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**ACADEMICALLY TALENTED UNDERGRADUATE BLACK WOMEN'S RANGE OF  
BELIEFS REGARDING IDENTITY AND EXPERIENCE IN STEM**

A DISSERTATION in

Higher Education

by

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## ABSTRACT

Though gains have been made in broadening participation in science, technology, engineering, and math (STEM) for underserved and historically marginalized groups, challenges remain with recruiting, retaining, and graduating Black women in STEM. This study offers a nuanced response to this underrepresentation and centers on participants' understandings of race and gender across the contexts of high school, family, society, peer interactions, and college. Bronfenbrenner's ecological model, Crenshaw's intersectionality, and Collins' Black feminist thought, taken together, were utilized to explore Black women's range of beliefs about race and gender in relation to how they see themselves and others accessing and thriving in STEM.

Qualitative research methods (narrative inquiry) were used to explore the range of beliefs held about race and gender by 24 academically talented Black women in a merit-based STEM summer bridge program at a predominately white institution. Participants reflected on how they saw racism and sexism enacted in their day-to-day lives and how they viewed themselves and their STEM identity. The participants articulated a need for changes in the educational system to dismantle practices that dissuade Black women from pursuing and succeeding in STEM; to see themselves in their academic experiences and future career settings; to see same-race, same-gender people in the positions they coveted; and to have mentors and role models assist them in navigating their chosen field. Research implications include an emphasis on education and training for those who work closely with Black women, and ultimately a shift from white-centered norms to those that are inclusive of the increasingly diverse student populations across higher education institutions in the United States.

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## Chapter 1. Introduction

The societal imperative to broaden higher education participation has been widely appreciated and its socioeconomic benefits well documented (Grandy, 1998; American Institutes for Research, 2013). Within the discourse surrounding this imperative, particular attention has been focused on expanding the United States' recognition as a global leader in science, technology, engineering, and math (STEM). In this context, researchers have probed the effects of racial and gender diversification in the STEM fields and have suggested that diverse perspectives contribute to productivity and innovation (e.g., Espinosa, 2011; Museus, Palmer, Davis & Maramba, 2011; Ong, Wright, Espinosa, & Orfield, 2011). As such, for the past four decades higher education institutions have been challenged by national funding agencies such as the National Science Foundation to increase the enrollment and persistence of historically marginalized populations in STEM. In response, universities have secured grant funding, allocated institutional funding, created dedicated positions, and developed specialized programming to advance these goals. The aim, too, of many grant-funded programs center on creating opportunities and experiences that close the gap in knowledge and prepare minoritized populations for careers in STEM (Ong, et al., 2011; Strayhorn, 2011; Johnson, 2016).

On the national level, a number of such programs exist, and longstanding programs such as the Meyerhoff Scholars Program, Ronald E. McNair Post Baccalaureate Scholars Program, and Minority Engineering Program have tracked their effectiveness and positive outcomes (Stole-McCallister, Domingo, & Carillo, 2011). While the micro goals of each program are unique to each program's context, their macro goals tend to center on the success of students, whether it is preparation for graduate school or career opportunities.



The generally promising effects of the above-mentioned efforts on the enrollment, persistence, and retention of historically underserved and marginalized students in STEM could be enhanced, according to researchers like Fries-Britt (2000), through deeper exploration of the identity-specific experiences of academically talented, racially and gender diverse students. Much of the literature has examined student of color experience in the aggregate, rather than exploring individual identities. Therefore, through this study, I contribute to a limited, but growing body of research on the experiences of particular identity groups within structured educational environments. By exploring the experiences of academically talented Black women in STEM, my study addressed this gap in the literature and offers university and program administrators, as well as educators, practical recommendations for improving their offerings.

Furthermore, I embraced an anti-deficit approach (Harper, 2010) to explore how this population understands and negotiates aspects of their multiple, intersecting identities while reflecting on their high school experiences and navigating the particular context of their university-based STEM program. The use of an anti-deficit framework acknowledges the work that students regularly engage in to navigate their educational experiences and to avoid relegating a student's experiences solely to the barriers and reasons they may not succeed. In the study, I viewed the challenges that students faced as a way to broaden our understanding of their experiences overall, and how particular experiences contributed to their development as humans and scholars, as well as helped define what they needed to succeed. It is important to remember that the participants are intelligent, capable people, and while the anti-deficit approach is key, I also acknowledge that this study sought to be one focused on the participants' success and ability to negotiate the parameters of pursuing STEM fields. And, while the participants' experiences did not always reflect ease in navigating identity in STEM, my aim was to address the challenges

and acknowledge the ways educators and the systems they work within, can effectively reduce barriers and ultimately contribute to very goal of broadening participation in STEM for underserved and marginalized populations.

### **Statement of the Problem**

In the extant literature, the *success* of students of color, and Black women in particular, is often juxtaposed to other racial and gender groups without consideration for the context by which Black women are situated in higher education and STEM. In 2014, Black and white women earned bachelor's degrees in science and engineering fields at comparable ratios (28% of all degrees pursued by the former and 27% by the latter). This proportion lagged behind Black and white men (31% and 38% respectively). Furthermore, Black women earned 5% of all bachelors' degrees in science and engineering in 2014. This contrasted with 28% earned by white women, 3% by Black men, and 31% by white men (National Science Foundation, 2016). Thus, Black women completed STEM degrees at a ratio comparable to their white women counterparts. However, their underrepresentation in STEM becomes starkly evident when observing that while white women earned a similar share of all STEM degrees as white men (approximately 30% each), white men earned six times as many STEM degrees as Black women (31% versus 5%).

Comparisons to white men pervade the higher education literature with regard to the experiences of students of color, thereby privileging and perpetuating educational models that work best for the former group. The comparison stems from the persistence of white men in STEM. In their study, Penner and Willer (2019) findings uncovered the overpersistence of white men in mathematics and science. They found that white men demonstrated levels of confidence that propelled them forward in STEM, and were more likely to retake classes more than women.

Understanding this phenomenon is critical to further examining the continued gender inequity in STEM.

The comparisons, generally bleak, paint a picture of uneven access and success (e.g., persistence, retention, and graduation) for students of color. These statistics and observations foreground the issue of Black women's representation in STEM and suggest the need for further research. In Chapter Four, I address how the gaze of whiteness shapes and pervades STEM education and sets the norms for engagement and success that neglect other racial and ethnic groups. This gaze of whiteness is further complicated by gender roles and norms, thereby relegating other groups to the margins.

Given Black women's current underrepresentation in STEM and the systems they are often expected to navigate at predominately white institutions (PWIs), a clearer understanding of the early experiences of Black women who enroll in STEM programs would provide valuable insights for efforts seeking to increase their representation and thus the diversity of professionals working in fields that shape the nation's global competitiveness. Such research contributes to the literature examining issues related to students of color in STEM (e.g., Espinosa, 2011; Museus et al., 2011; Chang, Sharkness, Hurtado, & Newman, 2014), as well as expand anti-deficit research exploring the intersections of identity and their influence on perceived ability and persistence (Harper, 2010; Bentley, 2017). Harper (2010) described anti-deficit approaches as those focused on how achievers overcome disadvantage, especially those from marginalized backgrounds.

Through anti-deficit research, my study examined the range of beliefs about race and gender held by academically talented Black women in a merit-based STEM program. As academically talented Black women in STEM, they are achievers who through their narratives,

often described how they would ultimately overcome their challenges. This frame for the research is a promising one for providing faculty, practitioners, policy-makers, and grant funders with insights that can be used to inform their curricular, programmatic, policy- and funding-related decisions.

As noted above, there is a paucity of literature examining the experiences and reflections of women of color who successfully navigate and complete their STEM programs, with only a small subset focusing on Black women (e.g., McGee, 2017; Charleston, George, Berhanu, Amechi, & Jackson, 2014). Extensive research about Black women has, for many decades, focused on their challenges in higher education related to access, preparation, and persistence. Similarly, research in STEM on Black women, since the 1980s, has focused on the roadblocks and issues that this population has encountered, including longstanding discrimination based primarily on race and gender. This research has emphasized racism and sexism as contributing factors to inequitable educational outcomes (e.g., Howard-Vital, 1989; Yosso, Parker, Solorzano, & Lynn, 2004; Patton, 2004). Researchers are yet to satisfactorily complement this deficit-oriented work with anti-deficit work that examines factors that contribute to success among academically talented Black women. Consequently, there is a need for research addressing how the intersection of academically talented Black women's race and gender contribute to the development of their racial, gender, and science identities (Carlone & Johnson, 2007).

The multiple identities for Black women create what is known as a double bind for women of color in STEM at the intersection of race and gender. This double bind "refer[s] to the unique challenges minority women faced as they simultaneously experienced sexism and racism in their STEM careers" (Ong et al., 2011, p. 175). Hence, this study further explored how the double bind influences women of color in STEM and whether the participants articulated the

double-bind as a clear, contributing factor to their educational and collegiate experiences. My study expanded the opportunity to further our empirical understanding of the STEM-related early educational and collegiate experiences of women of color within the academic and sociocultural context of traditionally aged college students navigating change and development at multiple levels. By examining the range of beliefs about race and gender held by Black women, I was able to probe how context, self-perception, and identity shifts and shapes their early educational experiences, as well as their college experience, persistence, and retention.

Higher education scholars have increasingly focused on identity in their research on how particular populations experience and navigate institutions of higher education, examining such factors as sexual orientation, race, gender, socioeconomic status, faith and the intersection of identities. Torres, Jones, and Renn (2009) noted the multi- and interdisciplinary nature of identity development and formation, which have roots in psychology. They articulated that the social construction of identity is steeped in “majority culture,” (p. 584) which ultimately determines the norms and values that are placed on identity as “socially appropriate” (p. 583). This influence, they assert, necessitates an examination of “the role that culture and dominance play in personal and societal beliefs about identity [as] critical to understanding socially constructed identities” (p. 583). Other research on identity has indicated the salience of race and gender, both independently and separately, as important to the experiences of historically marginalized populations.

Further, despite the growing body of work on identity, there is no one term that encapsulates the multiple influences on identity formation and development for students of color in STEM which includes and/or intersects race, gender, and academic experiences. Taken together, for the purposes of this study, I use the term *STEM identity* (after Carlone and

Johnson's 2007 work on *science identity*) to refer to the academic-related experiences that shape a student's confidence, persistence, and retention in STEM (e.g., academic expectations and requirements, laboratory experiences, and research). Thus, this exploratory study focused on identity, in response to calls by STEM researchers for further examination of Black women's experiences (Museus et al., 2011). Accordingly, in this study I share my examination of the experiences of Black women pursuing STEM majors, whose experiences were shaped by their early educational experiences, and high school in particular. Guided by an interdisciplinary lens, the aim of the study was to build greater understanding of how academically talented Black women make meaning of their identities in relation to their range of beliefs about how race and gender present in their lives and the lives of others like them.

### **Purpose and Research Questions**

The purpose of this study was to examine the range of beliefs held about race and gender by academically talented undergraduate Black women in a merit-based STEM program. The STEM Success Program (SSP) (pseudonym) accepts students based on academic talent, in addition to other criteria. By examining these students' conceptions of identity in relation to their environment and experiences, this study provides insights for researchers, practitioners, and others to develop better experiences and more aptly support Black women as they navigate their academic programs in STEM. The following research questions guided my research:

1. How do academically talented Black women in an undergraduate, merit-based STEM program communicate about their treatment in high school regarding race and gender?

2. In what ways do race and gender influence how academically talented Black women in an undergraduate, merit-based STEM program articulate their own access and ability to succeed in STEM?

### **Research Approach**

My investigation of the narratives of Black female students in a merit-based STEM program utilized qualitative research methods, namely narrative inquiry. After exploring other methods, I identified narrative inquiry as the most appropriate method since the research centers on the narrated experiences and interpretations of particular and relatively exceptional (i.e., academically talented Black female) individuals. The narrative inquiry design of the study allowed me to present the individual voices of participants while also allowing me to note similarities and differences in their reflections on the multiple, intersecting identities of Black women in a selective, merit-based program at a large, public, predominantly white university.

I selected Bronfenbrenner's (1979, 2005) ecological model, Crenshaw's (1989) intersectionality theory, and Collins' Black feminist thought to ground the framework of the study. In her seminal work, Crenshaw (1989, p. 1243) consider[ed] how the experiences of women of color are frequently the product of intersecting patterns of racism and sexism, and how [those] experiences tend not to be represented within the discourses of either feminism or antiracism. Because of their intersectional identity as both women and racially marginalized within discourses that are shaped to respond to one or the other, women of color are marginalized within both.

This study further explored the layered, often complicated nature of the ways racism and sexism influence higher education and the study of STEM fields more specifically.

Bronfenbrenner's ecological model (1979, 2005) contrasts and complements theory that focuses

on identity. It examines environmental factors that influence a person's development over time as represented in multiple, nested systems. In short, these perspectives together comprise the study's conceptual framework and assisted my analysis, which focused on developing a nuanced understanding of how the environment, experiences, and identity of academically talented Black women in a merit-based STEM program ultimately affect their perception of self, perception of others, and how they see themselves in STEM. The framework is described in more detail in Chapter Two, which also includes a review of the literature addressing (1) identity development, (2) intervention and bridge programs, (3) women in STEM, (4) merit-based education, (5) role modeling and mentoring, and related concerns.

The site of study was a merit-based program situated within a predominately white institution. Its participants came to the program with particular experiences, understandings, and ways of making meaning of their past experiences in high school and their recent early experiences in university as Black women pursuing STEM careers. Through narrative inquiry, I acknowledged the uniqueness of each participant's experience while also analyzing the similarities and differences between their pre-college and early (summer bridge) collegiate experiences. This allowed me to identify salient conceptions and themes, whether they were voiced by one or many participants. The data originated from multiple sources: focus groups, responses to written prompts on race and gender, and secondary documents on the program and university setting. The primary sources of data that I examined came from students' focus group discussions, as well as (to a lesser extent) their written responses to prompts centered on race and gender, which were collected during their summer bridge program. For the written prompts, the participants were allotted a limited amount of time to respond, because initial responses often capture the true essence of an emotion or understanding of the idea at hand (Merriam & Tisdell,



2016). In addition to the focus groups transcripts and the written prompts, I examined secondary documents on the program and institution.

For this study, purposeful selection was used (Maxwell, 2013). I examined the narratives of 24 participants. Each participant had to meet the following criteria to be included in the study: (1) be at least 18 years of age, (2) be a participant in the summer bridge program of the SSP, and (4) self-identify as an African American or Black woman. In the Chapter Three, I share a more detailed description of the context and participants, and provisions to protect the identity of the participants, i.e., through the use of pseudonyms.

### **Significance**

As calls to broaden participation in STEM continue (Hurtado, Newman, Tran, & Chang, 2010; McGee & Bentley, 2017), research concerned with underserved and historically marginalized populations in these fields is becoming increasingly urgent. This study aimed to contribute to existing literature in three ways. First, the exploration of identity in its multiple forms for academically talented minoritized students in a structured, merit-based program provided insight into their experiences and expanded current understandings of how such students navigate their collegiate experiences. Second, this research aimed to contribute to a growing body of literature that employs an anti-deficit model for understanding the experiences of Black women. This was important because counternarratives about how and why students succeed can be instrumental in the creation or re-envisioning of commonly employed frameworks. Third, this work contributed to recent research concerned with Black women, since many past studies on college students' experiences have neglected to provide detailed understandings of this specific group.

This study also has implications for practice and policy. The findings provide institutional leaders with insights into (1) how and why some Black women in STEM navigate their collegiate experiences in the ways that they do and (2) practical recommendations about differentiated support to assist in fostering spaces in which Black women can thrive and develop holistically.

