a program that offered safe, humanizing spaces for Black girls to experience their mathematical brilliance. I enter the conversation with a relevant anecdote that should prompt all of us as researchers to wonder, "What is going on here?" Anecdote after anecdote, with respect to Black children's mathematics achievement, "it doesn't add up" (Ladson-Billings, 1997).

Vignette: About My Daughter Nasirah

The bell rang, and Nasirah was already in her seat. It was the first day of a new school year, and she was in a new school. She looked around her Honors Precalculus class, but there were no familiar faces. "At least there were two other Black people in the class," she said to herself. Palms sweaty, she pulled a notebook and pencil out of her bag while her teacher distributed the syllabus. Nasirah recalls:

Her accent was really thick. I could barely understand anything she was saying, so I just tried to follow along in the syllabus. I was so confused already. I just remember feeling overwhelmed and stupid...and all we'd done is look at the

syllabus. Then she gave us a diagnostic [test] to assess what we learned last year. I already knew I was going to do bad because I didn't learn anything last year in Honors Algebra II. My [Honors Algebra II] teacher was new, and he didn't know how to teach. He only taught us about what he learned in architecture school. He was always frustrated with us and said we "should already know this stuff."

Anyway, I think I must have started to zone out or something during the test because she called me out...in front of the whole class. It was so embarrassing, too. And I didn't even do anything, I was just stroking one of my braids probably because I was so nervous...I don't know. But she just called from her desk "You, young lady with the braids...pay attention instead of playing with your hair because this class is tough!"

At the time, Nasirah was 16 years old. She came home, and that was the first thing she told me about on her first day in a new school. It weighed on her so heavily that she said the rest of her day was a blur. Within the first week of school, Nasirah was so discouraged, she was asking to transfer to regular precalculus. She explained that between failing the diagnostic test, being ignored by her teacher when asking for help in class, and spending upwards of two hours per night just on math homework, she already felt defeated and discouraged. She was in the 11th grade and had never received an F. She didn't think she could make it through the year. I encouraged Nasirah to stick with it, to go to office hours, and take advantage of my math colleagues for tutoring assistance. A defining moment in my understanding of Nasirah's experience in this particular math class, however, was when she asked for clarification and her teacher responded, "Duh...what don't you get...it's common sense!" Nasirah recalls mumbling to herself,

“I don’t think this complex math is common or sensible to anyone.” She was right. This was not knowledge that is shared or widely known, but her teacher’s refusal to give her access to this so-called common knowledge placed her on the margins of learning and devalued her capacity to think and understand. Sadly, when observing mathematics classrooms, I have witnessed similar responses from teachers that leave students feeling dehumanized and discouraged.

We struggled through the year with hours invested in tutoring and office hours with the teacher only to have Nasirah succumb to tears, frustration, demoralization, and utter disdain toward mathematics. Despite her hard work and the hours invested, she only received a C, so she opted out of advanced-level mathematics in her senior year. It was one of the most upsetting experiences I have ever had when it came to supporting my child. Nasirah is an academically excellent, hardworking, disciplined, and resourceful student. She exudes confidence socially and academically. It did not seem like her teacher recognized these positive attributes. She often contacted me with comments on her “behavior” and suggested Nasirah invest her time developing her strengths in poetry performance instead of advanced mathematics. Nasirah, however, saw herself as capable of learning any mathematics content if given support and comprehensible instruction. Her grades and GPA have always been important to her. She believed her teacher did not think very highly of her, and she believed it was because of her zip code affiliation and the Southeast D.C. (SE) marker at the end of her address. It was our experience that many people were only familiar with the media representations of SE as inherently “bad” even though it is home to the affluent Capitol Hill. Instead, SE was like a scarlet letter,

and she was just another Black girl whose family did not care or could not provide for her because she was from a “poor and disadvantaged” neighborhood.

During that school year, I decided to pilot a program called “Black Girl Brilliance.” It was a Saturday program aimed at providing a safe, humanizing, and empowering space for Black girls to learn and excel at advanced mathematics while also gaining tools for self-love, self-care, and healing. There were four critical math educators, two who self-identified as Black and two who identified as white female, social justice mathematics educators. In addition, a number of Black feminist intellectuals and healers conducted classes and workshops for vitality and wellness.. I observed, and students attested that there was something very different and powerful happening in those Saturday sessions compared to their mathematics classrooms. It was within that context that I learned the importance of examining Black girls’ mathematical experiences as the basis for instruction in both theory and practice.

As other Black girls in high school shared their anecdotes with me, I began to wonder if there was something about being Black and female that uniquely shaped their experiences in mathematics class. I reflected on Nasirah’s description of her first encounter with the teacher, and I began to question the way the teacher interpreted Nasirah’s ‘Black girl body’ in an advanced-level mathematics class within an urban school context. What meaning was made from her class *being* predominantly White? How did the teacher understand and respond to the meaning of serving in an urban school? What did *being* a Black student in an urban school mean? How did *being* in her Black girl body, expressing herself with her long braids, her shimmery backpack and her ripped-up, distressed jeans, in her predominantly White class in an urban school context

factor into the teacher's appraisal of her social place and intellectual value? What assumptions were implicit in the teacher's veiled, yet targeted warning to Nasirah that the class was "tough." Was she singled out and accused of being too distracted to work because she was stroking her hair or because she was a Black girl? Nasirah raised a good point when she observed "white girls play with their hair all the time, they swing it and flick it, and it is considered beautiful and feminine." The teacher's comments assumed that Nasirah lacked the capacity to focus on her work *and* "play" with hair at the same time. There was also the assumption that she was still working when, perhaps, she knew the material and she was done. Further, the comment that the class is 'tough' revealed an assumption or belief that Nasirah was perhaps inherently ill-equipped to succeed and that she would struggle or fail.

These seemingly micro interactions (microaggressions)⁵ raised broader questions about being Black and female while learning mathematics and about the ways in which identity can influence the social place and intellectual value ascribed to students within the classroom. "The researched" in this study are more than subjects or participants from whom I collected data. They are "other people's daughters" (Evans-Winters, 2010), and I related to them, listened to them, and advocated for them with love and care just as I would my own daughters. I made theoretical and methodological decisions that I made were made mindfully with great purpose and intention. This study is informed by research on urban education, mathematics education, and teacher education. It aims to

⁵ Microaggression is a term to describe commonplace daily verbal, behavioral, or environmental indignities, whether intentional or unintentional, that communicate hostile, derogatory, or negative prejudicial slights and insults toward any group, particularly culturally marginalized and historically underserved groups

use methods, approaches, and theory that illuminate Black girls lived experiences in mathematics, the processes and encounters that shape these experiences, and the ways in which they maintain a sense of dignity and excellence despite barriers to their success.

This study documents how Black females understand and describe their experiences in K-12 math classrooms, and it examines these experiences using Critical Race Feminism and the instructional triangle for math as analytic frameworks. The study seeks to expand current understandings of why disparities in math achievement and STEM representation persist by exploring the following research questions:

1. How do Black girls face exclusion, marginalization, and other forms of oppression in their math classes?
2. How do Black girls identify and recognize negative attitudes and beliefs about their identity in math classes?
3. How do Black girls respond to and navigate their experiences in math classes?

This study is unique in the way it amplifies the voices of young Black females by centering their math stories. It contributes to existing scholarship that challenges the myth of a dominant narrative that Black females are incompetent in math, and instead illuminates the everyday barriers that limit their mathematical brilliance. Drawing from the individual and collective experiences participants share, I aim to begin developing a theory that humanizes the teaching and learning of mathematics for Black females and other underrepresented groups.

Situating the Study

Statement of the Problem

A standard way of stating the research problem is that Black girls are underperforming according to K-12 mathematics achievement measures, and they are underrepresented in post-secondary mathematics-related pathways, most notably STEM fields. While Black girls' performance outcomes continue to be overemphasized, their in-class mathematical experiences remain relatively understudied. The underachievement and underrepresentation framing narrowly focuses on performance outcomes, and it neglects to account for the day-to-day experiences that may threaten Black girls' mathematical attainment. While analysis of outcomes has value, it should be qualified with data that captures students' lived experiences so the root causes of problems are not obscured; otherwise, the remedies in policy and practice will arguably remain misinformed and misguided. In both theory and practice, we have distorted and fragmented understandings of the problem and possible solutions. In my estimation, the problems with and possibilities for improving mathematical performance and increasing representation in STEM for members of marginalized groups are consistent with the perspectives of critical scholars in the field who insist that we (re)frame issues of mathematics achievement and employ more liberatory research agendas.

To that end, the problem is also methodological, and this has been pointed out by both math educators and Black feminist scholars (Clark, Johnson & Chazan, 2010; Collins, 2001; Evans-Winters, 2019; hooks, 1990; Leonard, 2018; Martin, 2012; Schoenfeld, 1992). Despite increasing acknowledgement in mathematics education

research that mathematics classes are racially hostile spaces for Black students (McGee, 2013; McGee & Pearman, 2014), a great deal of urban, mathematics, and teacher education research and practice still centers on Black males (Adams, 2016; Jett, 2010; Martin, 2012; McGee, 2009, 2013; McGee & Martin 2011; McGee & Stovall, 2015; Milner, et. al 2013; Thompson & Davis, 2013). Research that emerges from the voices of academically excellent Black girls and seeks to understand what it is like to be Black and female while learning mathematics in an urban school context is instructive for theory and practice in urban education, mathematics education, and teacher education.

Understanding: 1) the centrality of students' lived accounts; 2) the role of intersecting identities; and 3) the oppressive nature of mathematics spaces for Black females is critical to teaching and learning mathematics and informing efforts aimed at redressing mathematical underachievement and STEM underrepresentation. Each dimension contributes to a collective narrative that provides insight into the ways Black girls experience marginalization and exclusion in urban mathematics communities and how those experiential inputs may produce the undesired outcomes we seek to change.

Purpose of the Study

Despite research by and on race, culture, and equity in mathematics education by Black female scholars who have made important contributions to the field (Bullock; 2017; Gholson, 2016; Goffney, 2010; Hubert, 2014; Joseph et. al 2017; Leonard, 2018; McGee, 2016; Joseph et. al 2017; Gholson, 2016; Bullock; 2017; Hubert, 2014), much of the mathematics education research on Black children still centers the male experience and/or utilizes research paradigms that produce a limited set of disproportionately dominant storylines of deficiency. There is a need for education research that challenges

long-standing myths of Black female mathematical incompetence and provides a more accurate understanding of performance outcomes. The relative invisibility of Black females' lived experiences in mathematics warrants qualitative research that examines and documents Black females' perceptions to illuminate the complexities underlying disparities in achievement and STEM representation. This study aims to do both by humanizing Black females' experiences while learning mathematics to advance theory and practice. I designed this study using exemplars of critical scholarship that privilege participants' voices and illuminate how they experienced mathematics as young Black women. The young women in this study tell stories that may be otherwise suppressed or overlooked in math education research. Using participants' accounts of their K-12 mathematics experiences, this study aims to contribute to critical, liberatory, and transformative research that gives voice to historically silenced groups. Validating and affirming these narratives to uncover the complexities of problems is an important aspect of identifying possibilities for math education research that advance anti-oppression and equity-oriented scholarship.

Rationale: Why Study Black Girls' Math Experiences? Why Use Qualitative Methods?

There are several rationales for conducting research specific to Black females in urban mathematics classrooms. First, it is important to integrate what we know about the social, historical, geographical, and disciplinary contexts with respect to society, schooling, and the Black female body. Negative attitudes and beliefs about Black women are rooted in racial ideologies of Black inferiority that can be traced back to slavery. Fannie B. Williams (1904) wrote about the exclusion Black women have experienced in

the U.S., both as objects of interest and of knowledge: “the American Negro woman is the most interesting woman in this country...she is the only woman in America who is almost unknown; the only woman for whom nothing is done; the only woman without sufficient defenders when assailed” (Sawaya, 2017, p. 92).

In addition, Black females’ experiences in mathematics spaces are particularly valuable for understanding and addressing a widespread form of school exclusion. Just as Black boys draw a great deal of attention in education research, research that centers the intersections of race and gender uncovers forms of oppression and marginalization that may explain disparate academic outcomes. In 1962, Malcolm X emphatically insisted that the Black woman is the most disrespected, neglected, and unprotected person in America (Emba, 2019). Today, the same seems true. It is critical, therefore, to examine how this type of vulnerability manifests for Black girls in the context of math, as well as how these assertions show up in mathematics teaching and learning.

Historically, Black bodies in the United States have represented two competing values: one ascribed to the internal self and the other to the external body (Berry, 2017, p. ix). As a researcher, I have been interested in the stories that numbers neglect to tell. Black Feminist scholar Venus-Evans Winters, reminded me, however, that quantitative measures have never served us. She explained that we were counted as chattel slaves, we have been counted as convicts, and we are counted as underachieving. If the numbers do tell a story, it is not one that illuminates causes and constraints. Instead, we often reproduce inequalities when we neglect to dig deeper into the meanings that reside in numeric data.

In *The Price for Their Pound of Flesh*, Berry (2017) reminds us that the “Black girl body” has been a site of contestation since the 14th century. Berry details the agony of living in a Black girl body during chattel slavery where ‘double invisibility’ was inherent to existence. While Black women were unacknowledged, despised, and relegated to the lowest status socially, they were hypervisible objects of necessity for reproducing human property. On the auction block, for example, Black females were displayed before the community and their naked bodies publicly examined. Berry explained that while Black females endured this degrading experience of appraisal for monetary value, Black women also struggled to hold on to the value that was instilled in them culturally and familially. Situating Black females’ current experiences within a historical context shows how interrelated identities of race and gender have developed as critical markers of social difference where Black females are often devalued.

Black Females in STEM and K-12 Math Classrooms

Despite bringing a wealth of intellectual capital to the mathematics classroom, storylines of Black female underperformance in K-12 mathematics and their underrepresentation in post-secondary STEM pathways continue to be a concern in education, policy-making, and research. In urban schools, Black females continue to experience devaluation that stems from the invisibility-hypervisibility contrast. Socially, Black girls are hypervisible as evidenced by the growing body of research that examines how they are disproportionately disciplined (Crenshaw, 2015; Morris, 2007, 2014, 2016) for infractions that penalize the way they dress, speak, or wear their hair (Crenshaw, Ocen & Nanda, 2015; Morris, 2016; National Women’s Law Center, 2018).

Furthermore, Black girls continue to be relatively invisible in research with respect to their academic experiences.

Notwithstanding the great potential and increasing rates of college attendance among Black females, less than 1% of PhDs in mathematics are awarded to Black women. Women represent 26% of STEM workers in the U.S., but only 9% of those women are of color. Of course, an argument can be made that Black girls simply do not choose to pursue careers related to mathematics. While this may be true, researchers should wonder *why*. Even when able to gain entrance to these fields, Black women experience gendered forms of racism that are reflected in lower earnings as compared to their white and/or male counterparts (Joseph, Hailu & Boston, 2017). Historically pervasive negative, rooted attitudes toward and beliefs about Black females, coupled with a mathematics culture that can be racially hostile toward and less inclusive of Black females, suggest that centering their lived experiences can be instructive for both theory and practice.

This study primarily centers the importance of mathematics not only as a high-stakes subject that structures access to college and career pathways, thereby facilitating economic mobility, but also as a white institutional space (Martin, 2018) that has historically been unwelcoming to Black bodies (Gholson & Martin, 2019; Joseph, 2017). Recent studies in mathematics education suggest that mathematics classrooms can be dehumanizing spaces where Black girls experience a great deal of pain and suffering (Gholson & Martin, 2019; Joseph, 2017). Stiff and Harvey (1988) drew attention to mathematics inequities decades ago. They argued that the secondary mathematics classroom is one of the most segregated places in American society, particularly in the

advanced course pipeline. Math classrooms as segregated spaces is a phenomenon that has been given minimal attention until recently. In both mathematics education research and policy, efforts to remedy the lack of diversity in STEM, the primary focus is on performance outcomes and programs to feed the pipeline. While I acknowledge the importance of performance, I believe we must examine, understand, and illuminate Black girls' mathematics experiences, acknowledge the validity of their pain, and orient ourselves to their insights by asking, "What if this were my daughter?"

Quantitative reports have rarely served Black women and girls. During slavery, we were counted as cargo. In the original constitution, we were counted as $\frac{3}{5}$ human. In the justice system, we have been counted as criminals. Now, in education, we continue to be counted as academic failures and social deviants. Despite high levels of achievement in all other academic endeavors, Black girls are reported to persistently underperform in mathematics, opt out of or have limited access to advanced-level mathematics courses, and have less access to qualified mathematics teachers compared to their White and Asian peers (Smith-Evans et al., 2014). Yet, completion of select mathematics coursework is a basic requirement for high school graduation. Mathematics has long occupied a valorized and privileged position in school curriculum in the U.S. (Berry, Ellis, & Hughes, 2014; Klein, 2003; Schoenfeld, 2004; Stanic & Kilpatrick, 2003; Tate & Rousseau, 2002). Knowledge of mathematics is frequently used as a proxy for intelligence, and access to high-level mathematics coursework continues to be proffered as a gateway to academic and economic opportunity linked especially to scientific and technological progress (U.S. Department of Education, 2008) regarding its content,

preferred pedagogical approaches, methods of assessment, and, more recently, issues of equity and inclusion.

A fifty-state comparison of mathematics courses required to earn a standard high school diploma revealed that forty-seven states and the District of Columbia have minimum statewide requirements that students pass and earn credits in four secondary mathematics courses, three of which are Algebra I, Geometry, Algebra II/Trigonometry. According to Chen and Buell (2018), the primary beneficiaries of mathematical opportunities have often been white, male, and wealthy students, although some Asian and Asian American students have been allowed to participate in service of various political and racial projects. In contrast, Black, Latinx, Indigenous, women, and poor students, have experienced long histories of underrepresentation in mathematics and mathematics-related domains (Joseph, Hailu, & Boston, 2017; Martin, Anderson, & Shah, 2017). Failure to earn a high school diploma or score competitively on college admissions exams can significantly diminish postsecondary and career opportunities. Because of its privileged status, school mathematics has historically been a site of political contestation among mathematicians, mathematics educators, and the general public.

When we consider that, in this country, we have mandatory high school graduation requirements for mathematics *and* we have what has been named a national crisis in math--concerning mathematics performance among minoritized groups, why have we not interrogated what resides beneath policy, practice, and performance? Research on Black girls' K-12 mathematics persistence (Joseph, et. al, 2017) provides evidence that the structural culprits of poor performance outcomes include a customary

culture of exclusion from opportunities to learn and participate that operates in subtle and overt ways (Annamma, et al., 2019). The narrative that Black girls are mathematically inept (mis)locates problems of mathematics failure within the individual. The enduring discourse on racial achievement gaps attributes Black children's underperformance to individual deficits, but rarely considers inequitable conditions for learning and stories of success that counter narratives that failure. Further, it completely ignores scholarship on the marginalizing ideologies, stratifying policies, and comparative practices perpetuated by the so-called achievement gap. In fact, Gutierrez (2008), Ladson-Billings (1997, 2006), Martin (2012) and several other scholars explicate the inherent flaws of achievement gap framing. Attitudes and beliefs about who can or cannot do math, and the misinformed reasons cited as the culprits create barriers to Black girls' success have been called 'gap-gazing' (Gutierrez, 2008) in the math education research community. Issues of achievement gaps and group underperformance has been interrogated and challenged (Gutierrez, 2008; Ladson-Billings, 2006; Martin, 2012). What seems to be given less attention, however, is that even the highest performing group does not seem to be achieving with the excellence that the comparisons suggest. Based on the 2019 National Assessment of Educational Progress (NAEP) math data, Black children are underperforming their white, Hispanic, Asian and multiethnic peers. Yet, less than 70% of the highest performing group demonstrates mathematical proficiency. Even amidst what can be considered far reaching mathematical underperformance in the United States, it is surprising that the significance of mathematics in the classroom in-class experiences of African American girls remains relatively understudied and undertheorized since they are among the lowest performing group. Conclusions that inform education policy and

school reform are drawn from performance outcomes, and it would behoove us to examine and compare the inputs that contribute to students' math learning.

Research Questions

This study documents how Black females understand and describe their experiences in K-12 mathematics classrooms, and it examines these experiences using Critical Race Feminism and the instructional triangle for mathematics as analytic frameworks. The study seeks to expand current understandings of why disparities in mathematics achievement and STEM representation persist by exploring the following research questions:

1. How do Black girls face exclusion, marginalization, and other forms of oppression in their mathematics classes?
2. How do Black girls identify and recognize negative attitudes and beliefs about their identity in mathematics classes?
3. How do Black girls respond to and navigate their experiences in mathematics classes?

The research questions focus on experiences with exclusion, marginalization and other forms of oppression; experiences with stereotypes and negative beliefs; and how participants respond to and navigate these experiences. The reader may ask, "What do these questions have to do with 'place value'?" I have appropriated the mathematical term 'place value' to characterize how students experience social place or belonging and intellectual value or brilliance, both in the context of math learning. 'Place value' is a metaphor to examine how students are socialized and develop math identity through the ways they experience visibility, positioning and knowledge production in their math

classrooms. I want to emphasize the distinction between what I name “intellectual value” and what Meece, Wigfield & Eccles (1990) name as “expectancy value”. Meece, Wigfield & Eccles (1990) examine how math anxiety impacts students mathematical learning experiences, their self-efficacy and decisions about coursework. They specifically investigated gendered differences in math ability perceptions, performance expectancies, significance of math, and math anxiety for 250 students grades 7-9. While findings from their study do confirm the critical role, especially for girls, that value perceptions play in determining students’ intentions to participate in advanced coursework, my study is interested in unpacking and uncovering some of the root causes in the form of lived experience, which remains understudied and undertheorized in math education research. The aforementioned study does, however, demonstrate the utility of integrating self-efficacy and expectancy-value approaches to better understand achievement behavior in school settings. I believe this is a point of mutual understanding between what Meece, Wigfield & Eccles (1990) found, and what I seek to empirically illustrate about social place and intellectual value.

My study is unique in the way it amplifies the voices of young Black females by centering their mathematics stories. Centering is a term that emerged within the Black female intellectual tradition (Waters & Conway, 2007). The influence of Black feminists like Patricia Hill Collins and bell Hooks, is found in Critical Race Theory and Critical Race Feminism. Within these theoretical frameworks, centrality of race, gender and lived experience are tenets that guide the research. Centering is a way for researchers to bring suppressed experiences from the margins of scholarship to the center of discourse for the

purpose of uncovering stories that may have been traditionally hidden, distorted or obscured.

Patricia Hill Collins explains how dominant epistemologies and ideologies can operate to deny credibility to intellectual contributions Black women make to theoretical landscapes (Waters & Conway, 2007). She emphasizes:

The shadow obscuring these complex Black women's intellectual tradition is neither accidental or benign. Suppressing the knowledge produced by any oppressed group makes it easier for dominant groups to rule because the seeming absence of dissent suggests that subordinate groups willingly collaborate in their own victimization. Maintaining the victimization of Black women and our ideas not only in the United States, but in Africa, the Caribbean, South America, Europe and other places where Black women now live, has been critical in maintaining social inequalities (Collins, 2000, p.3).

This study aims to share the stories of ten academically excellent Black girls who experienced exclusion, marginalization and other forms of oppression while learning math in urban schools. There are many stories of Black female mathematical success, persistence and resilience. There is also a body of critical math scholarship emerging that highlights the oppressive and dehumanizing learning conditions that discourage and derail Black girls' math trajectories (Gholson & Martin, 2019; Joseph, 2019; Young, et al, 2017). My study aims to contribute to existing scholarship that challenges the myth of a dominant narrative that Black females are incompetent in mathematics, and instead illuminates the everyday barriers that limit their mathematical brilliance. Drawing from the individual and collective experiences participants share, I aim to begin developing a

theory called Human Place Value to humanize the teaching and learning of mathematics for Black females and other underrepresented groups.

Human Place Value

Mathematically, we understand “place value” to be a method of positioning and ordering numbers to indicate their worth (Ross, 1986). That is, where a number *sits* in a sequence determines its arithmetic significance as compared to the other digits. So, the value of a digit depends on its place, or position, in a number. I use the mathematical understanding of place value as a metaphor to capture and conceptualize how historical constructs of Blackness and Whiteness have implications for students’ social and intellectual significance in school. I trace the etymological origins of place and value to explain how this metaphor has utility in mathematics education and research. *Place*, which originally meant a space, room, area or spot in 1200 Old French, took on additional meanings over time, and expanded from a word used to describe a physical location to one that could assign positionality to things and people. In the early 1300s, it was used in reference to one’s “position” on a social scale. Around the same time, *value* was used to determine “price equal to the intrinsic worth of a thing”. While *value* later took on meaning related to significance, utility and moral worth, the original meaning of value points to an inherent and ‘intrinsic worth’, an inner excellence or merit, that is externally decided and constructed. As the meaning of ‘place’ and ‘value’ unfolded during those eras, chattel slavery was instituted in America and across the diaspora, and human place value became significant to the historical construction of a social hierarchy where Black females have been relegated to the lowest rungs.

Being in a Black girl body, particularly in school settings, is imbued with deliberate efforts to assign a subordinate place and ascribe inferior value to our existence. Since the establishment of slavery as a foundational institution of American society and culture and subsequent eras of universal or compulsory education, to my knowledge, human place value has never been conceptualized in education research or discourse to characterize the conditions and constraints facing Black children in educational settings or to name the advantages and allowances afforded to white children.

‘Social place’ is ontological. It is a fundamental understanding of an orientation to *being*. The pilot study advances the idea that there are multiple states of *being* for Black girls in mathematics classes. The subconscious question for a Black girl in mathematics class becomes “What does it mean for me to be in my Black girl body in this math class?” Further, “What meaning is made of me and for me by my teachers, my peers, and within the discipline? How can I be in this space and be safe, be heard, be understood, be seen, be included and be considered worthy?” I aim to uncover an interpretive experience where Black girls wonder and operate according to “How do I see myself as being a part of or excluded from this space?”

‘Intellectual value’ is axiomatic, it is a fundamental belief in the brilliance of Black children. The pilot study finds that when given social place, students experience a sense of belonging, acceptance, and accomplishment. Similarly, when students are valued for their intellectual contributions, they are recognized for their unique ways of knowing, constellations of capabilities/competencies, and their mathematical brilliance. Though the sample size is small, findings from this study suggest that investigating the ways in which Black girls experience social and intellectual isolation, opposition and hostility,

and overall devaluation is a promising direction for research that can name ineffective practices and offer productive solutions that benefit all learners. My intention with this study is to establish an arc of research that will lead to studies that operationalize the Human Place Value framework and offer robust remedies for creating safe, humanizing spaces for learning math.

Chapter 2: Literature Review

Won't you celebrate with me?

won't you celebrate with me
what i have shaped into
a kind of life? I had no model.
born in babylon
both nonwhite and woman
what did i see to be except myself?
i made it up
here on this bridge between
starshine and clay,
my one hand holding tight
my other hand; come celebrate
with me that everyday
something has tried to kill me
and has failed.

Lucille Clifton

Why is a study on Black girls' lived experiences learning math in urban schools needed in education research?

Black girls' stories and experiences are underrepresented in math education research (Gholson, 2016; Joseph, 2017; Ireland et. al, 2018). Much of the math education research that does focus on Black girls acknowledges that: a)members of intersecting marginalized groups have distinctive experiences related to their social identities, learning processes, and educational outcomes in mathematics (Joseph, Hailu & Matthews, 2019; Ireland, et. al, 2018); b) interlocking forces of racism and sexism create barriers to success for Black girls (Joseph, 2017). Many studies on Black girls offer a great deal of insight to how they persist and succeed in mathematics, and the types of

pedagogy and classroom environment that facilitate math achievement (Joseph, 2019; Joseph, Hailu & Matthews, 2019; Leonard, 2018). However, even math scholars who advance research about Black female mathematical success also acknowledge the continued need for studies that examine Black girls' experiences in mathematics classrooms because it is relatively nonexistent, unknown and undertheorized in education research (Gholson, 2016; Joseph, Hailu & Matthews, 2019; Joseph, 2017, Ireland, et. al 2018).

There are infinite narratives, known and unknown, that can tell what it is like learning math while Black and female. This study aims to articulate the individual stories and suppressed narratives of ten academically excellent young Black women. Throughout the dissertation, I will make collective reference to Black girls, and I will frame issues with respect to being in a Black girl body. This is an aesthetic decision that speaks to the shared nature of individual experiences at the intersection of race and gender. It is not my assertion or claim that the experiences described by participants in this study is representative of Black girls' experiences in urban math classes writ large. Research does, however, point to the unique challenges Black girls face while learning mathematics as racialized and gendered forms of experience (Gholson, 2016; Ireland, et. al, 2018; Joseph, Hailu & Matthews, 2019; Martin, 2012). This study is guided by scholarship that examines how Black girls recognize negative attitudes about their ability or identity and their experiences with exclusion, marginalization and other forms of oppression in math.

Scholarship on Black girls' experiences with racism and sexism in math is a growing body of research that acknowledges math classrooms as historically white

institutional spaces that operate on dominant culture norms and ways of knowing. Even when Black girls' math and racial identity is robust, their performance outcomes can be influenced by the extent to which the environment was supportive and nurturing (Jones, 2003). This includes having opportunities to learn with peers and a classroom culture that valued both correct answers and mistakes (Bishop, 2012; Gholson & Martin, 2014; Jones, 2012; Jones, 2003). In a study of two Black girls' reflections on their math learning as rising 9th graders, Johnson (2009) found that the young women expressed an ethic of caring and experiences feeling smart and successful as influencing their math performance and identity. Similarly, experiencing a sense of belonging is a key factor to young women's persistence in math (Rattan & Dweck, 2012; Joseph, 2017; Joseph, Hailu & Matthews, 2019).

Unfortunately, for Black girls, math spaces can be particularly hostile, exclusionary and unwelcoming (Joseph, Hailu & Matthews, 2019). Some studies show that even subtle messages in learning environment can make the learning environment toxic and create barriers to persistence (Thackeray, 2016). Additionally, math learning can be particularly painful for Black girls (Gholson & Martin, 2019), whose identities are not perceived as congruent with math identity (Gholson, 2016). Persistently painful encounters with math can become oppressive for students whose existence and identities are racialized and gendered (Martin & Gholson, 2019). Joseph, Hailu & Matthews (2019) found that Black girls' contemporary experiences with oppression and dehumanization of their personhood in schools, and particularly in math classrooms, is historically rooted. They argue that while Black girls have earned legal rights to equal education, they still are positioned as "outsiders" to mathematics learning and knowledge production

(Gholson & Martin, 2014; Joseph & Alston, 2018).

Research shows that Black girls at the secondary level are often aware of the gendered racism they face in math class (Davis, 2019). Some qualitative studies find that Black girls describe instances of prejudice, discrimination, differential treatment, stereotyping and low teacher expectations in their math learning (Joseph, Viesca & Bianco, 2016). Black girls in urban school math classrooms are particularly vulnerable to gender and racial stereotypes related to math achievement (Young, et. al 2017). The precise impact of these stereotypical images for Black girls and women in mathematics is not well understood, but studies have shown that Black girls are discouraged and deterred (Gholson, 2016). For example, a study on teacher perceptions of black girls in the classroom found that Black girls are perceived as less attentive and more disruptive than other white and non-white students (Francis, 2012). Another study found that teachers were less likely to recommend even high performing Black girls to advanced level math courses, and that they frequently made subjective judgments about Black girls' mathematical abilities regardless of their performance outcomes (Campbell, 2012). Lin (2008) found a similar pattern among two African American middle school girls who had differing personal and academic profiles. Findings from Lin's study suggest that race and gender do influence learning experiences and performance outcomes in math. Other studies show that Black girls experience being silenced when trying to participate in math class or unsubstantiated [teacher and student] doubt regarding their intelligence (Harkness & Stallworth, 2013).

Studies that examine how Black girls describe and understand their experiences with racism and sexism are needed to explicitly identify examples of exclusion,

marginalization and oppression in math classrooms. The relative invisibility of Black girls' experiences in math with respect to the nature of the obstacles they face produces obscurity to many mathematics teachers and leaves them with little understanding of what it is like to be Black and female in math spaces (Joseph, 2017). Joseph (2017, 2019), Gholson (2016) and other critical math scholars acknowledge the need for research that can help math teachers become more aware of how their perceptions and beliefs show up in teaching and learning interactions in ways that hinder Black girls' academic achievement. It is important that research on Black girls' math experiences:

- Acknowledge that educational outcomes can be a product of structural forces that were historically designed to dehumanize Black girls
- Consider evidence of how anti-blackness (Bullock, 2015, 2017; Cedillo, 2018; Gholson & Wilkes, 2017; Martin, 2019; Valoyes-Chavez, et.al 2017; Valoyes-Chavez & Martin, 2016), gendered forms of racism (Bullock, 2017) and resistance to black girlhood (Crenshaw, Ocen, Nanda, 2015; Evans-Winters, 2014; Morris, 2016; Nunn, 2018) function in schools, and specifically math spaces, in ways that disadvantage Black girls.

The physical and symbolic violence enacted as a response to educate Black children is well documented. Evidence that Black intellectual merit is overlooked and dismissed is common in academic spaces. Infinite accounts of opposition and hostility to the Black female aesthetic has been established over the course of history.

This study aims to illuminate the lived experiences that participants in this study had with being marginalized in their K-12 mathematics school recollections.

Furthermore, this study will document and examine how Black girls: a) describe and understand their experiences with exclusion, marginalization, and other forms of oppression in mathematics classrooms; b) recognize and identify negative attitudes and beliefs about their abilities and identities; c) respond to, navigate, and cope with experiences that exclude them from learning and participation in mathematics. Bullock (2015, 2017), Martin (2019), Valoyes-Chavez (2015) name anti-Blackness as a defining characteristic of mathematics as a discipline, and they use anti-Blackness as a lens for problematizing and analyzing racialized mathematics experiences and outcomes. Similarly, I contend that the literature compels us to also consider anti-Black girl(hood) for interpretive insights into lived experiences. In doing so, we not only consider relevant scholarship on anti-Blackness (Dumas & Ross, 2016) and Black girlhood (Epstein, Blake & Gonzalez, 2017) but the centrality of socialization and identity to mathematics teaching and learning. Within these spheres, a number of topics are relevant, particularly in the context of urban schooling and mathematics education. Research on whiteness (Battey & Levya, 2016), anti-Blackness (Dumas & Ross, 2016); (not) belonging (Good, Rattan & Dweck, 2012; Joseph, 2015), dehumanization (Joseph et. al, 2019) and oppression can all be traced to the possibility and presence of anti-Black girl attitudes in the culture of mathematics teaching and learning. I am trying to articulate how the participants in this study describe and understand their learning experiences, which include their perceptions of interactions with teachers, peers and content. I also explicitly discuss literature on visibility and hypervisibility (Bell & Golombisky, 2004; Gholson, 2016), peer positioning (Gutiérrez, 2013) and knowledge production (Martin, 2010; Martin, Gholson, & Leonard, 2010).

Being

During the course of my doctoral program, I had the opportunity to study hermeneutic phenomenology, which prepared me to examine lived experiences. Lived experiences are shaped by recollections of *being*. In this study, I apply what I learned to construct interpretive renderings of what *being* in a Black girl body is like in the context of urban schools and specifically in mathematics classrooms. There are few spaces in both schools and society where Black girls can go and be unconditionally accepted or, as Detterman et al. (2019) point out, unconditionally educated. Literature on Black girls' schooling experiences coupled with critical math scholarship suggests that mathematics classrooms are white institutional spaces where Black females experience exclusion, marginalization, and other forms of oppression. As critical math scholars Valoyes-Chávez et al. (2017) note, "in some contexts, being in a 'black body' is associated with incapacity for mathematical thinking." (p. 691).

Mathematics education research on identity and socialization (Martin, 2000, 2009, 2012; Martin, Gholson & Leonard, 2010; Young, et al. 2017) are particularly important to this study. Mathematics socialization refers to the experiences that individuals and groups have within and across sociohistorical, community, school, and intrapersonal contexts, that facilitate or inhibit meaningful participation in mathematics. Mathematics identity encompasses the narratives and stories that individuals develop about their ability to participate and perform effectively in mathematical contexts (Martin, 2007, 2019). Martin argues that these narratives and identities represent a negotiated self or a negotiation between self-valuation and others' ascribed valuation.

Scholarship on mathematics as racialized forms of experience and the mathematics classroom as an institutionally white space (Martin, 2008, 2010) are also important to this study. The value in research on mathematics socialization and identity is that it helps illuminate the conditions that make mathematics teaching and learning inhospitable for Black students. Because this scholarship by and large focuses broadly on racialized experiences in math, it is important to intentionally interlace bodies of literature that illuminate the ways in which gender uniquely shape Black girls' realities. Situating these understandings within the context of research on urbanization and gentrification in schools is another important factor to discuss. This approach to mathematics education research reflects how mathematics teaching and learning are conceptualized with consideration of the sociohistorical contexts (Martin, 2000; Weissglass, 2001). Martin (2000) argued that problematic outcomes in Black children's mathematics achievement must be examined with social forces and historical contexts in mind.

The literature on Black girls' experiences in U.S. public schools is replete with examples that illustrate how they have historically experienced racism and sexism in broader society, and how those experiences play out in school settings. Given what we know from the abundance of existing literature, I limit this review to approximately two dozen works that comprehensively demonstrate not only the need for this study but the theoretical framings that humanize Black girls and recognize their intellectual gifts. Studies of particular import argue for recognition of Black girls' pain as oppression and call for practices that normalize Black girls' humanity in the context of mathematics teaching and learning (Gholson & Martin, 2019; Joseph et al. 2019). Additionally,

research that illuminates the significance of teacher disposition to Black girls' sense of productive math identity is important to the discussion on how students experience social place and actualize their intellectual value in classroom interactions (Bishop, 2012; Johnson, 2009; Wood, 2013).

Similar to Martin (2012) this study examines what it is like *being* in Black girl body while learning mathematics. The literature review aims to offer an ontological unfolding of human experience as multidimensional and with consideration for how anti-Black girl(hood) operates in math education. This is an important characteristic of the literature review. If we are to truly shift toward more humanizing and inclusive theory and practice in mathematics teaching and learning, incorporating literature from other disciplines is a necessary part of the transformation process. Collectively, the literature in this review acknowledges that mathematics classrooms are nested within and integral to the ecosystem of how Black girls experience school and how they experience life in broader society. It acknowledges that Black girls bring multiple identities and experiences to the mathematical context which shape how they make meaning of their encounters within those spaces. It considers the social, cultural, and historical influences that not only shape *what* students experience but *how* they experience it.

Being Perceived as A Problem

As a social construct, race and racism demand the distinction between standards of normalcy and “not so standard” deviations *from* the norm to justify stratification among and subjugation within groups. Historically, Whiteness has been socially constructed as supreme in mind and morality. Non-whiteness on the other hand, and specifically Blackness, has been constructed as a problem. The remnants of racial

intelligence ideology and cultural deviance pathology gave birth to stereotypes and archetypes of Blackness that remain alive and well in schools, especially in mathematics classrooms. In and out of the mathematics classroom, Black children are tasked with managing microaggressions, protecting themselves from microassaults, and coping with the injuries of microinvalidations. Critical math scholars acknowledge the need to examine the issue of *being* perceived as a problem in mathematics education and the purpose of advancing research that rejects reproduction of this status quo.

Being Black

Since chattel slavery in the U.S. and across the diaspora, human beings have been systematically stratified in society, and minoritized groups, including Black girls and women, have routinely been caste to a lower status than white people in America. Despite social movements and landmark legislation over the past century and a half purposed to advance educational opportunities for Black people, there have consistently been policies and practices that undermine, retrench and retract gains made by Black intellectuals and activists since emancipation. Lorraine Hansberry's popular stage play "To Be Young, Gifted and Black" has been lauded for its contributions to American literature and popular culture. "To Be Young, Gifted and Black" humanized various facets and nuances of Black life, the universal concerns of hopes and dreams, and the complexity, beauty, joy, and courage of black life (Jasmine, 2018). The song "To Be Young, Gifted and Black" was originally recorded by Nina Simone, disseminating the message of Black brilliance for mass consumption.

In 2004, three leading African American scholars published "Young, Gifted and Black: Promoting High Achievement among African American Students" to center Black

identity in discourses about Black children in schooling. A decade later, dozens of math scholars contributed to “The Brilliance of Black Children in Mathematics” as a canonical work to transform schooling for students who have historically been denied access to a quality education, specifically African American children. Still, in the year 2020, there remains a need for messages of Black giftedness and brilliance, particularly where math education is concerned. Because being a Black girl is not readily associated with being brilliant in broader society, examples and representations of Black female mathematical brilliance are not as visible as they need to be to orient teacher and student awareness.

In some spaces, if not many, *being* Black and female often means moment to moment management of and resistance to anti-Black paternalistic thought, pathologizing stereotypes, and various microaggressions because *being* Black is often perceived as *being* a problem. *Being* a Black, female and perceived as a problem, it is not surprising then that Black girls’ mathematical brilliance (or conversely their marginalization in mathematics) has only received minimal attention in education research.

Anti-Black Thought

The number of historians, scholars, literary geniuses, educators, and philosophers who advance critical pedagogy and acknowledge the centrality of racial ideology to issues of power, subordination and dehumanization is vast (Anderson, 1988; Evans-Winters & Peirt, 2014; Guy-Sheftall, 1990; Fanon, 2008; Freire, 2018). We know that constructs of racial intelligence were advanced to justify policies and practices underpinned by white supremacy. Blackness as inherently inferior, both socially and intellectually, was propagated as “The Negro Problem” during and after slavery (Gholson, 2018; Smith, 1993). Whether under the guise of morality, science, economics,

politics, and even safety, anti-Black thought governed American life and engineered the social stratification that survives today. Racial ideologies that portrayed Black people as mentally deficient, socially immoral, criminal, subhuman, lazy, and simply unworthy and undeserving of human dignity or rights were advanced by what Hull, Scott, and Smith (1993) call professional racists. These anti-Black sentiments were bolstered against arguments of whiteness as noble, righteous, exemplary, and meritorious.

Anti-Black ideology and constructs have been institutionalized and documented in our legal governance, economic policies, residential planning, and education agendas. Historically, anti-Blackness has placed African Americans on the margins of opportunity and actively excluded full actualization of truths that are said to be foundational to this country's greatness. There has been little interrogation, however, about the ways anti-Black ideology and its consequences differentially shape the lives of Black women as compared to men. In *Daughters of Sorrow: Attitudes Toward Black Women 1880-1920*, Beverly Guy-Sheftall (1990) notes that,

...it is difficult to find in this [American history] literature an assessment of differences in attitudes toward Black males and females. Almost without exception, both sexes are lumped together in studies of the development of racist theories...this tendency to see blacks as an undifferentiated mass and to overlook black women in matters ...because of the relative unimportance of their gender...was recognized by Black women in particular during this period. (p. 2)

Guy-Sheftall drew attention to how perceptions about Black women held by white people and Black men, contrasted with those that Black women held of themselves during the late 19th and early 20th century. This is a time that mainstream historians and traditional

feminists considered a high point in women's history. It was actually, however, a time when Black women may have been reduced to an incredibly low point being just on the other side of slavery, yet not granted true freedom. Despite the proliferation of the Black female intellectual tradition during this time, efforts to invalidate and dehumanize Blackness were successful. Of the many contributions Guy-Sheftall made to scholarship that deconstructed gendered racism, her use of primary sources to document the resistance to Blackness that prevailed in the late 19th and early 20th century stood out. Guy-Shortfall cites Thomas Pearce Bailey's racial creed of 1914, a concise description of racial ideology that permeated American culture:

...the white race must dominate...this is a white man's country; let there be no social equality; no political equality...let the lowest white man count for more than the highest Negro...In matters of civil rights and legal adjustments give the white man as opposed to the colored man the benefit of the doubt. In educational policy let the Negro have the crumbs that fall from the white man's table. Let there be such industrial education of the Negro as will fit him to serve the white man (p. 14).

Bailey was known as an educator and race theorist who published propaganda to influence disparities in the allocation of goods, services, and resources along the lines of racial difference. I will revisit Bailey's rhetoric on education policy in a section to follow, but it is this type of racial ideology, which anchors that have evolved over time into damaging stereotypes of Blackness, that exist today. While no one would see themselves as having internalized these ideologies, it plays out in everyday implicit bias and classroom interactions where teachers default to unfounded beliefs about students of

color based on things that they have heard and learned in error or simply never questioned. Many people of color, however, can offer endless examples of how pathologizing stereotypes shape worldviews and perceptions.

Pathologizing Stereotypes

I will spend little time here restating the damaging stereotypes, economic policies, and education agendas that have pathologized Blackness as inherently inferior, socially substandard, and culturally contrary to dominant, mainstream understandings of whiteness as the default mode of existence. We are all too familiar with how these depictions are erroneous and distorted. Dehumanizing representations of Blackness reproduced through historical propaganda, art, mass media, entertainment, reform policy, and school data are consistently challenged and invalidated by critical scholars. Whether the national consciousness recalls the 19th century depictions of Black people as savage and subhuman or Black children as mentally retarded and uneducable during the mid to late 19th century, images of Blackness continue to be, by and large, counter to any message of “Young, Gifted and Black.”

For Black women and girls, stereotypes of sexual promiscuity have historically been used to justify the exploitation and violation of the Black female body. Over the past four centuries, Black women have been depicted as jezebels, mammies, welfare queens, angry “bitches,” and, most recently in several musical genres, as “video hoes” (Moody, 2012; Welang, 2018). The hostility, discrimination, and injustice that Black people, and particularly Black women, face has been well documented by legal scholars and critical race theorists (Crenshaw, 1995; Davis, 2011; hooks, 2000; Collins, 2002). Black women have Black women endured the violation of their human rights so much so

that they have been designated as members of a protected class locally in the Allied Community and federally by the United States Government.

Managing Microaggressions, Insults, Assaults and Invalidations

In the 2018 movie adaptation of the book, “*The Hate U Give*,” authors and screenwriters Angie Thomas and Audrey Wells show how despite federal protections, deep seated racism permeates law enforcement, cross-community perceptions, and school experiences. The main character, Starr, experiences a number of racialized experiences in both her neighborhood (economically marginalized community of color) and her school (predominantly white affluent private institution). In the television series *Blackish*, the children on the show live in a middle-class neighborhood and attend predominantly white private schools in an effort to access the quality of education that will better equip them for post-secondary opportunities. These media representations reflect real-life problems that many Black families, from those who reside in low-income neighborhoods to those who live in working-class or middle-class communities, face in accessing quality schooling.

In the coming sections, I describe the “urban school crisis” and its implications for Black girls. Briefly, however, it is important to unpack why parents would risk exposing their children to environments that are racially inhospitable or unresponsive to their cultural needs. Why would parents add hours to their commute everyday so that their children can attend “better” schools? These patterns resemble the busing era trends, and they are inextricably linked to the de facto segregation progression of schooling that leaves some communities with high concentrations of poverty and underserved schools. In his work on culturally and linguistically responsive pedagogy, Dr. Sharroky Hollie

(2012) argued that high-poverty, high-needs schools provide poor customer service. He explained that underserved students and families receive “poor customer service” in schools, and that they have little to no recourse in terms of escalating complaints to a higher authority for resolution, requesting a refund on per pupil expenditure, or taking their business elsewhere, which in this case is finding a better school (p. 45). Examining Black girls as a special population that is not only designated as a federally (un)protected class, but as a specific population that schools have consistently and historically failed to serve, is a critical focus for mathematics education research to shift the discourse from matters of learner ability to institutional accountability.

In addition to being underserved in schools, the intersection of race and gender renders Black girls particularly vulnerable to routine verbal, behavioral, or environmental indignities that communicate hostile, derogatory, and negative prejudicial slights and insults toward their identities as students. Widely known as microaggressions, these types of insults and dismissals were named in 1970 by Harvard professor, Chester Pierce, who routinely observed African Americans on the receiving end of these distressing encounters with non-black Americans. More than 30 years later, use of the term was applied to the casual degradation of any socially marginalized group including members of the LGBTQ community, people living in poverty, people with (dis)abilities, and women. Sue et al. (2007) defined microaggressions as "brief, everyday exchanges that send denigrating messages to certain individuals because of their group membership" (p. 72). As Howard University Professor Emeritus. Leslie Fenwick, PhD, reminded us at the 2018 AERA Brown Lecture, “There’s nothing micro about a microaggression.” Indeed, there is not anything small about indignity. Sue et al. (2007) identify microinsults,

microassaults and microinvalidations as specific dimensions of these problematic racial encounters broadly known as microaggressions. Nearly two decades prior, however, Philomena Essed (1991) published *Understanding Everyday Racism* (1991) to illuminate her findings and theory on lived experience at the intersection of race and gender. Despite the groundbreaking nature of her scholarship, it receives far less attention than Sue's work.

Orozco et. al (2015) observed sixty diverse classrooms to examine the impact of microaggressions on learning environments. Findings from the study provide evidence that minorities frequently experience microaggressions in the classroom which can make the space feel hostile and toxic, and it can ultimately undermine students' learning. Microaggressions were found to be delivered most often by teachers, but they could also occur between students. We have many ideas about what it is like *being* Black, but more specific to this study is the question: "What is it like *being* in a Black girl body?"

Being in a Black Girl Body

Having multiple minoritized identities, Black girls have particular experiences of living, schooling, and specifically mathematics class (Leonard, 2016; Gholson & Martin, 2016, 2019; Gholson, 2016; Joseph, et al. 2017; 2019) that require us to revisit how we frame problems of mathematics achievement. The problem is multifaceted, and the existing knowledge base is fragmented. To offer more complete and comprehensive understanding of performance and achievement outcomes, research should emerge from voices of members of groups that continue to be underrepresented in math related career fields. The questions we ask and methods we employ to seek answers should provide greater understanding of this experience, the barriers, the processes of exclusion, and how

Black girls respond or navigate the complex world of mathematics. Research that uncovers varied narratives and multiple truths is a necessary starting point/for addressing so-called issues of underperformance and underrepresentation. Illuminating this reality is the primary objective of this research study.

In the previous section I provided a very cursory review of some of the literature that illuminates what it is like being Black in the collective sense that Blackness has historically been constructed as a problem, fabricated as inherently inferior, and pathologized as deviant. It is the year 2020, and we are on the losing side of a presidential impeachment that has incited a resurgence of racial hostility and intolerance for diversity through “Make America Great Again” rhetoric. The anti-Black sentiments underpinning this campaign are no different from their political predecessors like “*Nation at Risk*”, which codify Blackness as inherently problematic. The problems of teacher shortages, teacher quality, and student safety that the Freedmen's Bureau faced in the late 1800s continue to plague schooling and education for Black children today. *Being* in a Black body can place one on the receiving end of racial microaggressions, insults, and assaults that invalidate intelligence, capability, and overall humanity. In school, these racialized interactions can be a painful (Joseph, Viesca & Bianco, 2016).

I could cite innumerable works, and it still would not measure up to the tears I have shed studying what it has been like for Black children in this country since the 17th century. I aim to highlight research and social commentary that can bring us closer to what it is like being in a Black girl body, while acknowledging that there are multiple truths and experiences for any member of a group.

To understand what *being* is like when marginal identities are multiplied, I turn to Essed's (1990) cross-cultural investigation of gendered racism. Essed problematizes the everyday norms and customs that oppress and marginalize Black females around the world. She draws on accounts from fifty-five Black women who describe their day to day racial encounters. Essed uses participants' experiential knowledge to integrate micro and macro dimensions of gendered racism and make visible what is often obscured in research and theory on or about Black women.

Scholars who highlight the intellectual traditions of Black women draw attention to how:

- 1) Intellectualism is an act of both resistance and liberation;
- 2) Black feminism grew out of 19th century political and human rights activism found in literary, artistic, and political spheres; and
- 3) Knowledge produced by Black female scholars is often suppressed and marginalized in the academy.

Specifically, hooks (1991, 1996) reminds us that both pedagogy and practice in education should incorporate liberatory. Collins (2009) helps us understand how the interlocking oppressions of racism and sexism operate in schools to silence Black girls. Guy-Sheftall (1990) traces the historical roots of racial dominance and the ideologies that continue to disadvantage Black women today. Evans-Winters and Esposito (2010) highlight the challenges Black girls face in schools where they are often tasked with navigating both white supremacy and hypermasculinity or male toxicity. Within mathematics education research, the intellectual prowess of Black women and girls is examined by Joseph, Hailu and Boston (2017), Leonard, et al. (2016), and McGee (2013). In addition, the role mathematics plays in Black children's liberation (Martin, 2009), access to opportunity

(Martin, Gholson, & Leonard, 2010) and identity development (Leonard & Martin, 2013) is important to why I explicitly name and include Black women's intellectual traditions in this literature review.

Black female intellectuals call attention to the ways that Black girls experience racism and sexism in America as shaped by the structural and cultural exclusion of Black women's voices (Collins, 2002; Mirza, 2005. West, 2016; Yosso, 2005). In American society, social displacement and intellectual devaluation of Black females is a cultural norm in and out of school. Within the Black female intellectual tradition, scholars provide evidence that there is wisdom and brilliance that comes from living in racialized and gendered identities. This body of scholarship shows that the politics of inner and outer being that threaten Black girls' possibilities must often be met with agency and self-determination. Because intellectual invisibility is a key finding in this study, it is important to highlight a history of resistance to Black brilliance and Black female intellectual traditions. Chen, Weiss and Nicholson (2010) found that including Black girls in conversations and decisions about their education can be an effective strategy for improving outcomes. Harkness & Stallworth (2013), for example, found that when Black girls participated in action research about their mathematical experiences, they reported being silenced when trying to obtain mathematical knowledge or made to feel inadequate to manage the knowledge independently.

Gholson (2016), however, traces what can be considered anti-Black girl rhetoric in mathematics to post-emancipation ideology found in an essay title "The Negro Problem". She identifies four challenges that Black girls face in participating, persisting and achieving in mathematics. First, a history of colonization and chattel slavery position

Black girls as inferior to their white peers. Second, Black girls have historically been socialized to hold a single identity related to their place in society, and that identity was not associated with being competent in mathematics. Third, racial and gendered stereotypes erase the intellectual capacity Black girls bring to mathematical communities of learning (Lim, 2008). Lastly, Black girlhood has been presumed incompatible with mathematics because of erroneous racial ideologies of intelligence. Gholson argues that these challenges render Black girls and women invisible in mathematics discourse, research and classroom practice.

Black Girlhood

Much of the literature on Black girlhood starts with an acknowledgement that there is a need for research and methodologies that center Black girls as key stakeholders and allows them to voice their own issues to provide key insights on their wants and needs. Whether conducted in the field of Black Feminist Thought (Collins, 1990), Intersectionality (Wing, 1997) or Black Girlhood Imaginary (Brown, 2009; Brown, Daley, Hunt, 2019; Owens, 2019) to name a few theoretical perspectives, scholars acknowledge gendered racism as particularly problematic to the trajectories of Black girls in school and society. Many scholars argue the need for multivalent analytic prisms that aid in recovering what has been lost or undermined and illuminating the maintenance of joy, magic, and brilliance despite layers of violence and degradation. I briefly discuss the importance of understanding Black girlhood and identity for schooling and the reason why knowledge of historical context is instrumental to modern praxis. Although some would argue that the historical remnants are beyond our contemporary consciousness, many critical math scholars situate their studies in ways that acknowledge the

sociohistorical influences on the phenomena of study. For a moment, I will broadly discuss how conceptions of Black girlhood were historically engineered. I will revisit the implications of this for schooling, and mathematics in particular, in the section to come.

There is a great deal of scholarship on Black girlhood in the 19th century and archival documentation of Antebellum Black girlhood that almost provides a genealogy of Black girlhood (Wright, 2016) and offers pedagogical considerations for incorporating insights from slavery (Stetson, 1982). These insights provide evidence that Black girlhood was taken hostage and denied under the institution of chattel slavery. In *I was a Slave: True Life Stories Dictated by Former American Slaves*, Howell (2004) focuses the fifth book in the series on the life worlds of children during chattel slavery. While I think it is important to amplify the narratives of Black girls who were outspoken and irrepressible during the height of gendered racism (Wright, 2016), it is also critical to portray the reality of those circumstances that structured suppression of Black girlhood. Whether living in the master's house or in a slave cabin, conditions and temperatures were untenable and inhumane. Lacking flooring, bedding, or adequate space, black girls as chattel were not considered human and therefore denied provisions for basic human needs (Maslow, 1970). Some plantations had a nursery that was designated for enslaved infants and children where they would receive rations of food, be treated for illness, and secretly play. Play often involved games that children created with their imaginations and natural resources (sticks, mud, rope) to make dolls and marbles, tell ghost stories, sing songs, or play games. On other plantations where there were no nurseries, children may have sat in the hot sun in the fields all day while their caregivers worked. Annie Osborne remarked, "I didn't know nothin' 'bout playin'. If I made too much fuss [noise] they put

me under the bed” (Howell, 1998, p. 7). During this time, members of society were socialized to believe that any display of behavior deemed deviant was a sign of a Black child’s demonic character traits. Children were not allowed to have shoes or more than one garment. The list of restrictions and denigrations against Black children and girls is endless. How would she survive under the imminent threat of assault?

Once Black girls were deemed of the age to work, they were assigned to the field to perform manual labor or to the house for domestic servitude. Either way, Black girlhood was marked by taking care of the needs of white adults and children, while witnessing and experiencing terrorism toward Black children and adults. The traumas included maternal separation at the auction block, whippings, rape, brutal beatings, and lynchings, being referred to as a little nigger child, a piccaninny, heifer, or wench, being sexually defiled repeatedly by white men as masters and Black men as breeders and birthing upwards of a dozen children who were likely sold away without even a mere moment of skin to skin contact. Black females were stripped of their rights to care for their own children, but fed the master’s children from their own breast. Cooking, cleaning, creating a life of comfort for white people while enduring a life of suffering is unconscionable. Black girlhood studies show how, from the period of enslavement forward, Black girls have not benefited from the assumptions of “childhood” innocence or the perceived need of protection granted their middle-class white counterparts (Griffin, 2016). Black girl bodies have been exploited, commodified, and devalued for the social and economic benefits of white America. The legacy of those truths and forms of treatment linger in the subconscious of our societal norms, and calls us to focus on vulnerability and vitality among Black girls (as opposed to the current emphasis on risk

and resilience, which, while important factors, can become unsustainable). On the one hand, we know that mandatory illiteracy laws and other forms of racial discrimination disadvantaged generations of Black people, but, on the other hand, Black girls are now given opportunities to go to school, and they are certainly being treated better than they were during slavery, right? So, what is the problem?

In *Sisters of the Yam* (hooks, 2015) and *Other People's Daughters* (Evans-Winters & Esposito, 2010) scholars draw attention to the dehumanization of Black girlhood and the toll it takes on Black girls' emotional health and well-being. Corbin, Smith and Garcia, (2018) and Martin, (2018) highlight the damaging consequences of racial battle fatigue on Black girls and in urban schools. Collins (2018) analyzes the unique impact of interlocking oppression for Black women, and echoes findings on the ways in which this interconnectivity of vulnerability increases risk for violence and violation. Much of the literature shows that Black girls negotiate multiple identities in school and enact a number of protective behaviors in an effort to achieve favorable academic outcomes (Butler-Barnes et al., 2017). A great deal of scholarship is framed through the lenses of risk and resilience (Evans-Winters, 2003), and some scholars point to the ways in which Black girlhood is constructed through narrative and media representations (Brooks et al., 2010; McArthur, 2016). The sexualization, adultification, and criminalization of Black girls are argued to erase the childhood innocence that most white children are afforded (Epstein, Blake & Gonzalez, 2017). For example, a groundbreaking study by The Georgetown Law Center found that Black girls, especially ages 5-14, are perceived to need less nurturing, protection, support, and comfort compared to peers who are not Black and female (Epstein, Blake & Gonzalez, 2017).

The perceptions are untrue. The perception that Black girls are more resilient, yet less innocent than students who are not Black and female justifies practices and dispositions that render Black girls more vulnerable to harsh discipline, hostility, disdain, and various forms of maltreatment. Because a great deal of Black girlhood spent in schools, the routine intolerance of their identities is concerning. In addition to frequently being stereotyped as loud and aggressive (Fordham, 1993), research shows that Black girls are pushed out, overpoliced, and underprotected in schools (Crenshaw, Ocen & Nanda 2015). A study that was conducted in D.C. public schools, a large urban school district in the nation's capital, found that Black girls were disproportionately punished in schools for their personal expressions through hair and clothing (National Women's Law Center, 2018). What then does this mean for recognizing and tapping into the intellectual capacities Black girls bring to the mathematics classroom?

Black Girls in Education and Research: Social Hypervisibility. Intellectual Invisibility

In educational research, policy, and practice, scholars acknowledge that analysis often assumes all Blacks are men and all women are white (Combahee River Collective, 1983; Guy-Sheftall, 1990; Evans-Winters, 2009; Hull, Bell-Scott & Smith, 1982; Walker, 2004). Educational research that focuses on Black girls is arguably disproportionality focused on discipline (Crenshaw et al., 2015; Morris, 2016), despite scholarship that draws attention to the need for research on Black children's brilliance (Leonard & Martin, 2013). For Black girls, this reifies a fixation on behavioral correction and surveillance, which is historically rooted in control of the Black female body. We know that, consequently, Black girls are socially hypervisible (Mowatt, French & Malebranche, 2013; NWLC, 2018), and they are subjectively disciplined for displaying "anger" or

“aggression” in words, disposition, or action (Crenshaw, Ocen & Nanda, 2015; Morris, 2016) far more than their white counterparts. With Black girls more vulnerable to school exclusion (Blake et. al 2011; Crenshaw, Morris, 2005, 2007; Ocen & Nanda, 2015; Morris, 2016; Rollock, 2007), experiential erasure (Evans-Winters, 2005, 2010, 2011), and social (dis)placement in schools, research that examines Black females’ intellectual traditions offers promising directions for addressing performance outcomes. Shifting our focus to the intellectual invisibility that Black girls experience in schooling and research (Mowatt, French & Malebranche, 2013) can also redress their underrepresentation and erasure in scholarship.

Despite the ways Black girl excellence may be obscured by inadequate balance of attention to their brilliance and the ways that they are both socially and intellectually excluded, Black girls have always resisted and continue to resist denial of their being, and they assert a great deal of agency as a protective measure (Brooks et al., 2010; Lane, 2017; Watson, 2016) One of the main instruments of self-defense and self-preservation that Black women and girls have at their disposal is their mind (Collins, 1990, Guy-Sheftall, 1990 ; hooks, 1981, 1984, 1991, 2015; Waters & Conway, 2007; White, 1985). Countless Black female intellectuals stand as exemplars of cognitive capability, and their contributions in the areas of literature, mathematics, science, and arts are immeasurable. Yet, we know that Black women and girls operate from a unique epistemological stance, which scholars find to be culturally and epistemologically incongruent with public school structures (Collins, 2002; Irvine, 1990).

Not only does scholarship warrant greater attention to the academic experiences Black girls have, we must include consideration of the schools where they have the

greatest access. We know that urban schools, while currently undergoing renovation for gentrification, are plagued with common inner-city problems of teacher shortages, teacher quality, achievement disparities, dilapidated facilities, and scarce resources (Anyon, 2005; Darling-Hammond, 2007; Ingersoll, 2002; Kozol, 1992; Shedd, 2015; Sugrue, 2005; Tate, 1994). Though many urban schools are undergoing makeovers, community members may still be living in poverty, the streets approaching the school still bear “drug free school zone” signs, and students still have to remove their belts and personal items to gain entrance through the metal detectors. We do not yet have a name to characterize the public schools in our major cities. “Inner-city” is dated and deficit based and the meaning that “urban” once held is going through a metamorphosis before our very eyes. Yet, we have no evidence that these upgrades are benefitting Black girls, particularly in mathematics.

Being a Black Girl in an Urban School Mathematics Classroom

Mathematics spaces are particularly oppressive, hostile, and marginalizing environments for Black girls (Gholson & Martin, 2019; Joseph, Hailu & Matthews, 2019; Valoyes-Chavez, et al., 2017). Historical legacy and legal precedent of gendered racism are brought to bear in subtle and overt (inter)actions, dispositions, perceptions, and beliefs about what Black girls can and cannot do socially, behaviorally, and intellectually. In many settings, Black girls are underrepresented in advanced mathematics courses and often rendered invisible. Findings from Campbell (2012) suggest that teachers’ beliefs about and expectations for Black girls’ mathematical abilities can be racially subjective and negatively influence students’ opportunities to learn.

Sadly, in mathematics, education and society, Black girls have been without sanctuary. That is to say, Black girls have suffered from socialization processes in and out of school that effectively obscure their brilliance (Leonard & Martin, 2011) and actively structure subjugation of their minds, bodies, and spirits (Berry, 2017). Scholars argue that the structural exclusion of Black girls from mathematics disproportionately disadvantages their access to high wage careers through disciplinary dispossession (Harvey, 2003).

The anti-Blackness and whiteness that mathematics scholars define and examine are not as overt as what we recall from segregation. Classrooms are not physically labeled, “WHITES ONLY.” Parents are not boycotting schools with signs that read, “WE WON’T GO TO SCHOOL WITH NEGROES,” and perhaps that is the reason why we do not accept the idea that both anti-Blackness and whiteness are defining, yet, uniquely distinct characteristics of exclusion in mathematics education. Even with the shifts to more politically acceptable characterizations like urban schools instead of inner-city schools, we continue to witness poverty and minoritization being concentrated in particular communities to structure the unequal distribution/allocation of educational goods and services. We know that even in urban schools with more diverse student populations, the tropes of cultural deficiency and diverse identity readily places students of color at a disadvantage. De facto segregation continues to thrive in American education, even in more multicultural school settings (Alonso, 2009), and Black girls are often targeted through gendered forms of racial maltreatment.

Findings from a study on Black girls’ math and racial identity in a small urban school district highlight that participants perceived themselves as competent in math, and

that their performance was influenced by the extent to which the environment was supportive and nurturing (Jones, 2003). . This included having opportunities to learn with peers and a classroom culture that values both correct answers and mistakes. Additionally, Black girls' confidence in their ability to master skills taught in math reduced the odds teacher recommendations to advanced courses (Campbell, 2012). Further, teachers' expectation of Black girls' mathematical attainment levels was related to the recommendation process. These findings suggest that teacher beliefs about Black girls' math ability and expectations for success can be subjective and influence students' persistence along the math pipeline. Researchers have documented a connection between disparity in students taking of courses and opportunity to learn

Urbanization and Gentrification of School Contexts

Before highlighting some of the common features of an urban school classroom, it is important to acknowledge that, as far as I know, we have not identified a new name to reflect the shift from "urban" schools to schools that have been modernized and community demographics/populations that have been gentrified. Without digressing, I wonder if "post-urban" or "urban(e)" captures the essence of what we are currently witnessing in public schools. By definition, the National Council for Education Statistics (NCES) categorizes schools as urban, suburban, or rural according to geographic locale, proximity in or to a metropolis, size, and population density (NCES, 2006). What has come to distinguish urban schools as uniquely challenging are the inner-city characterizations of high-need, over populated, dilapidated, underfunded, and under-resourced schools in communities with poor, misbehaving, low-performing children of color. However, with the influx of middle-class, predominately white residents into

communities of color, neighborhoods are changing in character and demographics. Housing price inflation and business revitalization are displacing long-standing residents and services for those who are more native to the community. This change process of gentrification is, by definition, designed to reshape communities in ways that displace longstanding residents to serve those with the means to pay more for renovated properties and added amenities. Akin to a purging, cleansing, or purification, countless schools have undergone “urban modernization,” and the now gentrified communities in which they are nested have shifted to public schools that are predominantly white institutions in the span of five to ten years. Regardless, we know that zoning and boundary practices influence the quality of urban schools, and public schools in more affluent neighborhoods may have more material resources. Still, teacher shortages and teacher quality are national concerns across public, private, and parochial settings. These challenges have more enduring consequences for historically underserved groups, and we are still in a place where urban schools are in need of competent and caring educators to fill persistent vacancies across many districts. According to NCES, almost 100% of urban schools had teaching vacancies at the start of the school year in 2008. Furthermore, high quality mathematics educators are particularly difficult to attract and retain. The problems in urban education are not only structural, but they reify social misunderstandings and stereotypes of students of color. As long as performance is measured using standardized tests and schools continue to underserve minoritized populations, students of color will continue to be perceived and portrayed as deficient.

Equally important to what defines and characterizes an urban school are the pedagogical practices often observed in urban schools. Aptly regarded as the pedagogy

of poverty (Haberman, 2010), the rote nature of teaching and learning that is practiced in urban schools is designed to maintain behavioral control and social order rather than to cultivate cognitive capacity or advance intellectual aptitude. Issuing information, giving directions, assigning low cognition busy work under the guise of rigor, asking closed questions but calling it higher order or critical thinking, mediating instruction with worksheets, reviewing homework and classwork, teaching to and administering tests are not only ineffective, default teacher practices; these instructional norms are state sanctioned protocols argued to increase student achievement. There is enough evidence for us to know that these practices are ineffective teaching practices and they do very little to produce more desirable performance outcomes. Yet, in addition to many urban school mathematics classrooms having yearlong teaching vacancies, which contributes to racialized gaps in learning and performance outcomes, teachers are also required by their districts to use scripted curriculum like Eureka math to address Common Core State Standards. In addition to geographic and contextual factors shaping academic outcomes for Black children in mathematics, there are at least five additional considerations acknowledged in critical math scholarship that are consistent with this study's findings: socialization and identity, whiteness and anti-Blackness, (not) belonging, pain as oppression, and dehumanization (Gholson & Martin, 2019; Joseph, 2019).

Math Socialization and Identity in Urban Mathematics Classrooms

Martin (2000) states that mathematics identity refers to participants' beliefs about (a) their ability to perform in mathematical contexts, (b) the instrumental importance of mathematical knowledge, (c) constraints and opportunities in mathematical contexts, (d) the resulting strategies used to obtain mathematical knowledge. Math

socialization describes the processes and experiences by which individual and collective identities are shaped within sociohistorical, community, school, and interpersonal contexts. Martin argues that racial identity and socialization are important considerations in mathematics learning and participation because math processes are deeply involved in the production and reproduction of racial meanings. Martin (2000) raises several important points about the study of socialization and identity in math to argue the importance of specifically examining Black girls' math experiences given the history of exclusionary school practices with regard to Black children.

Relevant to this study, then, is the literature on mathematics learning as a racialized experience which specifically includes scholarship on the ways Black children are socialized into their mathematics education by a national discourse on achievement gaps, school tracking and ability stratification, and a less comfortable conversation on whiteness and anti-Blackness in mathematics. These bodies of research are instructive, and emerging studies on how Black females experience in math spaces reveal a need for more intersectional scholarship that examines: 1) how and why Black girls' mathematical experiences are unique and distinct from those of other groups and 2) how those experiences can provide insight to conceptualize marginalization and exclusion in mathematics.

Developing understandings of mathematics experiences and outcomes from the perspective of socialization and identity allows research to account for Black girls' sociohistorical and present-day experiences in school, and specifically in mathematics class. Socialization includes considerations of historically rooted differential treatment, the influence of community and cultural beliefs, institutional barriers in schools and

classrooms, and students' individual ways of navigating it all. Since slavery, there has been strong opposition to Black education and active exclusion from particular high wage occupations. Martin (2000) claims that individuals negotiate contextual forces, opportunities, and constraints, which are brought to bear on mathematical development and achievement.

Students are socialized and sorted as mathematically (in)competent in a variety of ways. Racialized hierarchies of math ability (Martin, 2012) position white students as the standard by which success is measured, and males are reported to outperform females. Racial ideologies and misperceptions of children's intellectual abilities permeate mathematics education and research (Battey, 2013; Martin, 2009, 2010, 2012). White and Asian children are perceived to be mathematically superior to Black, Latinx, and Native American children, and these perceptions are upheld by achievement data. Thus, Martin explains that while racial comparisons reveal achievement disparities, they also sustain them by overemphasizing persistent racial gaps in achievement. He further illustrates how racial comparisons establish a "racial hierarchy of mathematics ability" (Martin, 2012, p.48) in which Black children seem permanently caste at the bottom. Martin argues that this hierarchy of math ability and knowledge reflects and reproduces social stratification that is evident outside of school. In and out of school, racial sorting maintains a system of access to opportunity for whites and limitations for people of color. This framing leaves for consumption a public perception of Black girls as residing at the bottom of this achievement hierarchy, and that portrayal is powerful. Students are also socialized through curriculum and standards. Milner (2018) explains that curriculum takes the form of explicit, implicit, null, and hidden means of socializing students into

privileged and disadvantaged statuses in schools where race and class are used to oppress poor and minoritized students.

The focus on identity allows for examination of collective and individual experiences related to Black girlhood, schooling, and mathematics. In theory, it aligns with Black feminist epistemological priorities of promoting self-definition and self-valuation, but it has been defined along a spectrum from robust or strong, productive or functional, and fragile or weak (McGee, 2015). Still, with scholars finding a connection between mathematics identity and academic identity, understanding Black girls' perceptions is a detour from the focus on disproportionate failure. Instead, identity also considers how Black girls integrate understandings of historical influences, familial perspectives, and school forces into their sense of *being* in math.

whiteness vs. anti-Blackness in Math Spaces

There are at least two important schools of thought when thinking about mathematics culture, norms, and ideologies. One argues that math spaces are institutionally white spaces that oppress students of color and reproduce racial privilege for white students (Battey, 2013; Battey & Franke, 2015; Battey & Levya, 2016; Martin, 2013). Some scholars, however, go beyond whiteness studies and argue that the resistance and opposition that Black students face in mathematics can more aptly be characterized as anti-Blackness (Bullock, 2015, 2017; Valoyes-Chavez, Martin & Spencer, 2017). In a study on access to mathematics, Battey (2013) illuminates the role mathematics education perpetually plays in disadvantaging students of color and structuring access to elite universities, higher-paying jobs, and the accumulation of wealth for white students. Battey (2013) and Martin et al. (2012) explicate how

differential access to mathematics education reifies a national agenda of racial privilege and marginalization that maintains the status quo of inequality. The ways in which math teaching and learning are socially structured and impacted by institutional culture constrains Black children's achievement, post-secondary opportunities and, subsequently, their economic mobility, and, ultimately, the material stability of the broader Black community. Given that 40% of Black females with children live below the poverty line, access to mathematics as a gateway to economic opportunity is critical.