### **Researcher Perspectives**

My identity, first and foremost, provided me with a perspective that helped contribute to a more nuanced understanding and analysis of the experiences of the participants through their written narratives and verbal responses about their experiences in the merit-based program. As a Black woman, I have had a particular interest in the experiences of African Americans and Black people (i.e., all identities that span the diaspora) in higher education contexts. Even more, as someone who initially pursued an undergraduate degree in a STEM field, I have been invested in and intrigued by the opportunities, tactics, and possibilities that Black women navigate to both learn about themselves in their academic processes, as well as successfully complete a rigorous academic program. The completion of the program is just one marker of success, however. Academia could benefit from more diverse, well-trained STEM professors, and industry could use more diverse, skilled professionals.

When engaged in qualitative inquiries, some literature asserts that the researcher should refrain from being too connected to the research, as it may detract from their ability to effectively conduct the study. While appreciating the noted pitfalls, for this study I aligned with the view that qualitative researchers cannot suspend who they are when acting as the instrument of analysis.

In being forthcoming about my lived experiences and stance regarding this research, I share the following personal narrative to contribute to the trustworthiness of this study. In my first year of college as an undergraduate student, I pursued pre-optometry courses with a desire to one day be an optometrist. Since the third grade, I wore corrective lenses and grew fascinated with the science and math behind how the instruments and doctor's management of an eye exam eventually resulted in me being able to see clearly. As a child, I do not recall having an optometrist whom I perceived as a woman or person of color. I did not have the foresight to ask questions about why there were no women or people of color; however, I was still able to envision myself as the person conducting the eye exams. What I did not understand as a college student, however, were the rigors of pursuing coursework steeped in advanced biology and mathematics. And, since I did not have adequate preparation in high school, I felt woefully underprepared to continue with an educational and career plan that I did not feel equipped to pursue. These experiences inspired my interest in understanding how women and people of color succeed in fields where as a child I rarely, if at all, saw them.

Throughout my higher education experiences, I have been drawn to issues of access and equity for historically underrepresented and marginalized groups. My coursework, research experiences, and support of larger projects fueled my desire to conduct this research. I am an outsider, not having persisted in STEM; however, my continued interest in these fields and issues of access, equity, and success have sustained. In my current work as a cultural center director, I have shared my explicit interest in equity with colleagues and was invited to participate in the university's first-ever equity scorecard professional development and training meetings to address STEM equity gaps at the university. This work reifies my commitment to STEM and provided me with additional perspective for the conducting the interpretive work of this study.

In sum, I assert that the subjectivity tied to my established interests in STEM, equity, and the experiences of Black women did not detract from my abilities to conduct the present study in a thoughtful, rigorous manner.

### **Definitions and Terminology**

The following terms were used throughout the study. These terms are defined here to clarify meaning and prevent confusion or misinterpretation:

**Black and African American.** These designations were used interchangeably to describe those who racially identify as Black or have heritage that intersects the African diaspora. Research often refers to either or both racial/ethnic designation, and I used the terms throughout this study in accordance with the cited literature. For the participants in the study, I used Black as the racial designation.

**Academically talented.** In this study, the term academically talented aligned with the application standards for the merit-based program from which participants were drawn, and which I detailed in Chapter Three. Some research refers to this group of students as high-achieving.

**Merit-based program.** This referred to a program with particular standards for membership or participation that highlight a student's academic skill and potential.

**Persistence.** This indicated the state of a student persisting or continuing through milestones pertinent to STEM and through which they did not shift to a non-STEM degree.

**Success.** Success is a broad term used throughout education literature. In this study, when referencing the participants, success was defined as a student's ability to articulate their development in positive ways.

**STEM identity.** Carlone and Johnson (2007) refer to science identity; in this study, I more broadly referenced STEM identity to include the various fields in STEM that the participants were pursuing in their degree programs. STEM identity referred to how a student saw themselves a member of the scientific community.

### **Outline of Future Chapters**

This study was organized into five chapters. Chapter One described the topic under investigation, purpose of the study, research questions, and significance of the research to various stakeholders. Chapter Two reviewed and critiqued literature relevant to the study with an emphasis on African Americans and Blacks in higher education, the presence of racism and sexism in universities, identity development in STEM, role models and mentoring, and the role of bridge and intervention programs. It also more fully described the study's conceptual framework. Chapter Three detailed the methodology of the study, the participants, the data collection process, and how the data was analyzed. Chapter Four highlighted the study's findings. Chapter Five included the study's discussion, implications, and suggestions for future research.

## Chapter 2. Conceptual Framework and Literature Review

Higher education scholars are increasingly addressing the role of identity and multiple, intersecting identities as factors in students' success in college. Black women, considered as a group, are among those that have been challenged in negotiating their identities in higher education contexts and in STEM specifically. For these reasons, I used three frames, taken together, to better understand the role of environment or context, race, and gender in Black women's experiences with race and gender across contexts. These frames, detailed in the following section, are Bronfenbrenner's ecological model (1979, 2005), Crenshaw's (1989) conception of intersectionality as a means to understand the complexity of people's multiple identities, and Collins' (2002) Black feminist thought/standpoint to situate Black women's experiences as different than the majority given their layered marginalization. Immediately below, I address and make connections between each of these frames and the study's research topic. Following this, I parse literature that is useful to understanding the experiences of this study's target population, i.e., undergraduate, academically talented Black women in a merit-based STEM program at a predominately white university.

Bronfenbrenner's ecological model (1979, 2005), Crenshaw's (1989) intersectionality framework, and Collins' (2002) Black feminist thought/standpoint comprise the study's overarching framework and provide conceptual grounding for my intentional focus on the experiences of Black women and the ways in which gender and race, as intersecting identities, present in the various contexts that shape the students' experiences. Indeed, their experiences may be best understood using frames and perspectives created for and by self-identified Black women (i.e., Crenshaw and Collins). More importantly, my choice to utilize these frames helped

avoid faulty or unfaithful interpretations that more easily arise from the use of models and schools of thought that were not created with marginalized identities in mind.

### **Ecological Model & Environment**

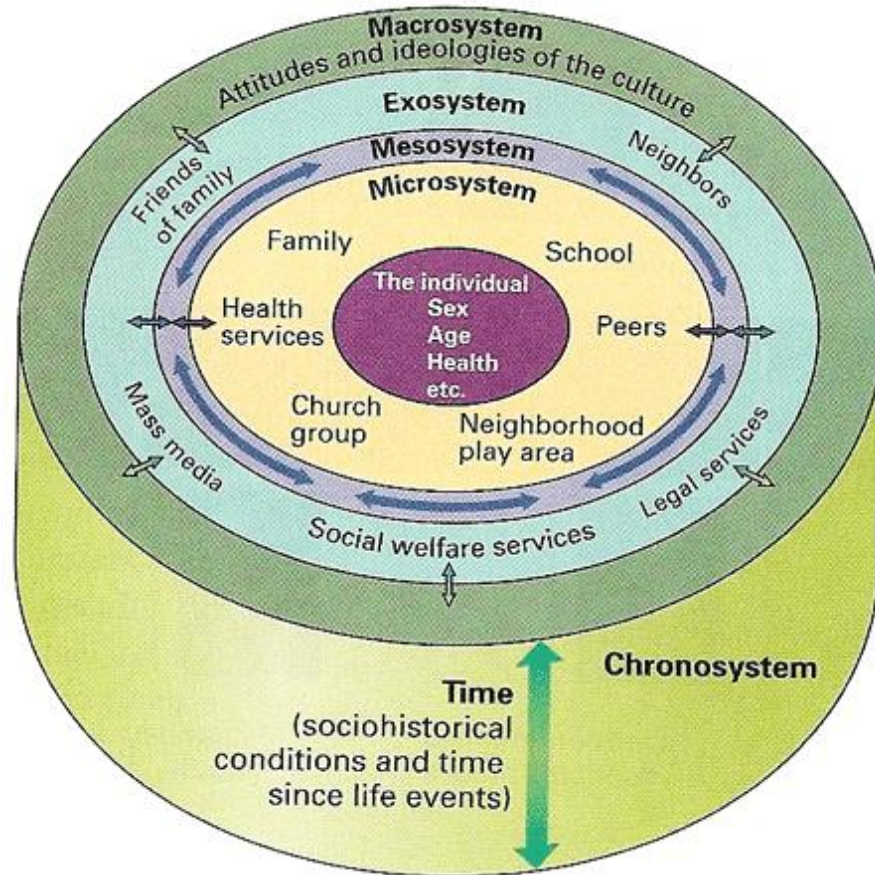
Student–environment interaction and subsequent outcomes have often been examined in higher education through Astin’s (1993) Inputs-Environments-Outputs (I-E-O) college impact model. The three components of the model, inputs (pre-college factors), environment (college campus), and outputs (academic performance), interact and provide researchers with a holistic understanding of the ways that students learn to navigate campus. The first iteration of the model was based on white men, and it was not until subsequent versions were created that diverse populations were incorporated. Many models of student development reference or even include aspects of the I-E-O model, including iterations of the ecological model. While Astin’s I-E-O model more broadly addresses three dimensions of a student’s experience, Bronfenbrenner directly addresses environment or context and how various contexts (i.e., systems) shape or inform human development.

The ecological model also allows for another layer of analysis that takes into consideration the experiences of humans in different contexts that shift due to that context. In order to develop an understanding of how, in what contexts, and when Black women negotiate the multiple influences on their development and how they understand the interplay of race and gender, this study utilized Bronfenbrenner’s (1979, 2005) ecological model. A depiction of this model is included below as Figure 1 (image source: Kohli, 2013). Using this model, I identified how the participants negotiated and navigated various educational and social contexts while in recognition of their racialized, gendered, and academic identities. Bronfenbrenner (2005) situates systems as the locales for various people and/or groups to centralize their influence.

Bronfenbrenner's (1979, 2005) ecological theory offers levels that contribute to human development. For the purposes of this study, I describe these levels and relate them to the context of the research site:

1. The microsystem involves the structures and processes taking place in the immediate setting, for instance the classroom and program.
2. The mesosystem is a system of microsystems that are linked and contribute to the development of a person. The mesosystem could be comprised of the student's classroom and familial experiences taken together.
3. The exosystem also maintains linkages and influences the student's immediate setting. However, it does not directly involve the developing person (e.g., policy makers and policies that inform the student's experience). The exosystem in this study could be named as the relation between the student's program experience and the leadership group or driving force that determines what happens in the student's experience.
4. The macrosystem is the overarching pattern of ideology and organization. The macrosystem is the institution itself, as it brings a certain culture or subculture that drives the establishment and implementation of program culture (Renn and Arnold, 2003; Bronfenbrenner, 1979).





*Figure 1.* Overview of Bronfenbrenner's Ecological Model

Bronfenbrenner's ecological model has been used across educational settings and in higher education specifically to articulate how the environment influences the experiences of students (e.g., Renn & Arnold, 2003; McGee, 1999). In a recent monograph, Cabrera, Franklin, and Watson (2016) offer an additional lens from which to understand environment, noting the differences in how students of color experience environment in comparison to white students. Even more, Bronfenbrenner (2005) created the Process-Person-Context-Time (PPCT) model, which describes the interactions a person has with their environment over time. The aspect of time is crucial to the model, as the author asserts that time accounts for cumulative effects.

Therefore, this study explored how, if at all, Black women students addressed the effects of time during their transition from high school to college.

### **Black feminist thought**

While Bronfenbrenner's (1979, 2005) model offers the context and time perspective for how people develop, it does not explicitly address identity. Therefore, in an attempt to explicitly probe the unique and complex experiences of Black womanhood, I incorporate Patricia Hill Collins' (2002) Black feminist thought (BFT), which offers a lens for African American women to formulate and rearticulate their distinctive, self-defined standpoint. This standpoint, or perspective, is one that is grounded in the historical experiences of Black women. Black feminist thought has its origins in the literary work and experiences of African American women who, through their writing, offered examples of Black women's lived experiences, notably Anna Julia Cooper, Ida Wells, Sojourner Truth, and Fannie Lou Hamer. These experiences were often formed in and around whiteness and patriarchal norms set by the majority. As such, BFT seeks to (re)define lived experiences from an authentic, untampered space without the gaze of whiteness. The gaze of whiteness entails the expectations and norms established by white people who hold power and make specific determinations about how those without power navigate systems not created for them.

With systems and those who hold power in mind, an authentic understanding is required if STEM programs are to attract, retain, and graduate greater numbers of Black women (no less other minoritized students) who are able to navigate educational systems with less harm (e.g., racism, sexism, microaggressions, bias). As such, my study employed BFT as the foundation from which to understand the layered and unique experiences of the participants. I used BFT as a framework and analytic tool to give light and bring depth to often ignored, dismissed, or

misunderstood experiences of Black women in higher education, and STEM more specifically. And, while BFT contextualizes the narratives of Black women, intersectionality extends the appreciation for Black women's multiple, intersecting identities and the ways in which power serves as the driver for how identity is experienced by those who are marginalized.

### **Intersectionality**

Coined by Kimberlé Crenshaw in 1989, intersectionality addresses multiple, often inextricably linked identities such as race, sex, and class. Cho, Crenshaw, and McCall (2013) conducted a robust analysis of intersectionality, as the use of intersectionality as a framework and tool for analysis had, since its inception, garnered broad multi-disciplinary critique. More recently, Collins and Bilge (2016) addressed critiques about intersectionality and identity in their book, noting that it incites "identity politics." The concern, as articulated by Cho, Crenshaw, and McCall (2013) may be steeped in researchers and practitioners identifying intersectionality as only addressing "categories of identity versus structures of inequality" (p. 797). These concerns are necessary to address, as they influenced my interpretive work in this study. In higher education research, intersectionality has often been used to understand and explain the role of identity in the experiences of a population. In their article on identity development, Dill and Zambrana (2009) define intersectionality by the following four theoretical interventions:

- (1) Placing the lived experiences and struggles of people of color and other marginalized groups as a starting point for the development of theory;
- (2) Exploring the complexities not only of individual identities but also group identity, recognizing that variations within groups are often ignored and essentialized;
- (3) Unveiling the ways interconnected domains of power organize and structure inequality and oppression; and
- (4) Promoting social justice and social change by linking research and practice to create a holistic

approach to the eradication of disparities and to changing social and higher education institutions (p. 5).

Dill and Zambrana (2009) offer a nuanced definition of intersectionality that necessarily incorporates power and social justice. These constructs heavily influence the experiences of historically marginalized populations and are important considerations when deconstructing the lived experiences of those who are studied. By utilizing this understanding of intersectionality, the experiences of Black women in STEM are centered. In this study, I framed the experiences of the participants from both the macro and micro levels, i.e., I examined the institutionalized structures and contexts and their interplay with multiple, intersecting identities. Both contributed to the individual and shared narratives of Black women in STEM.

In the following section, I review literature on the historical foundation for how Black people navigate higher education.

### **African Americans and Blacks in Higher Education**

Before, and arguably for decades following the 1954 *Brown vs. Board of Education* decision, African Americans did not have broad access to higher education, particularly at PWIs. As a result, historically Black colleges and universities (HBCUs) served as the higher education institutions where the majority of Black students enrolled (Geiger & Gasman, 2017). Even after laws were enacted, African Americans still experienced challenges regarding access to education at all levels (Nave et al., 2016). The longstanding challenges related to access have had lasting, detrimental effects on the access, persistence, and retention of African Americans in modern educational systems. The aforementioned issues foreground this study, as the challenges experienced by African Americans since *Brown vs. Board of Education* have been pervasive, affecting educational attainment overall and especially in STEM fields. Arroyo and Gasman

(2014) referenced the struggle for success as “particularly acute” for Black college students (p. 59). Their description is one that paints a rather bleak picture, yet it is accurate in relation to the access to higher education and success of the population.

The general understanding of the ways in which African Americans and Black people navigated and continue to navigate educational contexts was important to this study, as it situated how power, privilege, access, and norms have shaped educational experiences and outcomes over time for historically underserved and marginalized populations.