In mathematics education, it is argued that “whiteness” reproduces racial advantages for white students while structuring disadvantages for historically marginalized students of color. Whiteness refers to ideologies and practices that maintain white supremacy by positioning the performance of white students as the standard of achievement over others in overt and subtle yet widely accepted ways. Whiteness in education is used to characterize the ways in which mathematics teachers, mathematics educators, and mathematics researchers tacitly perpetuate racism in school through expectations, interactions, and the kinds of mathematics that students experience. It leaves Black, Latinx, and Indigenous students mathematically disenfranchised. Martin (2012) names the racial hierarchy of mathematics achievement as one very common example of whiteness. The way and degree to which the underperformance of Black, Latinx, and Indigenous students is highlighted for public consumption begins to embed itself into how mathematics teachers view students of color, causing them to attribute achievement differences to students' innate abilities to succeed in mathematics. As the theory goes, with white and Asian students consistently at the top of math-achievement rankings and Black students continuously trailing behind other subgroups, teachers start

to expect lower performance from Black students, they teach lower-level content, and they use lower-level instructional practices. By contrast, white and Asian students are given the benefit of the doubt and automatically afforded the opportunity to perform more sophisticated and substantive mathematics. As a result, Asian students not excelling in mathematics are seen as an oddity, and Black students excelling in mathematics are seen as outliers. Some scholars argue that the lack of attention to whiteness and its deficits-based ideologies is the culprit for the persistence of a dominant culture in the discipline. Similar to naming and deconstructing white Privilege, naming mathematics classrooms as white institutional spaces, as well as identifying the mechanisms that oppress and privilege students, can give those who work in the field of mathematics education specific ideas of how to combat structures and practices that exclude Black girls and other historically underserved groups.

Achievement disparities are often attributed to a fixed set of factors including cultural differences or deficits, oppositional orientations to schooling, limited mathematical knowledge, inability to problem solve, and other negative claims about learning and cognition that are ascribed to students of color. In much of his scholarship on mathematics as racialized forms of experience, Danny Martin argues that the national ideology of racial achievement gaps negatively shapes teachers' views of Black students, students' views of themselves, and students' perceptions of their peers. According to Battey (2013, 2016), this type of profiling has material consequences for how resources are distributed in both school and society. He argues that ideological and material racism operate in mathematics classrooms through differential treatment of Black children, the impoverished instruction routinely given to students of color, and the structural limits on

access to advanced coursework, all of which should be problematized when examining gaps in achievement, rather than highlighting so-called deficits within learners. Battey (2013) further notes that stratified mathematics coursework can lead to income differentials, and he describes how mathematics has ideologically and materially been used to sort students, give access to college, and filter people into higher- and lower-wage work. Because of its power in structurally providing and restricting access to college and career options, mathematics is often regarded as a gatekeeper to opportunity that can maintain social stratification.

Similar to Battey (2013), Danny Martin (year[s]) also examines how Black children experience oppression in mathematics through whiteness, which he defines as the use of norms, beliefs, values, teaching approaches, assessments, and production of knowledge that are based on the perspectives of white scholars. Whiteness in mathematics, Martin argues, permeates research and national policy whereas Black children are stereotyped as entering school as mathematically deficient learners who struggle to develop mathematical literacy, reasoning skills, and the ability to use ideas or symbols abstractly. While this description, however, seems more like anti-Blackness, such research and policy, Martin explains, ignores the mathematical literacies and legacies that students of color bring to communities of learning, especially when it is not congruent with the way that mathematics is being presented. In practice, white mathematicians like Pythagoras and Gauss have visibility while historic figures like Benjamin Banneker or Katherine Johnson go relatively unacknowledged.

McGee's (2013) research on eleven high-achieving Black males speaks to the racial ideologies and stereotypes pervasive in mathematics education as well as to the

systems of stratification that threaten Black students' future opportunities. Participants in her study attended an urban high school and reported frequent encounters with racial stereotypes in their mathematics classes. Some were generalized ideas about Black people that reinforce myths of laziness, poor work ethic, or inferiority to whites and Asians. Math specific stereotypes included teachers' comments about Black children's inability to do math and lack of qualifications for mathematics-related careers. McGee identified a variety of protective strategies that participants used in response to racial stereotypes including ignoring or disproving teachers' negative racial beliefs. She found that, while these strategies had academic benefits, the emotional consequences took a toll on participants, causing them to doubt their abilities or feel constant pressure to prove their intellectual worth.

Other studies on Black children's mathematical experiences document how racial ideologies influence teachers' beliefs about Black children's mathematical abilities. Findings from these studies explain that students of color face diminished opportunities to learn mathematics in ways that facilitate understanding and allow them to participate meaningfully at all levels. Opportunities to learn are facilitated by instructional strategy, delivery and clarification of concepts that are prove effective in the discipline and for the context. Opportunities to learn also include access to honors and advanced placement (AP) coursework (Spencer, 2006; Strutchens & Westbrook, 2000). Martin (2012) calls for researchers to expand this knowledge base by increasing research that documents students' day-to-day experiences in mathematics. He specifically suggests that studies unveil how Black children experience mathematics learning and participation in honors and AP contexts where they may be regarded as exceptions to dominant beliefs about

Black learners. He also recommends studies of how students' self-efficacy and identity are shaped by racialized experiences in mathematics.

Because of persistent differential access to advanced mathematics courses, tracking, teacher quality, and gendered race-based assumptions about learners, Black children are positioned at the bottom of a hierarchy of mathematical ability where white students are considered intellectually superior, males are considered more mathematically capable than females, and the idea that Asian students outperform everyone is accepted as the absolute, model minority truth (Anderson, 1990; Gutiérrez, 2013; Martin, 2008; Powell, 2002). In mathematics education research, however, Black girls' experiences with racism, sexism, and oppression are often systematically omitted in that they are either "whited out (subsumed under white girls' experiences), blacked out (generalized within the Black male experience), or simply pathologized" (Evans-Winters, 2011, p. 9) in theory, practice and policy.

Critical scholars who acknowledge the problem of whiteness in mathematics education research also point out that anti-Blackness must be examined as different from whiteness (Bullock, 2015, 2017; Dumas, 2016; Martin, 2019) because they are not necessarily opposite sides of the same coin. Both are important and defining characteristics of the domain (Martin, 2019), but a focus on anti-Blackness necessarily disempowers white privilege and places whiteness back on the margins of discourse where it belongs. Examining anti-Blackness creates space to acknowledge the type of hostility and disdain that has historically silenced and suppressed Black people, particularly in white spaces and in schools. Dumas and Ross (2016) explain that specifying anti-Blackness helps us to more incisively analyze how Black bodies become

disregarded and despised in educational spaces. These scholars point out that “anti-Blackness is not simply racism against Black people. Rather, anti-Blackness refers to a broader antagonistic relationship between blackness and (the possibility of) humanity” (Author, year, p, 429). Anti-Blackness is also ‘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’ (Black Liberation Collective, 2017). Further, within studies of anti-Blackness, we come to understand that these ideologies and practices are historically rooted and distinctly include pessimism toward Black intellect, especially in STEM fields (Morton, Gee & Woodson, 2019). Anti-Blackness ideology does not simply view the Black person as “Other” rather, the Black person is “Other.” Rather, the Black person is viewed as other than human, that is sub-human. As such, the Black person has a particular social place, which remains below that of others who are considered human, and similarly are not considered to have intellectual value. Thus, anti-Blackness does not signify a mere racial conflict but an irreconcilability difference between Black and any sense of social or cultural regard. Scholars who theorize anti-Blackness instead of focusing on Whiteness are not attempting to offer solutions to racial inequality. Instead, they are trying to help researchers and practitioners arrive at a deeper understanding of the Black condition within the context of what it is like *being* Black and in school when utter contempt for and violence against one’s personhood is completely acceptable (Dumas, 2016).

Whiteness centers supremacy, superiority, and dominance of white people over people of color. Anti-Blackness, however, calls attention to active opposition, hostility,

and resistance to Black existence. Whiteness is the support, encouragement, and expectation of white success. Anti-blackness, on the other hand, is the suppression and discouragement of Black excellence. Whiteness is the default portrayal of the dominant culture as hard-working and having intrinsic motivation. Anti-Blackness is the common media representation of Black people as anti-work, anti-school, anti-family, and, therefore, anti-success. In education discourse, anti-Blackness subconsciously underpins beliefs and assumptions about familial dysfunction and deprivation. The distortions of Blackness are rooted in deep seated racial ideologies that associate Blackness with intellectual inferiority and whiteness with intellectual superiority.

The intention here is not to position Black females as victims in the math education enterprise, or to discount the incredible achievements of Black women in math related fields and higher education. Rather, I aim to draw attention to literature that acknowledges how math learning can be shaped by race and gender in ways that threaten their persistence and achievement. Despite Black female excellence in mathematics, underrepresentation in math related fields remains a concern in education policy. Research that investigates gendered racism as influencing success or failure in math is important. A study on mathematically high achieving Black girls (Campbell, 2012) found that even with demonstrated mathematical competence, teachers were less likely to provide recommendations and access to AP math courses. The young women in this study were academically high achieving and that there was a pattern specifically in math classes where that excellence was met with resistance and opposition. With canonical works like *Learning mathematics while Black* (Martin, 2012), *The Brilliance of Black Children in Math* (Leonard & Martin, 2013), and *Mathematics Success and Failure*

among African American youth (Martin, 2000), existing scholarship opens many threads for inquiry. While a path of self-efficacy (Pajares & Schunk, 2001) or expectancy value (Wigfield, Tonks & Eccles, 2004) provide important insights for understanding students' mathematical experiences, the research questions for this study seek to examine participants' experiences with exclusion, marginalization, oppression. Math education that investigates intersecting identities of race and gender are also worthwhile pathways for understanding barriers to success in math learning (Davis, 2019; Gholson & Martin, 2019; Ireland et. al, 2018; Joseph, 2019; Joseph, Hailu & Matthews, 2017). These bodies of literature does not negate or dismiss findings from studies on self-efficacy or expectancy value. Rather such scholarship encourages researchers to acknowledge math spaces as institutionally white spaces, and to consider how and why Black girls may have painful and discouraging experiences in math, even when they are academically excellent. The guiding questions for this study warrant a focus on math education research that amplify how Black girls can be made to feel socially out of place and intellectual of little value when learning math in the context of urban school environments. In the sections to follow, I review relevant literature on Black girls' experiences with feeling dehumanized (Joseph, 2019), oppressed (Gholson & Martin, 2019) and like they do not belong (Joseph, 2017) in math spaces.

(Not) belonging

In mathematics, both anti-Blackness and whiteness contribute to overall feelings of rejection and exclusion. Studies found that Black women and girls rarely feel a sense of belonging in math spaces (Dweck, 2012; Joseph, 2017; Solomon, 2007). Maslow's hierarchy of basic human needs affirms that belonging is a key component of actualizing

success. There are a number of ways that Black girls' can internalize messages that they do not belong, which can reduce their participation and derail their persistence in math. Research has shown that the absence of images, objects and references relevant to Black girls' mathematical identities plays an important role in the extent to which they feel accepted in math spaces. This is conceptualized in math education as ambient belonging, and it helps to articulate the notion of experiencing social place and intellectual value in a math space. The concept of ambient belonging is an important concept in the process of underrepresented minorities (URMs) feeling accepted or not; whether Black girls feel a sense of fit with the materials in the space; if they feel at ease by how the environment is structured and organized. In other words, ambient belonging includes consideration for the ways material or physical objects, structural components and layout of the environment, and human capital are leveraged to intentionally create a sense of safety and inclusiveness in the space.

A study on math spaces found that even subtle messages can have a toxic influence on math identity and persistence (Thackeray, 2016). Research shows that objects and artifacts in math learning environments are not as inviting for women and girls, including the male role models referenced and the tools used rarely relate to innovations by women. There is a documented history of deliberate exclusion and erasure of Black female contribution in the field. These oversights and omissions can amplify threats to Black girls' identity and self-efficacy by hindering the positive experiences and contributions of Black women.

How might it feel to be a Black girl in math class, a white institutional space, and not have this so-called common knowledge? What does it feel like to learn in an

aesthetically sterile environment where there are likely few if any representations as inviting for women and girls, including the male role models referenced and the tools used rarely relate to innovations by women? A history of deliberate exclusion or mere oversights of Black female mathematicians? Can we imagine how painful it is to be on the receiving end of microassaults, insults and invalidation on a regular basis? Patterns of Black female irrelevance to and invisibility in mathematics and related career fields can amplify threats to Black girls' identity and self-efficacy. Findings from a study conducted in a small urban school district show the importance of a nurturing and supportive environments to Black girls' persistence and achievement in math (Jones, 2003).

Being in the minority, however, can lead to feelings of isolation and invalidation. Microaggressions, dismissal, and erasure of contribution, judgments as intellectually inferior, or simple resistance to active participation lead to self-doubt and questions of belonging. The mathematics culture of competition, meritocracy, objectivity, and emotional sterility is not welcoming to the collaborative, supportive, and emotional assets women bring to math spaces. Sexism and incivility cause trauma, stress, psychological and social injury, particularly for socially undervalued groups. Findings from studies on mathematics persistence and self-efficacy show that these experiences reduce well-being and alienate underrepresented minorities (Estrada, et. al, 2016). Additionally, feeling the weight and threat of stereotypes (Steele, 2003) ascribed to identity or internalizing the insecurity of imposter syndrome (Reis, 1987; Yong, 1992) are very real and debilitating experiences.

Studies also find that traditionally stigmatized groups rely on cues in the social environment to determine if they are welcome and accepted. Ambient identity cues in the environment—for example, only seeing posters of white male mathematicians—signal and message belonging. Underrepresentation exacerbates feelings of displacement and not belonging. Women of color are particularly subject to a number of cues that make them feel unaccepted, inferior, unheard, and unseen in math spaces (Ballenger, Polnick & Irby, 2016, p.43). There are scores of studies on minoritized women's experiences and factors that influence persistence and the inequitable conditions that perpetuate exclusion in math related fields at the intersection of race and gender (Joseph, Hailu & Boston, 2017; Malcom, Hall, & Brown, 1976) as well as further marginalize culturally responsive pedagogies for mathematics teaching and learning (Sleeter, 2012). Maslow's hierarchy (1970) emphasizes the importance of belonging to human development, and scholars are beginning to apply this understanding to math education research.

Joseph (2017) maintains that that why Black girls may or may or may not feel a sense of belonging in their math experience these feelings It is critical for teachers to understand the role of access, power, and participation to math outcomes (Joseph, 2017). In other words, having a sense of belonging, as Maslow's canonical framework asserts, is key to student success. It is also, as critical math scholars find, foundational for inclusion and equity in mathematics learning. Findings from a study on the role of Black girls' social networks to math achievement show that peer relationships were instrumental in creating a sense of belonging and shaping learning opportunities and the development of academic, mathematical, and racial identities of the Black girls who participated in the study (Gholson & Martin, 2014).

Though many studies do not disaggregate data to show negative performance outcomes for Black females, and in fact some studies show that Black females outperform Black males, the focus of this study is less about outcomes and more about the inputs that may contribute to what we interpret as performance outcomes. There is evidence of the how systemic disciplinary exclusion of Black girls can impact their math experience in the form of low participation and poor achievement in mathematics. Such outcomes are a byproduct of structures that neglect to include Black girls' participation in meaningful ways, validate or affirm their intellectual capacities, and support their development of productive mathematical identities (Booker & Lim, 2016; Borum & Walker, 2011, 2012; Joseph et al., 2017).

As with all students, Black girls' identities come partly from what they think of themselves and partly from how their parents, teachers, and counselors position them. West-Olatunji and colleagues (2007) argue that Black girls "see themselves as positioned outside of mathematics and science excellence in the way that resources are allocated to low-income and culturally diverse students at their school" (p. 221). More specifically, middle school Black girls were aware of their schools' support (or lack thereof) of mathematics learning, teachers and counselors were aware of Black girls' social positioning but were not always actively advocating to positively transform their mathematics experiences, and educators underutilized parents' knowledge about their daughters.

Francis (2012) provides important evidence about the relationship between Black girls' race and mathematical participation. She found that math and science teachers perceived Black girls as less attentive and more disruptive. For example, the teachers

were less likely to see the Black girls as “never” disruptive and more likely to see them as disruptive “some of the time” and were also less likely to characterize them as attentive “all of the time” and more likely to see them as attentive “some of the time.” After controlling for academic performance and socioeconomic status, differences in perceptions of attentiveness—but not disruptiveness—among Black girls were mediated.

Associating Blackness with deviant behavior or being disruptive is common trope that messages (not) belonging in math spaces. Previous research has found that teachers’ use of this language is subjective and diminishes Black girls’ academic and math identities (Annamma et al., 2016; Epstein et al., 2017; Morris, 2016). Francis also found that white girls were 19% more likely to be recommended for honors classes than Black girls. When teachers enact conscious or implicit bias in their views that Black girls are more deviant and intellectually incompetent than their peers, it shows how Blackness can be pathologized and reproduced in mathematics classrooms. If Black girls are perceived to be disinterested, disruptive, or mathematically deficient, then their feelings of displacement and not belonging are not imaginary.

Pain as Oppression

Navigating through, and much less succeeding in, unwelcoming and unsupportive white institutional spaces is painful. Day to day coping strategies include Black girls’ performance that requires them to negotiate their academic, mathematical and personal identities (Gholson & Martin, 2019). This performance takes an emotional, psychological, physiological, and intellectual toll on Black girls. In a recent study on pain as oppression, Gholson and Martin examine the micro interactions between a Black

girl, her teachers, and the content in a secondary mathematics classroom. In focusing on the pain associated with mathematics learning, the authors describe the mindful approach to data collection and analysis for the purpose of preserving the participants' childhood, something that can get lost in research on Black girls (Evans-Winters, 2019). Gholson and Martin acknowledge that because "Black girls and women were often thought to be innately emotionally strong and unbreakable" (Beauboeuf- Lafontant, 2009; Harris-Perry, 2011) they are not granted permission to express a variety of human emotions (Evans-Winters, 2017, p. 419). In this study, the researchers also draw attention to a very important but often unrecognized truth; not only are Black children brilliant in both ordinary and exceptional ways, but more important, that brilliance does not inoculate one from experiencing pain. McGee and Martin (2011) echoed these points in their study on stereotype management, where mathematically excellent Black students found themselves having to constantly prove their intellectual value (McGee and Pearman, 2014, 2015) also recognized this in their later research on mathematically successful Black students, where they found students had to enact specific protective factors and behaviors to cope with or survive routinely painful learning interactions in mathematics.

Enacting protective measures is not just in mathematics, but in all facets of life for Black people, and in this case for Black women. Critical Race Theory and Critical Race Feminism provide the theoretical tenets to examine the role of race and gender in uniquely shaping learning experiences. Because there is an emphasis on underrepresentation of Black females in math related fields, and much of the current research focuses on performance outcomes; research on culturally specific pedagogy (Leonard, 2018), Black brilliance (Leonard & Martin, 2013) and Black females

persistence (Joseph, 2017) gives insight to the importance of identity and socialization for Black females' mathematical experiences. Just recently scholars like Gholson, Joseph and Martin are following the research thread to unpack the barriers that reside in lived experience. Critical approaches acknowledge that racism and sexism are ever present in school experiences, not to victimize female students of color, but rather to advocate for their protection from victimization in learning spaces that can be hostile.

Gholson and Martin (2019) contend that the pain and hate of mathematics that Black girls express in their study are similar to mathematical learning experiences that many people recall (Black et al, 2009), so instead, they raise the question, "at what point does pain and hate of school mathematics become oppression?" In addition, they highlight the need for educators to employ reflexive practice to implicate their own role in reproducing or interrupting these painful cycles of oppression. Gholson and Martin (2019) articulate the importance of focusing research on the interactional-level of occurrences in mathematical experiences to inform macro-level policy efforts. Gholson and Martin argue that teachers believe if they are not physically or verbally abusive to students, then they are not a part of problems associated with differential or inequitable treatment in math. They cite one example of why this belief may be prevalent in the field. The scholars explain that when we have high visibility cases of maltreatment in mathematics like a teacher publicly humiliating a Black girl in the first grade by ripping her paper up in front of the class and berating her for "confusing everyone", many teachers would note that they do not shame or oppress students in such horrifying ways, and they would conclude that their practice therefore is without problem with respect to fair, just and humanizing treatment of all students.

One of the many takeaways from this study, however, is that if students are experiencing pain, the class culture, teacher practice, peer relations, content interactions, and policies brought to bear on the classroom must be re-examined as sources of oppression (Ball, 2018). In this sense, oppression underpins microinvalidations of a student's mathematical thinking, particularly among members of marginalized groups or in the contexts of many urban classrooms. Feelings of pain, frustration, and struggle can trigger emotions of feeling subjugated to or suppressed by maltreatment. This is important to consider in research and practice because even among well-meaning teachers who are kind, helpful, and compassionate, persistent socio-cultural and socio-mathematical patterns that suppress Black girls' sense of well-being are described at the human-to-human level as suffocating, headache-inducing, and painful. The study draws our attention to the quiet, interior moments of Black girls' experiences in stark contrast with how Black girls are typically perceived—as “expressive, dramatic, or loud” (Quashie, 2012, p. 3). If Black girls are typically perceived as inappropriately vocal way, but have expressed that they often feel silenced and suffocated, this misalignment demands attention.

(De)humanization

Joseph, Hailu, and Matthews (2017) argue that Black girls' oppression in the United States is largely related to the historic dehumanization of their personhood, which extends to various institutions, including secondary schools and, especially, mathematics classrooms. They conducted a study with ten Black female high school students and found that classroom spaces and instructional practices need to be more humanizing for Black girls. Because Blackness has historically been constructed as sub-human, Black

girls' humanity is given little consideration or contemplation in mathematics education theory or practice. Humanity is a human right, the ability to experience a self-defined life as a composite of personal experiences, backgrounds, histories, languages, intellect, personalities, bodies, and physical and emotional well-being. Black girls, however, have historically been subjugated and stripped of the rights and privileges often afforded to others (Crenshaw, 1989; Crenshaw, Ocen, & Nanda, 2015; Harris-Perry, 2011; Kendi, 2017). Joseph et al. argue for the recognition of Black girls as human and therefore equally deserving of these inherent rights as others (Evans-Winters & Esposito, 2010).

Joseph et al. (2019) argue that Black girls' humanity in the United States yet to be realized because the subjugation of Black girls is rooted in the devaluation of Black women throughout history (Butler, 2004; Collins, 2000). As discussed earlier, Joseph et al. (2019) highlight that the Black female experience with chattel slavery defined not only the economic hierarchy but also their femininity (Kendi, 2017; King, 2005). The physical exploitation that socially characterized Black women as polluted and white women as pure also positioned Black women as intellectually inferior and educationally inept (Kendi, 2017; King, 2005). In turn, this age-old devaluation of Black women's and girls' humanity, coupled with active resistance to and disregard for Black female intellectual traditions (Guy-Sheftall, 1990, 1995; Waters & Conway, 2007), has contributed to contemporary narratives that continue to shape educational, professional, and social outcomes at the intersection of race and gender (Annamma et al., 2016; Crenshaw et al., 2015; Joseph, Viesca, & Bianco, 2016; Morris, 2016; Patton, Crenshaw, Haynes, & Watson, 2016). In the context of mathematics teaching and learning, I define and describe this pattern of experience with social place and intellectual value as Human

Place Value; and I use Black girls' accounts of their experiences in learning mathematics in urban schools to identify dimensions of this phenomena that provide direction for theory and practice.

Joseph et al. (2019) situate Black girls' lives and educational outcomes within the broader social contexts of marginalization faced by Black families and communities. Specifically, they demonstrate how racism (a form of dehumanization), housing segregation, and inequitable schooling are inextricably linked and perpetuate racist ideologies. They argue that as a discipline, mathematics is particularly susceptible to inequities in the classroom because it is shrouded in a myth of objectivity. The popular idea that "numbers are universal" leads educators to assume that mathematics classrooms are uniform in their curriculum and pedagogy. While some argue that mathematics content is empirical and free of bias, critical scholars acknowledge that the teaching of mathematics is a political activity (Aguirre et al., 2017; Clark et al., 2014; Gutierrez, 2013). Indeed, the mathematics classroom is one of many schooling spaces where Black girls suffer (Dumas, 2014; Gholson & Wilkes, 2017), are taken for granted, and dehumanized (Gholson, 2016; Gholson & Martin, 2014; Jones, 2003). Findings from Joseph et al.'s study support Gholson and Martin's conclusions that teachers' mathematics instruction can reproduce oppressive systems, such as racism, sexism, classism, and xenophobia. Related to this, mathematics is often constructed as a white, male, and exclusionary institutional space. And because of this, it can be challenging for Black girls to understand themselves as mathematics learners (and develop robust "math identities") and difficult for teachers to have a vision for how the space changes when Black girls are in the classroom (Gholson & Wilkes, 2017; Hottinger, 2016; Joseph,

Hailu, & Boston, 2017; Nasir, 2017). The question becomes, do math classrooms as historically white institutional spaces change when Black girls are in the classroom? If so, how?, Moreover, how can teachers orient themselves to axioms of mathematical brilliance for Black children and be committed to an asset-based understanding of Black female epistemology?

Findings from Joseph et al. (2019) show that Black girls' humanity has routinely been undervalued in the U.S., and in many ways, their experience in school has been and continues to be negative, which ultimately limits their life, general educational, and mathematics outcomes (Cox, 2015; Crenshaw, 1989; Crenshaw et al., 2015; Harris-Perry, 2011; Morris, 2016). What we know from previous research is that some Black girls are very aware of their marginalization in schools, and particularly in mathematics classrooms (West- Olatunji et al., 2007), so it is crucial to hear what they have to say about what can make a difference for them. The study also found that Black girls' mathematics learning experiences are complex. Their experiences in secondary mathematics classrooms included a wide range of descriptions, from viewing themselves as capable mathematics students to perceiving classroom procedures as illogical and, therefore, a hindrance to learning. Joseph et al. (2019) concluded that:

Given that these ten girls represented varying levels of mathematics engagement and attended public schools in a major urban metropolitan area with high percentages of racial minorities, we think their experiences are not qualitatively or quantitatively different from most Black girls' in similar school settings. While the girls in this study provide us a glimpse of what many other Black girls in the US may contend with, we recognize that Black girls enrolled in rural and

suburban schools, private or parochial settings may encounter very different experiences (p. 148).

Overall, how adolescent Black girls experience mathematics classrooms, what they perceive about themselves as learners and doers of mathematics, and what kind of mathematics teaching practices influence and shape their participation are all understudied lines of inquiry. The Black girls in Joseph et al.'s (2019) study described their experiences in secondary mathematics not only as places to learn mathematics but also as spaces they hold in high regard when their mathematics teachers are approachable and help them understand concepts they are unsure about.

Conversely, math spaces can be sites of suffering where there is no sanctuary for Black girls who experience shame, ridicule, and humiliation for not knowing the material. These experiences challenge mathematics teachers to not only be more equity focused in their practices, but to actively take inventory of their ideologies to identify traces of anti-Blackness or defaults to whiteness. Scholars argue that this type of reflexivity in practice can help teachers humanize Black girls' experiences in learning mathematics. Joseph et al.'s (2019) study enriches the education field's understanding of the important role teachers play in shaping Black girls' interest, motivation, participation, and achievement in mathematics, which arguably, can only be realized when the complexities of Black girlhood are not divorced from teaching and learning, the core processes of the academic enterprise. Moreover, the researchers theorize that Black girls in similar demographic and contextual situations need to be viewed and understood holistically within the context of their mathematics experiences.

Davis (2019) found that Black girls in an urban high school were incredibly aware of how their mathematical trajectories and career pathways were hindered by their racial identities. More important, however, participants in the study described their math classes as socially toxic spaces, which was found to intersect with racial identity in ways that negatively impacted their post-secondary possibilities. Young and Capraro (2017) found that classroom socializing agents were critical components to Black girls' math achievement. The extent to which and nature of social networks that develop within math classroom shape Black girls' opportunities to learn and the development of academic, math and racial identities (Gholson & Martin, 2014).

Conclusion

Black girls' experiences with racism, sexism, and oppression are often systematically omitted from research and education discourse. At the same time, a historical and politicized legacy of matters related to Black bodies renders Black girls hypervisible in a society that has stereotyped, subjugated, and commodified their *being* for more than 600 years. Further, our scholarly preoccupation with Black girls' risk and resilience could instead shift to examine ways gendered racism makes Black girls' vulnerable to maltreatment transform pedagogy and practice in ways that encourage Black girls to find validation in their own vitality.

It is my hope that this literature review helped to paint a picture of what various bodies of research reveal about what it is like being black and female in school settings, and specifically while learning math. I selected the title Place Value absent of reference to dimensions of social place and intellectual value that comprise the broader concept of a

human place value. I did so with the attention of drawing math people into the study and then using it as a plausible concept for human experience. While I acknowledge the important research on Black mathematical brilliance and Black girls' math persistence, research questions for unveil experiences that receive less exposure in math education research. I hope the reader will feel compelled and called to action by the injustices that the ten participants' described as constraining their opportunities to learn math. Much of it is about being in a Black girl body, and how that is perceived in white institutional spaces like math classes. More studies are needed, and with more studies we may learn what it is like not only to be in a Black girl body, but in a trans girl body, in a disabled body, in a non-binary body, in an immigrant body, and in any body that is different from normative white standards. I think these stories are important to build the empirical evidence needed that justifies the Human Place Value framework which conceptualizes ways that we can create social place and ascribe intellectual value to all students regardless of their identities...and in doing so, it is my hope that we will have more positive stories because students will be in spaces that are intentionally designed to humanize, include and support them.

To that end, this research study aims to empirically uncover how these hidden truths about gendered racism are reified for Black girls in their day-to-day school experiences in mathematics. We can consider how math spaces can be sites of suffering for Black girls, and we can think about how the disciplinary norms reproduce practices that are tacitly “anti-Blackgirl”; both as ways to theorize more humanizing approaches to mathematics teaching and learning. Findings from this study are instructive for all students and the spaces we create to recognize and nurture their brilliance—what I will

call “social place” and “intellectual value” —in mathematics classrooms. Findings from studies on math learning show the importance of leveraging student-teacher, student-student and student-content interactions to bolster the achievement and socialization of Black girls (Young, et. al 2017).

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Chapter 3: Research Design

Pilot Study

Prior to detailing the methodological approaches for this study, I would like to describe the pilot study that informed the design outlined in this chapter. I conducted a small-scale pilot study with eleven 11th grade girls who identified as Black and female. The pilot study data was gathered while working with students and teachers during a weekly Saturday seminar called Black Girl Brilliance that I created to provide a safe space for Black girls to learn math, increase their math performance on the SAT, and acquire tools to cope with day to day stressors. I selected female math educators with whom I had worked in the past and whose pedagogy and practice were grounded in what Martin (2009) articulates as axioms of brilliance. In other words, the math educators who facilitated instruction understood that Black girls are brilliant and they were invested in ensuring their success.

I was not surprised at the level of focus that students sustained for the two-hour math block, but I was amazed by the synergy that permeated the space. When I noticed that there was something incredibly powerful and positive happening during the sessions, and students' feedback confirmed the benefits of the program design and offered direction that was tailored to their strengths and needs; I began collecting data on their experiences. This included their experiences in and out of the program, their perceptions coupled with my observations of the range of teaching-learning interactions related to content, peer relations, and classroom educators. I juxtaposed this data against recollections they shared about their elementary, middle and high school math experiences. Based on data from participant observations, student feedback, interviews

and focus groups, I began conceptualizing ‘Human Place Value’ as a useful and relevant framing to characterize the ways in which *being* in a Black girl body can be received or rejected in math spaces.

I use the term ‘human place value’ to conceptualize how students are either given or denied social place and intellectual value in math spaces, and I use participant data to illustrate how this occurs in racialized and gendered ways. Findings from the pilot study suggested that in K-12 math classes, Black girls face exclusion, marginalization, and other forms of oppression through encounters with teachers, content, and peers that socially displace and intellectually devalue them. Before discussing the design for the current study, I explain the ontological, epistemological and axiomatic underpinnings of Human Place Value.

Human Place Value

I trace the etymological origins of place and value to explain how this metaphor has utility in math education and research. In the early 1300s, it was used to in reference to one’s “position” on a social scale. Around the same time, *value* was used to determine “price equal to the intrinsic worth of a thing.” While *value* later took on meaning related to significance, utility, and moral worth, the original meaning of value points to an inherent and ‘intrinsic worth,’ an inner excellence or merit that is externally decided and constructed. I aim to uncover an interpretive experience where Black girls wonder and operate as related to the question: “How do I see myself as being a part of or excluded from this space?” . Further, studies that examine how Black girls are made to feel inferior and inadequate will be of use in theory and practice.

The epistemological underpinnings of ‘Human Place Value’ are grounded in Critical Race Feminism (CRF) (Evans-Winters, 2010, 2019). CRF is an intersectional framework that applies Black Feminist Thought (Collins, 2000) and Critical Race Theory (CRT) (Solórzano & Yosso, 2001) to the field of education with a particular focus on how race and gender uniquely shape learners’ lived experiences. Three tenets of CRF guiding this study and call attention to the realities and the states of *being* for Black girls’ education:

1. School based exclusion, marginalization, and other forms of oppression
2. Prevalence of negative perceptions about Black girls’ identities and abilities
3. Persistent threats to Black girls’ academic vitality, which renders them vulnerable to perpetual subjugation of their psyches and bodies

As I recorded my observations and reflections, I began to code the data for essential emotions expressed in the episodes that participants described. I then identified and organized themes into an ever-evolving framework of Human Place Value (Table 1). My thinking is simple. If we can learn from participants what actions, non-actions, attitudes and experiences contribute to or result in social (dis)placement and intellectual (de)valuation, then we can also identify ways to facilitate social place and demonstrate intellectual value for them in mathematics classes. The goal of this dissertation study is not only to illuminate multiple truths about *being* a Black girl in an urban math class narratively, but to build and operationalize a theory of Place Value, empirically and systematically.

Table 1. Preliminary Conceptualization of Social Place and Intellectual Value

Human Place Value			
Social Place		Intellectual Value	
Create social place by fostering	Don't socially (dis)place through	Do amplify intellectual value through	Don't intellectual (de)value by
Belonging Acceptance Approval Connection Access	Isolation Hostility Disdain Opposition Restriction	Respect Recognition Acknowledgement Accomplishment Opportunity	Minimizing Hindering Ignoring Overlooking Discouraging Failing

The identified themes informed the dissertation study and suggest that Black girls are particularly vulnerable to states of being that render them socially hypervisible, but intellectually invisible. This is evidenced in ways that students described socialization processes in mathematics classes, which include traditional structural and cultural norms that are commonly practiced in the domain. Structural norms such as within group and within school tracking practices position students in a hierarchy of ability (Martin, 2009). Students are positioned in and across math spaces in ways that reinforce race and gender hierarchies of mathematical ability. Dominant cultural norms within the discipline include invalidating students of color and their ways of knowing while creating space for dominant culture students to express mathematical ideas. Black girls are often constrained by disciplinary ways of acquiring, producing, and validating knowledge that do not necessarily lend themselves to ways of knowing that have been identified within

Black female epistemology. In terms of ontological and axiomatic understandings, findings from the pilot and the literature suggest that Black girls are afforded few opportunities to *be...to be* free and to *be* brilliant. I designed the dissertation study with this evidence in mind. This study leverages participant accounts to define the dimensions of social place and intellectual value with greater empirical and theoretical precision.

Guiding Frameworks

The purpose of this study is to document and examine how Black girls understand and describe their experiences in K-12 math classrooms. The study seeks to expand current understandings of why disparities in mathematics achievement and underrepresentation in related fields persist by exploring the following research questions:

1. How do Black girls face exclusion, marginalization, and other forms of oppression in their math classes?
2. How do Black girls identify and recognize negative attitudes and beliefs about their identity in mathematics classes?
3. How do Black girls respond to and navigate their experiences in mathematics classes?

These questions are important for understanding Black girls' experiences and identifying ways to improve their experiences. While some literature points to the resilience, coping strategies and protective factors Black girls enact, resisting racism, sexism and other forms of oppression is exhausting and leads to forms of battle fatigue. Black girls are members of a federally protected class because they routinely face injustices and indignities as a consequence of gendered racism. While teaching students protective

strategies is important, researchers and teacher educators have a responsibility and an obligation to provide scholarship and pedagogy that eradicates injustices and provides protection for vulnerable populations. In amplifying the stories of young Black females, this study contributes to existing scholarship that challenges the myth of a dominant narrative that Black children and girls are mathematically incompetent, and instead it illuminates the everyday barriers that limit their mathematical brilliance. Drawing from the individual and collective experiences participants share, I aim to build a theory of student place value that humanizes the teaching and learning of mathematics for Black females and other underrepresented groups.

Critical Race Feminism

This is a qualitative study guided by Critical Race Feminism (CRF), an intersectional framework that applies Black Feminist Thought (Collins, 2000) and Critical Race Theory (CRT) (Solórzano & Yosso, 2001) to the field of education with a particular focus on how race and gender uniquely shape learners' lived experiences. Stake (2010) suggests that a qualitative study is appropriate when the goal of research is to explain a phenomenon by relying on participants' rendering of experience. Because the purpose of this study is to examine Black females' mathematics experiences as lived, rather than observed or measured, a qualitative approach is the most suitable choice. By centering the voices of participants from an often-silenced group, this study aims to provide new insights to the barriers that constrain mathematical opportunities

Black Feminist scholars examine race and gender to highlight the interlocking nature of race and gender oppression, and to produce new knowledge about the ways in which these forces constrain Black females' sense of self-definition, valuation, and

identity in their day-to-day lives (Collins, 1986). Thus, within a Critical Race Feminist framework, lived experiences are central to Black females' identity development, reality, and life worlds. In the context of education research, Black feminist thought recognizes lived experience as a credible source of knowledge for theory and practice (Collins, 2009; hooks, 1991). Similarly, CRT in education acknowledges that the experiential knowledge of minoritized students is legitimate, appropriate, and critical to understanding, analyzing, and teaching about racial subordination in the field of education (Yosso, 2005). The research questions in this study allow for analysis using three tenets of Critical Race Feminism to examine Black females' experiences with exclusion and marginalization, and to identify the ways they to resist oppression, exercise agency, and create strategies for coping with hindering beliefs (Evans-Winters & Esposito, 2010). In education, one of the elements of critical race theory (CRT) that forms basic insights, perspectives, methodology, and pedagogy is the centrality of experiential knowledge (Solórzano & Yosso, 2002). Critical race theory recognizes that experiential knowledge is legitimate, appropriate, and critical to understanding, analyzing, and teaching about subordination. Similarly, within a Black Feminist epistemology, Collins (1999) and hooks (1981) argue that research and theory generated about Black women should emerge from their knowledge and experiences. I also draw on Black Critical theory, which specifically names anti-Blackness as a field of study in education research that provides the theoretical insights necessary to examine the issues of exclusion, marginalization, and oppression of Black bodies (Dumas & Ross, 2016).