### **Sexism and Racism**

Pervasive throughout the everyday and educational landscape are challenges related to racism and sexism. In higher education, in particular, racism and sexism play a key role in maintaining systems of power and privilege that systematically disadvantage women and people of color. What this means is that those whose identities have not been centered as powerful, i.e., those whose influence does not shape policies, procedures, and norms, are relegated to the margins. And, continued marginalization makes the goal of a more diverse, competitive, and innovative STEM workforce seemingly unattainable.

Gibson and Espinosa’s (2016) research sought to expand the limited research on Black women’s identity formation experiences in undergraduate engineering programs. They noted that while literature has begun to explore Black men’s experiences in some detail, researchers have neglected to focus on Black women, thus leaving their lived experiences “in the margins” (p. 57). They found that Black women were cognizant of their two oppressed identities and thus identified themselves as “double minorities” (p. 68). The participants named instances in which they perceived their interactions with peers and faculty as challenging, because they were not seen as a part of the community. Specifically, non-Black students did not opt to work with them

or even speak to them in class. The challenges they encountered with peers and faculty were often steeped in stereotypes about women, Black people, and the intersection of the two identities. For example, one participant shared that conscientious changes to her physical appearance resulted in shifts in how she was treated. To her frustration, she found that if she dressed “like a man”, she was more likely to be accepted and perceived to be knowledgeable (p. 64). Gibson and Espinosa (2016) found that the identity development of participants was an iterative process, which involved multiple actors and was primarily shaped by external factors including norms established by white men. They also reported that participants often felt like they had to perform in ways that others perceived as acceptable. There was an overarching theme of needing to prove themselves in certain spaces, i.e., academic and STEM related ones.

The notion of proving one’s self pervades research on students of color and women in STEM. In Harper’s (2010) research that presented an adapted anti-deficit achievement framework based on data from the National Black Male College Achievement Study (NBMCAS), he explored how students “resolved identity conflicts, negotiated popularity alongside achievement in peer groups, and thrived in environments that were sometimes racist and often culturally unresponsive” (p. 66). While this research focused on Black male collegians, the assertion made by Harper is one also experienced by Black women. The need, therefore, for students to navigate such environments is not surprising; and it requires their attention across their multiple identities.

To address racist ideologies in an educational context, McGee’s (2016) research expanded knowledge about the experiences of high-achieving Black and Latino students, focusing on the similarities and differences in how they experienced and contended with racial stereotypes as STEM undergraduate students. Her study sought to move beyond the common

research focus on the effects of stereotype, and instead report on how students engaged in “stereotype management” to navigate (successfully or not) the stereotypes they encountered.

Interestingly, three participants articulated that stereotypes did not affect them. One in particular shared that although he recognized that he was regularly stereotyped, he would become numb to the incidents and that they did not impact him. The participant articulated not feeling the effects of stereotypes, but also named being numb, which could mean that the effects were felt initially and eventually became so commonplace that they did not have the same impact on him.

McGee’s work is important because research has often reported the experiences of students who struggle in their STEM programs, but regularly about high-achieving students. Her analysis is even more poignant because the population of students she examined were academically well-equipped for the rigors of STEM but found themselves negotiating challenges that entailed having their intelligence questioned, racial and ethnic backgrounds mocked, and expectations lowered. That is, McGee articulated how faculty, students, and other key players downplayed or devalued their presence and experiences.

McGee (2016) also found that students often engage in “frontin’,” which she defined as “an imitation of stereotypical forms of whiteness or anti-whiteness—polarized opposites—to either defuse or further agitate the racialized situation” (p. 1628). She also described it as “the performance of acts that are socially acceptable to the dominant culture but demand the sacrifice of aspects of one’s racial, cultural, and/or ethnic identity” (p. 1634). While McGee’s work explored the experiences of students of color generally, she shared that students often engaged in efforts to “substantiate their intellectual and academic credibility to teachers, peers, administrators, and the larger STEM educational community,” and that their skin color was sometimes compounded with their gender (p. 1633). The author’s research highlights how

harmful the process of acculturation and substantiation of intellect by others can be on a student. These ideas are important to consider in this research because the participant's development may be consumed by the acts or performances noted by the author.

### **College Students in STEM**

In addition to the serious, unavoidable influences of racism and sexism in the experiences of historically underserved and marginalized student populations, there are other factors that must be considered to understand the full scope of influence on students' lived experiences. This section addresses pre-college factors, race and ethnicity, sex and gender, institutional context, academic ability, and identity development. In particular, the next section attends to their linkages to student success as described in the existing literature.

**Pre-college factors.** Authors frequently cite pre-college factors as having influence on the experiences of college students. Specifically, Astin's (1996) I-E-O college impact model examines how inputs, environment, and outputs interact to shape a student's college experiences. To situate how students engage in their college environments, authors extensively address how pre-college factors, or inputs, such as demographics and academic performance, are important considerations to their access, persistence, retention, and graduation. Researchers who seek to determine the future outcomes of students who pursue degrees in STEM often reference high school grade point average, STEM coursework, and standardized tests as predictors for success.

Perna and colleagues (2009) explore the strategies that contributed to STEM degree attainment for Black women at Spelman College. The authors acknowledged that pre-college factors such as STEM coursework and test scores are often touted as the clearest predictors of a student's success in STEM. They also noted that the policies and practices enacted by the institution can offset lack of academic preparation. Their findings suggested that the status of



Spelman as an HBCU focused on women provided faculty an opportunity to create a culture that valued relationships centered on nurturing and thriving. For example, in a pre-first-year orientation, women in STEM engaged in an indoctrination process revolving around the notion of “sisterhood.” The findings from Perna and colleagues (2009) suggest that further research could yield additional insights into policies, structures, and practices that focus explicitly on fostering student success for Black women with the understanding that HBCUs and their institutional context matter greatly to how students experience and navigate their collegiate careers.

**Race and ethnicity.** The racial composition of higher education overwhelmingly favors white students. Historically, the number of racially and ethnically underrepresented students has remained disproportionately low in comparison to white students. For example, 3.2% of Latinos, 3.7% American Indian, and 3.9% of Blacks aged 18-24 earned a bachelors’ degree in 2014. In comparison, 6.7% of whites in that age range received a bachelor’s degree (National Science Foundation, 2016). These comparisons are vital to understanding the disproportionately low representation of Blacks in higher education among traditionally college-aged Americans (Census, 2014). Figueroa, Hurtado, and Wilkins (2015) elucidated the complexities of how Black students, in comparison to white students, navigate what they coined as the “STEM opportunity structure.” This structure encompasses co-curricular and supplemental learning opportunities that aid or hinder a Black student’s relational capital with faculty and other institutional agents. Relational capital is the value placed on a relationship between two people that is often steeped in a sense of belonging. The understanding of the structure is important, as it provides a frame to understand how opportunity is offered by or accessible to diverse groups. Relational capital, then, can likely determine if and how students successfully navigate their collegiate experiences.

Since my study's location was within a PWI, it was critical to unpack how whiteness influences the overall academic experiences of students and especially Black women. The examination of whiteness, therefore, serves as an integral role in understanding how other racial and ethnic groups negotiate the contexts not created with them in mind. Earlier in this dissertation, I mentioned that the gaze of whiteness pervades higher education and often shapes the norms and behaviors enacted by its actors. To further complicate the issue, Lipsitz (2006) described whiteness as a "social fact, an identity created and continued with all-too-real consequences for the distribution of wealth, prestige, and opportunity" (p. vii). In higher education, it is wealth, prestige, and power that solidify the privilege held by white people and the persistence of norms generally established by the group as right or expected. Lipsitz (2016) goes further by explaining that, race is a cultural construct, but one with deadly social causes and consequences.

Conscious and deliberate actions have institutionalized group identity in the United States, not just through the dissemination of cultural stories, but also through the creation of social structures that generate economic advantages for European Americans through the possessive investment in whiteness. Studies of racial culture too far removed from studies of social structure leave us with inadequate explanations for understanding and combating racism (p. 2).

Lipsitz's (2016) use of "possessive investment" refers to the "relationship between whiteness and asset accumulation in our society, to connect attitudes to interests, to demonstrate that white supremacy is usually less a matter of direct, referential, and snarling contempt than a system for protecting the privileges of whites by denying communities of color opportunities for asset accumulation and upward mobility" (p. viii). Hence, systems steeped in whiteness have

detrimental effects on people of color and relegate them to a position in which navigating whiteness becomes imperative. Within STEM, researchers have repeatedly noted the norms that students are expected to understand and adhere to without question. In the language of theorists and researchers like Freire (2018), those who create the norms without an equity-minded stance are oppressors, as they shape an environment that benefits a particular group of people who understand and can successfully navigate the established norms. Freire (2018) elucidates how the power of the oppressor can shape the experiences of the oppressed, sharing that “the oppressed, who have adapted to the structure of domination in which they are immersed, have become resigned to it, are inhibited from waging the struggle for freedom so long they feel incapable of running the risks it requires” (p. 47). Together, the positions of Lipsitz and Freire situate how whiteness is pervasive and sometimes harmful, and that those under the rule of whiteness may not be able to detach from its grip because of the consequences of not adhering to the prescribed norms or expectations. In regard to STEM, the students who are not aware of the norms, typically those from marginalized backgrounds, are confronted with the necessity to learn, understand, and master an environment that was not created for them or with them in mind. This perspective is an important one to keep in mind as we consider the locales where Black students thrive and in particular Black women.

**HBCU role in STEM student success.** In empirical research, there are often comparisons made to Historically Black College/University (HBCU) in regard to positive outcomes for Black students compared to PWIs. HBCUs, unlike PWIs, are the largest producers of racially and ethnically underrepresented STEM degree completers (NSF, 2004). Students who attend HBCUs to earn STEM degrees report a high sense of belonging, faculty support, and opportunities to engage in research (Nave et al., 2016). As such, there are well-defined pathways

to success in STEM, with HBCUs leading the efforts. Conversely, findings on Black STEM students at PWIs report them as steeped in challenges related to a missing sense of belonging, limited faculty support, and lack of opportunities to engage in high-impact educational learning and practices (e.g., research). Hence, there is a stark contrast in the reported experiences of Black STEM students at HBCUs in comparison to PWIs. This lends to the finding that institutional context indeed influences a student's experiences in STEM (Griffith, 2010).

The institutional differences between HBCUs and PWIs and how they educate, support and graduate Black students are corroborated in the findings of various researchers. For example, HBCUs are noted to effectively create spaces for consistent mentorship from faculty, along with opportunities to learn and develop through research or lab experiences (Gasman & Nguyen, 2014). In contrast, PWIs are generally described as places where the academic experience is steeped in a culture created and maintained by white males that perpetuates a “weed out” culture. As a result, students of color—and Black students in particular—are often expected to conform to the established culture and engage in performative ways that demonstrate their ability to “fit in” and be successful based on the norms (Russel and Atwater, 2005). These norms create a need for Black students to understand what the expectations are and how to “fit” in the structures established for their respective programs of study. These differences in STEM culture are important to note, as they highlight how culture can impact a student's way of being in their program of study. By “way of being” I mean how they understand their place as members of disproportionately underrepresented racial or ethnic groups in a system that was not created for them, but necessary to navigate for their own success.

**Sex and gender.** Men represent the largest percentage of students pursuing degrees in STEM. For example, in 2014, men received 80.2% of the bachelor's degrees in engineering as

compared to only 19.8% earned by women. This percentage is consistent with reports on gender representation for the past four decades (National Science Foundation, 2017). The representation of females in STEM has been, in recent decades, of greater interest to researchers, policy makers, and institutions alike. Blickenstaff (2005) examined the factors that have been purported to contribute to the “leaky” pipeline for women of color. In particular, he addressed explanations for why women leave STEM that include biological differences between women and men, lack of preparation for a STEM major, and lack of women as role models. Blickenstaff argued that while some of the explanations that have been shared in research over the previous decades are warranted, several have no merit, e.g., the assertion that biological differences matter.

Further, he observed that when it comes to academic preparation, “even when women are equally or better prepared than men for scientific or technical majors, they still drop out of programs at greater rates” (p. 374) and noted that other challenges that lead to opting out of pursuing STEM degrees are sometimes closely connected to faculty and pedagogy. Specifically, “the methods teachers use to teach science to young people clearly have an effect on how students perceive the subject. Science pedagogy can re-enforce girls’ negative attitudes about science by devaluing the contributions of female students and over-emphasizing rote learning” (p. 330). Ro and Loya (2015) posit that the intersections of identity for women and men of color are often overlooked due to researchers’ tendency to aggregate quantitative data. What they describe as a problematic practice assumes that there are similar pre-college backgrounds shared with other racial or ethnic groups. Given the pitfalls of this common practice, Ro and Loya suggest that valuable findings may result from more careful study of racially minoritized women “in traditionally male and white fields like engineering, where these students are most

vulnerable” (p. 366). These findings further problematize the issue of representation and success of women of color and STEM.

Ong and colleagues (2018) reported on the experiences of women of color in STEM. The authors found that there are greater similarities among women of color and their experiences navigating STEM spaces than there are dissimilarities. Their findings confirmed what many researchers have identified as contributors to STEM retention and persistence of students of color in STEM, including intentional, positive relationships with peers and involvement in STEM organizations. The study’s semi-structured interviews with 39 undergraduate and graduate women of color revealed the central supportive role of counter spaces. Counter spaces are defined as “safe spaces” that often occupy groups of “non-traditional” students. An example of a counterspace is a student organization whose members are non-majority and members in the group hold similar identities outside of the majority. Ong and colleagues found that if students are able to identify and connect with one or more counter spaces, they are more likely to be validated and continue to persist.

**Academic ability.** STEM is generally discussed as a grouping of fields that require rigorous training for students to become prepared for graduate school or industry work. The rigor is often defined by high-level math and science courses that require both a level of knowledge and skill, as well as ability to learn and navigate challenging or complex topics. Considering the level and rigor of classes needed for students to excel in STEM, Ellis, Fosdick, and Rasmussen (2016) articulated that, “Calculus I is an established milestone in the STEM trajectory, and we have shown here that it is contributing significantly to the STEM ‘gender filter’” (pg. 10) as noted by Blickenstaff (2005) regarding the leaking pipeline for women in STEM. The authors suggest that building mathematical confidence is key to not losing women in STEM. Finally on

this topic, Perez, Cromley, and Kaplan (2014) examined how “the role of perceived costs in students’ academic choices” (p. 326) affected their achievement motivation.

**Identity development.** There is growing research on students’ identities, namely race, gender, sexual orientation, socioeconomic status, national origin, ability status, ethnicity, and spirituality. The commonly referenced identities, often referred to as the “big 8,” offer a lens from which to understand the whole person. The big 8 are often associated with privilege and oppression in complex, often intersecting ways, depending on the saliency of the identity to the person. To address the concern that there were no models or frameworks that honored multiple identities, Jones and McEwen (2000) created the model of multiple dimensions of identity. They described the model as “a fluid and dynamic one, representing the ongoing construction of identities and the influence of changing contexts on the experience of identity development” (p. 408). This is especially important, as contexts have a significant influence on the ways a person thinks about and names identity for themselves. Even more important, they noted that the awareness of systems of privilege and inequality shifted depending on the salience of identities of their participants.

In their reconceptualization of the model of multiple dimensions of identity, Abes, Jones, and McEwen (2007) incorporated a consideration for “meaning making” into the perceptions students have of their multiple identities. They state:

Meaning making capacity is drawn as a filter. How contextual influences move through the filter depends on the depth and permeability of the filter. The depth (thickness) and permeability (size and openings) of the filter depend on the complexity of the person’s meaning-making capacity” (p. 6).