In the sections to follow, I explain the methodological choices that guide this study, and I describe the pilot study that inspired this study. Profiles of the participants

and school contexts are also included to provide insight. In closing, I outline the methods for collecting and analyzing data.

Other Relevant Research Aesthetics

In addition to operationalizing tenets of critical race feminism for education research, Evans-Winters (2019) recently released *Black Feminism in Qualitative Inquiry*, a methodological guide for scholars to conduct research that centers the “concerns of Black women as researcher(s) and the researched” (p. 3). This handbook provides advanced and novice researchers with the tools for humanizing the research process, and it offers insights for liberatory approaches to collecting, analyzing, and representing data. Balancing traditional and non-traditional research approaches, Evans-Winters (2019) aims to help scholars effectively “breathe life into research participants’ personal histories and commentary in ways that emotionally connect the reader to the research subject at hand” (p. 3). She goes further to specifically name these processes as research rituals that characterize how to analyze data collected on ‘other people’s daughters’ and states, “Although Black women have always conducted research using qualitative methodologies, rarely are Black women given space to play with or theorize methodological moves in qualitative inquiry” (p. 1). As a Black mother, my educator and researcher lenses are informed by my relationships with and the lessons learned from my daughters. The experiential knowledge and skills that I have developed through parenting is similar to what the research enterprise would deem disciplinary or pedagogical content knowledge. In fact, education researcher, Max van Manen (2013), maintains that pedagogy itself *is* a practice of caring adult-child interactions—contact, and relations with practice in the caring contact of the adult-child relations.

This study was also inspired by research aesthetics and techniques found in phenomenology and narrative inquiry. These approaches examine participants' lived experiences (van Manen, 2016) and rely on their personal stories (Clandinin, 2006). Specifically, I draw methodological inspiration from narrative inquiry as an approach that: 1) pursues the epistemological aims of producing new knowledge and understanding of human experiences and 2) advances ethical goals of increasing empathy and compassion for those experiences (Clandinin, 2006). Storytelling, a natural part of social life, is recognized in narrative inquiry as a rich source of data (Clandinin, 2012). Similarly, phenomenology is the study of lived experiences. It is a search for what it means to be human and it aims to understand the meaning of everyday experiences (van Manen, 2016).

These approaches are consistent with Critical Race Feminism and Black Feminist Qualitative Inquiry (BFQI), where theory is rooted in experiential knowledge (Evans-Winters, 2019; hooks, 1991; van Manen, 2016). By examining participants' lived experiences and personal stories, this study aims to generate counternarratives that: a) humanize the experiences the unique and universal nature of Black girls' experiences, b) reflect multiple truths that discredit ideologies of racialized and gendered intellectual inferiority, and c) provide pedagogic insights that are instructive for theory and practice. Black feminist qualitative inquiry allows for the ethic of care and empathy in research (Evans-Winters, 2019). It acknowledges that Black females' narratives, perceptions and responses to the world are grounded in "Black women's sensibilities and onto-epistemologies" (Evans-Winters, 2019, p.3). An onto-epistemology is the central idea that what we research is entangled with how we research. It suggests that practices of

knowing and being are not isolatable, but rather they are mutually implicated. The onto-epistemologies to which Evans-Winters makes reference to include oral history, storytelling, and biography. BFQI honors multiple methodological approaches because it aims to articulate human experience, which is dynamic, and it insists that our (re)presentations and analysis of data are authentic renderings of participant accounts. Thus, it gives the researcher permission to resist formulaic methods of documentation or analysis of lived experience and provides systematic guidance for adopting narrative, prose, poetry, and performance to construct credible (re)presentations of data.

Designing the Study

Participants in this study are recent graduates of Allied Community Public Schools (ACPS)⁶. The study was conducted in Spring 2019, and it centers the math stories of 10 high school graduates who self-identify as Black and female. In both phenomenology and narrative inquiry, small sample sizes are encouraged to provide the researcher with time and space needed to provide in-depth accounts of participant experiences (Creswell, 2013). For example, a recent study on Black females' mathematical experiences utilized sample of 10 participants to allow for in-depth data collection through a one-on-one semi-structured interview process (Joseph, Hailu & Matthews, 2019).

⁶ The pseudonym for the school district in the study is Allied Community Public School System (ACPS)

Participant Selection

I used a combination of criterion and snowball sampling strategies to recruit participants (Creswell, 2013). Participants in the pilot study were instrumental in helping me to recruit young women who served as contributors to the formal research project. The young women in the dissertation study chose to contribute their stories after learning about the study from pilot study participants. Eligibility for the study required that participants were recent graduates of Allied Public Schools, 18 years or older, and self-identified as a Black female. My decision to invite graduates who were over the age of 18 was influenced by feedback I received from some of the young women in my pilot program who had participated in a study that gained attention locally and nationally. While the participants expressed pride in making visible the inequitable treatment Black girls experience in school disciplinary policies, they also described the discomfort of returning to schools where administrators confronted them about exposing a suppressed truth. As graduates of the schools, participants did not have daily engagement with the context they were discussing. Additionally, as young women who are 18 or over, they were either already attending college or headed to college, so their worldviews were maturing and they could likely offer reflections that were separate from their lived experiences in school at the time of the interviews. As graduates of Allied Public High Schools, participants in this study provide invaluable sources of expertise to guide research on urban education, mathematics education and teacher preparation.

Participant Profiles

I would like to offer a cursory introduction to the beautiful and brilliant young women who gave graciously of their time and energy to recount their experiences while learning mathematics, some of which were painful and some that were empowering. To do so with fidelity, I have dedicated a separate chapter to them, which will provide a great segue to and context for the findings. In chapter 4, I discuss profiles of the school contexts and study contributors, and I explicate the deliberate and intentional framing of participants as beautiful and brilliant. As a precursor, however, I provide an overview of participants' academic profiles to highlight their intellectual excellence and scholarly achievements. Before conducting each interview, I gathered basic demographic information about participants' academic performance, school history, home life, personal attributes and aspirations. Table 2 displays a summary of information about the high school from which each participant graduated, their cumulative GPA, math SAT score, math coursework and the college they attend.

Table 2. ACPS Participant Profiles

School	Participant	HS GPA	Math SAT	Highest Math Course	College
City HS (CHS)	Taylor	3.6	580	GWU early college program	Associates from GWU University of Pittsburgh Psychology & Communication Rhetoric
	Carter	4.01	640	AP Stats & AP Calculus	Syracuse, Film & Media Communication
Adams HS (AHS)	Dakota	4.01	520	Honors Precalculus	Pratt Institute Fashion Design
	Jazzie	2.7	530	Probability & Statistics	St. John's College Psychology
	Sage	3.2	540	Probability & Statistics	North Carolina Central Nursing and Midwifery
	Celia	3.3	450	Probability & Statistics	George Mason, Communications
Jo Baker HS (JBHS)	Ola	3.3	530	Precalculus	Hawaii Pacific, Film, Multimedia Production
	Billy	3.9	500	Honors Precalculus	Emerson, Boston Marketing & Communication
	Kennedy	3.3	470	Probability & Stats	Clark Atlanta University, Journalism & Mass Media Communication
	Assata	3.4	450	Probability & Stats	Fashion Institute of Technology (FIT) Photography & Language

Four Carnegie units of high school math are required to earn a standard diploma in Allied Community Public Schools. These courses must include Algebra I, Geometry, Algebra II or equivalent and a mathematics course designated as upper level.” What I

hope to show through repeated references to participants' accomplishments is that these young women demonstrate excellence in and out of the classroom. Not only do their GPAs, math SAT scores,⁷ and post-secondary fields of study suggest that they are academically on par with or performing above the local and national averages, but their additional areas of expertise, their extra-curricular activities, hobbies and talents, their organizational affiliations, and accumulation of accolades demonstrate their orientation to excellence, service, and active community participation. While they all self-identify as Black and female, they also insist on defining themselves for themselves to truly illuminate the unique qualities and contributions they bring to their schools, families, and communities. Their voices and insights offer critical wisdom for pedagogy and practice in mathematics and urban education. In the remaining sections, I outline the methodology for collecting, organizing, and analyzing data.

⁷ The national average for math SAT score in 2019 was 527

Methods

Critical race theorists view experiential knowledge as a strength and draw explicitly on the lived experiences of people of color by including such methods as storytelling and narratives (Solórzano & Yosso, 2002). Using personal accounts can expose deficit-based research methods that distort the racialized and gendered experiences of Black females and serve as rich sources of knowledge (Solórzano & Yosso, 2002). Creswell (2013) argues that stories and accounts of personal experiences can be analyzed to reveal experiences with and responses to oppression, marginalization, and exclusion.

Historically, Black female intellectuals have documented and analyzed educational accounts at the intersection of race and gender to expose injustice and advance equity-oriented solutions. The methods of data collection and analysis that I use are informed by Black women's intellectual traditions and represented through an assortment of stories, anecdotes, examples, artifacts, and memories. I have analyzed and assembled the recollections participants shared in this study to uncover patterns in an effort to illuminate what it can be like to be Black and female while learning mathematics. The data are not representative of all Black females' experiences in math. There are many stories of success and persistence in the literature. The young women in this study, in many ways, demonstrate success and persistence. This research, however, emphasizes an understudied aspect of Black girls' math experiences. Though the sample size is small, the new knowledge and understanding about disparities in mathematics education that emerge through the process of using this data to build the theory of Human Place Value remain significant. The theory of Human Place Value remains informed by

participants' lived experiences in the context of Critical Race Feminism and the principles of Black Feminist Qualitative Inquiry (BFQI).

Data Collection Procedures

Data for this study were collected through a background questionnaire (Appendix A) and a one-on-one, semi-structured interview (Appendix B) with each participant. The background questionnaire ensured that relevant identifying information about each participant was accurate, and it provided helpful background information to conduct the one-on-one interviews. I gathered quantitative data on participants' GPA and math SAT scores, and most importantly, I learned about participants' personalities, interests, and experiences. This helped me to establish rapport with each young woman, and it demonstrated an ethic of genuine care, interest in, and value for their contributions to the study. The background questionnaire was an effective segue to the interview which began simply with "Tell me how you feel about math and why?" For some participants, this question was sufficient and elicited a life history of math experiences Prek-12. For others, the semi-structured interview design prompted participants to recall specific accounts of their lived experiences as Black females in the context of learning mathematics. The protocols gave me the flexibility as a researcher to begin the interview using conversational methods (van Manen, 2016), but to ask participants specific questions as needed. Each interview closed with participants offering their do's and don'ts in the teaching and learning of mathematics, especially as it pertains to Black girls.

Each interview was audio recorded using the dictate2us voice capture and transcription application. Each audio-recorded interview was subsequently named and dated with a pseudonym and stored in a digital folder on a secure external hard drive. All

files within the folder (consent form, background questionnaire, interview audio recording, transcript, memos) are similarly labeled by pseudonym and date. Initial interview transcripts were generated by the dictate2us software application. I utilize the Framework Method, a seven-stage process, to describe the bridge between data collection and analysis. Borrowing from multiple qualitative traditions, I aim to develop a theory of Human Place Value, and I the seven stages of the Framework Method to facilitate the analysis process.

Data Analysis

Analysis in qualitative research aims to provide an explicit rendering of patterns found within and across cases (Flick, 2013). The process of qualitative data analysis involves organizing the data, conducting a preliminary read-through of the database, coding and organizing themes, representing the data, and forming an interpretation of the data (Creswell, 2013). In Black feminist qualitative inquiry and data analysis, socialization, identity, and epistemology are considered with respect to decisions about what gets told and how it is represented (Evans-Winters, 2019).

BFQI aims to acknowledge and carefully address the dilemmas inherent in decisions related to applying inclusion and exclusion criteria. In a study that highlights the injustices of exclusion, I am faced with determining what aspects of participant experiences will be included when writing the findings from the analysis. I recognize that human participants have a totality of experience, and the researcher's rendering is but one interpretation of extrapolated data. The purpose of a singular rendering is to illuminate the essence of experience.

The Framework Model (Gale et al., 2013) was useful for structuring the data analysis process in this study. Gale et al. (2013) explains that this approach is of value to scholars, particularly novice researchers, who aim to generate themes by making comparisons within and across cases. The Framework Method is considered appropriate for thematic analysis of textual data, particularly interview transcripts, where it is important to compare and contrast data by themes across many cases, while also situating each perspective in context by retaining the connection to other aspects of each individual's account. The seven-stage approach helped me to explicitly delineate my analysis process and produce credible and relevant findings.

Stage 1: Transcription

Initial transcripts of the interview recordings were automatically generated by the dictate2us application. To ensure that the transcripts reflected an accurate and verbatim textual version of participants' accounts, I read each transcript and corrected them as needed, cross-referencing them against the audio recording. Accuracy of the data were confirmed through a member check where the I followed up with each participant to verify or amend the transcript and accounts that were shared during the interview.

Stage 2: Familiarization

After transcribing audio files into textual transcripts, I read of the transcripts to become familiar with the overall narratives of the participants. While becoming familiar with each participant's narrative, I recorded my initial notes, questions, insights and interpretations. In qualitative research, this process, also referred to as memoing, is a strategy that bolsters reflection and inquiry (Huberman, Miles & Saldana, 2014). It helps

the researcher process the data, explore its meaning and “synthesize [it] into a higher level” (Miles, Huberman, and Saldaña, 2014, p.95) that allows for the coding process. Memoing complements systematic analysis because it leads to code development, documents the evolution of ideas over time and makes visible the reflective thoughts that emerge across cases. It is a qualitative research technique that researchers use to create, dissect, and analyze codes. I used memoing to develop and strengthen codes, some of which emerged from the pilot study (DP for displacement and DV for devaluation) and others that emerged during this preliminary stage of engaging with the data (for example HOS for hostility and visual codes or emoticons that represented reports of sadness, crying, anger, fear or frustration). The process of memoing is an iterative means of constantly engaging with data through an ongoing process of (re)familiarization, coding, and re-coding the data to clarify understanding of and deepen meaning that resides in the data.

Stage 3: Coding

Two core elements of qualitative data analysis include coding the data and combining the codes into broader categories or themes. Coding transforms statements to analytic interpretations. It is an iterative process that involves reducing the data into meaningful segments and naming those segments to assign significance (Huberman, Miles & Saldana, 2014). The goal of this process is for the researcher to condense codes into overarching themes essential to participants’ experiences. I describe the iterative process of combining, sorting, categorizing, and refining the data as ‘coding sweeps.’

The first coding sweep was rather informal, and it was informed by coding approaches in qualitative traditions, which facilitate theory building. I used a

combination of inductive and deductive codes to identify data that was salient to the research questions. For example, I closely examined fragments of data within each case. In this study, I use the term ‘soundbyte’ to identify fragments of data in the form of words, lines, segments, and incidents. During the familiarization stage, I informally used an open-coding approach to allow new ideas to emerge. While this approach was flexible, it also acknowledged that as a researcher, I may hold prior ideas about the phenomena; and I engaged with the data through inductive or preliminary codes informed by the pilot study. The provisional nature of initial codes, however, permits revision, and they are tailored to the data collected within the context of the study phenomena. This approach helped me to identify what was both abundant and lacking in the data. Equally important, initial coding encouraged me to begin analysis from the participant’s perspective. The idea with initial coding approaches is to create codes that get as close to an insider’s view of experience as possible (Charmaz, 2006).

During the second coding sweep, I used focused coding to synthesize and explain larger segments of data (Charmaz, 2006). The first set of codes were informed by the research questions, and I used them to formally code soundbytes that illustrated/revealed instances of exclusion, marginalization, and oppression (EXCL), negative attitudes or beliefs (NEG), and strategies participants used to cope with these instances (COP). After additional sweeps of sorting and categorizing, I noticed that there was a broader category of responses that included various responses in the form of action and non-action. The predominant emergent codes identified in this sweep were EXCL, NEG and RESP. The next step in the coding sweep was guided by the instructional triangle (discussed in Chapter 2). I coded soundbytes for student-teacher (ST), student-student (SS) and

student-content (SC) interactions. I then organized the coded data into a 9 x 9 matrix that arranged instances of exclusion⁸, negative attitudes⁹, and student responses¹⁰ by student encounters with teachers, classroom peers, and mathematics content across all ten participants. This preliminary analytical framework provided a working structure to manage the cross-case comparisons needed to identify and define emergent themes.

Stage 4: Developing a Working Analytic Frame

After conducting multiple coding sweeps using the guiding frameworks for the study, the 9 x 9 matrix illustrated below provided a useful working framework to further analyze the data. It shows the intersection of CRF tenets and Instructional Triangle dimensions (Herbst & Chazan, 2012; Loewenberg Ball & Forzani, 2009), and it further organizes the data in a way that made visible emergent themes of social place and intellectual value, which are discussed in stage 6.

Table 3. Initial Coding Sweep

	Student-Teacher Interactions (A)	Student-Student Interactions (B)	Student-Content Interactions (C)
RQ1	1A	1B	1C
RQ2	2A	2B	2C
RQ3	3A	3B	3C

⁸ Research Question 1: How do Black girls' experience exclusion, marginalization and other forms of oppression in math class?

⁹ Research Question 2: How do Black girls recognize and identify negative attitudes or beliefs about their abilities and identities?

¹⁰ Research Question 3: How do Black girls respond to and navigate their experiences in math classes?

The data in the first row of cells provides rich evidence of Black girls' experiences with exclusion, marginalization, and other forms of oppression in mathematics classes. Data in the second row illustrates the various ways negative stereotypes and ideologies surfaced in teaching and learning interactions. The third row of data captures Black girls' various responses to the social (dis)order in math contexts that attempted to dehumanize and oppress them (Evans-Winters, 2019). The columns organize the data by students' interactions with teachers, peers, and content. I conducted additional coding sweeps to code data in each of the nine cells for instances that illustrate social (dis)placement and intellectual (de)valuation. I specifically focused on identifying these instances in direct response to the research questions that guided the study. In the following section, I detail my procedures for applying the analytical framework and refining these broader conceptual codes.

Stage 5: Applying Analytical Framework

After sorting the data into a 9 x 9 matrix using CRF tenets and IT dimensions, I borrowed a technique from grounded theory called advanced memoing, and I applied the technique to each cell to refine the broader conceptual categories into subtopics.

Advanced memoing is a technique in grounded theory used to cluster data by codes or emergent patterns and further define the properties to reveal empirical strengths in the data (Charmaz, 2006). Through this process, I identified more than forty specific cross-case issues that show, in the context of being a Black girl in a mathematics class, experiences with disrespect, disregard, and hostility are normal and routine disciplinary customs. This analytic step uncovered common patterns in the codes that yielded

analytic concepts. I then defined these issues using participant quotes to articulate the properties of the problems and conditions by which they occurred. I applied this process to each of the nine cells illustrated in stage 4. Table 4 illustrates this process applied to cell 1A and the results it yielded.

Table 4. Cell-by-Cell Conceptual Refinement

	Student-Teacher Interactions (A)
<p>RQ1</p> <p>How do Black girls face exclusion, marginalization, and other forms of oppression in their mathematics classes?</p>	<p>Student Experiences</p> <ul style="list-style-type: none"> • Being made a spectacle or unfairly targeted • Being ignored, dismissed or instructionally neglected • Being denied support empathy and/or encouragement <p>Teacher (Dis)positions</p> <ul style="list-style-type: none"> • Focusing on social v. intellectual attributes • Treating students differentially/inequitably • Having an unproductive, unwelcoming, disposition
<p>Defining characteristics and properties of Social vs. intellectual reinforcement:</p> <p>Differential treatment (maltreatment) in the form of inequitable praise and punishment)</p>	<p>STUDENT EXPERIENCES:</p> <ul style="list-style-type: none"> • Being made a spectacle <p>Examples</p> <ul style="list-style-type: none"> • Being negatively singled out for talking, asking questions, or for some so-called behavioral infraction • Being embarrassed or publicly humiliated, especially for not knowing or understanding <p>Quotes</p> <p><i>“He’d say, ‘Look who’s coming in late,’ and if I apologized and Said, ‘I’m sorry.’ he’d be like, ‘you’re not sorry,’ and he’d try to like joust with me over being late.”</i></p> <p><i>“Whenever I didn’t understand he’d go on a rant like, ‘you should know this, everybody else knows it, it’s not my job to teach that, that’s why this is an honors class’.”</i></p> <p><i>Sometimes I’d ask a friend and he’d say, “You must have the answer since you are talking so much.”</i></p>

I then used axial coding to reassemble the data into clear and coherent instances of social (dis)placement and intellectual (de)valuation. Axial coding aids the researcher in identifying thematic relationships after fragmenting the data through focused coding

(Charmaz, 2006). In this study, axial coding was an effective strategy to make the emergent themes visible. By coding the categorical data for social place (SP) and intellectual value (IV), three specific themes of visibility, positioning, and knowledge production emerged. These became the pillars for the theory of Human Place Value.

Stage 6: Charting the Data

Axial coding helps the researcher identify relationships between categories on a conceptual level rather than the descriptive level. This allows the text to be converted into analytic abstractions (Charmaz, 2006, p. 61). The three concepts or themes of visibility, positioning, and knowledge production specify the dimensions of social place and intellectual value, the broader categories of human place value. Table 5 below illustrates the analytic frame that emerged from this process and the sub-themes that were identified within each cell.

Table 5. Analytic Frame for Social Place and Intellectual Value

Themes	Social Place	Intellectual Value
Visibility	Social Hypervisibility * <i>being</i> made -a spectacle -a bull's eye -an object of antipathy	Intellectual Invisibility *Hidden Figure *i ² : imaginary ineptitude - <i>being</i> actively ignored - <i>being</i> instructionally neglected -feeling intellectual intimidated
Positioning	Allies & Accomplices	Angels & Idols Antagonizing Archetypes
Knowledge Production	Opportunities to Learn (OTL)	Packets as Pedagogy Curriculum as Punishment

I used axial coding to further unpack these categories and sub-categories. I used diagramming to integrate and link relevant categories to form a substantive theory of action. To make these links visible, I grouped participants' statements into components of an organizing scheme to address:

1. *Conditions*—the circumstances or situations that form the structure of the studied phenomena
2. *Actions/interactions*—participants' routine or strategic responses to issues, events or problems
3. *Consequences*—outcomes of actions/interactions

The axial coding in this study provided a framework for developing the theory of human place value. The interrelated process of sorting, categorizing, and integrating is reflected

in Figure 1 below, where the data is charted into a sampling of theoretical concepts and themes.

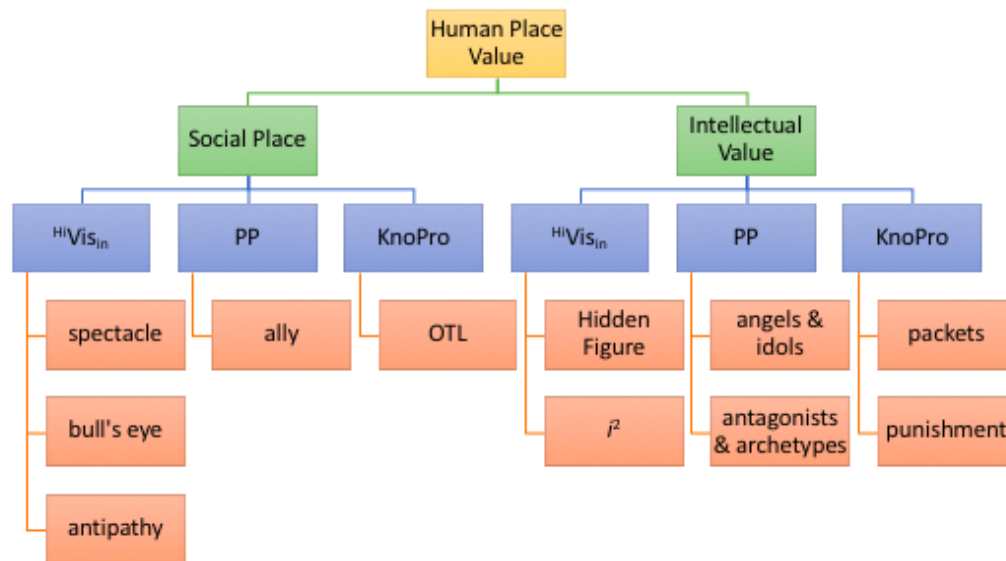


Figure 1. Developing a Theory of Human Place Value

In Chapter 4, I describe the emergent themes of visibility, positioning, and knowledge production in the context of this study, and I detail their properties using data from the eleven related dimensions of experience within each sub-category. The diagram above depicts Social Place and Intellectual Value as comprised of the three above mentioned themes, respectively with the dimensions of being made a spectacle, being a target or bull's eye, being the object of antipathy, having allies in class, diminished opportunities to learn, being a hidden figure in mathematics knowledge production, experiencing imagined ineptitude, navigating stereotypes and archetypes, worksheets and packets as teaching and learning and what Milner (2018) describes as curriculum as a form of punishment.

Stage 7: Interpreting the Data

Within both grounded theory and phenomenology traditions, interpretive understandings and renderings are truly about entering research participants' worlds through their lived experiences (Charmaz, 2006; van Manen, 2016). The goal of this research study is not only to educate teachers, researchers, and policy makers about routine injustices and inequities in mathematics education, but to humanize Black girls' experiences in mathematics in order to preserve their human dignity even if there are additional questions about their perceptions.

Interpreting the data with integrity involved multiple rounds of reflection where I asked myself:

- Have I collected enough background data about persons, processes, and settings to understand and portray the full range of contexts in the study?
- Have I gained detailed descriptions of a range of participants' views and actions?
- Do the data reveal what lies beneath the surface?
- Are the data sufficient to reveal changes over time?
- Have I gained multiple views of the participants' range of actions?
- Have I gathered data that enabled me to develop analytic categories?
- What kinds of comparisons can I make between data? How do these comparisons generate and inform my ideas?

Interpreting the data required a balance of discipline and discernment. This process required me to have the discipline to identify and set my own assumptions and preconceived notions about the phenomena aside, and it required the discipline to discern and discover meanings that resided within each participant's story.

To achieve a sound interpretive understanding and to produce a high-quality interpretive rendering of the data, I conceptualized the data and findings using the interpretive metaphor ‘Human Place Value’. Metaphors enable qualitative researchers to borrow ideas from one domain and apply it to another or assign new meaning to it as well as to effectively listen through insider researcher positionality (Hammersley & Atkinson, 1995a; Hammersley & Atkinson, 1995b). In phenomenological investigations, metaphors help researchers provide an interpretive rendering of experience. Going back to my research question, I propose to re-conceptualize numeric “place value” as a way to conceptualize the ways in which Black girls describe and understand their experiences in urban mathematics classes. In the discussion section of this study, I will explore if and how participants’ experiences can be understood in terms of the social place assigned and intellectual value ascribed to them in their mathematics teaching and learning experiences. This interpretive rendering aims to capture and conceptualize the “essence” of the experience and represents the culminating aspect of the study. It is typically a long paragraph that tells the reader “what” the participants experienced with the phenomenon and “how” they experienced it (i.e., the urban school context).

Limitations & Considerations

As with any study, there are considerations for the limitations of the research agenda. This research requires me to elicit, interpret, and represent participants’ experiences and identify from instances of racism, sexism, and other forms of oppression without projecting any preconceived ideas or assumptions that I may bring to the collection or analysis of the data. My positionality as more of an insider versus an outsider certainly allowed me to notice and name patterns in ways that have yet to be

introduced in urban mathematics education discourse; and in this way, producing such new knowledge is a strength of Black feminist epistemology. In some cases, I had to conduct multiple iterations of coding and sorting data during analysis to ensure that I was truly moving from “me-search” to rigorous “research.” Though I acknowledged earlier in the chapter that knowing and being are entangled, traditional research pressures me to acknowledge this reality.

While I can identify a number of limitations, such as scope and scale of this project, including the fact that I am a single researcher collecting and analyzing the data, there are many benefits to consider. In fact, Venus Evans-Winters (2019) recently introduced *daughtering* as a methodology that embodies an ethics of love (hooks, 2000), and in discussing my research, she reminded me of the advantage within some of these limitations. She notes that in institutional research protocols, emotionality is discouraged if not forbidden but that *daughtering* as a methodology “comes with no manual or moral handbook” and exists in covenant between female child and adult caregiver.

I believe that in using Black feminist qualitative inquiry to conduct this study, limitations become less important to the discourse than the possibilities that are unveiled over the course of the project. I do aim to minimize conflating my researcher perception with participant experience through member checks where I confirm with participants the accuracy of my interpretation. In addition, this is a relatively small sample and not intended to be representation of or to essentialize all Black females’ mathematical experiences. Rather, this research aims to provide new directions for the discourse on Black females’ mathematics outcomes by critically examining their experiences within the teaching and learning process. This study acknowledges that participants’ experiences

are offered as authentic and valid perceptions, and that there are other aspects of the context that could be studied and used in triangulating the data. This study acknowledges that there are many methodological approaches and interpretive frames, and that this is an example of one way to investigate gendered racism in mathematics. In the appendices, I include the background questionnaire and the semi-structured interview protocol.

Chapter 4: Context & Contributors

Profiles of School Contexts

The ten participants who contributed to the study graduated between 2017-2019 from one of three urban high schools located in a mid-Atlantic school district. Allied Community Public Schools (ACPS)¹¹, a district that spans grades Pre-Kindergarten through 12 and had approximately 48,000 students enrolled during the 2017-18 school year. Serving predominantly Black students and families, 60% of those students were identified as Black, 20% Hispanic, 15% White, and just under 5% were identified as Asian, multi-racial or other during from 2017 to 2019.

Of the 21 secondary schools in ACPS, the schools from which contributors graduated are in high demand for their program offerings, academic enrichment, and extracurricular activities. Graduates of City High School, Jo Baker High School, and Adams High School are attractive candidates for top universities and colleges in the country. Participants, therefore, not only attended highly selective schools in the community, they demonstrated excellence in their academic performance and extracurricular activities.

Though this study de-emphasizes standardized tests as a lens through which student outcomes are interpreted, Allied Community Public Schools' performance data warrant discussion, given how poorly minoritized learners are portrayed in discourses on mathematics achievement. PARCC assessment data in mathematics during those two years indicates that 26% of students were "on target for college and career readiness," while nearly three-fourths of the student population was underprepared for post-

¹¹ All references to schools, school districts and participants are pseudonyms

secondary college and career pathways. The average math SAT score in Allied Community Public Schools was 442 during the 2016-17 school year, 447 during the 2017-18 SY, and 454 during the 2018-19. The average math SAT scores in the community were well below the national average. Some would argue that there is a correlation between students in the community performing poorly in mathematics, writ large, and students served by ACPS predominantly identifying as minority. What this study aims to interrogate is the storyline of Black female underachievement and demonstrate that it is an incomplete and distorted rendering that reifies notions of racial and gendered intellectual inferiority.

School Profiles

City High School (CHS)

Two participants attended CHS. Ranked one of the top schools in the nation based on standardized test performance, graduation rates, and college-prep programming, CHS is one of six selective admission schools in the community. It is known for its magnet program and early college program partnership with a local university. The school has approximately 600 students, 31% of whom identify as Black.

Adams High School (AHS)

Four contributors attended AHS. AHS is the largest, most diverse public high school in the ACPS. At the time of the study, approximately 1829 students were enrolled in the school; 32% identified as Black. Located in an affluent area in the city, Adams is a boundary-only school that admits students based on zip code or feeder school affiliation.

Jo Baker High School (JBHS)

Four contributors attended Jo Baker High School. JBHS is a selective admission school with eight majors across visual, performing, and media arts. Baker is a high demand arts school that prides itself on pre-professional training and college preparatory academic programming. The school has approximately 571 students, 74% of whom identify as Black.

Allied Community Public School District Geohistorical Context

As participants talked about their schools and shared their experiences in mathematics classes, it is important to make note of the undertakings getting to and from school and having friends across the city involved. The Allied Community is divided into four quadrants that consists of eight wards and over a hundred unique neighborhood contexts. Whether traveling from Southeast to upper Northwest or just a few miles across Rock Creek park for school, participants experienced sexual harassment and police surveillance. Likewise, they witnessed violence and substance abuse, and they were exposed to a great deal of toxicity before they even reached the doors of their schools, two of which were guarded by metal detector entrances. Not only was the commute long and far for some of the participants, but it was exhausting mentally, spiritually, and emotionally. As educators, how familiar are we with what it is like for our students before they walk into our classrooms. While they all lived in peaceful and stable home environments, navigating cross-community contexts could involve enacting multiple identities, none of which could ensure safeguard from racial hostility or sexual aggression. Such contexts do not make invisible the suffering and poverty that plagued

particular neighborhoods. While Black girls enact protective strategies to survive in and out of school, these means of coping do not change the reality of or inoculate one from *being* in a Black girl body. This is evidenced in the ways the young women in the study spoke of the environmental conditions and challenges they faced navigating the commute to and from school.

Profiles of Study Contributors

Carter (CHS '18)

Carter described herself using multiple identity markers. She identified as a Black female and an African American who is part of the diaspora, and. Carter stated that she offered:

“I am grateful that I am a Black woman...the legacy...the history...understanding struggle and who we [Black women] are because of that...just existing...especially in white spaces...is special. The knowledge and wisdom that we have (in any field) to offer is unparalleled.”

Carter emphasized, however, that her spiritual identity is most salient in her life. “I’m Christian. That is a big part of my identity.” She described how her career passion shifted from math to media because she wants to raise multicultural awareness and advocate for social justice through interfaith community work. Carter was the oldest of three. She stated that “being an older sibling has made me detail oriented” which helps in school. She described herself as an “energetic, passionate person” who does well in school and “cares a lot about morals.” She said, “I am technically high achieving... I get As... but it’s not about the grades it’s about doing my best, I do well to please myself and my family.” Cart enjoys cooking and her family was known for hosting cook offs so that she can have fun with her friends. She sewed, knitted, and crocheted, and she enjoyed

outdoor activities like kayaking, walking, and biking. Carter added joyfully, “I’m a pretty weird person...a lot of things interest me...I love to learn.”

Carter traveled abroad, and was chosen to serve in Argentina for a highly selective study abroad program. Her father, a former principal in the school district, is currently a program analyst in city government. Her mom is a real estate agent and an impressive homemaker. I had the pleasure of talking with Carter’s mom at length after our interview, and she provided a great deal of insight that I could relate to about what it is like to be a Black mother raising academically excellent children. Carter, who stated, “I actually love math, and in my junior year [of high school] I was planning to go into math in college.” Carter graduated from CHS with a 4.01 GPA. She is currently pursuing a Bachelor of Fine Arts in Film at Syracuse University, a private research institution in New York. Carter said that she decided to pursue her passion for multimedia studies, and that being at a predominately white institution where she “literally has to clean up behind white people” for her work study assignment at the dining hall gives her more motivation to expose race and gender inequality in our society.

Taylor (CHS ‘18)

Taylor described her race and gender identities using African American female and Black female interchangeably. Some of her greatest personal attributes include a heightened awareness of and sensitivity to others. She indicated that in addition to being extremely empathetic, she is “detail oriented and family oriented.” Taylor is the youngest of three children in a family where both her mother and father had children from previous relationships. Without prompting, Taylor shared, “I have always prioritized education because of my ancestors. My ancestors didn’t have access to education. I am a first-

generation college student. My dad is an electrician, and my mom is a research specialist for the federal government.” Taylor, as a first-generation college student and a Black female, had strong cultural and historical motivators to achieve at high levels. Her extracurricular interests and talents also revealed a level of strength and endurance that bolstered her excellence. Her involvement with the crew team demonstrated her abilities to achieve physical and mental balance, group synergy and command of waterway science. Taylor enjoyed writing for pleasure in the form of journaling, freewriting prose, and poetic expression.

Taylor graduated high school with an impressive 3.6 GPA, which reflected her dual enrollment in both a high performing magnet program and the partner University’s early access program. Taylor took a full-time college course load each semester of her junior and senior year while completing her high school graduation requirements at CHS. During her enrollment in the program, she took two college level mathematics courses and earned an Associates of Arts degree. Since graduating, Taylor has been studying Psychology and Communication Rhetoric at The University of Pittsburgh. She has pledged membership to a sorority, joined a club to support cancer research, participated in a number of athletic endeavors, and remained involved with crew.

Dakota (Adams HS ‘18)

Dakota self-identified as a Black (afro-Latina, biracial) female. She is a talented visual artist who described herself as “an empath seeking answers to questions bigger than myself.” She said that while she is an artist at heart, she has always been interested in social issues. She grew up with her “black Cuban father, white Spanish mother, and Peruvian nanny.” Dakota has a younger brother, older sister, and two additional sisters.

She is bilingual and well-traveled. Her mother, who was an extremely knowledgeable and a passionate advocate for Dakota's mathematics education works at the Pan American Health Organization. After graduating from high school with a 4.01 GPA, Dakota began studying art at Pratt Institute in New York City. She planned to take a gap year to travel and get in touch with her aspirations, which she said included, "Peace of mind and making a positive impact on something bigger than myself."

Jasmine aka Jazzie (Adams '19)

Jazzie identified herself as a Black female and woman, and emphasized the importance of these identities in her life.

"That has really shaped who I am, how I act in certain settings...some people are intimidated by it. When I walk into a room, you know...I have a certain *je ne sais quoi* and people are intimidated by my confidence and my greatness and you know...just my excellence."

Jazzie's presence wonderfully commanded attention when she comes into a space. As Jazzie described herself and the way she is perceived by others, she noted that she often has to adjust her personality. She remarked, "I know there is a narrative that there is an anger [among Black women], but [when there is an issue] I try to talk and have a conversation because I am very diplomatic." She saw herself as having a good sense of humor, a kind and caring heart and a pleasant disposition. She is well traveled, having numerous international experiences in Brazil, South Africa, Dubai, Australia, Germany, Monaco, Italy, France, and the United Kingdom. Jazzie is a singer who loved to paint and express herself through her beauty and fashion choices. Her father was a real estate developer and her mother works mom worked for the federal government. Jazzie

graduated with close to a 3.0 cumulative GPA and is currently studying psychology at St. John's College.

Sage (Adams '18)

Sage demonstrated a fun-loving, spirited disposition. She was vibrant and full of life, literally lighting up the room when she walked into it. She self-identified as a Black female and described herself as “pretty outgoing, pretty nice, talkative and caring.” She is a dancer who was in a dance company that performed ballet, African, modern, jazz, hip-hop, and other genres in which students expressed interest. She also played lacrosse and enjoyed making wigs. Her mother was a respiratory therapist and her father was a cybersecurity specialist. Across both parents, Sage had a total of three younger sisters. Sage graduated from high school with a 3.2 cumulative GPA, and is currently studying Nursing at North Carolina Central University. Sage specialized in midwifery, the science of women's health and reproduction. She aspired to provide compassionate and competent care to women for sexual health and mothers before, during, and after childbirth. A fantastic fact I learned about Sage is that she was a talented hair stylist who was constantly engaged in self-education about the chemistry of hair as a natural polymer, making her own wigs, and the mathematics embedded in production of synthetic and stylish hair products.

Celia (Adams High School '18)

Celia self-identified as an African female and noted that she usually does not say “Black” because her family is Senegalese and that has given her a stronger cultural foundation in her African identity. She said that when people see her, they assume that

she is African American/Black and that sometimes African American/Black people express a great deal of negativity, hostility, and stereotypes about African people. When I asked Celia to tell me about herself, she described her family and her parents' style of childrearing. "My parents are really strict because they are African, and they have a different culture." Celia shared that they were very protective and that they only wanted to make sure she was safe and focused on her education. Celia had a brother and a sister, and they had a very close-knit family. Celia described herself as caring, energetic, and funny. Celia was multilingual, having a command of English, French, and her native tongue.

As we talked, Celia realized that she did not really have hobbies outside of studying and spending time with her family. She said she liked to paint her nails and explore new types of nail polish, but she said she has been thinking about getting into YouTube because she really enjoyed editing videos. Celia's mother owned a hair salon, and her father worked in construction. Celia graduated with a 3.3 cumulative GPA and is currently studying Communications at George Mason College. She was unsure what career path she would like to pursue, but she shared, "I know I want to be financially self-sufficient, so I will definitely go to grad school."

Assata (Baker High School '18)

Assata self-identified as a Black woman, and when I asked her to tell me a little bit about herself she shared,

"I love to learn...I love engaging with knowledge. I'm really respectful and considerate of others' feelings. I love using my hands to create. I love doing hair

and makeup. I love reading, making jewelry, and listening to music. I love being able to document and journal what I think and feel.”

With all of the things Assata loved, it was not surprising that she was chosen to attend the highly selective arts school Jo Baker High as a Literary Media Communications major. I sensed such gentle humility in Assata’s disposition, so I asked her to tell me what other people said about her. She smiled and replied, “They say I’m amazing, I’m helpful, I’m respectful, I’m thoughtful and I’m loving and very organized (laughs).” In addition to making jewelry, Assata enjoyed photography and documenting things on the street or abroad, especially body language and image. Assata has traveled to South Africa, Amsterdam, and Mexico. She had three siblings, a 10-year-old sister, a 16-year-old brother and a 21-year-old sister who is also in college. Her mother worked at the esteemed National Institute of Health and her father was a chef. Assata shared that as Black women, “we can be assertive and talkative” but that she preferred more personal one-on-one interactions instead of public speaking. When I asked Assata about her academic identity, she remarked,

“I would consider myself as academically excellent. I’m always working as hard as I can at any given moment, but the school setting might see me as otherwise. I’m always striving for excellence, so I’m high achieving but my grades aren’t always perfect.”

Assata graduated with a 3.4 cumulative GPA, a traditional high school diploma, and a Multimedia Arts Certificate for writing, journalism, and mass communications. Assata is taking a gap year and will begin studying photography and international languages at the Fashion Institute of Technology in the fall of 2019.

Billy (Baker High School '18)

Billy, self-identified as Black and female. When I asked her to tell me about herself, she shared that she loves documentary film making and photojournalism, and that she likes fashion and modeling. She was an Instagram ambassador who represented young adults at national events and provided the company with product feedback. She was also a D-Pop ambassador who helped build the brand and market their clothes. Billy explained that as a Black female, it was important to have “a close knit and supportive community [because] being a minority even in your own community, people are typically focused on Black boys so Black girls get pushed to the side.” Billy, who was a model, talked about the importance of self-esteem and academic confidence. She explained that even though people comment on her beauty, she struggled in mathematics, which often made her feel inadequate and unintelligent. She explained that now more than ever, “self-esteem is important and equal access to education [because] being in white academic settings is difficult.” Her mother held a juris doctor degree from Howard University and was a compliance regulation specialist for the Food Drug Administration. Billy's father was a global security specialist, and she was well traveled having had experiences in Argentina, the Netherlands, Brussels, Spain, France, Amsterdam, and Dublin. She graduated with a 3.9 cumulative GPA, a traditional high school diploma, and a Multimedia Arts Certificate for writing, journalism, and mass communications. She was currently studying marketing at Emerson College in Boston. She aspired to be a director of photography for film and media productions.

Ola (Jo Baker High School '17)

Ola self-identified as Black and female. She described herself as a “hardworking person who doesn’t get enough breaks from responsibility.” She added that she will often “stretch myself thin [and that she is] really hard on myself, and it’s usually my artistic expression.” Ola has talents in creative writing and documentary film. She was interested in psychology and matters of the mind. She was very active and had received a number of accolades, but she was incredibly humble and had difficulty talking about her accomplishments. With a little additional research, I learned that Ola was an artist activist who received more than a dozen academic scholarships for college. Representing Girl Power Meetups, she served as the Director of Speakers and helped to organize the Women Trailblazers/Gender Equality Film Discussion forum. Ola was a Pulitzer Center Award recipient for her photojournalism in Senegal and she wrote, produced, and debuted her own (auto)ethnographic film to raise awareness about anxiety, depression, self-love, and self-care for Black girls. She was involved in a number of community-based efforts including the Union Market #KindComments mural. She had local affiliations as an intern at 21st Century Fox, and she is a domestic ambassador for Instagram, which helped her to use media for social justice. Ola graduated with a 3.3 cumulative GPA, a traditional high school diploma, and a Theatre and Drama Arts Certificate. She is currently studying film and multimedia cinematic production at Hawaii Pacific University in Honolulu. She aspired to be a director of photography for a TV drama series and hoped to work with sci-fi and dystopian universes.

Kennedy (Baker High School '18)

Kennedy identified herself as a young Black woman. She is currently a 19 years old sophomore attending Clark Atlanta University. There, she majors in Mass Media with a minor in Fashion Styling. She describes herself as creative, outgoing, and tenacious. She is a classically trained opera singer who enjoys the fine arts, theatre and the growing media realm. Kennedy currently interns with ESPN sports as a junior journalist. Post-college, she plans to work at Essence magazine in the creative department, and she is specifically interested in social media or creative directing to ensure that Black creatives will always have an outlet. Kennedy describes her family as a middle class, and she was raised by her mother, stepfather, and biological father. Kennedy spoke a great deal about her parents, especially her father, who works for NASA. In addition to her academic and artistic talents, Kennedy was a state beauty pageant winner during her last year of high school.

Chapter 5: Social Place

Central to this study is the question: What is it like *being* in a Black girl body in math classrooms? ‘Social place’ is fundamental to understanding the experience of *being*. Findings from this study suggest that when given social place, students experience a sense of belonging and acceptance. Social place provides interconnectivity with peers, disciplinary content, and the teacher. Social place is salient to the ways Black girls have existed in American society since the inception of slavery. The anti-black girl sentiments constructed centuries ago suggested that the mere presence of Black girls, who they are and to what they aspire, are aberrations. These ideologies and sentiments are inextricably linked to extant social determinations of who does and does not have ‘inherent’ competence (Smith, 1993). In math education, Black girls have been and continue to be socially displaced, excluded from opportunities to learn, and marginalized through oppression, opposition, and isolation. My findings suggest that we further examine social place in math classrooms to gain more informed insights to socialization processes for Black girls and students from traditionally marginalized groups, more broadly. Social place as a line of inquiry helps to shift research, policy and practice from problem solving around achievement outcomes to focus on the inputs and transform the nature of experiences that students have while learning math.

Social (Hyper)Visibility

Findings from the study show various types of unfair treatment, emotional injury, and academic injustice. The ways participants described their experiences with socially hypervisible in math spaces suggest they were often seen for behavioral correction and

overly disciplined in math class. This type of maltreatment often resulted in participants becoming the object of or target for public ridicule and humiliation. Students attempted to inoculate themselves from abuse through silence, avoidance, disaffection and/or some form of self-determination. The states of being identified in this chapter speak to a potential line of inquiry in math socialization and identity studies. I describe three states of *being* in math class through descriptions offered by participants—*being* made a spectacle, *being* made a target and *being* made the object of antipathy—for Black girls in mathematics classes through participant quotes that specifically show their social hypervisibility. More specifically, participants described how their mathematics experiences were impacted by being made socially hypervisible in negative and enduring ways.

Caricature: Being Made A Spectacle

A caricature is a cartooned portrait that, in regard to Black people in the U.S., has historically been used to insult, mock, or otherwise minimize and dehumanize Black identity. The young women in this study described many instances in mathematics class where they felt they were on public display for ridicule and humiliation. Their recollections conveyed feelings of overwhelming embarrassment and shame. Embarrass means to hamper or hinder, and interactions marked by such limitations can arrest students' ability to perform with confidence and competence. Societal norms rooted in the practice of exhibiting, exploiting, and exposing Black females is historically situated in distorted narratives of Black women as commodities and damaging archetypes of Black women as angry and having unbridled and unwarranted emotions, and emotion.

Yet, we know that the ways Black people have been publicly debased are socially brutal and intellectually debilitating.

Jazzie described how she often avoided going to math because she constantly felt “*on display*,” as her teacher routinely made a disapproving example of her in front of the class. Sometimes, she would go to class late, and upon her arrival, the door would be locked. Jazzie recalled the discomfort she felt when her White male teacher engaged her in a back-and-forth power struggle. Jazzie recalled, “He’d say, ‘Look who’s coming in late’ sorry,’ he’d be like, ‘You’re not sorry,’ and I’d say, ‘I am,’ and he’d say, ‘No you’re not,’ and try to like joust with me over being late.” Many participants described these types of verbally combative exchanges with teachers in their math classes, and they noted they did not observe in teachers’ interactions with White or male students.

As Jazzies’ account shows, Black girls can be made a spectacle through the enactment of stereotypes that peg them as loud, aggressive, and oppositional. Jazzie’s insights compel math educators to be more aware of and sensitive to their own actions, dispositions, and practices as mathematics educators, which occur within the backdrop of history, regardless of their intentions.

Jazzie described how she often avoided going to mathematics class because she constantly felt “*on display*” as her teacher routinely made a disapproving example of her in front of the class. She would go to class late, and upon her arrival, the door was always locked, and she believed this was intentional. Many participants described verbally combative exchanges with teachers, which they did not observe in other student-teacher interactions where the students were either White or male.

Carter recalled her frustration when she noticed that many of her questions in math classes were met with teachers' resistance or performance antics that aimed to belittle her; whereas when her white friends asked questions, they were treated with kindness and patience. She distinctly remembered a moment of confusion in mathematics class when she raised her hand for clarification, and the teacher accusing her of "disrupting the lesson." She reflected, with confidence, "I feel like she [the teacher] would have responded differently if I were white. My friend, she was white, and she never had issues getting her questions answered."

These types of teacher-student interactions make Black girls socially hypervisible in ways that can have enduring and negative impact on their mathematics and academic identities. While individual incidents may seem trivial, their collective accumulation not only speaks to Martin and Gholson's (2019) arguments that the pain Black girls' experience in math is oppressive, but these occurrences mimic historically rooted public shaming practices that were practiced during slavery. In other words, the young women's accounts of being made a spectacle symbolically resemble how Black females have been publicly shamed throughout history. It is a ritual of ridicule and dehumanization that is deeply embedded in American culture where Black bodies are concerned, of which math. Thus, mathematics teachers must develop greater awareness in their everyday interactions with students.

Bull's Eye: Being Made a Target

Some participants described being negatively singled out for talking, asking questions, and for other actions construed as behavioral infractions. Many participants

offered various versions of a common experience with talking to a partner about the work to getting help or clarification and being reprimanded by the teacher in front of the whole class. Being on the receiving end of disproportionate chastisement as compared to their peers, participants' descriptions articulated a painful piercing of their personhood, one that when experienced repeatedly, left them feeling wounded and lifeless. In hearing each account, it was clear the young women felt they were at the center of a bull's eye. The idea of a bull's eye is about targeting, which is not only about accuracy and precision, but can also be about penetration, sometimes extermination, and certainly victimization, and extermination.

Carter vividly recalled a time when she was whispering to a white classmate in a legitimate attempt to figure out the solution to a problem that everyone seemed to be confused about, but the teacher, from across the classroom, directly reprimanded her. She said her teacher yelled across the room, "You must have the answer since you are talking so much." Carter observed that White students were not targeted in this way. Carter noticed that White students were not accused of disrupting the class when asking questions. Carter drew these conclusions over the course of her Pk-12 schooling experiences. She explained that she matriculated through a cluster of schools that was initially populated by predominantly white, and that in middle school, with neighborhood demographic shifts, there were fewer students of color.

"Middle school is very problematic...it was A-E tracks in 7th grade, and that's when you are like I'm in the smart class with the white kids. It was always a competition, but I was like I'm just as good as the white students. Still it was a very weird phenomenon of racialized competition. In high school, it was very

competitive...and being the only Black person in my group is isolating. I was always the one being called out and disrespected me out, and he did that to the Black students and students of color...I think it is because it is more of a threat for White parents to be disgruntled, so teachers are more careful with how they speak to them.”

Kennedy, on the other hand, said that she attended a predominantly Black school, and she believed that her teacher was biased against females pursuing math. She said that he was an architect by trade, and she observed that he would answer questions asked by male students with patience, but that female students were often berated if they had questions or needed clarification. She shared that often times, if she didn’t understand, was a sort of performance where her teacher would go on a public “rant” and he would single her out, comparing her to other students in the class. Kennedy said that a very common exchange was, “You should know this, everybody else knows it! It’s not my job to teach that. That’s why this is an honors class. Maybe you need to be in the regular class.”

The experiences Carter described seemed racialized and may speak to a broader pattern of how Black girls’ intentions and objectives when participating in class can be misinterpreted or distorted as problematic. Similarly, what Kennedy describes raises questions about the role of teacher disposition in student math participation, socialization, identity and persistence. In both cases, participants described being routinely targeted in ways that they did not observe either for their white peers or male peers. While we have scholarship that substantiates math spaces as racially hostile and male dominant spaces,

Carter and Kennedy's accounts give us a glimpse into how these interactions may play out in tacit student teacher interactions.

Dakota expressed similar sentiments of feeling targeted. I interpreted her description of interactions with her precalculus teacher as a series of sharp, recurring jabs that left her emotionally injured and feeling defeated by the end of her first advisory. Dakota stated, "She would call me out for talking to my partner...or she'd call out other brown kids for talking...and we are talking about the work...but I'm like...all the white kids were talking, too...and she doesn't say anything to them." Dakota remembered that her teacher, "was singling out...only like a few kids...like we were doing something wrong and everyone else was doing it."

Participants distinctly noticed that they were often singled out for talking when others who did not look like them were also talking without penalty. Some of the young women explained that the custom of penalization and social policing caused them to be silent simply to avoid trouble or harassment. Findings from the study show, particularly in response to research question 3, "How do Black girls respond to and navigate their experiences in math classes?" that the young women enacted a variety of strategies for protection and persistence. These include what I characterized as them existing on a spectrum from "speaking their truth", self-advocating, and exercising agency to disengaging, divesting, camouflaging, and even suffering in silence. In other words, when unfairly targeted in math class, berated for needing help or accused of being wrongly placed in an advanced math class, participants shared a range of responses:

Carter shared that she'd speak their truth and let her teacher know that it was her "dad [that] has been teaching [me] not you." Other participants attempted to advocate for

themselves by telling their parents, other staff or administrators about maltreatment, and they exercised agency by getting a tutor or attending office hours during lunch and after school. Dakota and her mother said that they implored the administration to investigate the teachers' differential treatment toward students of color, but they did not believe any action was taken because there were no changes in staffing or practice. Carter's reflection is powerful here, "I mean, we would tell our parents of course, but their Black (you know) so it's like white parents' thoughts and feelings always outweigh the problems that Black parents bring up. It's more of a threat for white parents to be disgruntled, who cares if I disrespect you, your parents won't do anything." There is so much in this single quote. There are issues of power and privilege; there are matters of equity and doing what is just and fair; there are questions of place and value, who belongs in this space and to what extent are they shown that there is equal value for every learner?

Three participants shared that they would avoid engagement by minimizing contact with the content and or the teacher. One of the young women said that they would "eject from class" or mentally zone out, despite physical presence. Another participant shared that she occasionally "skipped class" altogether. Recall, Jazzie's strategy, where she'd simply "come late."

Kennedy, Assata and Billy, I suspect because the repercussions they suffered as a result of not having a teacher freshman year for Algebra I, explained that they "stopped spending so much time and energy" on math and came to feel "indifferent" about it because it didn't produce improved outcomes. In their cases, they seemed to increasingly

divest from mathematical participation. Sage said, “Honestly, I don’t really try for math because I’m just trying to get my grade, I don’t even want to learn this for real.”

Some participants described perhaps one of the most frequently travelled paths of least resistance, and that is camouflaging and suffering in silence. These seemed to be ways that participants made themselves invisible because of unwarranted behavioral hypervisibility. To go unnoticed or to blend in, mainly for protective factors, some participants described simply not asking or answering questions. They remained quiet and selected seating that was less proximal to the teacher. However, I would be remiss not to acknowledge that there is suffering in silence. Dakota, Kennedy, Billy, Ola and even Carter shared stories of crying in class, worrying before and after class, inability to sleep at night because of the experiences they were having in math.

Kennedy, who had an extended school day for arts and academics, shared, “I’m losing my mind over this math...I’m going crazy... I’m literally up until like 3 a.m. trying to understand concepts.” Dakota explained,

“Having to be in there for 80 minutes was like just a lot and I would be like crying in class. I cried like because like it was just I hated being there...I will feel myself getting bummed out like even while I was in 5th period just thinking about having to go to that class and I would like cry before...math class definitely brought my mood down overall. It was so overwhelming, so humiliating, so hostile.”

Carter camouflaged herself among white students for protection. “I sat with Erin and Lily, the white kids who the teacher liked. It made me seem more like an approachable Black girl.” Jazzie’s strategy was not only to come late, but upon arrival she shared, “what I would try to do is sit in the back...because I felt targeted”

Kennedy believed that many Black girls learned to avoid “joust[ing]” with teachers by simply not asking questions, which was often perceived by teachers as “interrupting.” Participants’ descriptions of their experiences, conjures an image of their hypervisibility as a target, very much like a bull’s eye.

Dakota described working under the protection of a white ally. Despite the ally’s active attempts to protect her, the teacher directed more accusations of misbehavior toward her. Dakota and her partner agreed that they did not find the teacher’s routine of reviewing problems from the packet on the board engaging, meaningful, or helpful for learning, but nonetheless they were usually talking about the work as instructed. Dakota described seeking refuge in her interactions with this student, but she continued to feel like the teacher aimed a great deal of unnecessary and unwarranted animosity toward her. Dakota recalled,

“she [the teacher] would call me out for talking to him [the friend and partner], but she [the teacher] wouldn’t call him [the white ally] out, and sometimes he would be like ‘NO...it was my fault. I was talking.’ He [my friend] was so sweet, and she [the teacher] would just be like ‘no, I know it was her’...so she [the teacher] thought that I was like corrupting him.”

Dakota recalled the teacher accusing her of, “getting in the way of his [the white ally’s] education.” The teacher not only targeted Dakota and suppressed her attempts to access mathematical knowledge, the teacher also blatantly devalued Dakota’s educational aspirations and goals to prioritize the white male student’s opportunities.

Dakota continued to describe how she was unfairly hassled by her teacher who would insist that Dakota was distracting him. Dakota and her partner agreed that they did

not find the teacher's routine of reviewing problems from the packet on the board engaging, meaningful or helpful for learning, but nonetheless, they were usually talking about the work as instructed. While every student is presumably in class to learn, Dakota, one of two Black girls in the group, appeared to be assigned the social place of disruptive, distracting or disengaged. Dakota said that the teacher accused of trying to "steal" her partner's education. On the other hand, the teacher seemed to give her partner a position, status and place in the class to which she was not similarly offered. Based on the interactions Dakota described, this raises questions about how teacher perceptions, beliefs and attitudes influence interactions among students and their teachers. It seems that Dakota's peer was perceived as more deserving of having place in the class for learning, and Dakota's recollections warrant more inquiry into how social place can play out along markers of identity.

Participants' descriptions of their experiences in math classes speak to the social hypervisibility of Black girlhood as problematic and deviant even when Black girls are in compliance with stated expectations. With recent turns in pedagogy and practice to math talk and mathematics discourse, it was not uncommon for the young women in the study to be assigned to work with their partner, nor was it uncommon for them to be penalized for following those directions. Participants described several instances where they would ask a teacher for assistance, only to be told to "Work with your partner" or "Talk to your partner;" and moments later, they were reprimanded for following the very instructions given to them by their teacher.

Being the Object of Antipathy

The idea of targeting was also echoed by participants who described incidents that I interpreted as teacher antipathy toward the participants' presence in the classroom space. Participants described feeling particularly unwelcome in upper-level math classes. They described sensing hostility or resentment towards their presence and participation. Jazzie remarked that it often feels like her visibility as both a Black person, and specifically a Black girl, is perceived as disturbing. These sentiments are echoed by Black female mathematics educators. One colleague with whom I discussed my findings added, "It feels like just our being is what, as named in scholarship, anti-Blackness looks and sounds like. It is presuming deficiency or deviance based on skin color before hearing ideas of the mind or experiencing disposition to learn.

Another example of what could qualify as anti-Blackness, is Kennedy's recollection of her first day of Honors Algebra II. In addition to feeling a rapid descent into the realm of "not knowing anything," she described the penetrating intimidation and fear she felt during her first encounter with her mathematics teacher.:

".....off the top, the first day, I thought 'you don't like me.' The way he looked at me...he'd just look like he was annoyed, like I got on his nerves...and the way he spoke to us, like he'd always say [things] that was kind of like speaking down on us about whatever we have learned...and [listening to him] he's belittling me or saying things like, 'This is my class and y'all better know what's going on cuz it's going to go fast.' I just remember I was so intimidated."

When taking Algebra II, Kennedy described feeling her teacher's gaze of disdain and contempt for her, but she did not know why he would disliked her so much so soon. She

tried to name exactly what it was that gave her these feelings but struggled to name them with precision. The emotional and psychological toll these interactions had on Kennedy, however, were visible. Her voice quivered, and she gasped for air repeatedly as she described this circumstance. Kennedy, Assata and Billy offered similar versions of the same account, and she remembered that this particular mathematics teacher announced day after day that the classroom was *his* space. Kennedy, but it was not clear what that meant. She described what seemed to be a very authoritative stance, yet noticed his inability to effectively manage the class or deliver instruction with clarity, two indicators of effective teaching for Allied Community Public Schools. Kennedy shared how these instructional shortcomings interfered with his teaching and her learning.

“He would have a bunch of graphs on one board, and the front board would be like today's lesson which would have new notes, but the notes were always sloppy, and he couldn't spell that well, so there were a lot of errors that resulted in me not calculating stuff right because the steps were out of order and because he was all over the place. He would get frustrated and yell at us because people would be talking while he was teaching and people stopped paying attention because it was boring and confusing.”

The teacher's tactics, as described by Kennedy, are not uncommon in urban schools (Haberman, 1994). Similar to strategies outlined in *Teach Like a Champion* (2014), these practices promote policing, zero-tolerance, overly strict tones, and 100% conformity from students. Similar to Kennedy, who felt a sense of subtle malice from her mathematics teacher when “he'd just look at me and roll his eyes and seem annoyed”; Dakota recalled how her teacher would often ignore her when she tried to ask a question. Even if she

tried to participate by offering an answer or contributing an idea, Dakota said that her raised hand went unacknowledged and her ideas were often dismissed or discredited. For example, Dakota said, “sometimes I would raise my hand and ask a question and she [the teacher] would just ignore me, or she would look at me dead in the eye and just turn around or walk away. Other times she’d be like “yeah like what is it now.” Dakota also emphasized the antagonizing and dismissive way her teacher treated students with “darker skin,” regardless of their mathematics ability, which was different and worse than the way her teacher treated White students.

“She didn’t like brown kids. This kid Marco was actually good at math and she targeted him, too. He’s Hispanic. He, he has darker skin, and he would get in trouble for talking while all the white kids were talking, too, and plus we are supposed to be working with our partners, so it doesn’t even make sense.”

This moment in the interview resonated with me because Dakota’s mother briefly joined the conversation to share her experiences with the Honors Precalculus teacher. She also suspected the teacher treated white and students of color differently.

Findings from the study suggest that *being* the object of antipathy subjected participants to cold stares unaccompanied by helpful feedback. Being the object of antipathy is the absence of an approving smile or willing assistance from a teacher. Antipathy occurs when a student makes eye contact with a teacher who then neglects to follow with a response to or acknowledgement of their gesture for affirmation or explanation. Antipathy is a hand left raised in the air when it is the only hand in the room vying for attention. Being the object of antipathy can mean that calls for help go unanswered and opportunities to learn are withheld. What is clear from participant

accounts is that when a math teacher's disposition was unwelcoming, hostile, and inhumane, it made each girl feel like a complete inconvenience. Moreover, these accounts suggest that Black girls are socialized into race and gender roles where they are simply not allowed to *be*. They are not allowed to be late, to be talkative, or even be thoughtful, and Black girls' states of being can leave them vulnerable and without sanctuary from routine maltreatment or resistance to their identities.

Social Positioning

In the instructional triangle for math teaching and learning, student to student interactions are an important aspect of the classroom ecology. Findings from this study suggest that students can be excluded or included by the extent to which participants were marginalized in their mathematics classes. The ways they are positioned among their peers. Participants' in relation to each other and perceived by other classroom actors were often through race and gender stereotypes. Their accounts revealed some of the barriers they faced and navigated in order to fully participate in mathematics class in an effort to achieve at high levels. Social positioning in a math classroom can be directing by a teacher assigning groups, or it can be reflected when students are permitted to self-select their partners. Students can be positioned among their peers in ways that either helped or hindered their mathematics success. Peers can be positioned by their teacher's direction or through their own self-selection.

The gendered racism, bias, and other negative perceptions of Black girlhood that the young women experienced was often subtle, intangible and difficult to name. How students perceived each other could be influenced by structural, cultural, or institutional factors. Most relevant to these findings are the grouping patterns described by the young

women in the study as well as messages about Black girls' identities that were explicitly and implicitly communicated by peers, in school and the broader community, and society. In the sections that follow, I share participants' accounts of status in the classroom and occurrences that address research question 2: How do Black girls identify and recognize negative attitudes and beliefs about their identity in math classes?

Having an Ally

There were several instances where participants described a sense of safety and security they derived from having a peer who acted as an ally to them. In this study, I name peers who positioned themselves in solidarity with participants through sisterhood or partnership which provided friendly association, support, and encouragement. Allies are persons who attempt to protect each other in the face of hostility or differential treatment by speaking up, intervening, or explaining on behalf of a peer who is noticeably targeted and maltreated by the teacher or another student. Dakota and Carter described incidents that illuminate the power of allyship and the role it played in their ability to gain access to mathematical knowledge, participate during class, and maintain a sense of dignity despite being made to feel inadequate.

Dakota recalled:

“I befriended this kid who was a grade younger than me. He was really good at math. He’s like a white uptown kid that’s always been good at math, and I definitely talked to him about non-math-related stuff because he became my friend and he wasn't rude about it...he actually cared about helping me. I even said to him, ‘Yeah like I know that you’re not supposed to be like talking to me,’

and he said ‘Nooo...the other kids were talking to you like...you know (looks concerned and pulls away to imply disrespect or disregard), and I’m not trying to do that.’.’

This student was an ally and an accomplice (Jackson, 2018), covertly aiding Dakota’s efforts to survive. He became her “buddy,” and he could see the teacher was singling out Dakota for behaviors that nearly everyone else in the class were engaged. This type of allyship and solidarity was observed in my pilot program and noted as important for facilitating math learning mathematics when I piloted Black Girl Brilliance. When students had a supportive community that was invested in collective success instead of competition and hierarchy, it helped students feel safe in learning.

Dakota continued by describing what occurred when she was positioned with a student who did not actively serve as an ally. She recalled:

“...We would still talk about other stuff cuz he was my friend. But eventually [the teacher] moved me away from Aiden [my ally], that was really devastating for me. Sitting next to Aiden was helpful because he understood my frustration and how difficult it was for me...and he knew how to help me...he actually cared about helping me. He was my friend, and he knew that I’m an emotional person and that I was struggling...and he was super nice about everything. He always answered my questions and was always patient with me. You know? He was acting like a teacher should be acting. She saw that I was actually being successful, and she didn’t like that, so she moved me away.”

When Dakota’s teacher assigned her a new partner, Dakota recalled that she immediately recognized a stark difference and contrast in her new partner’s behavior and

disposition toward her. Dakota described the classmate with whom she was subsequently paired as condescending and arrogant:

“She [the teacher] moved me all the way in the front with one of the smartest girls in the class and she was the worst! I just remember being like annoyed with her because she would like kiss her [the teacher] a**. I wasn't comfortable with her at all. I wasn't comfortable asking her questions, but sometimes I would have to since she was my partner and she was it was kind of awkward. She wasn't really good at explaining it to me, and it's not her responsibility to do that, so she is not to blame, but it was harder for me because she would say things like ‘well maybe you should take notes’ or ‘maybe you should do this or that’”

Perhaps Dakota's new partner had the best of intentions, but Dakota experienced the impact of her relationship with the young white girl as unhelpful. Dakota mentioned several times that the teacher positioned the young woman as a model math student and that because she “understands what's going on and she is [the teacher} treating you like a queen” the partnership was less collaborative and more competitive, which heightened Dakota's sense of vulnerability.

Carter, who always experienced success in math and had what would be considered a robust mathematics identity, initially planned to become a mathematician and pursue a career in STEM. During her junior year, however, she decided she did not enjoy mathematics and chose to follow her interests in media and film production. I wondered how much of that joy was diminished because of peer positioning. Carter talked a lot about being placed further and further away from her Black peers as she advanced through mathematics courses, and she reflected on her relationship with White

peers with whom she attended Pk-12 school. It seemed like for Carter, despite having confidence and competence in mathematics, part of enjoying mathematics was anchored in peer relationships.

“I sat with Erin and Leo *then* Lily [indicating transgender identity]. They were the White kids I sat with in middle school. I’ve known them since I was 4 and so they think I’m the approachable smart Black girl and I always think ‘yeah, that’s why you are friends with me’.” (Carter)

What Carter’s insights revealed was the importance of sisterhood, particularly in White institutional spaces. While she did have positive experiences with her white friends and peers, she missed her Black female friends who were placed into lower tracks.

“Most of the people in my math classes were white, with white stories and white lives. Being in groups and being the only black person, just being in that environment and feeling isolated. I never felt like that because I was good at math, but there was something about that and just not having the confidence that I needed to prove that I was just as good as them.” (Carter)

“Black people [in the class] were in the minority and they were [stereotyped as] the ‘loud Black girl section’. [When I could], I sat in the front row, so I was near them but also because I didn’t fit in with the other students like ‘the popular white kids’, ‘the super smart kids’, or ‘the random quiet kids’.” (Carter)

Carter’s reflection, similar to Dakota, also demonstrated a strategic self-positioning with peers who could provide her protection. Unlike Dakota’s school setting, which was more restrictive, Carter attended a school that gave students a great deal of independence and

autonomy. Carter opted to partner with select White students not only because of organic friendships, but because she observed that the teacher favored them. Carter noticed that, in general, there was differential treatment of White and Black students in school and particularly mathematics. Carter attributed this, in part, to white privilege as was reflected in an earlier quote where she asserted differential treatment extends to parents as well, and she observed that White parents' grievances carry more weight those issued by parents of color.

“Teachers are always more cautious with how they treat white kids. White parents' thoughts and feelings always outweigh the problems that Black parents bring up. It's more of a threat for white parents to be disgruntled...[but] ‘Who cares if I disrespect you? Your parents won't [do anything].’” (Carter)

Peer positioning with white allies seemed to create a sense of safeguard from what could be considered routine injustices, but it was also isolating in that Carter could not commune with anyone who experienced the disadvantages to her that resulted from privileges afforded to her white peers. Carter described that her teacher was often very disrespectful in his responses to her questions and that he would call her out, by name, in front of the class in a scornful manner; and in a way that she did not observe with Erin or Leo. Interestingly, Carter's theory about differential treatment of Black students and disregard for their parents' advocacy efforts was corroborated by her mother. Dakota and her mother described the lengths they went through to advocate for Dakota and to hold the teacher accountable. In their experience, their efforts yielded minimal changes.

The incidents Carter and Dakota describe offer some insight to how student-student interactions can help or hinder math learning. In Dakota's account, a white

student positioned himself as an ally because he believed she was being targeted for unfair and differential treatment compared to white students in the class. In Carter's account, she positioned herself with white students with whom she had a relationship as a protective measure to buffer maltreatment or unwarranted social correction. Both cases reveal a great deal about peer positioning. In Dakota's account, a White student who, in observing the inequitable treatment of peers of color compared to his White peers, chose to position himself as an active ally. In Carter's case, the cross-racial positioning was a strategy that Carter employed to mitigate any mistreatment directed toward her. Carter and Dakota's conclusions align with scholarship that documents the ways Black children have historically been mistreated in schools and in society at large. Just taking advanced mathematics classes is not enough. Being separated from peers and disrespected constantly is truly an inhibitor to demonstrating math competence or persisting in mathematical spaces.

Knowledge Production

In illuminating the unique challenges Black girls face with finding place among peers for sanctuary and maintaining a sense of value when they are often only seen as behavioral problems, I turn attention to how these patterns of socialization interfere with Black girls' efforts to acquire and produce mathematical knowledge. The findings, thus far, are consistent with scholarship on how opportunities to learn are unequally distributed in mathematics and how those opportunities are influenced and shaped by students' identities (Oakes, 1990; Tate, 1995; Tate & D'Ambrosio, 1997; Darling-Hammond, 2004). In the following section, I share examples of how participants faced various forms of exclusion and marginalization in their interactions with math content. In

the cases identified, the ways in which participants were socially placed constrained their opportunities to learn mathematics.

Opportunities to Learn

Up to this point, I have discussed how the participants, as Black girls, were socially hyper-visible for behavioral correction in math classrooms and the positioning strategies they utilized to inoculate themselves from maltreatment and to gain access to mathematical knowledge. Still, perceptions of Black girls' social place compared to white students can diminish their opportunities to learn. This is evident in participants' accounts that call attention to teaching practices in which teachers assign work without formal instruction and "teach yourself" models of so-called inquiry-based learning. In addition, participants' accounts revealed that in these routines of acquiring and producing mathematical knowledge, there seems to be a binary culture of right or wrong that can (dis)place Black girls in the fixed state of being intellectually inadequate and mathematically impaired.

Participants explained that, as Black girls, they were afforded little mercy where misunderstandings of content were concerned. They described how missing information due to a sick day, isolated incidents of being briefly distracted, or even looking away from the board to copy notes was often mischaracterized as lack of motivation, interest, or capacity. Jazzie shared an interesting perspective on attendance,

"When we miss class, we are expected to make the work up and if we don't then it's like we aren't good students, but if they [teachers] are out, they don't have to make anything up. My teacher was out for a week and she came back teaching without covering what we missed and said we should have learned it from the sub

[substitute teacher]. That really upset me because it was the end of the advisory and we were having PARCC testing, and I really needed to get good grades.”

(Jazzie)

Kennedy mentioned that she was easily distracted, and that she had difficulty taking notes.

“He [the teacher] never saw that there was something about him, he always blamed us and said that we should ‘already know this’...but I didn’t and even when I tried taking notes, he’d write so much so fast if I missed one thing I was confused...and if I asked him to review something, he’d embarrass me and announce that I wasn’t paying attention.”

Jazzie described the angst that accompanied her experiences with learning math in school. She stated,

“Math is really stressful because you have to keep up with a lot of stuff and if you miss one lesson you are messed up because it builds on top of each other. If you go to class one day and you got it and you do your work and the next class if you are tired because of whatever and you aren’t full paying attention you missed it next class you could be paying full attention and you still won’t know what you’re doing because you missed the lesson before and now there’s a hole in your learning.”