This process is described in detail by Hannon, Woodside, Pollard, and Roman's (2016) research elucidating African American college women's experiences in college. They found that their participants identified their race and gender as adding complexity and challenge to their experiences as students. This acknowledgement or awakening to the ways in which identity shaped their experiences is consistent with other higher education research (e.g., Fries Britt, 2000).

### **Bridge and Intervention Programs**

This study focused on academically talented students who participated in a summer bridge program (SBP) as a part of their overall support structure during their collegiate experience. Summer bridge programs are traditionally "designed to support distinct populations of students as they transition from high school to college" (Johnson, 2016, p. 207). Exploring the literature on SBPs provides additional context for understanding the participants' experiences.

For decades, bridge programs have been created and implemented to "close the gap" in academic ability of students entering higher education institutions or to reinforce the expectations and rigor of college (Strayhorn, 2010; Swail & Perna, 2002). In either instance, these programs tend to employ structures that prioritize the facilitation of smooth academic transition (Tsui, 2007; Veenestra, Dey, & Herrin, 2009). The structure of SBPs varies depending on institutional context and priorities of the program, though they often incorporate college-level courses, academic and social workshops, and mentorship from faculty and staff (Kezar, 2000; Ackermann 1990). Due to the high variance in structure, it is difficult to research the success or effectiveness of SBPs as a group. Instead, each program must assess success individually, based on institutional and/or external expectations. With regard to STEM-focused SBPs for historically



marginalized groups, the Meyerhoff Program at the University of Maryland, Baltimore County, is noted across the literature as an example of SBP success.

### **Socialization**

In the pursuit of education both in K-12 and high education contexts, students learn how to engage through the process of socialization. Weidman (1979) shared a comprehensive model for understanding how undergraduate students experience socialization from many different perspectives. The model (see Figure 2, below) is similar to that of Astin's I-E-O model in that there are inputs (student background characteristics), experiences (socialization across groups), and outcomes (results of socialization). In the socialization process, Black women collegians pursuing STEM receive messages about who they are, their ability, and potential through the socialization process. Weidman's model is comprised of the following components:

1. Student background;
2. The normative influences exerted by the academic and social structure of the college through the mechanisms of both inter- and intrapersonal processes, and
3. The mediating impacts of both parental socialization and non-college reference groups during college despite influences brought to bear upon students by participation in the more immediate campus social structure. (p. 298)

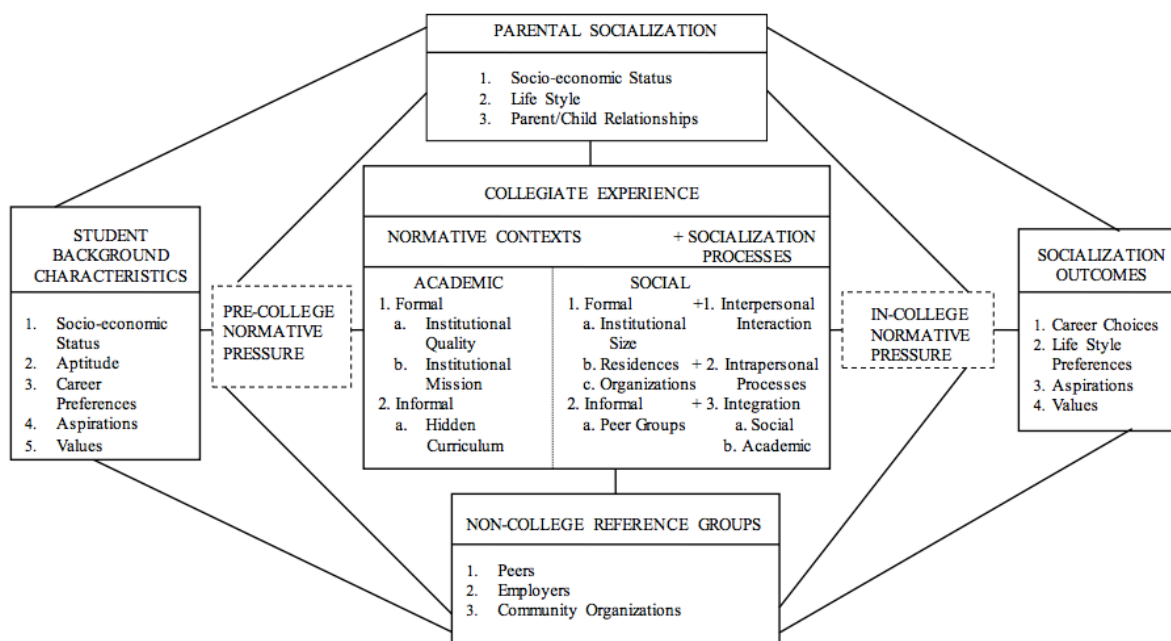


Figure 2: A Conceptual Model of Undergraduate Socialization

In regard to Black women in STEM, and those who participate in a summer bridge program, the pre-college normative pressure refers to the ways students are acculturated into their institution and field of study. Socialization can also have negative influences on how students negotiate various contexts within their collegiate experience.

### Role Models and Mentorship

Literature that focuses on Black women's mentorship experiences is limited. Like most research shared thus far, researchers tend to address underserved and marginalized groups in the aggregate. As a result, this section addresses literature centered on so-called minorities and Black women specifically. Mentoring has been noted as a critical component of success for students of color. Dortch and Patel (2017) concluded that Black women in STEM need to see people who look like them, but went further to articulate the need for greater numbers of Black women being

recruited to STEM programs. Even if there are not same-race, same-gender individuals available to serve as mentors—or simply be seen as successful in STEM—the representation of other peers can be helpful.

In their article seeking to understand what shapes the experiences of Black undergraduate women in mathematics, Borum and Walker (2012) identified mentoring as primary factor in retaining women. Mentoring, it seems, provides students with the opportunity to be guided by someone who is well-versed in the norms, expectations, and how to successfully navigate those expectations. Good or effective mentors also help students to see themselves in the STEM field.

Alternatively, Kendricks, Nedunuri, and Armet (2013) clarified that while mentoring relationships can be beneficial, not all students have successful relationships with mentors. In fact, the authors noted that students recognized that their “mentors” were not sincerely invested in them, but instead engaged in the mentoring for recognition or more tragically, to take advantage of a student’s work, claiming it as their own.

### **Chapter Summary**

This chapter synthesizes some of the existing literature on students of color in STEM, with a focus on Black women navigating their intersecting identities in STEM merit-based, academic programs. I determined that the primary bodies of literature that inform this work are (1) STEM in higher education, (2) the experiences of students of color in STEM, (3) racism and sexism as institutionalized practices in education, (4) the function and enactment of meaning making, (5) intersectionality, (6) merit-based bridge programs, and (7) the influence of environment and context on a student’s experiences. The study explored the experiences of academically-talented Black women in STEM majors as they developed their multiple, intersecting identities.

### **Chapter 3. Research Design and Methods**

The purpose of this exploratory, qualitative study was to examine how undergraduate, academically-talented Black women in a merit-based STEM program communicated their range of beliefs about race and gender in STEM across educational contexts and systems. The research questions that guided this study were:

1. How do academically talented Black women in an undergraduate, merit-based STEM program communicate about their treatment in high school regarding race and gender?
2. In what ways do race and gender influence how academically talented Black women in an undergraduate, merit-based STEM program articulate their own access and ability to succeed in STEM?

The focus on this particular population was important, since Black women have not been widely represented in higher education literature, and even less so in STEM. In this chapter, I first detail the study's design, which was qualitative in nature and employed a narrative inquiry methodology. Second, I describe the site, which was a large, public predominately white research university, and the rationale for its selection. Third, I detail the data collection methods, analytic tools, and reporting procedures. Finally, I discuss trustworthiness and the limitations of the study.

#### **Study Design**

This study employed qualitative methods to answer the research questions. Maxwell (2015) explains that qualitative research is useful for “understanding the meaning, for participants in the study, of the events, situations, experiences, and actions they are involved with

or engage in” (p. 30). Merriam (2016) succinctly describes qualitative researchers as having an interest in how people construct meanings of what happens around them. This study, therefore, aligned with these stances on qualitative research, as the purpose of the study was to understand the experiences and reflections of the participants and glean insight into how they communicated about race and gender as students who were pursuing STEM degrees. Given this aim of the study, my epistemological stance was grounded in a social constructivist paradigm. By this, I mean that I viewed experiences as shaped by the multiple contexts in which the students’ experiences were situated. The ways in which participants wrote, spoke about, and reported their experiences as members of a merit-based STEM Success Program (SSP) were grounded in their previous high school and daily experiences and norms established by the SSP, academic expectations, and university context. As such, the research design was chosen to assist in uncovering the complex layers of understanding related to race and gender, and ultimately how the students saw themselves and others in relation to STEM degree pursuits.

**Narrative inquiry methodology.** Qualitative research may follow a number of approaches, e.g., phenomenology, narrative inquiry, grounded theory, and ethnography. After considering the merits of each, I determined that narrative inquiry was most appropriate for addressing my research context and questions. This study followed a narrative inquiry design to illuminate how undergraduate, academically talented Black women in a merit-based program shared their range of beliefs about race and gender as students pursuing STEM degrees. Narrative inquiry allows the researcher to probe the “retrospective meaning making” of participants and helps to build an understanding of “one’s own and others’ actions” and well as a way of “connecting and seeing the consequences of actions and events over time” (Denzin & Lincoln, 2008, p. 64). Narrative inquiry emphasizes the participant’s point of view, while also

conveying their “emotions, thoughts, and interpretations” (p. 65). Furthermore, this method of interpretation highlights the uniqueness of each participant’s voice while also allowing for the possibility of “attend[ing] to similarities and differences across narratives” (p. 65). It also allows the researcher to acknowledge the influence of the setting in which narratives are shared, such as the focus group setting that yielded much of the data for the present study. Finally, researchers who utilize this methodology view not just their participants but themselves also as narrators in how they present their research findings. This stance encourages the researcher to employ the first-person in recognition of their own positionality and role in the interpretive process.

### **Research Site Description and Rationale**

**Rationale for site selection.** To understand the experiences of Black undergraduate women who were members of a merit-based STEM program, I sought to identify a program that models the highly researched and successful Meyerhoff Scholars Program at the University of Maryland, Baltimore County, because of its utilization of a strengths-based approach and its track record of graduating students of color (Stolle-McCallister, Sto. Domingo, & Carillo, 2006; Maton, Hrabowski, & Schmitt, 2000). As such, I selected the study’s site because it housed a STEM program that explicitly incorporated lessons learned from the Meyerhoff program and had likewise demonstrated success in aiding students of color in their pursuit of STEM degrees. Unlike the Meyerhoff program, however, the STEM Success Program (SSP) accepted students from all racial and ethnic backgrounds. The racial, ethnic, and gender composition of the program since its inception fluctuated year-to-year and admitted some non-minoritized students since its first year of implementation.

In addition to selecting a site with a strengths-based approach to programming for students of color in the STEM fields, I wanted to conduct the study in the context of a

predominantly white institution (PWI). While research indicates that historically Black colleges and universities (HBCUs) are the largest producers of Black STEM graduates (Arroyo & Gasman, 2014), identifying a PWI was important to the study, because the literature points to unique challenges experienced by students of color at PWIs (Harper, 2016). Hence, the context allowed me to research the ways in which race and gender were conceptualized and experienced by the participants in this setting. And, by focusing on Black women at a PWI, this study succeeded in contributing to the limited but growing body of research that focuses solely on Black women.

**About the site.** The STEM Success Program (SSP) was housed at Large Public University (LPU) (pseudonym), a public institution located in the northeast quadrant of the United States. According to the Carnegie Foundation for the Advancement of Teaching, the institution was classified as a “Doctoral University – Highest Research Activity.” As part of a multi-campus system, LPU enrolled over 90,000 students with 47% identifying as female and 53% as male. African American and Black students accounted for a total of 4% of the student population. LPU’s retention rate had shown improvement in recent years, and as of 2015 it was 93% for all campuses. According to a 2007 university news article, around 68% of Black students were graduating from LPU annually, ranking it nationally among similar institutions.

SSP was a grant-funded program modeled after the Meyerhoff Scholars Program, which focused on supporting the success and diversification of STEM through structured practices and support. Five years prior to my data analysis, the SSP program began as a cohort model to recruit and support academically talented students interested in pursuing degrees in STEM and eventually completing a doctorate in STEM. High school students who were interested in becoming a SSP participant were required to apply to LPU, indicate the institution as their first

choice, select one of the five participating colleges, submit two essays, two letters of recommendation, and scholastic aptitude test (SAT) or ACT scores. The program website noted that successful applicants were high achievers with a strong academic record, committed to diversifying STEM, eager to collaborate with others, and prepared for the rigors of studying STEM. Students selected to participate also received tuition remuneration, along with room and board.

Each year, the number of students admitted to SSP varied, in addition to the demographic make-up of the cohorts. Upon admission to LPU and acceptance into SSP, students participated in a six-week long bridge program prior to the start of their first year. The aim of the bridge program was to help facilitate the students' relationships with their cohort members, take foundational courses in STEM, receive an introduction to research, learn important skills to aid in their success, and participate in team and community building activities.

The program also included a scholarly community, program components aimed at assisting students to be successful in their programs, and academic coaching. Specifically, SSP recruited faculty mentors who offered lab or research experiences to the students, in addition to engaging them in conversations about graduate school. The presence of faculty mentors was noted as a "critical component" of SSP, according to the online description of faculty engagement with the program.

### **Participant Selection**

I used the purposeful selection approach to identify the study's participants. Purposeful selection contrasts with sampling. The latter connotes representation of a larger sample, whereas the former is a strategy through which "particular settings, persons, or activities are selected deliberately to provide information that is particularly relevant to your questions and goals, and



that can't be gotten as well from other choices" (Maxwell, 2013, p. 97). I identified 24 SSP participants who were eligible to participate in the study, i.e., African American or Black women.

Participants in the study met the following criteria: each student (1) was at least 18 years of age at the time of the study, (2) was a participant of the summer bridge program of the SSP, and (3) self-identified as an African American or Black woman. Immediately below, I present a table of participants in the study. Each of the participants participated in both the race and gender focus group. Next, I discuss the second and third criteria.

Table 1. Table of Participants

Pseudonym	Cohort
Camille	Three
Bethany	*
Ella	Four
Tracy	*
Ladonna	Five
Amerie	Four
Sarah	Four
Tammie	Five
Brielle	*
Arie	Five
Teneisha	One
Melissa	One
Dami	Four
Kourtney	*
Maxine	Four
Alisha	Four
Malaika	Four
Ro'Nisha	One
Taylor	Four
Brandy	Four
Solange	Four
Marsha	Five
Ashlee	Five
Tracee	Four

\*Indicates incomplete information from the larger, qualitative project

**Criterion 2: participant in summer bridge program.** In LPU's STEM Success Program (SSP), students were required to participate in a six-week summer bridge program. The bridge portion of the program was the foundation to the student's experience at LPU, and informed the development of the student's multiple, intersecting identities during their collegiate career. The programming of this summer program aimed at helping students understand and navigate their holistic development and socialization into STEM.

**Criterion 3: African American or Black female identity.** As I noted in the literature review, Black women have long been underrepresented in STEM at the undergraduate level, and especially at PWIs (Espinosa, 2011). As such, the focus of this study required that the participants self-identified as African American or Black women to align with the study's goal of illuminating the experiences of this population. Identifying as Black or African American also included those who may have described themselves as bi-racial, multi-racial, and/or multi-ethnic. The inclusion of all who identify was intentional.