With normal occurrences of physical or mental absence in class being treated as an offense, some of the young women in this study missed opportunities to learn and face barriers to acquiring mathematics knowledge. Given these experiences, many of the participants resolved that mathematics teaching and learning is about accuracy rather

authentic understanding. The habitual drive toward completion instead of competency creates what Nardi (2003) described as a quiet disaffection for math.

In addition to teachers' justification for withholding mathematical knowledge, the young women's social place in urban schools rendered them vulnerable to teacher shortages: yet another factor that diminished their opportunities to learn. Participants noted the unfair expectation to perform with proficiency in the absence of a teacher of record for extended periods of time. Four of the ten participants in the study said they were without a mathematics teacher for six months or more. It seemed that in some urban schools permitted, teachers quit, go on leave, or strike or they simply left teacher vacancies unfilled without any responsibility or accountability for the resulting student underperformance. Research shows that this is not uncommon in urban schools, and as a parent I have had personal experiences with math teacher vacancies that would have contributed to gaps in my children's mathematical knowledge if I were not equipped to teach them myself.

In formal schooling, knowledge production largely hinges on knowledge acquisition. Jazzie described the angst that accompanied her experiences with learning mathematics in school. She stated:

"Math is really stressful because you have to keep up with a lot of stuff, and if you miss one lesson you are messed up because it builds on top of each other. If you go to class one day and you got it and you do your work and the next class if you are tired because of whatever and you aren't fully paying attention you missed it next class you could be paying full attention and you still won't know

what you're doing because you missed the lesson before and now there's a hole in your learning."

Kennedy, Billy, and Assata all attended the same school where, as freshmen. In their freshman year, they did not have an Algebra I teacher for the entire school year. As Kennedy reflected on significant moments in her mathematics learning, she recalled particular classes with frustration and despair:

"I didn't have a teacher all of freshman year, then I had a terrible teacher who was new to teaching my junior year, so I didn't learn anything either time...[and when I took] AP statistics and I didn't have any algebra background whatsoever. When my teacher was like 'you should know this', I'm like 'you should know that I didn't have an algebra teacher [at all]. Period'

Kennedy identifies two points salient to social place. If or when social place is not readily provided for a student, it may be difficult for them to carve it out for themselves either because they have not consistently had a math teacher of record and/or they have had several ineffective math teachers of the course of their PK-12 schooling experiences. She went on to describe the layers of problems she experienced with acquiring mathematics knowledge and the impact it had on her postsecondary options. These problems destabilized her mathematics foundation and contributed to her inability to produce the mathematical knowledge needed to score with proficiency on the Math SAT. She expressed, in frustration, "My [SAT] math score is super low not cuz I want it to be [but] just cuz [I didn't have a teacher my freshman year so] I didn't learn [the material]." Kennedy describe how her opportunities to learn were further diminished when she took Algebra II and her teacher focused more on displaying his own skills than ensuring

students had the necessary structures, supports, and skills to produce grade-level mathematical knowledge. Kennedy stated:

“He just flaunted his architect skills drawing elaborate pictures that had nothing to do with what we were learning... the notes were sloppy, and he couldn’t spell that well. It often resulted in me not calculating stuff right because the steps were out of order...and because he was all over the place.”

As Kennedy recounted her experiences, we both wondered what messages she received about her place and value in that math class. The teacher provided his phone number but never answered. He encouraged students to email him with questions, but he never responded to her messages. She went to his office hours, but he would not show up.

The relationship between knowledge production and opportunities to learn was reflected in stories participants told about barriers to the acquisition of mathematical knowledge. Whether a participant was assigned work without instruction, subjected to a teach yourself model or in a class without a teacher of record for sustained periods of time, the interactions participants report having with content caused them stress, confusion and struggle despite their efforts. In considering scholarship on knowledge production and opportunities to learn, we cannot neglect the importance of and the barriers to knowledge acquisition. We must further acknowledge that the ways in which knowledge is validated often leaves Black girls on the margins of learning. We know from Critical Race Feminism that Black women and girls have unique ways of knowing, and that epistemologically these ways of knowing are often not accepted or respected in traditional dominant culture spaces. When we think of the relationship between knowledge production in the context of math classrooms as white institutional spaces, we

can better understand how Black girls' opportunities to learn are minimized if their thinking and ways of knowing are perceived as incongruent and frequently delegitimized. The literature is replete with theory and empirical data on how Black children's ways of learning and demonstrating their intellectual capacities are inhibited by disciplinary norms. Black girls, however, continue to find themselves in places of "restrictive vocalization" or routine erasure by those who do not value the unique perspectives they have to offer (Evans-Winters, 2015, p.24). Whether through silence or oversight, Black girls' intersecting identities can socially place them at a disadvantage for acquiring and producing knowledge, which diminishes their opportunities to learn.

Conclusion

In this chapter, I discussed the dimensions of Human Place Value through findings from this study connected to the lens of social place in this study. The three cross-cutting themes I described were visibility, positioning, and knowledge production. Data show the ways participants were rendered socially hypervisible through daily rituals of public humiliation and shame. They were often targeted for embarrassment in ways that their peers were not simply for asking a clarifying question. Not surprisingly, participants discovered that finding a white ally or accomplice could place them in a safer position and protect them from some of these routine social assaults on their being. Findings also suggest that Black girls' opportunities to learn are greatly diminished because they are socially (dis)placed when trying to gain access to mathematical knowledge.

The regular exclusion of Black girls' experience in accessing mathematical knowledge, in turn, seemed to arrest their ability to engage in knowledge production. In

addition, the study found that Black female epistemology and ways of knowing are marginalized in the domain. The tacit hostility that participants, as Black girls, experienced in mathematics class and disdain toward their presence in math spaces was evident in their interactions with teachers, students, and the content. These accounts provide empirical evidence of how social place functions in mathematics classrooms as a mechanism of inclusion or exclusion. Recall the examples of how Dakota and Carter were positioned among allies, which gave them access to content and facilitated an increase in their participation in class. Conversely, when Kennedy was compared to another student and Dakota was paired with a student who antagonized her, they felt placed on the margins of learning.

Participants' accounts of public ridicule and humiliation during interactions with teachers and other students evidence how Black girl bodies are socially hypervisible in math spaces. This type of hypervisibility renders Black girls vulnerable to various types of unfair treatment, emotional injury, and academic injustice. The ways participants described their experiences with socially hypervisible in math spaces suggest they were often seen for behavioral correction and overly disciplined in math class. This type of maltreatment often resulted in participants becoming the object of or target for public ridicule and humiliation. Students attempted to inoculate themselves from abuse through silence, avoidance, disaffection and/or some form of self-determination. The states of being identified in this chapter speak to a potential line of inquiry in math socialization and identity studies. In the next chapter, I revisit the themes of visibility, positioning, and knowledge production to discuss how study participants, Black girls, were intellectually devalued in math spaces.

Chapter 6: Intellectual Value

For Black girls, *being* inside a body that is racially and sexually interpreted from the outside has historical significance that is relevant to their everyday lived experiences. The notion of *being* for Black girls is historically rooted in silence, absence, erasure, and ultimately dehumanization. In *The Price for a Pound of Their Flesh*, Berry (2017) reminds us that “Enslaved people...had very particular ideas about their value...ideas that differed greatly from their enslavers. Looking at their views of commodification...adds to our understanding of social and cultural systems that continue to (de)value Black life” (p. 5).

Berry (2017) distinguishes Black people’s inner, self-actualized value from outside, external valuations assigned to Black bodies before, during, and after their lives as enslaved people. The former, she explained, was derived from familial, cultural, and community teachings that affirmed intelligence and worth. The same was true for the young women in this study who were raised in stable homes with caring families, some of whom attended African-centered schools that validated and affirmed their brilliance; all of whom came from families that instilled in their children that they are smart, capable, and worthy. Yet, external societal appraisals of that devalue Black girlhood serve a role in sustaining social. So, while Black girls live the inside/outside contradistinction of self-love and societal loathing, *that* dialogue has never been given place in educational research, and certainly not in mathematics education.

Kennedy, for example, expressed what many of the young women implied about their intellectual experiences in mathematics. She went on a thinking-out-loud tangent to say, “I know I’m not dumb, but being there [in math class] makes me feel like I am.”

Kennedy's concept of herself mathematically, which was situated in a broader academic identity of herself as smart, capable, and deserving, did not translate to her math identity. In her math class and in her 'Black girl body,' there was no place for the value of her inner *being* to enter into dialogue with the value ascribed to her outer *being* by her teacher and sometimes peers. To echo this point, scholar Amber Marie Pabon reflected on her high school math experience noting, "These teachers could not see our pain and seemingly regarded our bodies as inanimate disruptions subject to marginalization away in alternative spaces" (Justice & Tenore, 2017, p.1 47). It is this lived, human experience of *being* (dis)placed and (de)valued that calls me to revisit the question: How do high achieving Black girls experience 'place value' in urban mathematics classrooms?

In chapter 5, I shared findings on the dimension of social place that participants experienced. Across experiences, being given 'place' presumes that students feel a sense of acceptance and belonging. It involves feeling included in and connected to the community of learners through a recognition of ideas and affirmation of ways of thinking or knowing. When students are given social place in mathematics class, it inherently demonstrates value for their presence and participation in, and contribution to the mathematical community.

In this chapter, I present evidence that show how study participants experienced intellectual (de)valuation. Intellectual value can be reflected in grades and demonstrated through external appraisals. It can be a regard that is routinely afforded to them which communicates adequacy, capability, and purpose. More importantly, as articulated in Black feminism, Black women have authority to create and validate knowledge just as members of the dominant culture. In math, it means we create space for the multiple

ways that students process and communicate information, and that we acknowledge their unique ways of *thinking* as is required by mathematical standards of practice.

Being (dis)placed and (de)valued in mathematics class involves frequent feelings of failure and rejection. These feelings may be amplified when there is a sense that one's presence in the class is disdained or disliked, as reflected in participants' descriptions of peers' and teachers' verbal and non-verbal (re)actions to them. Participants' accounts suggest that the inability to find social place among peers can lead to feelings of detachment and alienation in the class. The findings further show that the micro-failures, experienced as a result of day -to -day confusion and disorientation with math content, can result in feelings of inferiority, discouragement, and helplessness. Black girls who routinely experience social displacement and intellectual devaluation in their K-12 learning may conclude they have little value or worth in terms of mathematical capability. Based on conversations with the ten academically excellent Black girls in this study, it is clear that, for them, *being* in a Black girl body is received and treated differently than being in a white girl body, a Black male body or a white male body. The stereotypes that are tied to Black female identity can threaten the possibilities of *becoming* mathematically competent.

Intellectual Invisibility

In 1952, American novelist, literary critic and scholar Ralph Ellison published, *Invisible Man*, an award-winning book that highlighted social and intellectual challenges facing African Americans in the early 20th century. More recently, Mowatt, French, and Malebranche (2013) point out that “invisibility is a fundamental aspect of being Black in a White-dominated society.” They, along with other scholars, highlight the ways in

which Black women remain invisible, especially where research and intellectualism are concerned (Evans-Winters, 2007; Hull, Bell-Scott & Smith, 2015; Justice & Tenore, 2017). Amber Marie-Pabon's (2017) analysis captures the intersectional nature of invisibility with precision and specificity in the context of Black womanhood. She articulates how being Black and female renders one "invisible" and "hypervisible" at the same time. A number of scholars also examined the ways in which Black children are rendered intellectually invisible in mathematics (Leonard & Martin, 2013). In a study of academically successful Black math students, (McGee & Martin, 2011) found that Blackness, Black students' racial identities, and Black intellectual capacity, writ large, were undervalued and constantly under assault within mathematics and engineering contexts. The study found that social constructs of racial intelligence left Black students on the margins of learning. Keeping in line with scholarship that examines questions of *hypervisibility* body politics and *invisibility* in relation to the systematic oppression that besets Black women in society, I analyze the *invisible* marginality that Black girls experience in mathematics through two emergent subthemes. Findings from the study suggest that Black girls can experience intellectual invisibility as "hidden figures" and as "imaginary units" because their intellectual capital (Lemons-Smith, 2013) remains unrecognized and untapped in White institutional spaces like mathematics classrooms.

Hidden Figure: Brilliance Buried

In the groundbreaking book, *Hidden Figures*, the story of ways Black women faced and navigated racism, sexism, and other forms of exclusion in mathematics and science fields, heightened the nation's awareness of how Black women have historically been made to feel socially unacceptable and intellectually insignificant in particular areas

of study or professions. I borrow the “hidden figure” phrasing to describe another state of *being* that Black girls experience while learning math. In many ways, it reveals an overlap between social hypervisibility and intellectual invisibility. Using Shetterly’s (2016) “hidden figure” framing appropriately reveals how stories of Black women’s mathematical brilliance have been covered up in the broader society, education, and research. With this in mind, I share examples from participants who had robust math identities and who demonstrated confidence and competence in mathematics. Findings from the study suggest that by virtue of *being* a Black girl, at some point, one is likely to experience the “hidden figure” paradox.

Taylor, who completed her mathematics coursework early and took college mathematics courses at a local prestigious University, described instances where she doubted her abilities because of teachers’ or peers’ reactions to her questions and contributions. Taylor recalled that she immediately learned that, as a Black girl, she did not have permission to ask questions during a lecture because it was perceived as a disruption. She also did not have permission to remain silent, which was perceived as disinterest in learning. Taylor also said even when she knew the answer, the teacher did not call on her:

...[teachers] always call the same people... it was only when we [the black people], none of us had our hands up that we would get called on. But when I did know the answer and raised my hand...I never got picked.

This anecdote reflects both social hypervisibility, as discussed in chapter five, coupled with the intellectual invisibility.

In addition to being discouraged to ask or answer questions, Taylor observed that she was also not allowed to have her own opinion or line of thought if it questioned or disagreed with the teacher's reasoning. She described a parent conference where one of her mathematics teachers reported that she was adversarial and confrontational. In an effort to defend herself and provide a more accurate characterization of her purpose for asking questions in class (as if this should be necessary), Taylor explained she was "genuinely just trying to understand." Again, these examples reveal a historical pattern of racial ideologies that negate Black intelligence. Taylor, who exited the high school mathematics sequence of coursework in her sophomore year and began taking college-level mathematics courses with undergraduate students at a selective university, is an outstanding example of a hidden figure. Her accounts show how the mind, when embodied in a Black girl, can be rendered invisible and inadequate yet seen as not having the capacity to think, know or understand.

Other participants described similar experiences in class adding that many times, they were either ignored or made to feel intellectually inferior. Carter, who had aspirations of becoming a mathematician, had a number of telling experiences. She described having had very strong African American mathematics teachers in elementary and middle school who did celebrate and elevate her intellectual value in class. She attributed her mathematics competence and robust math identity to those teachers who had an ethic of care for and confidence in her abilities. Carter, who stated that she always loved math, described her experiences in high school, however, as less than desirable. She shared incidents in a class where she felt particularly out of place and unwelcomed. At every turn, it seemed like her teachers refused to see her as intellectually capable,

despite her strong foundation and competence in mathematics. She described the barriers she faced in being recognized for her intellectual worth. “I’d ask [the teacher] a question, and he’d be like ‘look it up’, but if I tried to look it up or ask a partner, he’d say ‘if you have a problem, you can ask me.’” Oftentimes Carter also reported that her teacher, instead of answering her question, would retort with subtle sarcasm, by saying, “you can figure it out...or ‘can’t you [figure it out]?” Evidence from prior research and this study raise the possibility that Carter’s mathematical curiosity and intellectual inquiry were less visible and of less importance simply because she was a Black girl.

While calling attention to the “hidden figure,” I also discuss how some participants’ intellectual capacities went unacknowledged and underdeveloped. I refer to this state of being as “*i*²”, where Black girls are made intellectually invisible through instructional disregard. Black girls are agents of knowledge who possess complex ways of thinking (Collins, 1990). I highlight that when in math spaces, how Black girls are often imagined as intellectually inferior and ascribed attributes rooted in deficit racial ideologies. The “*i*²” status includes being ignored, overlooked, or dismissed when trying to ask or answer a question and being blatantly denied support, empathy, or encouragement. This idea somewhat different from the hidden figure in that hidden figures have relatively strong math identities and have developed proficiency with the dominant ways of knowing in the discipline. The “*i*²” status, however, considers students whose math identities are less robust and who, therefore, need more academic, social, and emotional support to thrive, which I will describe below. What I observed from students’ stories of this state of *being* is that it eroded students’ sense of self and strength to persist and actively participate in mathematics.

i²: Imaginary Ineptitude

Participants in this study described instances where their intellectual needs were not being met and their contributions were overlooked. They recounted experiences of routinely being purposely ignored or disrespectfully dismissed by teachers when trying to gain understanding in class. Kendall recalled, “I always felt out of place because when I asked him [teacher] to explain something, he’d start going on about how I should already know this.” She later noted that, “He [teacher] wouldn’t even try to explain it, and when I went for office hours he didn’t show up. I wasn’t comprehending anything, and I felt like I got a good grade, but it was just handed to me and I still needed to understand all of this stuff for the SAT”. Kendall’s recollection of her teacher reiterating, “these kids don’t know anything, they are coming in with no solid background” raising questions about the extent to which more urban math teachers share this deficits mindset. Dakota recalls, “she [teacher] wouldn’t even respond to my tutor,” and would insist that the work was “easy” or that “it’s not [her] job to communicate with my tutor.” These instances suggest what is found in urban education literature about teachers having low or no expectations and it illustrates an assumption of ignorance or incompetence that could make students feel intellectually inferior.

In addition, participants reported being wholly denied instruction, explanation, support, empathy, or encouragement as compared to their white or male peers. This was evident in the negative forms of non-verbal communication they received. Students described eyerolls, pursed lips, crossed arms, and deep sighs as common responses to their questions or efforts to participate. Recall Dakota’s accounts where she shared, “sometimes she’d be like ‘yeah what is it now (deep sigh)’...or sometimes I would try to

raise my hand and ask a question and she would ignore me.” Carter explained an instance when she asked for help and her teacher refused. “I was like I don’t understand and the teacher was like just let me finish my lesson, he didn’t even acknowledge my concern, he just dismissed me”. Even Sage offered that she was discouraged from asking questions in class after a teacher told her during class practice time, “I can’t help you right now.”

There was often some form of intellectual intimidation that belittled them and incited a sense of fear, worry or self-doubt. The Black girls who stood on the receiving end of these interactions were constantly reminded that in *those* spaces, they had no intellectual import. I describe the essence of these interactions as an imagined ineptitude where teachers’ actions reflect underlying beliefs that Black students are inherently ineducable. I borrow the math notation i^2 to highlight the *real and negative* outcomes¹² that occur when students’ capacities are overlooked, obscured, and distorted by the stereotype of racial incompetence.

Being Actively Ignored

Participants described other shorter, more subtle remarks by teachers that speak to patterns of passive aggressiveness and elitist behaviors that render students intellectually invisible like, “This is easy,” “you should know this,” and” or “this is an honors class.” Participants also described trying to ask questions in class, but being actively ignored by their teachers and their questions remained unanswered. Whether they alerted the teacher

¹² An imaginary number is a complex number that can be written as a real number multiplied by the imaginary unit i , which is defined by its property i^2 which equals a -1 (a negative number). I use this notation metaphorically to describe the complexity of Black girls’ social and intellectual identities, which are real, yet their experiences with gendered racism (which are rooted in imaginary beliefs of intellectual ineptitude) can yield negative outcomes

of their confusion through verbal expression by raising their hand, or through a written note on their work indicating lack of understanding, participants were often treated with hostility and opposition. This type of routine experience of being ignored, dismissed or “shot down,” is further described in these findings.

Dakota, trembling as she scrolled through her memory bank, remembered from her honors precalculus class, “I would try to ask questions and [the teacher] would just like shoot me down...or sometimes she’d be like (rolls eyes, deep sigh) yeah what is it now?” Dakota added:

“Sometimes I would try to you know raise my hand and ask a question and she would ignore me...like turn around with her back to me...or she would look at me dead in the eye and just ignore me...or she would answer someone else’s question instead or she’d [just] move on.”

The anecdotes that some of the young women shared illustrate the ways they were excluded from learning, even when they actively tried to participate. Teachers’ inactions and nonverbal cues, suggested, “I see you and I know that this complex math is beyond your ability to understand, so I won’t waste my time or energy trying to explain it to you because you don’t have the intellectual capacity to learn it.” In other words, when it comes to Black girls, unfortunately, many teachers do not have a reference point for Black female mathematical brilliance, and they are not aware of the low expectations they reproduce in everyday habits of instructional exchange.

Being Instructionally Neglected

Participants recalled being particularly invisible when in need of support, empathy, or encouragement, which was often denied. Instances where teachers did not

make themselves available for assistance, for example not showing up for office hours or being unresponsive to emails. Participants also report never really being given positive affirmation and feeling active opposition to their efforts to gain understanding. From careless cancellations like, “He’d schedule office hours then not show up” and casual yet cold, “I can’t help right now” to blatant refusals to support success such as, “Why is your tutor emailing me? I’m not technically required to respond to her,” findings from the study suggest that study participants were often simply not intellectually valued in their mathematics classrooms. This is quite clear in Dakota’s remarks when she exclaimed, “*WHY wouldn’t you want to respond to my tutor?!?!’*” Again, as a Black female researcher, I do not believe the teacher would have been so inconvenienced by or resistant to helping a White student.

Carter recalled a time in her honors trigonometry class when she raised her hand for clarification, and similar to Taylor, her teacher accused her of disrupting the lesson: “I was like ‘I don’t understand’ and the teacher was like ‘just let me finish my lesson!’ he didn’t even acknowledge my concern, he just dismissed me”. Jazzie remembers,

“I was trying to tell her because we were having a quiz and PARCC testing on the same day, but she was gone for a [whole] week and so I didn’t understand anything we were going to be tested on, and I didn’t want my grade to drop but she [wouldn’t answer my questions] she just kept teaching like she was there the whole time.”

The *i*² state of being is an important finding because it helps to describe how Black girls can be imagined as mathematically inept, and their intellectual capabilities can be obscured. In each account, we can view being intellectually invisible in mathematics

classrooms as historically white institutional spaces. Again, these are things to which no teacher is likely to readily confess or accept, but these are teaching and learning interactions that were observed and reported from participant attempted to participate and advance understanding of the content. The responses that they received are difficult to explain or understand. The incidents participants describe leave us with more questions than answers. What can explain why the young women in this study report several instances of being denied basic forms of instructional support?

Feeling Intellectually Intimidated

One participant from the pilot study described the futility of her efforts to get assistance in mathematics class, and distinctly recalled how foolish she felt when she asked a question and her teacher responded sarcastically without ever providing the clarification requested. Some participants in the current study described a range of behaviors from passive aggressive tones to elitist attitudes through which teachers would make it difficult for them to access information or actively withhold the mathematical knowledge they needed to understand content or be successful.

Participants' descriptions of constantly being made to feel unwelcome is reflected in scholarship on belonging, math identity, and figured worlds (Boaler & Greeno, 2000; Joseph, 2014; Martin, 2012). Their descriptions also speak to an intellectual intimidation that reveals an overlap with themes connected to social hypervisibility and intellectual invisibility. For example, Kennedy said that there were few days in her Honors Trigonometry class where her teacher would not say to himself in frustration, "These kids don't know anything." Yet, in teacher education, we focus a great deal on developing teachers' content knowledge without specifically addressing the ways damaging and

unfounded beliefs about students disadvantage young people who have historically been marginalized and excluded from opportunities to learn mathematics.

The ways that Black girls in this study were socially (dis)placed and intellectually (de)valued occurred through forms of microaggression, microinvalidation and microinsult. As Dean Emeritus Dr. Leslie Fenwick of Howard University noted at the 2018 AERA Brown Lecture, “there’s nothing micro about a microaggression.” As an example of one such aggression, Kennedy recalled, “The way [the teacher] spoke to us was kind of like speaking down on us about whatever we have learned...he would say things like... ‘these kids don’t know anything’ ... ‘they are coming in with no solid background in math.’” In recalling this math.’ At that moment, Kennedy seemed to have a liberating epiphany where she came to the realization that it was not necessarily her own deficiency, but rather how she was perceived and treated as a doer of mathematics that created barriers to learning.

“He talked down to me and belittled me. I don’t think he really understands me...and I don’t think he thinks before he speaks. I think he has this kind of high horse attitude. On the first day of class I was so intimidated because he was like ‘Y’all better know what’s going on cuz its (honors Algebra II) going to go fast.’”

(Kennedy)

Kennedy was placed in Honors Algebra II/trigonometry by her previous teacher who recognized and tapped into Kennedy’s mathematical capabilities. When she arrived at her new class on the first day, however, she recalled feeling immediately out of place and literally terrified. She described that encounter as the first of many rants that year

where her teacher would make hurtful, sarcastic criticisms about her math deficiencies.

As Kennedy recounted her first day, she trembled.

“I remember sitting there thinking, ‘ok, you don’t like me, and I need help...me and my friends...all three of us need help...and we’re going to drown in this class if you don’t help us. We were pretty good in math, but we were not ready for the stuff in Algebra II because we didn’t have a teacher for Algebra I’.”

As she reflected, I could imagine her trepidation and the discouraging, defeating thoughts that amplified in her mind. These types of occurrences created a toxic and unsafe learning environment.

What was so powerful about these particular accounts from Kennedy, is that her teacher was a Black male. Through this account we can bring into conversation the import of intersecting identities, power and privilege, dominance, and subjugation. Several scholars point out how the exclusionary nature of anti-Black ideologies and practices that often characterize the culture of mathematics education (Bullock, 2017; Martin, 2019; Valoyes-Chavez, Martin & Spencer, 2017) have devastating impacts on Black children’s mathematics performance. I have found few studies on math identity and socialization, however, that specifically discuss how instructional interactions can also be a function of implicit anti-woman bias. The value of scholarship grounded in the perspective of “anti,” is that it uncovers the ways in which any actor, teacher, or peer, regardless of race, gender or other identity marker, can enact classroom customs that overlook Black girls’ intellectual capabilities and discount the reality that their experience is uniquely shaped by multiple marginalizing identities. “Anti” stances can

manifest anytime there is a contrast between teacher beliefs and aspects of student identity the teacher does not necessarily value.

In conclusion, the hidden figure and imaginary ineptitude emerged as common states of *being* for Black girls in the study. Participants routinely experienced being ignored, overlooked or dismissed when asking or answering questions. They were, it seems by custom, differentially denied support, empathy and encouragement as compared to their peers. Participants describe having asked questions that went unanswered, being slighted by teachers or peers when participating in mathematics discourse, and being constantly criticized but rarely complimented in mathematics class. These were just a few examples that the young women in this study were intellectually overlooked. Findings from the study suggest that Black girls' brilliance can become buried over the course of their k-12 experiences learning math in school. These accounts also show how Black girls can be imagined as mathematically inept. The young women in this study described being on the receiving end of an imaginary identity that was very different from the one that they held for themselves. This difference of outer and inner ascriptions of social place and intellectual value pushed the young women to the margins of learning where their desire to participate fully remained unfulfilled. When Black girls are imagined as inept, it keeps them hidden as individuals with mathematics intellect. In the discussion to follow, I present findings to further evidence how Black girls' intellectual abilities can be perceived and positioned through peer comparisons and grouping assignments.

Intellectual Positioning

Study findings show that, in math classrooms, participants were positioned in ways that created competition among peers instead of cooperation, and they were

perceived in ways that encouraged separation instead of synergy between classmates. While participants said white students were rarely if ever reprimanded for or discouraged from working together, they recalled that Black girls were not allowed to learn in solidarity with their sisters or have community with other students, even when the teacher was Black. Carter recalled having a long-term substitute teacher who referenced Beverly Tatum's *Why are all the Black kids sitting together in the Cafeteria* (2017) and insisted that the Black girls sit separately in class. Seemingly, the teacher's takeaway from the book or title, was that Black girls needed to work with other students and not "default" to working with each other "just because [they] feel comfortable sitting together." Carter's very logical response was, "What's wrong with me feeling comfortable in school? So I can *learn*?!?" As findings from the study show, differential treatment as an intersectional phenomenon showed itself in many forms.

Sage recognized, "everyone has a different perception of you from the outside." Kennedy shared, "It's like I'm smart...I know I'm smart...but in here [math class] I'm the farthest thing from that. So, why is that? I know I'm not the only one." Something does not make sense about these patterns. The young women in this study were performing with excellence in their academic pursuits, and they shared similar experiences about feeling dehumanized and devalued specifically in the context of math teaching and learning. Other research on mathematics inequities for Black children, "Something's not adding up."

Billings asserted what is clear to critical mathematics educators, that the young women are brilliant, yet at various points in their k-12 math education, they faced resistance and opposition to ordinary attempts to participate in a mathematical

community. It was as if their interest in sharing intellectual space with other students was perceived as audacious. In the sections to follow, I share findings from the study that present issues of student status and peer perceptions that may help to explain this otherwise incomprehensible pattern of academically excellent Black girls experiencing struggle and strife specifically in math.

Angels & Idols

In addition to describing classroom interactions where they felt maltreated, the young women in the study discuss how teachers' social positioning of students as superior was made clear through adoration and idolization of particular students. Kennedy described being bothered when her teacher compared her to another student. "Why don't you know this? Jaylen knows it. Tarik knows it...Erin you know how to do it right?"

Carter described how white students were progressively positioned as idols to which other students should aspire. "Even as they became the absolute minority at school, they were still the standard for success". Participants cited several accounts of teachers recognizing only a select few students for their mathematics competence and instances where there seemed to be an unspoken competition to outperform the top students in mathematics class. Participants described how some students held the status of "angel" in the classroom and those who performed less than perfectly seemed to idolize the higher performing White students in the class.

Angels

Kennedy recalled routine positioning practices in her Honors Algebra II class which involved a warm-up activity, homework check, and classwork. She recalled:

“[The teacher] would walk around and check work or give [other] students praise, but he would just look at me [staring intensely] and I’m like ‘what am doing wrong?’ and he’d just look at me like this [she purses her lips, lowers her eyes, then quickly flicks her head to side] ...and I’m like ‘tell me what it means so I can get it right!’ and he just like walks away [without saying anything].”

Kennedy shared that she could almost count on her efforts going unrecognized while specific students’ work was publicly praised on a daily basis. Dakota echoed a similar instance and said that she witnessed obvious favoritism for white students juxtaposed to disdain for students of color. She recalled this disparity in the everyday ways her teacher circulated around the classroom. Dakota said white students who were perceived as “good” in math often went without surveillance¹³. Dakota recalled,

“A lot of times [the teacher] wouldn’t check their [the white kids] homework because she would be like, ‘Oh I know you did it’ and she would just be like ‘oh you’re so smart’... like ‘good job’ and like just you know like complimenting them and making them feel good.” She’d look at everyone else and tell them

¹³ Historically, Black bodies have been stereotyped as criminal and have been objects of surveillance or correction. The era of desegregation and the aftermath of integration often positioned students against each other in harmfully competitive and racialized ways. Several math scholars point to differences in student treatment based on race and discuss studies of how expectations of Black students are often lower than that of white students. White students are often perceived to be inherently smarter and hardworking, while black students are presumed to fail and be less motivated.

‘good job’ or compliment them, but with me she’d just look or frown. I don’t know why she didn’t like me obviously.”

Through the kinds of peer-to-peer positioning that Dakota and Kennedy described teachers sort students into the binary of good/bad or angel/devil, socially positioning them relative to their peers and to mathematics. This not only distorts perceptions of students’ abilities but creates a dynamic among students that discourages peer acceptance and harmony, which hinders any efforts to promote educational equity and group learning through mathematics discourse.

Dakota’s accounts provide insight into how students may internalize and process the positioning practices described above. It raises questions about participation, performance, and the relationship between confidence and competence. Dakota described how she felt when her teacher changed her partner from a classmate who was helpful to a classmate she described as a teacher’s pet. She stated:

[The teacher] moved me again...so I was all the way in the front with one of the smartest girls in the class...and she was like the worst. I just remember being annoyed with her cuz she [the student] would like kiss [the teacher’s] a** and be like ‘oh she’s so funny ha ha ha’ and I’d be like ‘no she’s not she’s the devil...she’s not funny at all’...but then I was like ‘that’s easy for you to say because you know what’s going on and she’s treating you like a queen’...I just remember being so annoyed by her.

Dakota experienced a noticeable difference in the way she was treated as compared to her partner. She described her partner being treated like royalty, suggesting the teacher offered her kindness, assistance, and encouragement: affordances that should

be given to all students but were not in Dakota's class. According to Dakota, the teacher served the "angels" or her favorite students in ways that she did not serve other students. The teacher offer the angels the benefit of a doubt, trust and respect. In contrast, Dakota, who were not considered an angel, were subject to unwarranted hostility and surveillance.

Carter recognized the subtlety of these classroom norms as racialized as we got further into our conversation:

I never noticed before, but there's like little things that you notice like the people of color versus the white kids in class...like it seems like the white kids understood it [the math content] and the kids of color don't because the teacher is always like 'BLANK' is gonna explain this or 'SO AND SO' will help you, and it's always...the white boy that's always been good at math. I think that kind of favoritism of certain kids is problematic.

It is quite possible that this type of peer to peer positioning could contribute to tacit competition among students. I would add that it is not only problematic, but it is thought provoking in that it is not outside the realm of possibilities that this type of peer-to-peer positioning could also contribute to traces of quiet competition in student actions and math identities. This can also occur with gender differences, and in the anecdote above, Carter stated that it was the student who was white *and* male that was identified as the standard of success. A similar outcome can occur where there is racial diversity but with males positioned as the dominant authority or holder of knowledge. For example, simply by having males demonstrate or explain disproportionately to girls, a message of who has social place and intellectual value is communicated and reinforced.

Idols

While scholarship on ability tracking (Oakes, 1990) and racial hierarchies of school achievement (Martin, 2012) speak to the racialized ways in which students are positioned in relation to their peers in mathematics class, this literature has not specifically discussed the culture of competition these practices can create. In addition to students feeling isolated and intellectually inadequate because they are confused and believe classmates are not, there are instructional practices that racially position students as superior or inferior. This dichotomy not only mischaracterizes the nuances of students' complex mathematics abilities, but it obscures the reality that mathematics content can be confusing for any students and that misunderstandings are more common than educators may acknowledge in the classroom. Jazzie, who displayed strong social and intellectual identities, mentioned times she, "felt inferior because I didn't know what I was doing in math class and it seemed like everyone else knew."

Carter described the mandatory 10-minute period in her high school mathematics class in which students had to ask their neighbor for help before consulting the teacher. She observed that a lot of students "don't learn like that" and that some students would often just sit and wait or go to the "smart" students. In response, Cam asked, "and who are the smart kids?" She concluded, matter-of-factly, that smart students were "the white kids" and added, "She also observed that her, "white friends were always in the higher-level math classes."

Carter shared that she began her schooling experiences and progressed from elementary through secondary school with largely the same group of white students who attended the district's elite cluster of schools. Although she did not live in the

neighborhood like her peers, she defied the zip code stereotypes of poverty and underperformance. Carter explained that in elementary school math there was a heterogenous assortment of students and abilities. By middle school, however, classes were being increasingly separated by ability and race. She stated:

“In 7th is when they started tracking, and it’s when you are like ‘I’m in the smart class’ and a lot of the other white kids that I went to City High with always felt like a competition. I always used to say [to myself] ‘I’m good at math’ and ‘I’m just as good as the white kids like Josh’. And [in class] it would be like ‘oh can you beat Lillia? Can you beat Nick? Can you?’ or ‘Oh I got higher than you!’ and whenever somebody did that they would feel so much better about themselves even though there were only like four white kids in the class. They would feel much better if they scored higher than me because that meant they might score close to the White kids.

Carter’s account suggests that students can be positioned as idols, and in this case the positioning practice was racialized. According to Carter, there was a ‘white flight’ during middle school which meant many families removed their children from public schools and sent them to private or parochial schools.

She added that the middle school feeder option in the cluster was populated with Black students. Carter explained that this option was no longer desired by White families, particularly as other public schools in the neighborhood closed and there was an “influx” of Black students. She stated that White families had the resources to actually employ other options, and “*the white parents of course they didn’t say this, but it was like ‘ohhhhh...I want my kid to go to a better school.’*” As a consequence, her middle school

served predominantly Black students. Carter recalled about two dozen white students who remained in her middle school and matriculated into City High School with her. Moreover, there were within -school programs, such as the Montessori versus the “regular” program, which she described as also divided along racial lines. Based on her experiences, Carter strongly believed “they [white kids] really are the standard for success.” Carter’s school experiences are telling for a number of reasons, but particularly as she described, in her own words, the idolatry that occurred in math class. Carter’s characterization of these positioning practices as a form of idolatry suggested that white students were the standard of success, and that the goal was to perform like white students. She stated:

“Ugh...this is very problematic...they used to break it [math classes] up by letter so if you were in 7th grade, they had A,B,C...tracks and E is the most advanced, so 7E is like the most advanced [class]...and most of my friends were in the lower track, but the goal of everybody in the lower tracks they would be like ‘I want to be in a class with white people or what is it like being in a class with *them*’ as if they were especially smart.”

Carter went on to describe the phenomenon of being in a predominantly Black school, in an advanced mathematics class with a handful of white kids, and *still* experiencing racialized competition.

“So, the competition really was because of the white kids that came up in the traditional school system...and even though there weren’t that many...most of the students idolized them...even though they were the absolute minority at school! But... they really are standard for success.”

Carter explained how students would actually compare their scores to Gunter or the few other white kids in the class:

“they would be like ‘oh I got I got a 70 something’ and then someone else would be like ‘well what did JOSH get or what did *another white kid* get?’ The kids would say this...all the kids would do this...*and* the teacher knew it, too... we looked at them [the white kids] like ‘oh *they* are so smart, and we competed with them [as a measure of success]. In the context of Martin’s (2009) appraisal of how these cultural norms disadvantage students of color and his analysis of socialization processes as related to math identity, Carter’s insights warrant further examination of the role idolatry plays in students’ math identity development and the ways students are enculturated as learners and doers of mathematics.

Across these cases, when participants were positioned as either worthy of praise or as problems in class, opportunities to learn were differentially distributed. Ola remarked, “I think that was the case. People of color and white kids are treated differently. They [white kids] may have gotten more attention and the kids of color may have been more neglected which could explain why the [white kids] demonstrate more of an overall understanding of math.”

Antagonizing Archetypes of Black Females

Another form of peer positioning in mathematics class occurs through social and intellectual perceptions ascribed to Black girls from archetypes of the Black female. Stereotype threat and management (McGee, 2011; Steele, 1995) are salient to the experiences Black girls who have to navigate gendered racism. In response to the

research questions: “How do Black girls identify and recognize negative attitudes and beliefs about their identity in math classes? How does that play out in peer interactions or relationships?” subconscious archetypes seemed to influence peer and teacher interactions and antagonize Black female students.

Findings from the study show that participants faced and navigated a range of stereotypes of Black girlhood such as the “angry bitch” and the low class “ratchet” “hoodrat.” I discuss the roots and outgrowths of these damaging distortions to Black female identity in the section to follow. Danny Martin, and Dan Battey discuss anti-Blackness as a distinct form of exclusion of Blackness from Whiteness in mathematics education. This includes perceptions of Blackness as inherently deviant or criminal and whiteness as inherently wholesome and good. Blackness as intellectually inferior and Whiteness as intellectually superior. Blackness as undeserving of praise, support, or community, and Whiteness as worthy and deserving of praise, support, and empathy. Absent from this scholarship is the intersection of anti-woman sentiments, which is captured in literature about the historical archetypes that have painted inaccurate race and gender perceptions of Black females.

I can tell you by the look on people's faces, what their assumptions of what we are and if you know the stereotypical things people say...that right there is kind of the epitome of being a Black girl... people make assumptions about you based on the negative examples of what they see and I’m like... can you actually see me?

(Carter)

The accounts that participants shared thus far evidence their experiences with anti-Black girl attitudes. I wonder if, regardless of differences across experiences, if the stares

loaded with curiosity, judgment, and assumption about differences in hairstyle, clothing, speech, body language are common to our collective experiences as Black women and girls. I would call it a Black girl aesthetic, a Black girl vibe, which is neither singular or monolithic. It is energetic, it is spiritual, it is cultural, and in terms of research, it is ontological and epistemological. But this elusive essence of Black female identity has commonly been misnamed, mischaracterized, and unnecessarily feared since slavery. Further, the doubt and disdain directed toward Black girls as deviant, either in behavior or work ethic is incredibly damaging to the personhood and prospects.

In the section to follow, participants offer additional anecdotes that reveal how limiting presumptions about Black female identity are reproduced and reinforced in mathematics classrooms. The anti-Black girl attitudes that were uncovered during the interviews came from both teachers and peers. In addition to transactions that socially placed Black girls on the margins of learning, participants were frequently made to feel intellectually inferior through perceptions that seemed to peg them as loud, aggressive, and ignorant. Findings from the study are consistent with other research that shows the destructive nature of these tropes to the educational prospects of Black girls.

As Carter described one of her AP math classes, she concluded that the teacher had low to no expectations of success for the Black girls in the class.

It would be the loud Black girl section...that's where I sat, but [I sat] in the first row...and then behind me was that [Black girl] section. You know people said we were loud...get kicked out of class...don't do our work...cheat...do it at the last minute... just turn in a bunch of papers like 'I don't get it but too bad I don't want it to be late.' And so of course the other students would be like, 'I don't want to

sit next to them.’ Those were the weird kids, the popular white kids, the smart quiet kids...and at City High it wasn’t even Asian kids because we didn’t have that many, but they sat on the other side of class like alone, that

happens...especially in the AP classes, everybody would sit in clusters. (Carter)

In this case, students self-selected seating and sadly, it seemed that the teacher and perhaps other students’ only expectations of Black girls were failure and flaw. She continued, “I think he thought we were all one big stereotype, we were all ghetto...not there to learn...and he didn’t think we could even do the work or understand the work...and really, we just needed a little help.”

The perception of Blackness as inherently deviant or criminal, and whiteness as inherently wholesome or good surfaced in nearly every participant’s account. Participants frequently identified and named others’ views of them consistent with the literature in mathematics education research on the role of attitudes and beliefs to teaching and learning (Weissglass, 2001). Using words like stereotype, assumption, belief, participants shared instance after instance where being in a Black girl body threatened their possibilities. Jazzie shared,

“You could tell he held these stereotypes and assumptions about us...then you are so sad [because] like you have to work ten times as hard because if you don’t get something done...it’s not going to be like ‘oh, she’s got something else is going on’ it’s going to be ‘oh the lazy black girl she didn’t do her work.’.”

A great deal of the findings on perception and positioning can be explained and redressed by Martin’s (2009) axioms of brilliance. Scholars have found and established that Black children are intellectually devalued in school settings. We can trace ideologies of

Blackness as inherently inferior, socially, and intellectually, back to the colonial era where anti-Black girl sentiments were born. In Chapter 2, I reviewed a great deal of the literature related to this, with special attention to Beverly Guy-Sheftall's analysis of anti-Black woman sentiments of the 19th century and Danny Martin's axioms of brilliance as an antidote to anti-Black sentiments.

Findings from the study compliment conclusions advanced by scholars like Martin, Larnell, McGee and Lemons-Smith. As participants' accounts affirm, unfortunately many people in society, school settings, and especially math spaces, don't assume or expect Black girls to be mathematically or intellectually brilliant. We have limited understandings, conceptions, and definitions for brilliance. Further, there are no representations or expectations for teachers to know diverse representations of mathematical excellence. Many of the participants report that until the movie *Hidden Figures* debuted, they had no knowledge or exposure to Black females in mathematics. Some students recalled learning about Benjamin Banneker, but not one participant recalled ever learning about a Black female mathematician in their K-12 schooling experiences.

In the section to follow, I will further unpack the discussion on Black brilliance through findings about knowledge production. In closing, however, perhaps the most alarming findings about perception and positioning, are that the historically inaccurate stereotypes of Black girls continue to taint people's beliefs about and attitudes toward Black girls compromise their opportunities to learn mathematics. From discriminatory discipline and inequitable feedback to active efforts to extinguish particular students' success; participants' accounts of zero tolerance practices with Black girls; peer

positioning of white students as superior to students of color; and sustaining a culture of division all play a role in isolating and alienating Black girls in math.

Knowledge Production

Math education researchers and Black feminist scholars alike discuss the relationship between identity and knowledge. Martin (2009) maintains that “the production of knowledge cannot be disconnected from who we are as people, what we have experienced, and what we believe” (p. 28). If this is true, then a number of things make sense thus far. It is upsetting, but not surprising that Black girls face exclusion, marginalization, and negative attitudes in mathematics given that understandings about Black girls’ capacities have historically been colored by damaging stereotypes, their so-called persistent low achievement in mathematics is substantiated by standardized test data and the proliferation of research to serve as counternarratives fundamentally does not ensure that in pedagogy, practice or policy we make a shift to embrace brilliance as axiomatic for Black children. Findings from the study negate assertions that Black girls are less motivated, more troubled at home or simply less mathematically literate. Instead, the findings suggest that Black girls have few opportunities to acquire or produce mathematical knowledge because they are often treated as incompetent, disinterested, and capable of merely completing worksheets. They are subject to curriculum and standards that fail to make visible or validate diverse ways of knowing. Their contributions, efforts, and questions are perceived as unfitting and inappropriate.

Packets as Punishment

Across all participants accounts, it was clear that while there may have been some efforts toward teaching, there was little evidence of learning. Every participant talked about their frustration, apathy, dislike of a frequently used, yet ineffective tool for teaching and learning—packets. Perhaps this is a phenomenon across public, private, and parochial schools. Perhaps this is more of a recent turn in pedagogy and practice.

Haberman (1991, p.290), however, would argue that this is standard practice in urban schools. If you have not recently visited a mathematics class in an urban school or cared for a child attending an urban public school, you may be wondering, “What is a packet?”

Packets, as named by teachers and students, are literally multiple worksheets of mathematics problems stapled together for completion during a class period or school week. Jazzie shared that, “It’s like endless paper.” Packets are often teacher made and contain pages of problems for students to complete. They are distributed by the teacher who creates problems and/or acquires them from online sources and other curricular resources. While the availability and use of textbooks varied across each classroom and school, the packet was an unfortunate staple in participants’ mathematics experiences. As early as fourth grade, students recall receiving work packets upwards of ten sheets front and back for completion in as little as a 50-minute math block. Notice there is no mention of teaching a mini-lesson or providing formal instruction. A packet is often distributed *as* instruction. I asked each participant to describe a typical day in mathematics class as they recalled it from high school. Jazzie so poignantly described:

A typical day in math class? There’s a worksheet...but the worksheet is like four

pages front and back...It's like a packet. Every single day. A new one. Everyday. If I had a binder of all my math papers it would be just endless paper. Some papers are just the formulas just so you can even figure out the work. It's just so many papers...one with just the formulas and a new paper that has like the scores so that you can figure out the work...it's too much...and in the midst of all these papers the teacher is just like 'do the work' but not really teaching. It's actually just too much. It's so stressful.

Jazzie recalled that one of her high school mathematics teachers distributed a math packet at the top of each class. "She gives us the work and she goes really fast, but we never really finish or learn anything." Similarly, Assata remembered from her freshman year, "We would come in and the teacher would hand out packets, and we would just work the whole time." One participant shared, "You usually do problems from the textbook or things that they [teachers] come up with... no lessons, you know that kind of thing...for the entire class." In keeping with responses to a typical day in mathematics class, Celia commented, "...worksheets and packets is how it's taught," and Assata added, "...just problems on the board, worksheets for classwork and worksheets for homework."

Sage, who generally maintained a positive and optimistic disposition, expressed an indifference about mathematics. She did not love it, but she did not hate it. She understood that it was required for graduation and tried to do her best despite not feeling competent because she wanted to maintain a high GPA. Her comments on packets, however, echo other participants' feelings about this mode of instruction. Sage stated, "Worksheets is not how I learn. I need guidance...and I don't think I did well because of that [packets in place of teaching] because I'm not that good at math anyway."

Packet teaching was a staple across each experience (Haberman, 2010).

Participants describe receiving assignments instead of instruction. The instruction they did receive lacked clarity and coherence. There were rules for teaching, learning, and acquiring knowledge that did not facilitate true understanding. Given considerations for the quality of instruction, prior access to knowledge and competitive or constraining class culture, many of the conclusions about Black girls' mathematics outcomes are misplaced and misguided. Jazzie, in a very matter of fact tone, stated:

There's teaching then there's do the work...do the packet...and if you don't understand...they might try to help but they are not gonna make sure you understand...**there's never that**...even if I get an F on a quiz or there's a clear misunderstanding...there's no reteaching or anything...it's just not important to them...the class just keeps moving.

Dakota remembered, "I wasn't getting anything explained to me and I wasn't understanding, and she was in no way helpful like presenting information in a way that makes sense." Ola, innocently chuckled when she remembered that one of mathematics teachers who applied the 'ask 3 then me' rule: "Why would I ask students who barely know what you are talking about when I can ask you...what if they misinform me?"

Billie, Kennedy and Assata all went without a mathematics teacher for their entire freshman year. Billy recalls, "My math teachers would more like walk in class, teach, hand worksheet, sit at their desk, and we'd work on it all period and that was it."

Assata stated, "I would be frustrated and the teacher would get frustrated and they didn't try other ways."

Participants shared many instances of experiencing intellectual invisibility through the ways that knowledge production was facilitated and validated in their mathematics classes. The instructional practices of teaching and learning via packets, videos, and peers all seem to resemble Haberman's pedagogy of poverty. Martin, Gholson, and Leonard (2010) discussed knowledge production in mathematics as a gatekeeper where the subject has been used to create possibilities for some students while constraining opportunities for others.

Other accounts of instructional neglect occurred in the form of impoverished practices such as arbitrary grouping and packet teaching. Having to move partners, change seats, being blamed for causing distraction or being assigned to work with students who are not compatible in work ethic, socially, or academically were various ways Black girls experienced social place and intellectual value. The ways in which they were placed and positioned within the classroom and across particular class offerings revealed a lack of value for the intellectual capacity that each girl possessed.

Curriculum as Punishment

In his address for the American Education Research Association's 15th Annual Brown Lecture (2018), Richard Milner established not only that various forms of discipline and punishment disproportionately excluded and marginalized Black children but that standards and curricula serve as a distinct form of punishment that oppress students of color and keep them on the margins of learning. Milner provided a number of examples to illustrate how curricular practices in schools determine what students have the opportunity to learn and result in widespread school exclusion that is rarely highlighted in education discourse. Using Milner's conception of curriculum as

punishment, findings from the study suggest that the lack of diverse representations of mathematicians who are Black and female and requirements to teach to standards that are not necessarily culturally inclusive or oriented toward equity and social justice send messages about who is and is not intellectually capable of producing mathematical knowledge and what does and does not count as mathematical knowledge. Milner posits, “Historically and currently, the absence of providing curriculum opportunities that are germane to student success and healing is a form of punishment,” Milner said.

While there were only a few interviews where we explicitly talked about representation and social justice in the curriculum, many participants talked about the lack of utility in high school mathematics content. Participants shared a range of feelings and emotions about mathematics that reflected some of what Nardi and Stewart (2003) found to be what they described as quiet disaffection in math. They used the acronym TIRED to articulate the tedious, isolating, rote, elitist, depersonalized nature of mathematics learning. Participants’ accounts speak to this experience and day-to-day learning time that often felt punitive in that it subjected them to acquiring knowledge that outside of the context of standardized assessment lacked relevance, utility or purpose in many real-world contexts.

Ola realized:

That was what was driven into me for math...the focus on memorization and testing... and I think I had a more negative attitude toward math because it just seems like it was something that as I was getting older [I realized] that it is something that I had to do in order to succeed in school and it wasn’t started as a pattern of learning but [rather] to test, so what was the purpose of math? The state

of mind was, I guess, not really learning the material, but just simply trying to memorize...[and] it's just like another thing in school that gets students to conform to the learning styles that the state and school systems really want you to.

As Ola reflected, in line with critical math and race feminist scholars, she raised important questions about what counts as mathematical knowledge and who gets to validate the production of that knowledge?

Now that I am thinking of it, why couldn't we start engaging in [learning about] you know trade systems? They don't want us to have that knowledge. I don't see why our government...who acts upon systemic racism...would want to give a little black girl or person of color or any minority...that kind of power because with that kind of power you have the ability to bring up all of your friends and all of your family members and give jobs to more minority and people of underserved communities and with that power you know they can do all that stuff. So, it seems like, yeah math is institutionalized, and, in our schools, it is just another form of systematic racism in its manipulation. (Ola)

She continued to add what type of mathematics knowledge would be of value and potentially lead to economic liberation and financial freedom for people of color and people trying to survive poverty:

...put the same emphasis on finances or financial literacy...just putting the same emphasis on those things as they do on other math [required] like statistics, Algebra II...there are ways that math can help sustain students for college, and I don't think the state or government does a good job when it comes to the Board of Education...turning learning into life skills or things that can really be used to

really help people forge a better life for themselves because if I had financial literacy in school and they did more money management or even stocks and investments... learning about that in school...I'd be a lot more prepared for life than I am now.

Ola resolved:

The more we talk about it, the more I become convinced that math is just like an instrument of systemic racism in itself in a way that like a capitalist country can monopolize on young students and their ability to absorb knowledge because when I think about it the people who have that are white people...so white people who have knowledge in statistics and stocks and bonds and financial literacy are able to conduct themselves in a way in our society that can sustain oneself and live an elite lifestyle and also be able to shape systems within it because we see our country is being run on technology and artificial intelligence and these people have this access and this knowledge.

What Ola was talking about is 'education for liberation'. She was urgently calling for utility in mathematics education. She offered a macro analysis of policy and curriculum from her personal perspective and based on her lived experience. Ola's reflection allows researchers and practioners to see what Milner argues is the power of curriculum. She specifically spoke to the ways in which curriculum disadvantages Black girls and the possibilities that reside in curriculum that are grounded in justice, oriented toward more equitable outcomes, and purposed on freedom for historically disenfranchised groups.

When we understand knowledge production in the context of curriculum, and we apply Milner's conception of curriculum as a form of punishment, we can make sense of

Black girls' unique experiences. When they describe the mental and emotional toll of sitting in ninety-minute mathematics classes week after week, year after year in high school alone, we should feel compelled to do better.

Dakota recalled:

Having to be in there for 90 minutes was like just a lot, and I would be like crying in class. I cried like because like it was just I hated being there...I would feel myself getting bummed out like even while I was in 5th period just thinking about having to go to that class, and I would like cry before...math class...definitely brought my mood down overall

Jazzie added:

You'll notice that the death of my interest [in math] was my freshman year because I was a bit stressed out being in a new school and a new place in a new city, and it was terrible...just everyday... for 90 minutes....so many papers.

In addition to simply neglecting diverse modes of acquiring, producing and validating knowledge in mathematics class, there was an assumption that lack of prior knowledge equaled an inability to acquire or produce mathematical knowledge. There were routine instances where students were expected to produce mathematical knowledge in the form of demonstrating proficient use of graphing calculators. Most participants indicated that they never actually learned how to use a graphing calculator, and or that they had difficulty transferring skills across different types and models of graphing calculators.

Dakota shared:

I never received the formal instructions. I like never had a class where they were like ‘this is how you use a graphing calculator.’ A lot of us even though we owned one, didn’t know what to do with it because we never learned.

Kennedy’s commentary on knowledge production and validation are insightful:

I don’t want to have a 2.8 GPA going into college. I put in effort. And having a good GPA is like what’s important. So, where’s mine, where’s my proof that I’m smart that I can do it? My mom tells me that having a good GPA is important so that’s what has been put into my brain since I was a kid. Having a good GPA is what you need to go to college regardless of your talent or whatever because my mom she’s like yeah, you’re an artist, but you need to have good grades and math completely messed that up for me. When I got a D in Algebra 1 freshman year that pulled my GPA down, and my mom was like ‘what the hell is this’ and I was like you don’t even see that I DON’T EVEN HAVE A TEACHER. The whole year! We had a long-term sub at the end of the year. But she never even got out of her chair; she would just sit there all day.

Dominant research and practice with respect to knowledge production in the classroom and in the broader construction of mathematics education, continues to ignore the role of classroom interactions that contribute to gaps in understanding that is vital to mathematics competence, and how attention to these layers of learning can address issues of intellectual invisibility for traditionally marginalized groups. In the discussion, I build on scholarship that acknowledges how many African American students are invisible in mathematics classrooms as evidenced in diminished opportunities to learn, and I offer

instructional strategies and dispositions that emerged from the findings to address social place and intellectual value through visibility, positioning, and knowledge production.

Conclusion

I discuss the dimensions of Human Place Value through findings from the study in Chapter five on social place and in from this chapter on intellectual value. The three cross-cutting themes that I described were visibility, positioning, and knowledge production. In Chapter 5, I illustrated how the young women in the study were socially displaced in mathematics class through interactions that made them hypervisible for correction and discipline, peer positioning that constrained productive partnerships, and disciplinary norms for knowledge production that hindered their opportunities to learn. Findings on social place suggest that Black girls' experience a great deal of tacit hostility and hatred toward their presence in mathematics spaces.

In this chapter, I presented evidence that illuminated the ways Black girls are intellectually devalued in math spaces. Using the themes of visibility, positioning, and knowledge production, I discuss numerous instances of intellectual invisibility where young women in the study were instructionally neglected, intellectually intimidated, actively ignored, and treated as if they were intellectually inept or ineducable. Issues of intellectual invisibility were also evidenced that white students were afforded privileges and assigned positive attributes while the young women routinely found themselves managing stereotypes and assumptions about their character and intellectual capacity. The issues identified with teacher and student interactions were exacerbated by the young women's experiences with content. Findings from the study suggest that Black girls in urban mathematics classrooms have few opportunities to acquire or produce disciplinary

knowledge. Across all of the cases, participants expressed that the practice and pedagogy of “packets” as central to teaching and learning was ineffective and inappropriate for demonstrating content area competence. Further, the young women’s accounts provide empirical evidence of Milner’s (2018) assertion that for Black children in urban schools, the curriculum is a form of punishment.

The young women in this study give us insight to what we already know, that when one’s *being* is minimized; when their unique ways of knowing are ignored or the complexities of the cognition are overlooked; when they are routinely excluded from learning, discouraged when in need of help and experience more failure than success; they are getting the message day after day, year after year, in these spaces (math spaces) girls like you (Black girls) do not have intellectual value. The young women also, however, give us very clear and specific ways to create safe, humanizing, inclusive spaces for learning mathematics and recognizing their intellectual value. Many of the young women expressed that simple acknowledgement of their effort; recognition of their ideas, even if in the form of misconception; celebration of their academic accomplishments in and out of the mathematics classroom; and building on the constellation of skills that they bring to mathematical communities of learning would send powerful messages to all students that Black women and girls are brilliant and bring a wealth of intellectual capital to the discipline.

Recall from the literature review racial ideologies that originated from slavery forbade Black children to learn. When Black girls experience restrictions on their participation, it is important that we understand the historical disposition that has existed toward Black children’s educational attainment.

Chapter 7: Discussion & Implications

Discussion

The purpose of this study was to document and examine Black girls' accounts of learning mathematics in urban schools. I wanted to achieve several goals with this study, which included:

- Confounding existing narratives around Black girls' so-called underperformance in mathematics;
- Unpacking the role that classroom and instructional interactions has in the so-called STEM crisis as it pertains to Black girls;
- Drawing attention to the pain and suffering that Black girls are subject to in K-12 learning;
- Proposing continued development of mathematics theory and pedagogy about Black girls with place value in mind.

The scarcity of research on Black girls K-12 lived experiences in mathematics teaching and learning warrants continued research, and it requires theoretical framings that can illuminate how Black girls can be excluded from opportunities to learn math based on the extent to which they are given or denied social place and intellectual value. I argue and provide preliminary evidence that a theory of human place value has the potential to capture and portray individual and collective truths about marginalization and other forms of oppression. By developing a Theory of Human Place Value, I hope to provide a framework for creating more safe, inclusive, and humanizing spaces for learning math.

In building a theory of Human Place Value, I envision this framework as instructive not only for future studies on Black girls, but for examining the experience of

other students of color or otherwise underserved children who face injustice and inequity in school, particularly while learning mathematics. I also wanted to highlight the importance of *human* as a descriptor in the framework. In many ways, I wonder if we can consider *human* as axiomatic, just as Martin considers brilliance as axiomatic. That is, *being* and human are inextricably linked. If the concept of holding all students with regard for their *being* and their human-ness were axiomatic, it could be practiced and applied in mathematics education, particularly where Black girls are concerned.

Scholarship on Black children is replete with handbooks and guides to cultivate teachers' sensitivity, responsiveness, and empathy and. Best practices simply point to treating all children with basic decency and dignity. While seemingly fundamental practices, Black children have historically been underserved in educational settings.

The literature reviewed in chapter 2 provides insights into how symbolically violence against Black girls has taken the form of social exclusion from and intellectual invalidation within white institutional spaces like mathematics classrooms. At the macro and meso levels, we see enactment of this violence through structural and cultural forces in our society. Black women and girls have been subjugated to distinct forms of pain and suffering that evolved from chattel slavery and were reproduced in various spheres of society, including schools. At the micro level, the cultures within white institutional spaces, such as mathematics classrooms, have cultivated anti-Black, anti-woman, and specifically anti-Black girl attitudes, ideologies, beliefs, and norms.

Findings from the study show how maltreatment against Black girls, in the form of stereotyping, differential treatment, negative bias or exclusion, can be structurally enacted and culturally reproduced in everyday learning encounters that occur in the

mathematics classroom. When families with children of color put their children in schools, they learn lessons about exclusion, marginalization, and other forms of oppression. Before Black and Brown children even arrive in pre-kindergarten, they are burdened with misperceptions and erroneous beliefs about the intellectual capacities and community resources they have to learn writ large, but particularly in mathematics. When children of color underperform or experience failure in school mathematics, there are few reports that the school system underserved them, or that the false narrative of underachievement disadvantaged them. Reports say low-income students of color are underperforming in math. We say Black females are mathematics. The national policy discourse is concerned about the underrepresented of minorities and women in STEM. Despite students' efforts to make sense of content that is difficult, learn strategies that are unnecessarily complicated, and seek assistance from their teacher, many teachers default to these mischaracterizations as justification for their ineffectiveness. We know from Gorman's response to the culture of poverty (2008) and Bosmajian (1974) that the deficit-oriented beliefs pathologizing Black children as uneducable are unfounded, and the language used to justify these beliefs is oppressive.

Disrupting Prevalent Viewpoints

It is my hope that this study serves as yet another brick in the wall of scholarship that aims to disrupt damaging viewpoints about Black girls and provide more accurate accounts of experiences so that mathematics teaching and learning can be more humanizing for Black girls. Almost without fail, as I go in and out of various school settings, I am a witness to attitudes, beliefs, and ideologies across public, private, and

parochial K-12 settings, that actively resist humanizing the experiences of Black and brown students. Viewpoints such as:

“I’m a math teacher because it’s black and white” .”

The myth of mathematics neutrality and universality has been debunked, and critical scholars have identified the multiple ways mathematics reifies political, cultural, racialized, and gendered forms of experience. The young women in the study would challenge this racially and culturally neutral framing of mathematics, as their experiences show otherwise. They experienced mathematics classes as White institutional spaces where they were subjected to differential treatment from their white peers and active opposition to their participation in mathematical communities of learning.

“These kids aren’t motivated.”

This misguided belief that racially/ethnically minoritized youth are not academically motivated is reflected in Lewis’ (1969) theory of the “Culture of Poverty.” Often times, people who adopt this belief have little understanding of motivation theory or real evidence that their students lack motivation. “Underperformance is not the same as inability or unwillingness” (Leonard, 2009, p.304). Even in cases where students were unmotivated, there are endless instructional practices and pedagogical approaches designed to effectively engage learners.

“They don’t care.”

In talking to Black girls who attended top and selective admission schools in the Allied Community Public Schools, I learned they absolutely *do* care about learning mathematics, especially because it can make or break their GPA. Mathematical

knowledge was tied to their college prospects, and they desired to feel a sense of dignity in learning mathematics.

“Those kids have very difficult lives outside of school.”

Despite living in areas considered the most economically marginalized in the city, participants’ home lives did not reflect the widely held belief that all students who reside such areas have difficult lives outside of school or at home. In fact, the young women in the study came from stable families with parents who college degrees in their fields. The young women in this study were incredibly involved in their communities, and they articulated that their greatest educational and schooling challenges lay outside of their homes. These included their commute and arrival to school, which was marked by encounters with sexual harassment, peer stereotyping, and school security processes that greeted them with metal detectors upon entry into the school building.

“They are coming in with no math background.”

Participants experienced periods of time where they were either without a mathematics teacher for an entire school year, or had a novice mathematics teacher who lacked the pedagogical content knowledge (PCK) and mathematical knowledge for teaching (MKT) to make the content accessible and comprehensible. In other words, it is not necessarily that students lack the mathematics background knowledge or experience, but rather there are students who benefit from review of prerequisite content and teacher who need to improve their content area instructional strategies.

“They are low-income students of color.”

They are students of color, and regardless of SES, the young women in this study demonstrated capacity to achieve academic excellence. The assumption that perceived

poverty connotes deficiency or lack of ability and, or questionable ambition is flawed and counter to the goals of educating all students. Martin (2009) suggests that educators reject these perceptions which been disproven as valid ways to explain students' academic performance outcomes.

“He’s tried everything to engage them [in math] but they won’t do anything.”

The young women in the study described how *they* experienced K-12 math classes, which was often confusing and disorienting. Mathematics content and the culture of mathematics classrooms can be intimidating and competitive. Participants in the study participants described how they were often made to feel inadequate and inferior in math class. Teachers' negative perception mathematics class, despite their academic excellence in other areas of school. Teacher perceptions about student (in)action do not provide productive solutions or insights needed to create positive change in which all students can develop math confidence and demonstrate mathematical competence.

The everyday language used in narratives about children is incredibly important. Othering children by casual naming of “these kids and “those kids” suggests that some students fall outside of the norm. Distinguishing youth as either “good” or “bad” students perpetuates the inequity that we often seek to eradicate. Dehumanizing language “others” students of color as different from and not as worthy or deserving of the support, instruction, or basic respect afforded to white students. This study reminds us that when we are teaching and researching other people’s daughters, we have the privilege of learning from young women who are wonderfully complex, thinking human beings.

Using insights from studies on whiteness and anti-Blackness in mathematics education are useful for characterizing how Black girls experience mathematics teaching

and learning. Moreover, these insights can be used to build a theory of Human Place Value. What is apparent from the data collected is that there are important lessons we can learn about *being* in a Black girl body in urban mathematics classrooms that are instructive for theory and practice. When Black girls are often denied social place and intellectual value in mathematics class, their brilliance is obscured, they are positioned at a disadvantage compared to their peers, and they are excluded from opportunities to acquire or produce mathematical knowledge.

In the discussion to follow, I offer two different types of counternarratives as collective representations of the young women's individual experiences learning math while living in a Black girl body. It is my hope that you will feel what it is like *being* any one of the young women in this study by reading their personal reflections on learning mathematics while Black and female. Each reflection begins with an "I am" and unfolds to offer insight and guidance to those of us who have been charged with the sacred responsibility of researching and educating other people's daughters.

Different Kinds of Counternarratives

Counternarrative is a method of amplifying the voices of marginalized and underrepresented groups (Solórzano & Yosso, 2002). Counternarratives serve multiple purposes, which include illuminating experiences that dispel deficit-based storylines and telling alternative versions of an otherwise common place story. In mathematics education research, counternarratives are often used to portray stories of mathematical success. In this study, instead of using counternarrative to discuss success versus failure, I highlight the ways *being* in a Black girl body rendered participants particularly vulnerable to social displacement and intellectual devaluation in mathematics class.

I paired Dakota and Carter's stories because, together, their accounts illustrate that the power of robust math identity, positive self-efficacy, and productive disposition is diminished in the face of hostility, opposition, and other forms of oppression. Dakota and Carter, while having very different strengths, skill sets, and levels of math confidence, shared similar experiences with anti-Black girl energy in their mathematics classes. They, like all the young women, had strong a racial consciousness and incisive insights stemming from their intersectional identities. Their stories counter common understandings that a robust math identity and content area competence will somehow inoculate Black girls from everyday assaults on/against their humanity in math classes.

Using data obtained from the background questionnaire and semi-structured interviews, I constructed Dakota and Carter's counternarratives with "I am" statements. In Black Feminist Thought (Collins, 2002; hooks, 1993, 2000), "I am" statements achieve the goals of self-definition and self-valuation by allowing Black girls to have agency in shaping their identities and creating space for them to reclaim their humanity. Notice the contrast between participants' "I am" statements, or their internal valuation, and the external characterizations of Black students that are provided in traditional research. Here, I offer two different kinds of counternarratives of mathematics experience by sharing Dakota and Carter's reflections on *being* Black girls in urban mathematics classrooms.

I am Dakota

I am an empath seeking answers to questions bigger than myself. I am an artist at heart who's always been interested in social issues. I love any type of visual arts: drawing, painting, collages, mixed media. We have a lot of art in our home from all over

the world so we collect it, and I also create it. I am multicultural, multiethnic and multilingual. I grew up with my black Cuban father, white Spanish mother, and Peruvian nanny. My mother works in the translations department of the Pan American Health Organization. I am a loving sister. I have four siblings. I am considered middle-class or more privileged in terms of socioeconomic status, but in mathematics class my teacher doesn't treat me the way she treats the other students who live on that side of town because fundamentally we (my mom and I) believe she [the math teacher] doesn't like brown kids. So, in that space, my Blackness places me at a disadvantage.

Being in math class definitely brought my mood down overall. I cried so much that year. I felt like she hated me, and it felt like no matter what I did or how hard I tried, she'd humiliate me. I remember the first day I immediately felt confused and lost. I really struggled in that class because it made me feel stupid; and I know I'm not stupid, but like that's how *being* in there for 90 minutes every class made me feel. There was nothing memorable or motivating about the room. We didn't have any images or books of people of color. I don't think most teachers even know about Black female mathematicians or Latinx mathematicians.

I wish that my math teacher knew how painful it is to be in that class. I wish she cared about how much the things she says and does to me hurt. I cried every day. She saw it. I don't understand how someone could not want to help a student who is in need. It's like she got joy from my pain; and I feel like if I were one of the white girls in my class, she would have had more compassion and tolerance for me.

Despite my negative experiences in math, I graduated with a 4.01 GPA. I listened to my sister, who also graduated from Adams, and I opted out of math for my senior year.

Excelling in my other honors and AP classes helped combat the damage math was causing to my GPA. I took AP Studio Art, AP English Literature, AP Spanish, AP Spanish Literature and Environmental Science. I was accepted to and attended the prestigious Pratt Institute. I want to use my art for social justice. My future goals include peace of mind. I just want peace of mind, and I want to make a positive impact on something bigger than myself.

I am Carter

I am a Christian. That is a big part of my identity. I am a Black female and recently in my senior film on constructs of Blackness, I explored my identity as an African American, as well as other identities within Blackness like continental African, Afro-Caribbean, Afro Latinx, or just Black and of the diaspora. Having origins in Africa makes me Black, but as for my experience, am I Black American? Afro American? African American? For me, there is an urge to reject being American, where I geographically live, and more of a desire to embrace my culture which is African centered. I am also a cisgender Female, and that is very special to me. I am grateful that I am a Black woman and to be of this great legacy...this phenomenal history. I have great-grandmothers, grandmothers, aunts, and a mother. Understanding struggle and who we are because of that struggle, just existing (just *being*)...especially in white spaces...*that* is special.

I think that the knowledge and wisdom that we have in any field to offer should be respected and put to use.

I'm the oldest of 3, my brother is 17, my sister is 16. Being an older sibling has made me detail oriented. My dad was a principal in Allied Community Public Schools

for years. I would say I do well in school, I care a lot about morals, so I am technically high achieving. I get As and I graduated with a 4.01 GPA, but it's not about the grades it's about doing my best, I do well to please myself. I like cooking and we have cook offs. I try to have a lot of fun with friends, I crochet and knit, I sew, I like doing outdoor stuff, kayaking, walking, biking, I'm pretty weird person, a lot of things interest me, I just love to learn. I'm working on learning Spanish, and I went to Argentina on the ACPS goes global study abroad program.

Being in math, for me, was not like it was for most of my friends. A lot of my friends hate math. I actually love math. I was inspired by my great-aunt because she worked for NASA at Goddard and oversaw telescope operations. I did a summer program there, and it was so much fun. There is always geometry, calculus, statistics or something different to learn, and there is so much you can do with it. I was good at it [math], and I was like this is cool! For me, math was interesting, exciting and rewarding. I did have negative experiences, especially once I went to City High School because it was very racially competitive, but I understood what was happening because my mother is a Black feminist and my father was a principal. I also have faith in God, and that strengthens me. I was able to deal with it differently than my friends because I also had strategies. For me, *being* in math and *being* in STEM in general opened a lot of doors. Though it's no longer a career path for me, I still enjoy it. In my junior year, I was planning on pursuing math in college. I changed my mind, however, because I discovered my love for film. I think by being a filmmaker, like Ava DuVernay, I can do more to help my community than I could see achieving through a career in math or STEM. I can use my studies in film, media and communications for social justice. I am interested in

directing, filmmaking, screenwriting, community politics and affairs, and also communications in my community. I will always love math, and I don't feel like I wasted my time loving in that way. I wish more of my friends had the type of support and encouragement that I had learning math, because I think that is what made the difference.

Researcher's Reflections on being Dakota and Carter

I juxtaposed Dakota and Carter's stories for several reasons. Dakota and Carter had similar experiences with marginalization, exclusion, and oppression despite having different levels of math proficiency. Their accounts echo research findings that call for utility and purpose in mathematics content (Beswick, 2011; Boaler, 2002); the emotional trauma of pain as oppression in mathematics teaching and learning (Gholson & Martin, 2019); and the importance of agency to liberation in the lives of Black women and girls when facing subjugation, particularly in white institutional spaces (Collins, 2002; Evans-Winters, 2019; hooks, 1993). Also, having a robust math identity and having the keys to what for many is a locked gate to the STEM field was not enough to keep Carter in the STEM pipeline. Carter opted out of a career in mathematics as an act of resistance to oppression and in an act of love for her community. Dakota chose not to take mathematics her senior year as an act of self-recovery in order to heal the academic and emotional wounds she suffered from Honors Precalculus.

Finally, I chose these counternarratives because I am Dakota and Carter. I am an empath and a mathematician. I cry and I resist oppression. I work hard, and I exercise my agency to place myself in environments where I can be of service to others. Dakota and Carter's stories provide us with different kinds of counternarratives, and serve as proof that a narrow focus on performance outcomes offers an incomplete and misguided

understanding of the barriers Black girls face to actualizing their mathematical brilliance. Rather, these counternarratives show us that we must consider numerous factors when drawing conclusions about and identifying remedies for Black girls' mathematics achievement and decisions to pursue STEM careers.

Implications

The purpose of this study was to document and examine Black girls' experiences with exclusion, marginalization, and other forms of oppression in mathematics. After conducting the study, analyzing the data, and composing interpretive renderings of the findings, the questions then became:

What do I want people to know?

What do I want people to be able to do?