### **Data Sources and Collection**

Data from my study came from a longitudinal qualitative study on student experience in the SSP at LPU and was secured from the principal investigator of the project. Longitudinal qualitative research "is amenable to studying a broad spectrum of settings and situations that characterize contemporary social life" (Hermanowicz, 2016, p. 491). Its methods "are vital to identifying and characterizing trajectories, turning points, and interpretive stances that cover both short and long periods of time. Longitudinal qualitative methods thus push a frontier of knowledge about socially-rooted differences in development and aging" (p. 491). I mention these qualities of longitudinal studies, because they indicate that the kinds of questions posed in this type of study are consonant with my research interests. The focus group questions asked during

the summer bridge program appear below in Table 2. In Table 3, I present a summary of the free write prompts given to students on the topics of race and gender.

For clarity, my interest in this longitudinal study related to its granting me a larger pool of participants than would have been available had I conducted my own short-term research. Since I was interested in a particularly seminal moment in the development of students' STEM identity, i.e., during the summer between their high school graduation and their first semester of university, I did not look at participants across time. Instead, I was able to analyze a substantially larger pool of participants, each captured at this pivotal moment in their STEM education.

Table 2. Focus Group Questions

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Focus Group on Race:
Q1. How do you self-identify, in terms of race and ethnicity? How important is this identity to you?
Q2. Do you think race plays a role in STEM professions? Why or why not?
Q3. Do you think that people of all races/ethnicities are treated fairly in STEM classes? If so, share some examples. If not, share some examples.
Q4: What would you say are the greatest obstacles people of color face in STEM professions? How do people of color deal with such challenges in the field?
<u>Focus Group on Gender:</u>
Q1. Do you think gender plays a role in STEM professions? Why or why not? How does your background inform your perspective?
Q2. Do you think women and men are treated fairly in STEM classes? If so, share some examples. If not, share some examples.
Q3. What STEM advice would you give a younger person of your gender, based on your experiences in the Summer Bridge so far? How should aspiring students prepare for this work?
Q4. What would you say are the greatest obstacles women and men face in STEM professions and how will you deal with such challenges when you get out into the field?
Q5. Do women's thought patterns and study habits differ from men's? If so, how? Can you provide some examples? OR Do men's thought patterns and study habits differ from women's? If so, how? Can you provide some examples?

---

Table 3. Summarized Version of Free Write Prompts

Prompt for Both Free Write Exercises. Read each quote. Choose one on which to focus. Write in response to it, non-stop, for 10 minutes. Write whatever comes to mind...Just keep going.

#### Free Write on Race

Quote 1. Only 75% of all U.S. adolescents graduate from high schools. The rates are lower for non-white students (64% for Hispanics and 62% for African-Americans). As a result of these trends, we lose a lot of potential STEM students long before college. At the same time, many students [of color] graduating from high schools are not taking the math and science courses necessary to pursue a STEM career.

Quote 2. A report from the U.S. Department of Commerce's Economics and Statistics Administration finds that Blacks and Hispanics have been consistently underrepresented in STEM jobs over the past decade. Black and Hispanic professionals are half as likely as all professionals to have STEM careers, let alone be leaders in their field. In contrast, Asian professionals are nearly three times as likely as all professionals to have STEM jobs and assume leadership roles.

Quote 3. [Research suggests that] first-generation immigrant Asians typically pursue STEM careers -- fields that are secure, prestigious, pay well, and have low barriers to entry, explained Shinagawa. He added that two generations ago, Asian Americans (even those born and raised in the U.S.) also largely pursued stereotypical STEM careers. However, Asian Americans (second-, third-, or fourth-generation) have recently begun to defy the STEM stereotype. Now, a greater number of Asian Americans study humanities and social sciences versus STEM disciplines. And after completing their studies, an increasing number of them are entering into law and business.

#### Free Write on Gender

Quote 1. Why are there still so few women in Science, Technology, Engineering and Mathematics (STEM)? Girls are as excited as boys about science, so the potential is clearly there. Yet, we still do not routinely see female professors dominating examination panels, research institute directorial boards, or the Royal Society fellowship community. Why is it so?

Quote 2. The enchanting charms of this sublime science reveal only to those who have the courage to go deeply into it. But when a woman, who, because of her sex and our prejudices, encounters infinitely more obstacles than a man in familiarizing herself with complicated problems, succeeds nevertheless in surmounting these obstacles and penetrating the most obscure parts of them...without a doubt she must have the noblest courage, quite extraordinary talents, and superior genius.

Quote 3. "Men are better than women at math and science." This is a comment likely to rile the feathers of some of my more feminist readers. Yet, I could easily support such a statement with evidence showing that men get higher SAT scores in math than women or how science and technology careers are predominantly male disciplines. In spite of this evidence, I wouldn't be the first to get into trouble over comments like this. Larry Summers, a former president of Harvard University, lost his job after his 2005 speech on this subject to the National Bureau of Economic Research. What got Summers into trouble was saying that inborn differences in the aptitudes of men and women probably played a greater role than societal expectations. He felt that men were inherently better and not just situationally better in STEM.

**Longitudinal study data.** The larger longitudinal study from which I pulled my data set engaged students through a number of research instruments. Participants engaged in a sequence of surveys about their SSP experiences and learning, focus groups exploring race and gender, and written responses to prompts centered on gender and race. This sequence happened over the four-year period of each participant's college years. Participants' initial engagement in the larger study began prior to beginning the bridge program that followed their high school graduation and preceded their first year of university studies. They completed a pre-bridge program survey, and then during the bridge program engaged in two focus groups and responded to prompts focused on race and gender in STEM. Subsequent surveys they were asked to complete were quantitative in nature, though they included open-ended questions. The program staff and lead investigators for the qualitative and quantitative research teams worked closely together, along with the grantors, to align all items and data collection protocols.

The longitudinal study began in the year preceding my involvement, which spanned the second full year of data collection. The collection effort has been ongoing and at the time of this writing was in its fifth year. During my involvement in the study, I assisted in the design and execution of the data collection, for instance, by conducting two video-recorded focus groups, as well as creating the online form for the writing prompts, which I then sent to students, followed up on, answered questions, and helped troubleshoot technical issues. As a note, data collection involved student rotations and simultaneous collection efforts during the summer bridge program, thereby precluding the possibility of my conducting more focus groups.

The long-term, year-over-year design of the data collection effort presented some ideal and unideal aspects. I conducted a good amount of the data collection in the second year of the study. While it may have been unideal that I was not, for purely practical reasons, able to assist

during the subsequent three years of data collection, the advantage was that I was granted permission by the PI to access four years of data. This data came from the focus groups and writing prompts (without identifiers). I was not granted access to the survey data; therefore, I was not able to examine the open-ended questions included in that instrument. Typically, for an individual doctoral researcher, the gathering of longitudinal data is prohibitively expensive and time-consuming to execute alone. Hence, the advantages outweighed the disadvantages of this part of my chosen data set.

Any further involvement on my part in collecting data from students was circumscribed by the concerns of the longitudinal study's PI over research fatigue of the SSP participants. Even though data collection was ongoing, scheduling more time with participants for any additional research was ruled out as undesirable. As such, I adopted a pragmatic approach and participated in the process of negotiation, and renegotiation, that is often demanded in qualitative research (Merriam & Tisdell, 2016). Through this stance, I remained open and receptive to any shifts that needed to occur throughout the research process. In addition to the data I collected in year two of the longitudinal study, as part of the research team I had access to much of the study's data from years one through four (i.e., the span of the ongoing study at the time of analysis). Given the benefits of utilizing this rich, longitudinal qualitative data set, I discuss next its data sources in some depth.

My data sources included focus groups, written responses to prompts that centered on race and gender in STEM, and documents on the SSP and the institution. My analysis primarily drew from the focus group discussions and, to a lesser extent, the written prompts. The documents on the program and institution were perused mainly for my contextual grounding and as a way to triangulate the primary data sources. Together, the various types of data illuminated

participants' experiences and meaning-making process as they engaged in the SSP and their STEM education.

***Focus group interviews.*** During the summer bridge program, each participant engaged in two focus groups that centered on race and gender, and I conducted one of each of these focus groups. The participants were grouped with their cohort-mates, whose racial and gender identities were diverse. I selected pseudonyms for the participants to protect their identities throughout my study. The focus group questions and protocol were created by the lead qualitative investigator. The protocol was informed by the lead investigator's knowledge about race and gender in STEM. The focus groups each involved up to six students and were arranged to be purposefully diverse by race and gender. The focus groups lasted between twenty and twenty-five minutes and were video recorded and the dialogue transcribed.

***Written responses.*** As a part of the summer bridge program, immediately prior to the focus groups on gender and race, each student was tasked with reading three prompts and then providing an initial written response to the prompt. The students had fifteen minutes to type their response to one of the three prompt options that focused on the particular topic for that day's focus group. The students submitted their responses through an electronic portal.

The participants were separated into three groups (Group A, Group B, and Group C), wherein each group was assigned an initial activity. Students started alternatively with the focus group, writing prompt, or SSP staff-decided activity, or unstructured time. Each of the focus groups took place a month a part during the summer. All students completed the race focus group in one month and then the gender focus group in the other month. Table 4, below, depicts the data collection schedule that was followed.

Table 4. Sample Data Collection Schedule

8:00AM-8:30AM	8:30AM-9:00AM	9:00AM-9:30AM	9:30AM-10:30AM	10:30AM-11:00AM
Group A Free Write in Computer Lab	Group A Focus Group with Interviewers	Group A Activity SSP Staff or Unstructured Time		
	Group B Free Write in Computer Lab	Group B Focus Group Interviewers	Group B Activity with SSP Staff or Unstructured Time	
		Group C Computer Lab	Group C Focus Group with Interviewers	Group C Activity with SSP Staff or Unstructured Time

**Document review.** I reviewed the following documents:

1. The LPU fact book and website for general information about the university, since its context informed the experience of the study participants;
2. The grant submission for the Student Success Program that outlined the process by which the staff closely replicated the Meyerhoff Scholars Program;
3. The SSP qualitative reports that were written by the qualitative research team.

### **Data Analysis**

The data analysis plan unfolded over three phases. In phase one, I initiated my data analysis by organizing all of the data into password protected files on my password protected computer. In phase two, I reviewed the excerpts from the focus groups to which I was granted access and also reviewed the written prompts and program- and institution-related documents. As I engaged in the process of acquainting myself with the data, I wrote analytic memos that



captured my thoughts, questions, and preliminary interpretations. In phase three, I developed a robust coding scheme.

I used the qualitative software program MAXQDA to help facilitate the organization and analysis of the data and developed a codebook to assist with consistency and the constant comparison method of data interpretation. Throughout the coding process, I revised, created, and collapsed codes as expected during the coding process (Miles & Huberman, 1994). A code “is most often a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data” (Saldaña, 2009, p. 3). I engaged solely in open coding, meaning I derived my codes from the data and did not pull directly from the literature informing the study’s framework. I chose open coding explicitly because I wanted to remain faithful to participants’ perspectives and code as much as possible from an emic, or insider’s, viewpoint.

### **Trustworthiness**

Trustworthiness, or the credibility of the researcher and the management of their research, was important to the rigor of the research process. Maintaining ethical considerations while engaging in the research process was especially important (Merriam & Tisdell, 2016). To enhance the trustworthiness in this study, I engaged in two primary strategies. First, I wrote memos after I reviewed each data source to capture my initial questions or understanding of what I saw or heard in the data. Second, I utilized a peer review team comprised of scholars in my network familiar with STEM education and/or the experiences of historically underserved student populations.

**Memos.** At each point during data management, coding, and analysis, I detailed my thoughts, initial and emergent understandings, and instincts about decisions that needed to be

made as the process advanced. By writing regular memos, I maintained a record of the progression of my analysis, and this served as an internal audit of my process. Likewise I used memos to capture initial analytical thoughts and lingering questions. These memos created a record of how I contemplated and processed the data as the instrument of analysis.

**Peer debriefing team.** I worked with a peer debriefing team, which helped me ensure that what I reported was faithful to the perspectives and experiences of the student participants, and that I had engaged in accurate reporting and interpretation of the data (Spall, 1998). Members of this team included three peer scholars – some of whom had robust knowledge of the research topic, while others knew little to nothing about the topic. With such diversity on the team, I secured varied feedback about my work. This approach aided me in thinking more deeply about my research.

### **Limitations**

The limitations of the study are important to note, because they shape how the reader understands the study's design and interpretations. The first limitation of my study came from the fact that the data for the study was secured from a larger qualitative project. As such, the narratives were collected in a tightly defined and time-bound manner that did not allow for follow-up questions to the participants' responses. I was restricted from asking supplemental structured or semi-structured interviews with student participants, through which I could have had the opportunity to ask lingering questions directly. This limitation, which was the result of concern for research fatigue, was balanced by the advantages of a larger data set than would have been allowed through short-term research on a single cohort.

The second limitation of the study stemmed from the composition of the focus groups. The deliberately mixed-gender and -race groups created value by allowing me the opportunity to

analyze how Black women expressed themselves among non-homogenous peers. However, these mixed groups disallowed for more direct, focused reflections by the Black women only. I dealt with this limitation by employing some of the advantages on narrative inquiry, namely by giving attention to the effects of the environment in which the participants shared their narratives.

## Chapter 4. Findings

The purpose of this study, as discussed in Chapter One, was to examine the range of beliefs regarding race and gender held by academically talented Black women in STEM across various contexts and at a pivotal moment in their education, i.e., the period between high school and their first semester of college. By expanding perceptions about the ways in which race and gender function for historically marginalized groups, and Black women in particular, the study sought to equip educators, researchers, and policy makers with more nuanced perspectives. With this expanded understanding, I assert, it becomes easier to devote the necessary attention to this group and ultimately assist more Black women in pursuing and succeeding in STEM. In Chapter Two, the challenges experienced by Black women were reviewed, along with what they needed to persist in STEM both at the educational and career levels. Additionally, the ways academically talented students think about, understand, and integrate their thoughts into their daily actions as learners and future scientists in graduate programs and industry were discussed.

This study was informed by Collins' (1989, 2009) Black feminist thought (BFT), Bronfenbrenner's (1979) ecological model, and Crenshaw's (1989) intersectionality. Crenshaw's work seeks to address the systematic subjugation of Black women, while Collins (2009) articulates BFT as "a critical social theory...[that] aims to empower African-American women within the context of social injustice sustained by intersecting oppressions" (p. 26). Intersections of identity matter greatly, as do the ways in which power and privilege inform the subjugation of doubly-marginalized people like Black women. With BFT and intersectionality as the foundations from which I analyzed the experiences of Black women pursuing STEM, it became necessary to understand the contexts in which the participants experienced their multiple selves. Bronfenbrenner's ecological model considers the microsystem, mesosystem, exosystem, and

macrosystem of individuals and provides a way to understand the operation of power and privilege at various levels, in addition to how space and place inform a person's conception of self and others.

This chapter presents key findings obtained from 24 participants' focus group comments and writing prompt responses; these centered on race and gender during a summer bridge experience, which was part of the STEM Success Program (SSP) at Large Public University (LPU). Participants' reflections were gathered during their summer bridge program at LPU, which took place during the summer immediately after the completion of high school. The students participated in one focus group on race and one on gender. As detailed in Chapter Four, six students comprised each focus group, and the groups were assigned with the intent to ensure racial and gender diversity. In addition to focus groups, the students responded to writing prompts regarding current issues on race and gender in STEM.

Several findings emerged from this study; briefly, the most salient findings include:

1. The environment and wording of the questions posed to the participants yielded distinct, sometimes contradictory responses about the challenges they perceived and experienced related to race and gender in STEM.
2. Gender norms and racial stereotypes played a role in how participants perceived themselves and others, with particular consideration for how they began to see themselves as scientists and perceive their own STEM identity.
3. Participants' racial and gendered identities influenced how they understood their experiences with and perceptions of faculty and peers.

4. Participants communicated the importance of seeing themselves in their future profession, noting in particular that role models and representation in the field were integral to their success.

Below, I present findings from the study and highlight the evidence provided by participants to illustrate each finding.

### **Perception of Fairness in Treatment in High School**

In the focus groups with mixed gender and race, the Black female participants were directly asked (along with their peers) if they were treated fairly in high school STEM classes, with regard to gender and race. In this setting, participants near unanimously reported that classes, teachers, and high school experiences felt fair to them and their peers. None of the participants elaborated on what fair treatment looked like; instead, they provided what I assessed to be generally thin rationalizations for why this was or could be plausible.

When responding to the question on fairness, Briana said, “Based on my experiences in STEM classes, I’ve been treated fairly. I’ve never *noticed* [emphasis added] any discrimination or prejudice when I’ve been in a STEM class personally.” This reflection asserted that she did not quite notice discrimination or prejudice in her classes, but her language left open, the possibility that it did occur and that others noticed it.

In reflecting on the question of fairness in the gender focus group, Camille reported not being able to recall any differences in how anyone was treated in high school. She also offered a reading of the experiences of friends who attended other schools: “My other friends who go to other schools, their schools were pretty much the same. The teachers treated everybody the same. They didn’t have that gap between everybody.” Camille rationalized her answer to the question of fairness by saying, “I went to an all-girls high school, so it’s hard for me to say whether or not

I was treated fairly or not because my high school was all girls.” In making this comment, she revealed an underlying perception that gender composition and fairness were related. She seemed to suggest that Black girls in schools with mixed-gender student bodies experienced or were more likely to experience unfairness.

Additionally, in her comments, Camille drew attention to her male teachers. Specifically, while articulating a connection to fairness, Camille referenced the ways she experienced high expectation and accountability with teachers; expressly male teachers. She stated, “I did have male teachers, and they were never—they weren’t really compassionate with us. They were still very strict and stern and hard and pushed us a lot.” By only mentioning male teachers, it seemed that Camille perceived on some level that when male-identified educators were involved, issues of unfairness and inequity might ensue. These comments appeared to signal a latent perception that males were the ones who perpetuated unfairness in STEM. With regard to her male teachers’ harshness, Camille offered another rationalization. She asserted without detail that her male teachers’ behavior came from motives unrelated to bias. She simply put forth, “At least from that aspect [fairness], I definitely know that, at least with my teachers, my male teachers, they weren’t biased.”

Thus, in answering and rationalizing *how* (perhaps more than *whether*) her experiences were fair, Camille revealed an underlying understanding that gender had an influence on fairness and that, at best, mitigating forces like the school’s demographics and the male teachers’ apparent motives shielded her.

Just as Camille had reported fair treatment in light of gender, two participants specifically reflected on the racial composition of their high school as a reason they had *not* experienced a lack of fairness. In sharing her reflections, Ella communicated:

I don't think I have noticed any discrimination, but I did go to a mostly Black people's [high school]. I mean there were a lot of us. There were a couple of Indians and stuff. I guess the teachers just, they don't discriminate; they just want you to do the best and they encourage you to do well.

In this reflection, Ella expressed not *noticing* discrimination. It seems she needed to have a direct experience of, at minimum, noticing acts of discrimination. This contrasts with the possibility of a similarly aged student assuming or perceiving discrimination as a de facto quality of the educational setting. Along similar lines, Tracy expressed an impression of fairness in high school, saying:

In my [high] school, it's like a predominantly Black school, so when we take our higher level classes no one ever really feels discouraged. We actually feel pretty comfortable taking our classes and I've never experienced an issue with that.

On the question of fairness, two participants commented on the intersection of gender and race as a non-issue regarding fairness. Amerie discussed the number of girls in class versus males, and identified fairness very concretely: "I haven't experienced any discrimination because of my gender in my classes. If anything, there were always more girls in the class in my math and science classes than there were males. We were still treated the same." Amerie expressed the notion that a female-leaning gender imbalance in classes provides a basis for fairness in the treatment of students. Thus, she held up the notion that the presence of same-gender peers can reduce or eliminate the possibility of unfairness and discrimination in particular.

Sarah also expressed that she did not experience being treated differently. She shared that, "for me personally, I never felt like I was treated differently than anyone else in my classroom being the only Black girl. That was in all of my high-level math classes and high-level



science classes.” From her reflection, it seems that Sarah became accustomed to her status as the only Black girl in her grade’s upper-level STEM classes.

To summarize, participants did not report experiencing unfairness in their classrooms when asked about it point blank in a focus group with mixed gender and race. In reporting these findings, I purposefully elected to use words like “report” instead of “experience,” and “rationalization” instead of “reason,” because as I explore in the next two sections, when the participants were asked—and therefore given social permission—to directly discuss obstacles for women and people of color in STEM, they articulated with much more detail the ways in which they saw and experienced discrimination on multiple levels. These levels included the classroom (mesosystem), as well as the family (microsystem), and the education system (macrosystem).

### **Educational Systems as Problematic**

While participants articulated that they did not experience challenges in their own high school classroom related to fairness, they communicated with marked eloquence that inequity in school systems was a contributing factor that helped explain why students of color did not pursue or persist in STEM. Participants commented upon a number of factors from a system’s perspective, including the supportiveness and safety of the school environment, the skillfulness and expectations of counselors and teachers, and the access to and distribution of resources.

With regard to school environment, Amerie commented on how its supportiveness or lack thereof influenced students: “High school can be a very difficult time for students, especially if they lack support both at home and in school.” Tammie shared that too often “the school system does not care about its students...” Furthermore, she expressed a view that safety in the school environment directly influenced students’ pursuit of STEM careers. She said, “Some of the biggest challenges people of color face is that they may start off not in the best

environment...and there's a lot of violence, and that really inhibits their performance moving forward in the STEM career.”

Concerning the influence of counselors and teachers from a system's view, Amerie shared, “If a counselor or teacher is inadequate at helping students, then they will be more of a hindrance than a help to these minority students.” Tammie said that frequently students of color are left without good teachers, and without people pushing them to be the very best that they can be: “If the school does not care why should the students? At least that is what I assume they think. Society places them in this uncomfortable situation and really only leaves them with bad options to choose from.”

With regard to access to resources, Brielle said that in her observation, minorities “oftentimes in school didn't have the opportunity to take STEM classes.” Tammie elaborated along the same line that very often “the students are left without proper textbooks.” Concerning the distribution of resources across schools, Tammie shared the perspective that “all the good schools with the best resources tend to be primarily white institutions.” Her comments reflected a high level of contemplation and experience grappling with this ostensibly entrenched and problematic facet of the education system. She said:

in order to properly compete with others, non-white students would have to drop everything and move to an area that lacks people of color. In doing so, Black and Hispanic students are not only taken away from people like them, but also they lose part of their culture.

Tammie experienced this loss personally:

I know that in search for better schooling for me, really the only options available were those that were primarily white institutions. As a person that had to live that life, I deeply

understand the struggle. I feel like part of myself was lost, and just recently I have been on the lookout for a better, more together me.

The profound influence of the school system's inequity moved Tammie to share her aspiration of using her future success in a STEM career to encourage "unprivileged children," both Black and Hispanic, to "be more than a statistic...to beat the statistic." She expressed the desire to one day take on more (self-imposed) labor than the average researcher and "support them each and every step of the way" and be "a role model." In spite of the systemic challenges students of color face, and with which she herself has grappled, Tammie expressed a desire to show these students that they "have the power to do absolutely anything."

Dami provided a summation of how she felt issues in and touching education systems affect girls and students of color:

People often think that since it is 2016, everyone has equal education and opportunities, but that isn't the case. America still deals with systemic racism that allows favorable races to have an advantage in life. And that affects environments, school, education, and other factors. If we want to see more diversity in STEM fields, we need to start off with better education at the early level so that kids of all backgrounds can be prepared to enter these hard fields and excel at them.

In sum, several participants eloquently shared a rich reading of how educational systems prevented or dissuaded students of color from pursuing and persisting in STEM careers.

Participants spoke about these systems in alternately impersonal and personal terms, since they both observed trends in wider society and themselves had managed to avoid or find a workable solution for dealing with issues in their education systems. Indeed, evidence of their relative

success in navigating systemic pitfalls was provided by the fact that they were participants in LPU's summer bridge program.

### **Gender Norms and Racial Stereotypes**

Participants spoke similarly regarding how they were treated in high school; however, they shared distinct articulations about the expectations placed on them based on gender and race. A majority of the participants indicated that gender norms and racial stereotypes played a role in how they perceived themselves and others, with particular consideration for how they perceived their own STEM identity. As discussed in Chapter Two, the development of a STEM identity relies on a person being integrated into STEM and being seen by others as scientists. In Chapter Five, I further unpack how STEM identity was shaped for the participants.

When asked specifically about their greatest challenges in the pursuit of STEM, there was a near unanimous expression of disapproval about antiquated gender norms, which included the ability to negotiate caring for family with having a successful career. Likewise, participants were concerned about needing to prove their ability and debunk racial stereotypes, and working harder than others to become recognized and accomplished in STEM.

Teneisha examined the socialization of girls in regard to preparation for particular careers. Teneisha began by saying:

young girls are not always encouraged to do things that aren't typical for a woman. The influences on young girls are way different than the influences on young boys. Young girls are greatly influenced by influential women in the world and depending on a young girl's social and personal environment, the influential women in that young girl's life may not be women of math and science, but women of fashion and glamour, and publicity.

With this reflection, Teneisha articulated her understanding of how women and girls are tracked, in a sense, to engage in certain work that is associated with readily identified role models. These role models, she insisted, do not represent or come from STEM fields. By contrast, Teneisha commented that in the socialization of boys, they see many men who excel in the sciences and other fields, resulting in a situation where there are “mass amounts of male leaders in this world” for young boys to emulate. Owing to this apparent imbalance in visible role models, Teneisha said that “it becomes a matter of choice for the young boys and a matter of expectation or what is left for the young girls.” Teneisha clearly attributed the distinction between *choice* for boys and *expectation* for girls as a reason that relatively few women pursue careers in STEM.

In sharing her perspective, Melissa provided a pointed assessment of how gender stereotypes influence career choice and success:

Boys are pushed in science and math whereas girls are pushed into subjects that are more related to English, writing, or history. I think this is due to the stronghold on traditional values that women just aren't smart enough to excel in STEM.

She shared her feelings about this messaging: “I find that enraging. There is absolutely nothing that makes men better in STEM than women. I just think that girls get the idea from a young age that science and math are for boys.”

Like Teneisha, Melissa identified what she perceived to be tracking into certain careers, and the persistence of tradition in the determination of career access and success. She identified how stereotypes pedal the idea that intellect and aptitude are lacking for women but not for men. In this way, stereotypes reinforce the idea of traditional roles and values. Bianca elaborated upon this theme in her comments. She said:

I feel like society has these traditional roles for women to fulfill that pertain to the household, and taking care of the family. That makes it harder for women to be able to get jobs, or focus on the STEM field. You have to juggle both sometimes, in order to break away from those traditional ideas. It's harder for women to—yeah, break out of the traditional view of what a woman should do.

Tradition, it seems, was something many of the participants were aware of and possibly grappled with first-hand while contemplating the challenges they have faced or anticipated facing in the future while pursuing a STEM career. Participants consistently recognized tradition as an issue in regard to broadened participation in STEM. Ella, for example, reflected on her traditional upbringing. She stated:

coming from [my country], you are taught—or the traditional values, or ideas, are forced into you. You grew up thinking that men are better, men are supposed to do science, while women are to do the art-related fields, to take care of a man, to do house care.

The reinforcement of traditional, culturally connected values shaped how she understood her own ability. She was acculturated to the belief that men can excel in STEM and are “better” than women, while a woman’s place was in the house and in non-STEM careers. Ella’s culture as well as her immediate family microsystem sought to define what she could have access to and succeed in while pursuing a career. To counteract the gender stereotypes that surrounded her, Ella shared how seeing other women pursuing STEM careers was an important factor to her persistence and success, because it showed her that she, too, can succeed. Having a visual representation of women who looked like her reinforced her desired perception of self.

“Encouragement,” she said, is “showing other women that you have done it, and they can do it

too.” Thus, she identified the importance of mentorship in countering gender stereotypes and redefining gender roles. I explore mentorship in more depth later in this chapter.

The reflections about traditional values and choosing between family and career were further confirmed in Tracy’s perspective. She shared the saliency of traditional roles, stating, “I feel as though gender does play a big role and I feel like it’s a big reason why a lot of women don’t pursue STEM degrees.” Even though “a man and a woman have a family together,” she pointed out, “a lot of times men don’t view the women in the field as their equal, which is why they see them as the primary caregiver.” In her reading, this stereotype resulted in an unfair situation for women: “a lot of times they have to choose between having a family or going on pursuing their PhDs, which is a decision I feel like shouldn’t be a fair thing.”

Tammie continued the exploration of the either/or choice between family and career by communicating:

I think one of the problems is that when women are in the STEM field and they are working hard, they’re often criticized for it, for not focusing on domestic activities, but men aren’t so much criticized for it. They’re almost praised for putting their work above their family and getting farther in life.

In her view, this stereotypical thinking was pervasive and persistent: “that’s just a view that people have, I guess.” Tammie stated that the trap of these gender stereotypes created internal conflict and uncertainty for her: “I think I really wouldn’t know how to handle that.” She drew attention to her understanding of the differentiated expectations for men and women, and emphasized that the object of women’s effort was scrutinized. Women were not acknowledged for accomplishing hard work in their careers; rather, they were criticized for not caring enough for family.

Dami furthered this notion by articulating how she perceived that gender biases affected women pursuing STEM, in both their initial choices and later career decisions. With regard to their early career choices, Dami said:

Gender biases make women feel as though they can't pursue their dreams and passions, and I feel like that is the reason why aren't as many women in higher level fields like science, engineering, or math, because they were taught that they can't be great.

For women who did overcome these hurdles, Dami noted her perception that many failed to persist in their STEM careers:

I feel like they often quit their dreams and aspirations because society automatically appoints women as the caregiver for their families. Women are supposed to want to have kids and want to be married to a man for the majority of their lives, not use their talents to excel.

Participants consistently expressed the notion that women are the designated caregivers of their families. Kourtney provided a rich description of the difficulties created by gender stereotypes for women, starting at their youngest age. She stated:

One of the most difficult things to be in this day and age is a female. From birth until death, a majority of the time we are told that we can't. We can't play with trucks or video games because those are for boys and girls should be doing ladylike things. We shouldn't be playing sports, we shouldn't be exploring the world, and we should just be submissive and do as we're told. We are criticized for too much or too little makeup, being too interested in starting a family or not interested enough. No matter how we act or what we do, we're still never perfect.



Thus, participants articulated the powerful influence of gender stereotypes. Likewise, racial stereotypes appeared salient to participants, and raised challenges for them around expectations, pressure, and perceived worth. Adonne expressed an attunement to the added scrutinization faced by people of color because of preconceived notions and unequal representation in STEM fields:

I believe one of the greatest challenges that people of color face in STEM fields is the added scrutiny to them, because there's this pressure to always be perfect. Because if you're the sole person of color in your particular field, then you know people are—based on what you do, people are going to make assumptions on what people like you do.

Essentially, Adonne articulated how the notion of “representing” for an entire race of people happens in STEM fields. She understood that assumptions were going to be made and that people of color had a feeling of responsibility to debunk them. This pressure, it seems, was at the forefront of her understanding of what it meant to be pursuing her chosen field. She continued by saying, “there's also a lot of doubt and a lot of pressure to assimilate, and all these combined factors make it extremely difficult.” While she did not go on to say who precisely it is difficult for, her frame of reference and mention of the pressure to assimilate implied that she was speaking about those whose identities were similar to hers.