How can we use a theory of human place value to provide the knowledge and skills to create more inclusive spaces for learning math?

Recall that in Chapter 3, I introduced 'Human Place Value' to conceptualize and operationalize how students are either given or denied social place and intellectual value in math spaces. The theory of Human Place Value maintains that when given social place, students experience a sense of belonging, acceptance, and accomplishment. Similarly, when students are valued for their intellectual contributions, they feel respected for their unique ways of knowing, recognized for the constellations of capabilities/competencies they embody, and they are acknowledged for the various forms of mathematical brilliance they offer to communities of learning.

Findings from the study suggest that human place value functions in K-12 urban mathematics classrooms in racialized and gendered ways that disadvantage students of

color. This study illustrates how Black girls in particular face exclusion, marginalization, and other forms of oppression through encounters with teachers, content, and peers that socially displace and intellectually devalue them. In the following section, I answer these aforementioned questions directly and in relation to the Human Place Value Framework introduced in Chapter 3. I discuss the implications of this study to the education research paradigm, first with commentary on theory and practice. I close with reflections on the methodological insights we draw to improve the quality and validity of future research on Black girls.

Moving Toward a Theory of Human Place Value in Math Education

Based on findings from this study and insights from the pilot, in a mathematics class where Black girl brilliance is axiomatic, teachers understand the sociohistorical significance of intersectional identity, and specifically how Black girlhood has been constructed and constrained in the United States. Teachers then actively operate as anti-racist, anti-oppressors, critical race feminist mathematics educators, regardless of their own identity. This in and of itself has implications for practice. It means knowing representation matters, and it is clear from the teachers' disposition, the classroom aesthetic and the instructional approaches that the teacher has studied content, culture, and identity. The aesthetics of the space not only reflect a respect for diverse role models, but the physical arrangement is readily adaptable to whole group, small group, paired and individual modes of engagement with content and/or peers. The instruction is prepared with knowing that purpose and utility are salient to Black female epistemology. In a mathematics classroom that centers Black-girl Brilliance, mathematics is not considered Black and White, but rather an art where multiple ways of knowing are embraced and

discussed. Students are free to express their thinking without judgment, they are curious about the different ways of knowing presented by peers, they collaborate at will to reach shared understanding, and the collective cooperation in the room fosters a sense of harmony and synergy. Through incremental yet steady growth, they develop the confidence and competence to persevere through mathematical tasks and demonstrate the range of abilities we deem to reflect mathematics proficiency. I know this to be effective and true because I created and implemented this model of Black-girl Brilliance with my pilot study. I found that when Black girls are given the social place and permission to support each other, to consult each other and to advise each other, they were able to leverage non-mathematical, cultural, and community assets like sisterhood and solidarity, collective work and responsibility, that nurture excellence. Creating a safe space for students to have agency and autonomy, to think and learn (which involves trial-and-error and fine tuning) allows for building of skills and expansion of mathematical knowledge. All the while, students are acknowledged by peers and teachers for the intellectual value they bring to the learning community. They consistently feel respect for their presence, recognition for their effort, and they routinely experience accomplishment. They not only feel a sense of belonging, but they consistently have examples and experiences that communicate the same. They are given access to the content in comprehensible ways, and the teacher understands that their effectiveness is a direct reflection of student success. These practices are consistent with the findings that were uncovered by using Critical Race Feminism as a guiding framework for the research design and employing lived experience as a methodological choice in the data collection process.

Being in a Black girl body, therefore, takes on a new identity where external ascriptions of value seek to leverage intellectual capacity. *Knowing* from the standpoint of Black girlhood is recognized as an infinite field of multidimensional understanding. *Doing* the business of teaching grounded in axioms of Black girl brilliance requires consultation with Black women and girls (through research, study, and conversation) as bearers of specialized knowledge.

Implications for Theory: What do I want people to know?

Much of this study calls consumers of this research to orient themselves to particular ontological and epistemological understandings, while fundamentally embracing brilliance as axiomatic for Black children (Martin, 2011), and especially Black girls. As we consider the theoretical implications of this study and the findings related to how Black girls experience human place value while learning math, I want people to know that:

- Even as we continue to use standard measures of achievement and proficiency in K-12 math, Black girls are brilliant and bring a wealth of intellectual capital to mathematical communities of learning;
- Despite having the capacity to: 1) master various standards and skills identified to be essential for disciplinary competence and college-career readiness, 2) demonstrate adaptive reasoning, strategic competence, conceptual understanding, procedural fluency and productive disposition, *being* in a Black girl body uniquely structures access to, threatens opportunities for, and shapes experiences with respect to acquiring and producing mathematical knowledge;

- A shift is required in the way we talk about, research, and identify best practices for mathematics teaching and learning for students of color at the intersection of race and gender, particularly students who are Black and female. As scholars, the empirical data from this study coupled with sufficient evidence from other relevant studies on Black girls' mathematics experiences demands that we consider paradigm shifts that honor ontological, epistemological, and axiological principles of *being*, *knowing*, and *doing* with Black girls in mind.

According to Crotty (1998), the philosophical underpinnings of more liberatory research paradigms raise questions about the nature of reality, challenges single or scientific conceptions of reality, and acknowledges that we can acquire knowledge about many realities that exist in the human world. To that end, the principles that guide how we obtain, create, and validate that knowledge are equally important. A paradigm shift requires us to qualify any scholarly endeavor designed to theorize or draw theoretical conclusions about Black girls' mathematical outcomes with ontological considerations for *being* and epistemological understandings of *knowing* that center Black females. Doing so not only considers multiple identities, realities and expertise of the researched when applying or innovating theory, but it also gives the research the type of credibility that is often overlooked or invalidated by traditional standards.

As the literature, pilot study, and empirical data from the current study evidence, there are various states of *being* for Black girls in society writ large, and particularly in mathematics classrooms as white institutional spaces. This study illuminates ten accounts out of the thousands of Black girls currently taking mathematics in urban schools. Because of the sociohistorical remnants of slavery, segregation, systemic racism and

sexism, simply *being* in a black girl body, creates a very different reality for young Black women, one that readily renders them vulnerable to social displacement and intellectual devaluation. It is precisely because of this unique social perspective that Collins (1990) argues for privileging the distinct ways of knowing that emerge from Black women over and above the institutionalized forms of knowledge that have not served us (Evans-Winters, 2020). *Being* in a Black girl body and experiencing the complexities of Black girlhood over the course of K-12 schooling provides Black females with an ever-evolving knowing and understanding of exclusion and marginalization that, according to Collins (1990) and hooks (1991), equip us with the ability and authority to create new and non-traditional scholarly insights with validity. In fact, Martin (2019) calls for critical scholarship in mathematics education that rejects the use and consumption of research that is used to maintain the status quo.

The theoretical implications of this study turn us to critical and transformative paradigms that acknowledge the interplay of multiple constructs of *being* and reality. Findings from the study also illustrate that the realities of *being* and knowing are inextricably linked, socially constructed, and influenced by the dynamics of power/privilege and oppression/vulnerability. These forces operate at the individual, group, and institutional levels to create inequity in broader society that stems from exclusion of students of color and non-traditional learners within and across schools. For theory in mathematics education, moving toward more humanizing research agendas attuned to more ontologies and epistemologies that amplify the voices of historically subjugated and silenced groups has the potential to yield more pedagogically informed insights for mathematics teaching and learning that concerns non-dominant groups.

Implications for Practice: What do I want people to be able to do?

I hold incredibly high hopes for this study and its influence on teacher practice. More important, so did the young women who gave graciously of their time to contribute their stories. We ultimately want mathematics teachers to have the knowledge, skills, and ethics of care to create safe, humanizing spaces for all students to learn mathematics. I have discussed how an ontology and epistemology grounded in Black girls' lived experiences were the driving forces for the research design, and I explicated the importance of orienting research and practice with Black girls in mind to these particular forms of being and knowing.

One of the challenges of theory, however, is building the bridge to practice. How do we operationalize participants' wisdom? How do we create safe, humanizing spaces for learning mathematics? How do we create 'social place' and cultivate 'intellectual value' for Black girls and members of other marginalized groups? First, we look practically to participants' collective wisdom. Then within research we consider paradigmatic orientations and the underpinning axiology of our practice and methodological approaches. Finally, we circle back to theory as standing on the other side of the bridge to practice, and we consider the possibilities for a theory of Human Place Value in mathematics teaching and learning.

Collective Wisdom

Collective wisdom is shared knowledge within a community (Brown, 2013; Evans-Winters, 2005; 2002; Guy-Sheftall, 1995; hooks, 1989, 1993, 2014, 2018; West, 2016). Yosso's model of community cultural wealth (2005) exemplifies the power of

collective wisdom, and it shows how collective wisdom is a constellation of community capital.¹⁴ The term, also used synonymously with collective intelligence, is historically found within Black women's intellectual traditions where Black women harness their experiential, social, political, and scholarly knowledge to name truths universal to Black womanhood (Waters & Conway, 2007), actively resist dominance and oppression (Collins, 1998), and provide intellectual guidance to dismantle the structures that exclude and marginalize members of non-dominant groups. Within the broader Black community, Karenga (1997) identified collective work and responsibility as essential for building and maintaining strength, well-being, and prosperity in our community. In research, Black feminists, critical race theorists, and critical race feminists agree that leveraging collective consciousness are necessary acts of resistance and agency. Mathematics scholars who apply this concept argue that collective intelligence, in-group solidarity and peer collaboration are important factors for creating more equitable learning experiences and achievement outcomes (Aguirre et. al, 2017, Boaler, 2008; Gutierrez, 2000).

At the end of each interview, I asked participants to name what teachers would need to do to create safe, inclusive, and humanizing math spaces, particularly with Black girls in mind. I specifically asked them to share do's and don'ts for teachers. I then selected the most significant themes across their recommendations and shaped the collective wisdom as a letter to mathematics teachers. It is inspired by the aesthetics of composite (counter) narrative (Harper, 2009; Harper & Davis, 2012; Hayes & Juarez, 2009; Solórzano & Yosso, 2002; Wertz, et al., 2011), The Combahee River Collective

¹⁴ Community Cultural Wealth is comprised of cultural capital, aspirational capital, familial capital, social capital, navigational capital, linguistic capital, and resistance (coping) capital (p.78).

Black Feminist Statement (1977), and The Collective Black Feminist Aesthetic Statement and Manifesto written by Oberlin College Students (2019). Black Girl Brilliance Collective Wisdom is not a blanket statement. Rather, these are tenets that we suggest to create ‘social place’ for and to nurture the ‘intellectual value’ within Black girls and other marginalized students.

Black Girl Brilliance Collective Wisdom

Dear Math Teacher,

We are beautiful, brilliant, Black girls who are here to learn and gain access to opportunities just like you expect of our white peers and any thinking being in our society. We want you to be *your* best so that we can do *our* best. To assist you, we have some very simple do's and don'ts that you can easily implement in your practice without hesitation. You'll notice this isn't actually specialized teaching for Black girls. Alas, as Gloria Ladson Billings (1995) established, it's just good teaching.

Don't

- Don't compare students. For example, don't say things like "but Alex gets it, so you should too by now."
- Don't yell at students. In urban schools especially, a lot of teachers don't have familiarity with our experiences, and they easily get worked up because of their own inability to effectively teach. In ACPS, teachers raise their voice and make harsh remarks to students that push us further away from learning and make classrooms feel unsafe.
- Don't cry. Please don't cry. It doesn't make sense. On the one hand, teachers are unnecessarily hostile, and when that doesn't work, they cry to get sympathy. If we have such "difficult home lives," why are YOU crying?
- Don't rush us. That is actually the least helpful thing you can do. If I'm already nervous, afraid or unsure, give me time and space to think. Let me work with people who I feel comfortable. Try to figure out what I need to understand or be successful.

- Don't be so hyperfocused on students obviously struggling or students who present challenging behaviors because you inadvertently let the more cooperative, compliant, quiet students go under radar. Just because I am not being disruptive doesn't mean I don't need help. Don't confuse work completion for comprehension.
- Don't hand out information and not explain it thoroughly. A packet does not provide instruction. Like a book, it is a material resource that requires human interpretation.
- Don't be condescending, and don't make students feel less than worthy of dignity when they simply don't understand something. We are in school to learn. If we already knew everything, there would be no point in us being here.
- Don't have a mindset of frustration when students need reteaching or review. That is literally what your job is...to teach. Anticipate that students may need a review, and do it with joy and professionalism.
- Don't make assumptions about what students can and cannot do. Learn about students' mathematical experiences and personal lives. Students may not have had a math teacher for long periods of time. Students actually have equally important things occupying their cognitive space. Students actually forget things, too.

Do

- Do instill confidence in all of your students and let them know that they ARE capable and that this IS understandable, then go about the business of making that true.

- Do create a positive, warm, and friendly environment...and not just with posters and sunlight, but with your attitude and your beliefs.
- Do assign homework, but be reasonable. If you assign hours worth of work that is also not comprehensible, that creates stress and that's when kids cheat.
- Do make things interactive and have tangible, concrete objects or real-world examples, create common shared experiences.
- Do make sure you have thoroughly explained in multiple ways, perhaps multiple times, what you expect us to know and do.
- Do highlight assets, acknowledge and recognize effort, contribution and all forms of thinking. It is encouraging and builds confidence needed to develop proficiency.
- Do regularly elicit feedback from students and listen to the informal commentary available to you on a day-to-day basis. Just be open to what we have to say...listen to and hear us!
- Do create common ground and equity through incorporating shared experiences into your lessons, something all students can access, relate to, and reference
- Do educate yourself about and expose your students to female mathematicians of color. Representation matters. Identities matter.
- Do make the space feel more welcoming. Attend to the lighting, aroma, sound and the overall energy in the class. Make sure we feel safe, secure, and calm enough to engage and learn.

Applying Axioms of Brilliance

Whereas the ontology of this study calls us to see and view the world through states of *being* for Black girls; and the epistemology requires us to think about the world with Black females' sensibilities and ways of knowing; the premise of the study rests on Martin's (2009) axioms of brilliance.¹⁵ Axiology urges congruence between ontological and epistemological principles. It plays an important role in the rigor of the research and its philosophical underpinnings.

In *Proofs and Refutations*, Martin (2011) defined an axiom as a logical statement that is assumed to be true. Axioms are not proven or demonstrated, but rather considered to be self-evident. Axioms serve as starting points for deducing and inferring other truths. In culturally responsive pedagogy and African centered schooling, the brilliance of Black children is understood as a fundamental asset of *being*. In *Mathematics Teaching, Learning, and Liberation in the Lives of Black Children* (Martin, 2009) nearly two dozen mathematics education scholars contributed scholarship on Black children's mathematical brilliance, their unique ways of knowing and/or the methodological considerations for research concerning Black children and mathematics. Gholson et al. (2012), however, point out that in research and schooling, embracing the brilliance of Black children as axiomatic seriously disrupts any sense of doing the work

¹⁵ Martin (2011) identified five necessary orientations for educators and researchers to adopt in order to achieve productive outcomes for Black children math learning environments.

of mathematics education related to Black children. It means that we accept as truth Martin's Axioms of Brilliance (2011)¹⁶:

- Axiom I: Black girls are brilliant
- Axiom II: Black girls possess the intellectual capacity to learn mathematics
- Axiom III: Race and gender are not a causal variable in determining mathematical achievement among Black girls or any other group of children
- Axiom IV: Racism and sexism; racial identity and racialized gender roles; racialization and socialization of Black girlhood are important considerations in mathematics learning and participation
- Axiom V: Mathematics classrooms are simultaneously sites of oppression and liberation for Black girls

With this in mind, I revisit the pilot study to imagine what a safe, humanizing mathematics class would look and feel like; and what would we do differently with students, as teachers and with content to create social place and cultivate intellectual value for Black girls in mathematics? What would it look like if we were envisioning this for our own daughters? What would a mathematics classroom look, sound and feel like if it was grounded in “Black Girl Brilliance”?

¹⁶ These are an adapted version of the axioms as Dr. Martin originally wrote them. With his verbal permission in December 2019, I adapted some of the axioms to specifically consider Black girls.

Conclusion

The Human Place Value Framework is a work in progress that with further study will be continuously refined. It requires teachers to reflect on their practice and elicit student feedback, particularly students of color and Black girls, to the extent to which they are affording or denying social place and intellectual value. Distilled from participants' wisdom, this framework captures what students feel and experience when given or denied social place and intellectual value in math class.

Table 6. Human Place Value Framework

Human Place Value			
SOCIAL PLACE		INTELLECTUAL VALUE	
Create a sense of	Be mindful of	Amplify worth with	Take care not to
Belonging Acceptance Approval Connection Access	Isolation Hostility Disdain Opposition Restriction	Respect Recognition Acknowledgement Accomplishment Opportunity	Minimize Hinder Ignore Overlook Discourage Fail

Without embarking on another project and proposing a model for operationalizing the Human Place Value framework in mathematics classrooms, I simply revisit “daughtering” (Evans-Winters, 2019) as a comprehensible and accessible way to think about how to incorporate this approach into everyday practice. The first step is to

acknowledge that all students are human, and that students of color, non-traditional students, particularly Black girls, have historically been treated as other than human. The second step is to imagine that the young women in our classrooms are our daughters, particularly the Black girls. If we treated young women in our research and practice as if they were our daughters, we might operate with greater pedagogic sensitivity. If we employed daughtering in our practices, we might be more attuned and responsive to what it is like *being* in a Black girl body while learning mathematics. If we treated Black girls with the same humanity we would demand for white students, we might not find it such an exercise of the heart and mind to provide all students with the social place and intellectual value they deserve to experience success and actualize their mathematical brilliance.

Appendix A: Background Questionnaire

Name	High School(s) Attended	Math SAT Score(s)
Age	HS Graduation Year	Undergraduate College
Birthdate	HS Cumulative GPA	Major/Field of Interest
Pseudonym	Highest level Math Course (HS)	Future Goals/Aspirations

1. How do you self-identify (in terms of race and gender or otherwise)?
2. Tell me about yourself.
3. How would you classify yourself/your family socioeconomically?
4. What language(s) do you speak?
5. What are your talents and/or interests?
6. How many siblings do you have?
7. Growing up, who was/were your primary caregiver(s)?
8. What are their occupations?
9. Other information (personal, social, emotional, intellectual, academic, artistic) you'd like others to know about you:

Appendix B: Semi-Structured Interview Protocol

Examining the Experiences of Black Females in Urban Schools

Opening Question:

Tell me how you feel about math and why?

I. Personal Background

- Tell me about the schools you've attended?
- Tell me about the math courses you've taken up until now
- Have you ever been enrolled in an AP math course?
 - Specifically, please tell me about your experiences in AP math courses
- Have you ever been without a full-time math teacher?
 - If so, how did it affect you?
- How do you identify?
 - What do those identities mean to you?
- Tell me about the types of math teachers you've had in the past.
- Have you ever had a teacher that identified similarly to you? What was that like?
- How would you describe yourself academically?
- How do you see yourself as a math learner? What are your strengths?

II. Math Story

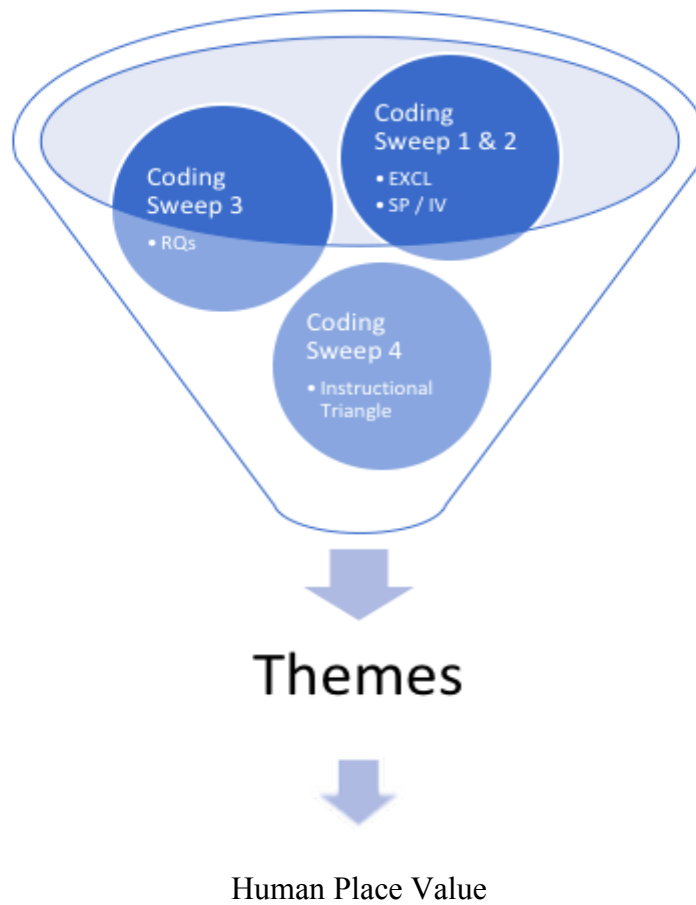
- How do you feel about math and why?
 - What appealed to you most?
 - What appealed to you the least?
- If you had to pick 3 words to characterize your experiences in math, what would they be and why?
- Tell me about some of your most positive experiences in math
 - What made your experience positive? Describe
 - Interactions with the teachers
 - Interactions with peers in your classroom
 - The environment/setting
 - The curricular resources
- Have you had any negative experiences in math?
 - What made your experience negative? Describe
 - Interactions with the teachers

- Interactions with peers in your classroom
 - The environment/setting
 - The curricular resources
- Why do you think these encounters occurred?
- Tell me about some of your responses to these negative experiences
- How have you learned to cope/what are your strategies for coping with negative experiences in math?
- Who or what helps you navigate challenges?

III. Recommendations

- Describe a typical day in your most recent math class
 - How does that compare to your other high school math classes? Similar? Different? Typical?
 - What was most successful/worked well with/about this class?
- What improvements would you make?
- Of all your math teachers, please tell about an exemplary or stand out teacher and their practice
- What can teachers do to make math experiences more positive and inclusive for Black girls?
- What are your top five do's and don'ts for math teachers, keeping the success of Black girls in mind?

Appendix C: Distilling the Data to Build a Theory of Human Place Value



Coding Sweep 1: exclusion (EXCL)
Coding Sweep 2: social place (SP) / intellectual value (IV)
Coding Sweep 3: Research Questions (RQ1, RQ2, RQ3)
Coding Sweep 4: Instructional Triangle¹⁷ (ST, SS, SC)
Themes: Visibility, Positionality, Knowledge Production
Human Place Value: Social Place & Intellectual Value

¹⁷ The Instructional Triangle for Math classifies classroom interactions as student-teacher, student-student, student-content (Ball & Forzani, 2009)

Appendix D: *being Jazzie*

I am a Black female...a woman...and that identity is really important to me...it has shaped who I am, How I act in certain settings...I think people are Intimidated by it. When I walk into a room, I have a certain jenesequa and people are intimidated by that confidence and the fact that I know I am greatness, and I am excellence. I know there is a narrative that there is an anger (referring to the angry Black woman trope), but I try to talk and have a conversation (even when I disagree or assert myself) because I am diplomatic. But nonetheless, I am kind of funny, good spirits, good humor. I am an understanding, caring and sweet girl. I think I'm pleasant to be around.

I speak a little Spanish and I'm well-travelled. We have been to Brazil, South Africa, Dubai, Australia, Germany, Monaco, Italy, France and the UK. I love painting. I am also a singer and fun fact, I can talk with my mouth closed! I have 2 brothers, one older and one younger. My dad is a real estate developer and my mom works for the federal government.

Another thing I think it's important to know about me is that I travel every day from Hilltop on the south side of town to Allentown on the North side of town. I commute at least an hour each way on the bus and metro. I deal with a lot just to get to school and then when I arrive its security guards with attitudes, administrators with orders, and teachers with their power and control issues. By the time I get to math, I'm like "can I just learn?"

I AM NOT my GPA or my grades...those things don't reflect my excellence. I had a very traumatizing freshman year that destroyed my GPA and it was hard to recover from that, no matter how well I did in my latter classes. It was so bad that I had to

transfer schools. There was no freedom. It was very jail-like and it was scary and it made me super depressed about school and it caused me to actually be depressed and have to get a therapist and all these other issues just from stress. I used to go home every day and just go straight to sleep because I was tired, and it was horrible.”

Once I came to Adams, things got better, but my GPA still suffered. I did ok on the SAT though and I had options for college. I attend St. John’s in New York and I study psychology. Now that I’m in college, I deal with these issues even more. But I am determined to be excellent. I aspire to. I hated going to math, the way he made me feel, the way he would look at me, he never helped me with my work and he never looked me in the eye. He was always staring at my lips and when I came in he’d scan my body up and down.

Overall, being in math class was stressful. I hated going. I wouldn’t take it again, I didn’t like it. I am taking math right now because I have to, but the way it makes me feel, I wouldn’t choose to be here. A typical day in math class no matter what grade there’s like a worksheet, but the worksheet is at least 4 pages front and back. It’s a packet every single day...a new one every day! If I had a binder of all my math papers **it’s endless paper**, some papers are just formulas, so you can even figure out the work. It’s too much. It’s stressful. There’s teaching...and then there’s do the work....that’s basically what *being* in math class feels like...and if you don’t understand, maybe they will try to help you...but they are not gonna make sure you understand. THERE’S NEVER THAT! Even if I get an F on the worksheet or quiz...even if EVERYONE does...the class just keeps moving...even when there’s a clear misunderstanding among EVERYONE...there’s

no reteaching or anything...it's just not important to them and most kids have tutors so, they will get it and pass.

Even when everyone was confused, there is something about the Isolation I felt just because sometimes I wouldn't know how to do the work and I will look at everyone and it would still seem like they knew something that I didn't...so I always felt a little abnormal in math because I felt like whatever it was that we needed to know somehow went over my head...and it felt like I was the only one. *Being* in math also made me feel really worried too...worried about my grades, worried about my GPA and knowing no matter how hard I work, I don't know if I'm going to fail or not. I never know if I'm going to finish all the worksheets or not, especially because I have so many other classes, so I was always worried it would do further damage my GPA.

Interestingly, though, *being* in math class never made me feel sad like it did with some of my friends. No matter what, I'm never sad...no never that...we're never sad. Disengaged and discouraged maybe, afraid definitely and the uncertainty of not knowing if I'd pass or not is awful and of course, causes insecurity, but not sadness. And even though I'm a very confident person, *being* in math compromised that self-confidence. I was raised to see beauty in my brown skin and excel in school, so I walk around like I'm that guy, but then I get in math class and the teacher starts talking and I'm like why don't I know what's going on? And I don't even know what to do...and *that* makes me feel helpless in general and inferior to my classmates, almost like an outcast..and that's just something I can't allow myself to feel, so then I just detach. I find the solutions so my grade doesn't suffer.

Up until my senior year I think all of my high school math teachers have been white males. In 10th grade I had a math teacher who was sexually harassing me. He would always try to flirt with me in class and whenever I would talk to him because I needed help, he would get in my face and he would never look at my eyes when I was talking to him, he would always look at my lips, and that's when I was in 10th grade and I realized wow, I'm really a black woman and I have black lips and people really stare at me (because of that) and it's really weird. I would try to sit in the back so that he wouldn't be all in my face, but whenever I would walk in class it would seem like all of class would stop because I was walking in. When I came in late he would be like 'oh look who's coming in late' and if I apologized like I'm sorry he would be like you're not sorry and he'd try to like joust with me over being late and I'm like Jesus Christ! And then I would come in late he would look me up and down, he kind of like scanned me every time I came into class...and he would keep the door locked so that he would have to let me in the class...so that he would have to look at me and see me and it was just nasty and horrible. I was so stressed out going to math class. I would skip class. I hated going. Because like I'm just trying to get my grade, I don't even want to learn this for real for real. I don't really try for math because it's just a lot of papers and it's a lot to keep up with and it's a lot to pay attention to and it's a lot of work...and (honestly) I'm not super dedicated to it...I have other things going on and I just need it to improve my GPA. I had just transferred, so I was still super depressed. My GPA had been trashed from my whole freshman year, and I'm like ok I'm about to get something new something better, but my teacher made me eject from the situation (disengage)... like I skipped class, I would come

late so I could be in there as little as possible...it was terrible...every other day for 90 minutes. I just really felt targeted in that class.

Appendix E: *being* Carter

I am a Christian. That is a big part of my identity. I am a Black female and recently in my senior film on constructs of Blackness, I explored my identity as an African American, as well as other identities within Blackness like continental African, Afro-Caribbean, Afro Latinx, or just Black and of the diaspora. Having origins in Africa makes me Black, but as for my experience, am I Black American? Afro American? African American? For me, there is an urge to reject being American, where I geographically live, and more of a desire to embrace my culture which is African centered. I am also a cisgender Female, and that is very special to me. I am grateful that I am a Black woman and to be of this great legacy...this phenomenal history. I have great grandmothers, grandmothers, aunts and a mother. Understanding struggle and who we are because of that struggle, just existing (just *being*)...especially in white spaces...*that* is special.

I think that the knowledge and wisdom that we have in any field to offer should be respected and put to use. I say that because the first time I experienced workplace discrimination was when I was a junior film intern with an all-male crew. The way they spoke to me was so disrespectful, and I think it was not only because I was Black (because some of them were Black), but because I was female. Now, attending a PWI (predominantly white institution), I literally clean up after white people for work study, and it is upsetting because all of the service staff are people of color.

I'm the oldest of 3, my brother is 17, my sister is 16. Being an older sibling has made me detail oriented. My dad was a principal in Allied Community Public Schools for years, and now he is a program analyst in the local government. My mom focused on parenting and homemaking for years, and now she is a real estate agent. I am an

energetic, passionate person. When I'm really interested in something, I am all in. I can be laid back but my siblings think I'm high strung. I would say I do well in school, I care a lot about morals, so I am technically high achieving. I get As and I graduated with a 4.01 GPA, but it's not about the grades it's about doing my best, I do well to please myself. I like cooking and we have cook offs. I try to have a lot of fun with friends, I crochet and knit, I sew, I like doing outdoor stuff, kayaking, walking, biking, I'm pretty weird person, a lot of things interest me, I just love to learn. I'm working on learning Spanish, and I went to Argentina on the ACPS goes global study abroad program.

Being in math, for me, was not like it was for most of my friends. A lot of my friends hate math. I actually love math. There is always geometry calculus stats there is something different to learn and so much you can do with it. I was good at it and I was like this is cool. For me, math was Interesting, Exciting and Rewarding. *Being* in math and STEM in general opened a lot of doors for me, though it's not a career path anymore. In my junior year, I was planning on pursuing math in college. I changed my mind because I discovered my love for film, and I think I can do more to help my community and with social justice through my film, media and communications studies. I have Interned at the DC Office of Cable Television, Music Film Entertainment, OCT-working with communications, staff writer and ghost editor Howard newsroom when I was at CHS. I am Interested in directing, filmmaking, screenwriting, community politics and affairs, and also communications in my community. But I was inspired by my great aunt because she worked for NASA at Goddard and oversaw telescope operations. I did a summer program there, and It was so much fun. I don't feel like I wasted time loving

math. I wish more of my friends had the type of support and encouragement that I had learning math, because I think that is what made the difference.

Appendix F: *being* Ola

I am a Black female. I am hardworking and I stretch myself thin. I am really hard on myself. I am a person who doesn't get enough breaks from responsibility. I am artistic. I am an only child. My mother raised me. She's a traveler, very nomadic. Right now, she's taking a break from her PhD and being a professor. I find the socio-economic classifications interesting. I don't know where we'd fall. Middle class? Working class? What can I say? Money comes in and out...mostly out, but we're not homeless, so that's a blessing.

I love creative writing and psychology. I love dystopian societies and alternate universes. I graduated with a 3.3 GPA and I took a gap year before starting at Hawaii Pacific. Now that I'm 20, I realize how little import the math that stressed me out in high school has now. I have no need for it in my day to day life career or college. I'm a film major, and I'm in the honors program and I feel more recognized as an individual for my talents and gifts. Whereas, k-12, math was integral to be recognized as intelligent and to succeed, and now that's not even a factor.

Being in math didn't feel safe. It didn't feel stable. There was always this fear of failing, this fear of being wrong, and as a person who didn't like to be wrong, and as a person who just being in my skin was wrong, that was difficult for me. I just remember that I never really liked math. It was never really my thing. And there were always just negative vibes, a lot of rules of what to do and not to do, but every teacher was different. Some teachers wanted you to "ask 3 before me" and some teachers accuse you of being off task if you are asking someone for help. It always felt confusing and isolating. I remember feeling lost and disconnected most of the time. Sometimes I didn't ask for help

because I felt stupid, and I felt embarrassed. There was a lot of memorization, and if you couldn't remember things, then you weren't good at it...and I remember "not being good in math" and being ashamed of it. Over time the more that it was drilled into me that it was something that I had to do to be successful in school, the more resistant I felt to it, especially when it started becoming more to do well on the state test.

By the time I go to high school, not excelling in math seemed to have greater consequences for my future. I went to a super competitive selective high school where I had requirements for a regular diploma and an extended school day for pre-professional certificate in Theatre. My friends that went to regular high schools attended school for thirty hours a week. I think the rigor of 40 hour plus school weeks for four years took a toll on me. I remember not knowing what I was gonna do. If I wasn't doing good in my academics and not excelling in my arts program, what was I gonna do? I didn't take math my last year. I remember of the two Black female math teachers I had, they had an empathy and affection for me that my white male teachers would not or did not have, even when they pushed, they knew how much and how far to take it.

Now that I think back on it though, as far back as 5th grade, the only time black girls could shine or get a gold in school was in the arts, and that was considered something that comes natural to us...like, "oh she can sing because she's a Black girl" or "of course she's a good dancer, she's Black". It seems like in math and science we have to supersede everyone else just to get basic recognition. Really, it's just another thing in school that gets the students to conform to the standard of intelligence. Instead of focusing and emphasizing financial literacy or something useful, we have to demonstrate mastery of things that don't actually matter unless it's in a specialized field. Learning

should be for life skills, like things everyone needs to know, like money management or even stocks and investments, so we can learn about wealth and financial freedom. I don't think the Board of Education does a good job of that, like teaching things to help people create a better life for themselves. The more I think about it, the more I am convinced math is an instrument of systemic racism, in a way that like a capitalist country can utilize young students and their ability to absorb knowledge because the people who have that knowledge are white people. They have the knowledge in statistics and stocks and bonds and that knowledge enables them to sustain themselves in our society and have an elite lifestyle, but also to be able to shape systems within itself and to divide people in our society. If White people can live an elite lifestyle or create systems that benefit them, then they can maintain control. So of course, they would not want more people to have that knowledge, because if more Black women were able to excel in math and benefit their communities, then that power can be a threat to this whole structure. Having extensive knowledge in math and science that goes beyond what the average a person of color has is like a weapon and to get that power you would have the ability to bring up all of your friends and all your family members, and I just don't see why our government which acts upon systemic racism would be invested in doing that.

Appendix G: Jazzie's Wisdom

Dear Math Teacher,

If you want to create more safe and humanizing spaces for Black girls to achieve in math you could focus more on our minds instead of our bodies. Yes, I change my hairstyle frequently, but can you say anything to me that is not about my hair? Like, I know you think that's being nice or "culturally relevant", but I have never seen you say that to the white girls, so it makes me feel, again, like some freak show exhibit instead of normal just like everyone else. And honestly, when white men in particular do it, it's like small talk and that's not what I'm here for...and what's worse is it's the only type of small talk that I get from them. I don't like it. If you are going to issue compliments on hair, be equitable. Sarah just got highlights, and I personally think they look great! If you are going to engage in small talk, find more small things to discuss. Focusing on my body makes me feel like I'm still some sort of commodity. Ask me how I'm doing. Ask me if I need extra help with the assignments. Like I have an F but you can talk to me about my hair not my grades or me...that doesn't make any sense.

How about we discuss if I know and understand what we are doing? What if you actually did something when I am having difficulty? Instead of having small talk, what if you actually genuinely cared about how I'm doing? What if you checked up on and checked in with me about school and life. Finally, DO NOT expect me to know what I'm doing when I go home if I didn't know what I was doing in class (and that's just the facts). Care enough to know how to teach me...I'm not that different from them.

Appendix H: Carter's Wisdom

Dear Math Teacher,

Not every student will love math or readily understand it. Your duty is not to make the best math student that ever existed, but it is your responsibility to help students feel comfortable while they are learning. Get to know *how* your students learn. Is it through visual or auditory means? Do they learn by rewriting things? Every student is different. Give them specialized attention tailored to the way they learn, not the way you think they should learn or the way you learn. Try to teach the black girls in the class. If the black girls are learning...everybody will learn. If you are teaching them to care about it, that will rub off on other students. Try to flip the script and the narrative from the people struggling the most to be the ones who are learning the most. What if you just tried Catering to us? What if teaching math *was* Specialized to what we think and say?

Or, just be human...don't care *so* much about teaching to the standards.

The whole point is to teach children, care about your kids and show it...and if you don't...then have some guest teachers who do care come in and teach from time to time. If you are not a black woman, know that representation matters. Expose everyone to something different, different perspectives, different approaches, different role models. It's exciting and it changes the flow. If you do it with consistency students will look forward to it. Give your students something to look forward to.

Finally, don't be racist...be respectful and understanding. Don't ignore the black girls. There is always a Black girl with her head on the desk every day in some math class in any given school. Some teachers say, "Get out!" Some teachers say, "She probably has a lot of stuff going on at home" But neither of those are appropriate

responses. Actually, showing care, and helping Black girls feel a part of something that they don't understand. Not everybody comes from home with a high school math educator. Not everyone can hire a tutor and most parents don't remember high school math because when do we really use it after that? Is that the stuff at home people mean? Probably not. But if you are not teaching Black girls, then you are failing them.

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