Kourtney spoke directly to the compounded influence of multiple identities on the stereotypes she and others like her face when pursuing STEM careers. She called specific attention to gender, race, and orientation: “It's unbelievably difficult to face criticism no matter what you do, especially as someone who is Black, female, and queer. No matter what my achievements are, they will always be diminished because of who I am.” She shared how she viewed and coped with the challenges created by stereotypes that touched on multiple aspects of

her identity: “I cannot change my race or my gender—so you can either accept me or keep moving. I have too much to do then to let another person criticize me for something I refuse to change.” Her confident, perhaps defiant approach, however, did not erase the painful trap she perceived, because, “when we yell, we are told to be silent. And when we are silent, we suffer.”

In summary, participants expressed clear and articulate understandings of the gender and racial stereotypes that shaded their pursuit of STEM careers. Participants noted how they countered and attempted to cope with these stereotypes, acknowledging that it seemed to require additional labor from them, for example, through seeking and eventually one day providing mentorship. They also acknowledged that the options they identified for handling stereotypes could not fully free them from their influence. Proving one’s self through action seemed to demand perfection, while additional psychological pitfalls accompanied both the option of speaking up and remaining silent. In the next section, I center the way in which the participants described how they perceived themselves, how others perceived them, and the treatment that resulted from these perceptions.

### **Perception and Treatment**

As recent high schoolers and new college students, the participants were able to eloquently describe the ways in which gender and race affected their perceptions of ability, the notion of needing to prove themselves to others, and the endurance of microaggressions in the midst of pursuing their education and envisioning their futures.

With regard to gender, several participants expressed that bias and discrimination took a toll on young women pursuing advanced STEM studies. Adonna shared that “one of the biggest obstacles” she perceived was “the skepticism” and “the sometimes misogynistic comments.” The effect of these comments was to:

wear people down a lot, especially when you're trying to stay ahead. Because if you wanna try to stay ahead you need to be at your top game all the time. If everyone's making comments, it's really easy to get worn down.

Malaika, who in high school was often the only female and African American in her STEM classes, provided an example of what content might be included in these misogynistic comments. She noted in particular how the perception of ability or intellect show up in her classes. She shared that “the stereotype would be, oh, I would be the one asking everybody else for help.” Paradoxically, she felt the psychological weight of these stereotypes “especially when I would answer the questions” in class.

Ro’Nisha recounted in detail when she started to receive explicitly discouraging messages about pursuing a STEM career from her teachers:

Back in secondary school, some of my science and math teachers would tell me I can only get so far in the fields of science, engineering and information. This probably started when I was 14 years old. I was one of about 28 girls in a science course with a class of 88 students on total. Meaning that the remaining 60 students were males.

Being told by teachers that she would not succeed in her chosen field affected Ro’Nisha’s thoughts about her ability, even though she persisted with her choice. She said, “Imagine going through the whole school year with teachers telling a young female student they are never going to get that far in life if they choose the science path?”

With regard to race, participants consistently shared the perspective that the perception of and treatment by educators played a crucial role (in more often than not) discouraging students of color from pursuing advanced STEM studies. Kourtney articulated the challenges that arose when educators believing the stereotypes associated with Black and African American youth.

She explained that “while in high school,” African Americans “are stereotyped/thought of as not being able to handle the ‘harder’ classes which normally fall into the sciences and math.”

Kourtney commented that teachers carried “preconceived notions” about students of color, whether Black or Hispanic. As such, teachers often deemed them “as only being average/subpar at school.” She continued: “By not helping or recommending/believing in minorit[ies] at a young age and then into high school, [teachers don’t] prepare them at all for success in the STEM fields.” The detrimental effects of “the perception of a lack in brain power from minorit[ies]...hinder[s] them later in life and keep[s] them from even having the option to pursue a tough degree in college.”

Kourtney shared that stereotyping by educators happened even though, “Many [African Americans] show more than enough signs that they are capable of handling the workload and critical thinking.” Teachers only seemed to recognize science- and math-related aptitude in students of color when “from a young age...they show exceptional educational abilities, because that’s the only way the teacher will notice.”

Maxine shared her awareness of the need to prove herself and overcome forces that opposed her success on the basis of race: “there’s definitely an aspect of proving yourself. I think it’s just a matter of making sure that you push through all the adversity and all the people who are looking down on you.” She identified a key strategy for accomplishing the tasks of proving and overcoming, specifically the importance of “finding the right people who support you and encourage you, regardless of your skin color.”

Another key strategy identified by several participants for overcoming barriers was an early and positive educational exposure to STEM subjects. Kourtney shared the perspective that early exposure to STEM could meaningfully broaden participation of marginalized populations

in these fields. Essentially, she shared that when youth in elementary and middle school are introduced to opportunities to learn about and later in life pursue STEM careers, this breaks discriminatory racial and gendered norms related to STEM.

In sum, participants articulated how the perceptions of and treatment by teacher and peers psychologically weighed and wore them down. Some identified coping mechanisms for dealing with these negative perceptions, including steps that they could personally take to surround themselves with supporters/mentors and steps that educators could take to provide earlier and more consistent, positive encouragement to students of color regarding the pursuit of a STEM career.

When considering their futures in STEM, participants indicated their understanding that as Black people and/or women, they would face a continual need to prove themselves. Alisha stated that people of color in STEM fields often have to “take the extra step to constantly...disprove them [naysayers] and just prove that they actually deserve to be in that field and that they’re as equally or even more qualified as everyone else around them.” She described the work of proving one’s worth in the scientific community as “a lot of weight to carry.”

The need to prove one’s self and the burden of carrying additional weight as a Black person and/or woman was consistent for many participants. According to Brielle, this supposed proof came not from simply matching white and/or male colleagues, but from being exceptional:

before I feel like an African-American or Hispanic or any other minority can even be taken seriously, they have to show exceptional skill in whatever area that they’re trying to be seen in or whatever. You can’t just be average.

She shared a nuanced perspective of the logic behind the perceived need to be exceptional:

it's like, well, if you're just average, why would I [an employer] choose you over, let's say, the next white person who's just as average as you? You have to be...twice as good so you can get that initial look.

In Brielle's view, the need to be exceptional did not end once a person of color showed themselves to be "twice as good." They had to establish and show "a track record" in order to be "taken seriously." At no point, in Brielle's reading, can a person of color relax in their career:

Then I feel like you have to continuously show that skill, and you can never be lackluster. You always have to be excelling. You always have to be pushing yourself to be better and better and better because if not, then it's like what makes you different and what makes them wanna choose you over some—over a white person—and I feel like it's always been like that.

Brielle's comments made it explicit that whiteness is the standard of comparison, and the inequities inherent in this standard require people of color to continually prove themselves and carry the weight of this additional labor, both materially and psychologically.

In summary, participants expressed a rich detailing of how the perceptions of and treatment by teachers and peers affected their self-perception of ability. Even while asserting their potential in STEM, they identified how stifling negative feedback from others was for them and presumably for other students of color and/or young women.

### **Moving Up the STEM Ladder**

Several participants noted that they anticipated or directly experienced unfairness or discrimination during their transition to university, including some of the students discussed above who perceived race and gender as non-issues with regard to fairness in high school STEM

classes. Sarah, the sole Black girl in her high school STEM classes, shared that while she did not articulate feeling treated unfairly in that context, she recognized that, “there’s a lot of that that goes on when, as you move up in your education.” As a high school student, she did not have an expectation for being treated differently in relation to her pursuit of STEM classes. She did, however, have an awareness and understanding that challenges will likely arise as she advances through her university-level education. She expressed a realization that shifts in her experience may occur based on changing educational contexts and environments.

For her part, Briana shared her anticipation that at the college level, fairness becomes an issue: “I’ve heard stories about people feeling like they’ve been discriminated against by their *professors* [emphasis added] and feeling like they’ve been treated differently, either like receiving lower grades and stuff like that.” While Briana stated that she did not notice any unfairness towards her by her high school teachers, she did mention a perception passed to her by others that professors treated students like her differently. An identification of professors as perpetrators of unfair treatment signaled her initial perception of educators in higher education as an issue.

Though Tracy felt comfortable during her high school classes, she shared that she noticed a transition that happened when she entered university:

I know, like, being at [LPU], occasionally, like, when I would state my major people would look at me like, “Wow, that’s the major?” Like, almost surprised that I’m having the major that I have. Although I don’t think I really experience it in a classroom, I do get a vibe like some people don’t really expect me to be where I am.

Though she did not necessarily connect it to her in-class experience, Tracy perceived people being surprised by her major choice; while she did not explicitly state that she attributed

the surprise to any aspect of her identity as a Black woman, she alluded to it. The “vibe” referenced by Tracy appears comparable to what another participant, LaDonna, shared about her experience. LaDonna recounted what it was like to share her major with others:

When I’m in a class, I feel equal and I feel like there’s an equal opportunity for all. It’s more so outside of class. Once we get [same physical space] the girls there, myself there, I feel comfortable and hopefully, everyone else does. It’s when I’m outside of the classroom, and I may tell someone what I want to do, that’s when they become really surprised about, “Oh, wow. You like science and you wanna go into this. *That’s surprising hearing that from you* [emphasis added].” I feel like it’s more so the people who are on the outside instead of the people [advisors or support people] who are actually trying to put you there [in a STEM major].

Both Tracy and LaDonna identified a difference in experience when interacting with peers studying STEM and those pursuing studies outside of STEM. Tracy stated that peers outside of STEM expressed surprise and expected her to be studying something other than STEM subjects. Her peers within STEM—specifically those sharing the context of the classroom with her—did not express these sentiments. Likewise, LaDonna said that in the specific context of a shared classroom, peers did not question her. Outside of the classroom, on the other hand, peers were surprised to learn she was pursuing a STEM career.

Furthermore, LaDonna expanded on her experience in the classroom, stating that she worked to establish rapport and comfort with other female-identifying students. For LaDonna, this rapport appeared to create a feeling of belonging and possibly helped her buffer against potentially unfair or discriminatory treatment within the context of the university classroom.

Thus, participants discerned a difference between their high school experience study math and science and their real or anticipated experiences at university.



## **Importance of Role Models and Representation**

*“...if other people like me can't do it then I can't do it.” ~Ashlee*

The previous findings highlighted participants' perception of and experiences with fairness in high school and college, the impact of gender norms and racial stereotypes on perception of ability in STEM, and the role of others' perceptions and treatment of marginalized people in STEM. In this section, I share the need expressed by participants for same-gender, same-race role models and representation of women and Black people in STEM. As new college students, the participants were able to spend time reflecting on their high school experience and, at the same time, consider what they needed to thrive in STEM going forward. A part of their perceived ability, reflected in participants' narratives below, is connected to seeing themselves in others. Participants noted several themes related to role models, including their quantity, function in students' lives, timing in which they enter students' lives, where they are located in the environment, and their representation in STEM classes and in industry.

On the theme of quantity, Tammie directly stated, “I feel like society really lacks a lotta women role models in the STEM fields, which often leads to women not really wanting to enter into the STEM fields.” Ella extended Tammie's perspective by sharing: “I think that there are not enough role models from ethnic minorities to influence students to head in that STEM-related career path.” This articulation of needing someone with which to share struggles highlights the fact that the STEM fields continue to be dominated by those who do not identify as racially or ethnically underserved. Ella pointed out that the shortage of apparent role models happened not only in person-to-person contexts, but in books. She noted a marked lack of representation and the effect she perceived this had on student of color:

Ethnic minorities do not have that many people to look up to when deciding what careers to do STEM-wise. I say this because in most books, it is usually the dominant Caucasians that are seen to have found a cure to diseases, been to the moon, and finding new discoveries in general.

On the theme of role models' function in students' lives, Ella said that "when there is no one that you can look up to, [it] makes everything harder." Ella elaborated that when members of the white or privilege-holding majority say things like, "Oh, it's so easy," students of color are left with "no one to share your common struggles with. You don't know the difficulties, or people don't know your difficulties." Having same-gender, same-race role models can "just to make life easier...for more people," that is, students of color and women. This comment about making life easier nods to the social capital that students gain from their association with role models. Specifically, it allows for meaningful access to and understanding of the field. Tracy agreed with this sentiment. She stated, "I feel like people always wanna identify with someone who's like them in their profession just so they can feel community" and "a sense of support."

Participants further explored the function of role models by describing the effects of *not* having them in their lives. Speaking on mentorship, Tracy elaborated:

with the lack of that, a lot of minorities feel like they shouldn't be where they are, always think they're like "imposter syndrome" where they feel like although they made it this far, they still shouldn't be where they are.

She explicitly identified imposter syndrome as symptomatic of and closely related to not having a role model. Imposter phenomenon, or syndrome, (Clance & Imes, 1978) refers to an individual experience of self-perceived intellectual phoniness or fraudulence. Since access to same-gender,

same-race mentors was not always an option available to her, Tracy described how she and other like her have persisted in STEM:

I feel like the lack of support and community in the STEM professions among different groups is a big challenge to it. A way I feel like minorities try to get through it is by, I don't know, just being resilient and just being motivated.

Thus, participants identified role models and mentors as critical to their success and the success of students like them. In the absence of this critical support, female students of color reported suffering from doubt and imposter syndrome and were forced to resort to overextending their already fraught internal resources in order to keep going.

On the theme of the timing in which role models enter students' lives, Tracee offered her understanding that "the initial cause for the small percentage of Blacks and Hispanics in STEM careers" was "the representation they get as a young adult. Not many Blacks and Hispanics have positive role models at home to push them in the right direction; therefore, they get lost in finding a good path to go down." She offered early intervention as a way to address the support needs for racially marginalized groups. Such support provided, in her assessment, a much-needed antidote to barriers to access and success in STEM. Ella shared a similar perspective regarding students' early need for role models. She stated that "the students who graduate, especially of color, may not take the math and science courses needed to pursue a STEM career because firstly, there may be no role model to push them towards any career in the STEM field."

On the theme of role models' location within the environment, Amerie shared her assessment that they are often situated outside the contexts in which students live and study. She said:

many Black and Hispanic kids don't know what is out there to pursue outside of their bubble. Many Blacks and Hispanics live in small communities where there are only other Blacks or Hispanics. In a lot of these communities, students don't have many examples of people who look like them who are successful. If you look around and only see people who work minimum wage jobs or part-time jobs, then you may not even consider doing anything different.

Taylor also pointed out how social replication worked against students who might have otherwise wanted to pursue a career in STEM: "Many try to follow in their family's footsteps because that is all they have known and it is easier to follow the path that others around you have traveled."

Amerie connected the location of role models to both their function and the importance of timing in students' lives. She explained that it was important for role models to be located in students' environments, and from the students' young age: "Being a minority, it is very important to see other minorities who are successful. It *makes you believe* [emphasis added] that you can be successful too."

Participants like Taylor looked to other adults in their environment to serve as proxies or rough substitutes for genuine STEM role models. Specifically, she turned to her high school counselor for the support she wished she could have received directly from someone in STEM who looked like her. She said:

Using myself as an example, I have no one around me who is in the STEM field or even pursued a college degree, so it was hard trying to see how school benefited me when I was young. However, the high school I attended had wonderful guidance counselors who

really helped me to explore my interests, and greatly influenced my decision to take harder classes. My school was fairly small, so it was easy to get this extra attention.

Taylor acknowledged that the effectiveness of these counselors was likely exceptional, since most counselors across the nation are overextended and her school's small size allowed the counselors to provide significant support. She elaborated upon her relative privilege by sharing the thought that "many other students are not as lucky at their respective schools. Minority students may not have a counselor who pushes them beyond their limits so they can reach their full potential." Without this support, she asserted, it became more likely that students would not pursue rigorous math and science classes in high school, and this lack of foundation would make it "extremely hard" for students to "pursu[e] a STEM degree."

On the theme of representation in STEM classes and in industry, participants indicated that this concern complimented their felt need for role models. LaDonna shared her recollections of a camp she attended over a number of years: "I remember being at a camp...and going through their classes. They [the faculty] were all male. Gradually, they started turning female. Seeing that and seeing that progress go through, encouraged me even more so." LaDonna clearly articulated the importance of seeing more women in the role of faculty member or instructor as key to her encouragement and continuation along an educational and career path in STEM.

Solange offered her understanding of the importance of representation in industry, and how it can directly influence the work environment:

The more women in leadership or executive roles in a company or agency, the more women are likely to be hired. By having this leadership role filled by a woman, people are able to see more clearly how successful and hardworking women can be. Without this representation, men are less likely to view women as their equals.

For Solange, the representation of women in STEM careers was important to her ability to see herself in similar lines of work. She also expressed a belief and hopefulness that women support other women in industry: “women usually focus more on gender equality than men, so a female head is more likely to want to see near equal gender representation in her employees.” LaDonna shared Solange’s optimistic assessment about the potential positive affects that greater representation by Black women in industry might have for the generation following them. She said:

I feel like once I get to where I want to be in getting my PhD in my intended major, I hope that [I] can be...not necessarily a role model but someone that...inspires other girls to continue on the path that leads to a higher education.

In summary, participants saw role models as serving a critical function in their pursuit of a STEM career, and I identified a number of themes that emerged from their reflections. Similarly, they ascribed great importance to an increased representation of Black women in STEM classes and in industry.

## **Chapter 5. Discussion, Implications, and Recommendations**

The representation of historically marginalized and underserved people in STEM, and Black women in particular, remains low. Calls to broaden participation in STEM are represented across higher education institutions and funding agencies; however, little research has been conducted to better understand the experiences of these populations as they seek to enter and navigate STEM education and industry. In this chapter, first I review the purpose of the study and its research questions. Second, I include a discussion of how the guiding theoretical frames relate to one another. Third, I contextualize the purpose of the study through contemporary examples of systemic and cultural bias that harm the Black community. Fourth, as an important part of the discussion of the findings, I discuss my own positionality and experiences. The voice of the researcher is encouraged in narrative inquiry; the identity I share with the participants as a Black woman equips me with a basis for commenting upon and comparing perspectives. Fifth, I discuss the findings in relation to the study's conceptual frames. Lastly, I provide recommendations for future research.

### **Study's Purpose and Questions**

The purpose of this narrative inquiry was to understand the range of beliefs about race and gender held by academically talented Black women in an undergraduate, merit-based program in STEM. I captured their perspectives at a pivotal moment in their STEM education and development of their STEM identity: the summer immediately after their graduation from high school and prior to their first semester in university.

For this study, I utilized theoretical models that complement each other, and which I connected closely to provide a framework for my analysis of the data. Bronfenbrenner's ecological model situates the multiple, nested systems that influenced the participants'

experiences. The participants' experiences as high school students, members of their families, new college students, and members of society likely influenced their understanding of what it was like to be a Black woman, and one pursuing a STEM career. These experiences happened at the level of family (i.e., microsystem), school (i.e., mesosystem), and school system (i.e., macrosystem).

Next, Crenshaw's intersectionality complicates how race and gender intersect power. For example, the Black female participants articulated how others (e.g., white and/or male) perceived their ability in relation to race and gender. These perceptions were often steeped in the norms of whiteness that the Black women, like other people of color, were expected to seamlessly navigate, but did not readily understand or easily navigate.

Finally, Black feminist thought highlights Black women's individual and collective standpoints. Black feminist thought, a critical social theory, was chosen to best understand and analyze the narratives of the Black women participants in this study, because it centers the lived experiences of Black women. Collins (1989) described Black women as outsiders-within. Since spaces are generally led by white people and males, Black women tend to manage from a position on the margins. While BFT is composed of nine core themes, I utilized the three that most connect to the participants' narratives. These include interlocking oppressions, controlling images, and the power of self-definition to analyze how the participants' experience vary across social contexts.

Thus, these three frameworks—the ecological model, intersectionality, and BFT—together, provided me with a comprehensive framework for examining how the academically talented Black female students viewed their multiple selves, interactions between self and other, and the influence of factors that shape how they engage in and manage their day-to-day.



In the present study, the Black female students understood the influences of society's expectations in juxtaposition to their ability and desire to succeed in STEM. Ultimately, they were able to identify their individual, as well as collective standpoint, which is highlighted in BFT. This fresh understanding of how newly admitted college students understood and reflected on their race and gender as these identities presented across various contexts provides important insight for how to better support Black women in their pursuit of STEM careers. More specifically, it provided an opportunity to expose the inner thoughts of future Black female scientists. The frameworks, as analytic tools, allowed me as the researcher to effectively articulate the numerous ways these Black women were required to negotiate white-centered spaces. The multiple frameworks emphasized that society's prescribed ways of being have been created for and are maintained by whiteness.

The ways in which the Black women in this study encountered everyday challenges presented by their race and gender were not new, and in fact, they have been pervasive throughout higher education institutions across the United States for decades. For the past 50 years, specifically, Black women have been more well-represented in higher education overall; however, their representation in STEM remains stagnant. The ongoing ways in which structural discrimination is enacted further necessitated this study.

The research questions that guided my research were:

1. How do academically talented Black women in an undergraduate, merit-based STEM program communicate about their treatment in high school regarding race and gender?

2. In what ways do race and gender influence how academically talented Black women in an undergraduate, merit-based STEM program articulate their own access and ability to succeed in STEM?

### **Summary of Findings**

To recap the primary findings of the study:

1. The environment and wording of the questions posed to the participants yielded distinct, sometimes contradictory responses about the challenges they perceived and experienced related to race and gender in STEM.
2. Gender norms and racial stereotypes played a role in how participants perceived themselves and others, with particular consideration for how they began to see themselves as scientists and perceive their own STEM identity.
3. Participants' racial and gendered identities influenced how they understood their experiences with and perceptions of faculty and peers.
4. Participants communicated the importance of seeing themselves in their future profession, noting in particular that role models and representation in the field were integral to their success.

### **Positionality as Comparison**

Like the participants, I, too, was socialized in various ways that shaped my lens for understanding my immediate and broader lived experiences. The inclusion of my reflections is helpful as a comparison, as it highlights the very nature of how race and gender function in various contexts across time. As such, I thought back to my own high school experiences and how I, as the researcher, have the power in decision-making to provide layered understanding of race and gender in various contexts and times, separate from the actual data collection process.

I attended a college preparatory high school in Singapore for ninth through eleventh grades where I never had a Black teacher. I then attended the Department of Defense (DoDDs) high school in Rota, Spain, for my senior year, where I had mostly white teachers. These contexts anchor my reference points. As a result of my immediate privilege living in a flat (apartment) paid for by the military, attending a private school, and living with a strong parental support system, I was permitted as a teenager to participate in Interim Semester. This was a weeklong, credit-bearing learning opportunity offered to the high school students. One year, I stayed in Singapore to take a cooking class focused on local cuisine; another year, I traveled to Nepal; and in my last year, I went to Australia. These particular reflections allow me to discern how my experiences as a Black teenager differed from those I envisioned other Black teens my age were experiencing with regard to their race and gender.

I never engaged in any conversations about discrimination, bias, racism, or sexism. If anything, I may have been able to point out when something did not feel right or felt concerning. Assuredly, however, I was unable to pinpoint what the “not right feeling” was connected to in terms of systems of oppression (e.g., racism, sexism). I was enmeshed in a multitude of cultures across my high school educational and cultural experiences. Also, having attended high schools abroad, my experiences were unlike what most Black women from the United States experienced, based on what I learned about those who lived in the U.S. In fact, the very notion of socialization, as a process to assimilate, happened to me in different ways and did involve the systemic injustice I have since, moving back to the United States, come to perceive firsthand. For example, the cultural norms living in Singapore required particular comportment, no littering, and navigating what I experienced as upper-income, Asian-identified people as a result of my

association with my private high school. The very systems within Bronfenbrenner's ecological model shaped my experiences quite differently from those of the participants in the study.

Bronfenbrenner's nested systems, in relation to my unique high school experiences, resulted in my various interactions that contributed to my understanding of cultural norms. These norms were learned through my interactions with locals, education in school, and relationships with many friends who identified as Singaporeans, Chinese, Indians, and Malaysian, for example. Every day, I lived what I perceived to be a normal life of those who occupied the island. It was not until I was in college back in the U.S. that I began to think critically on my high school time and acknowledge the oppression experienced by low-income, ethnically disadvantaged people. This showed up for me in the recognition of who occupied certain jobs, the location of particular groups of people unable to access the high-income spaces on the island that sometimes even included the downtown area.

This imperfect comparison is valuable in considering the interactions between Bronfenbrenner's system levels and Collins' power structures. As an American in Singapore, my presence was not dismissed, nor were power dynamics centered on my race as being Black, as being American held power.

Despite sharp shifts in social and political issues over the past ten years, my own experience as a Black woman in higher education in America merits analysis alongside the experiences of this study's participants, because the norms that the participants were expected to master and navigate with ease are familiar to me, having now been in the US for a number for over twenty years. In my transition back to the United States for college, I was forced to acknowledge the reality of race and the cultural nuances embedded in Blackness in America.

### **Being Black and Female in Public**

In the last decade, the media has successfully highlighted incidences of discrimination, bias, racism, and sexism. These pervasive social ills have been amplified through police brutality, the #MeToo movement, and the everyday actions of Black people being called out by white women (e.g. [BBQ Becky](#), [Permit Patty](#), and [Corner store Caroline](#)). For example, a young Black girl in Louisiana was sent home from school for wearing braided hair with hair extensions. The norms and expectations that prevent Black youth from wearing their hair in a particular style exemplify how whiteness and patriarchy invade a range of educational spaces. Essentially, the natural way of being was dismissed and not in alignment with the norms for whiteness. This instance, unfortunately, continues to pervade media in relation to professionalism. The lived experiences of Black people, therefore, are readily impacted by the systems steeped in oppression and therefore inform how groups of people are perceived and treated in the United States. Stacey Patton, an assistant professor of multimedia journalism wrote a piece for the *Washington Post* about [children being beaten in school](#). Essentially, educational settings are not always safe for Black children and minoritized populations in general. There are no assumptions made that all Black children experience trauma in school, however, these incidences paint a picture of the challenges faced by Black youth. It is important to provide context for what Black people experience simply living their lives. The situations noted above, indeed perpetuate discrimination, bias, racism, and sexism; they are maintained by those in privileged positions who hold power and those who have succumbed to white, or cultural assimilation.

Literature has provided a solid foundation for understanding the ways in which discrimination, racism, and sexism permeate the experiences of Black youth and women in predominantly white institutions and how they remain inequitable. Patton (2016) shared:

Popular rhetoric suggests higher education is the great equalizer and affords life opportunities, particularly to those who, regardless of circumstance, “work hard.” This meritocratic discourse is laced with racist and classist assumptions that ensure hard work alone is insufficient for marginalized groups to excel. This discourse attaches nobility to higher education without examining its contributions to the inequality it purports to disrupt. (p. 318).

Patton articulates that educators in higher education often miss the goal to equalize education. The “work hard” reflection that dismisses the inequities in education for high school students and inaccurately assumes the level of preparation Black women in preparation for the rigors of STEM. The notion of working hard will be addressed further in this chapter.

### **Findings and Implications**

The undergraduate Black women in this study shared their perceptions of how race and gender functioned in their lives and in the lives of others. I found that while the participants were able to shed light on various forms of perceived racial discrimination or bias, they were unable to articulate challenges related racism and sexism. In Chapter Two, the ways socialization occur and influence Black women was articulated and informs, generally, the findings. As such, the following discussion presents the perceptions and lived experiences of the participants in relation to current literature and the study’s conceptual frameworks. Next, I share the findings and their connection to the study’s framework.

#### **Perception of fairness in school systems**

Participants were asked to reflect on whether they were treated fairly in high school. They expressed varying perceptions and experiences related to high school demographics, recognition of other people’s experiences, and gender that provided glimpses into how they

perceived fairness. They inconsistently offer specific examples of what constituted fairness or unfairness. Participants were asked, “Do you think women and men are treated fairly in STEM classes? If so, share some examples. If not, share some examples?” and in their reflections, generally addressed classes in high school. Their responses regarding fairness and the contributing factors to fairness ranged from the composition of their high school in relation to demographics and recognition of other people’s experiences. Generally, their responses noted consistency regarding being treated fairly in their STEM classes. At first glance, I understood these recollections as genuine. Upon further examination, there was another, more analytically sensitive (and more plausible) reason for the seemingly positive reflections: the focus groups were race and gender diverse. Reasonably, I can assume that the focus group space was marked as a white space, and therefore the students did not feel—even on a subconscious level—comfortable to express the very negative experiences that may have been perpetuated by people who looked like their peers in the focus group who held majority identities (e.g., white or male).

Related, the Black women may have sought to project social desirability by responding in similarly positive ways as their peers, in the hopes of not disrupting the new relationships being built with them. Only once the students were asked explicitly to talk about obstacles for Black and/or female students in STEM did they open up and share more.

It is important to identify the high school as a system to best understand the influence of high school on the participants’ experiences. Bronfenbrenner’s ecological model, addressed in Chapter Two, offers four systems that influence human development, the micro-, meso-, exo-, and macrosystems. Each of the systems relates to immediate relationships and connections to systemic or institutionalized forces that tend to influence other systems. The participants negotiated their educational context as a part of a mesosystem as high schoolers, with the

combination of multiple microsystems inevitably influencing each other. The participants' experience in the mesosystem (i.e., high school) influenced their perceptions and the way they understood their lived experiences across various contexts. The participants very concretely communicated not experiencing unfairness; however, unfairness occurs at all levels of Bronfenbrenner's nested systems.

When I initially noticed nearly all of the participants express that their high school experiences were "fair," I wondered what they identified as fair and whether they could identify challenges around discrimination, bias, racism, or sexism as high school students. It seemed that the participants may not have had a developed lens for articulating discrimination and prejudice. In fact, an application of Black feminist thought suggests the possibility that the participants may have been socialized to see and understand their experiences through whiteness, and not through their lived experiences as Black women. Rather, a gaze of whiteness clouded their perception. The participants rationalized reasons for saying their high school experiences were fair, even as they indicated that they knew "it happened" in other places. "It," for the participants, indicated instances of unfairness. Notably, they did not specifically identify what those instances were. Therefore, the particular socialization of Black youth across familial and societal influences shaped their perceptions, and thus, experiences.

### **Being Black in college**

While this research was designed to avoid the deficit perspective of Black girls in STEM, many school districts across the country are under-resourced and do not adequately prepare Black youth for higher education and career. Conversely, there are students who are adequately prepared; however, the culture they encounter in higher education settings are not ones they are readily prepared to navigate. In fact, K-12 educators are expected to educate with a socializing



force that prepares them for enrolling in college. Yet, as teachers fulfill this expectation, there is no guarantee that students will be aware of or know how to navigate the white, patriarchy-designed college culture. Students are faced with an unspoken and unrealistic expectation.

Destiny recognized the ways in which education contributes to the challenges:

People often think that since it is 2016, everyone has equal education and opportunities, but that isn't the case. America still deals with systemic racism that allows *favorable* [emphasis added] races to have an advantage in life. And that affects environments, school, education, and other factors. If we want to see more diversity in STEM fields we need to start off with better education at the early level so that kids of all backgrounds can be prepared to enter these hard fields and excel at them.

Having “favorable races” is a form of racism. Destiny suggested that white people hold this favor, given that Black people, and all people of color, do not hold systemic power. Educational systems, in fact, were designed for white men. Therefore, she was aware of who she is up against. In recognizing racism, Adonne offers an option for counteracting or working against racism:

In order to combat the problem, a lot of minorities kind of prove them wrong, per se. Usually, it would motivate me to work harder and to do better, to show them that just because of my race that my race doesn't affect how I perform. It will just give me more of a push to do better.

While she has the goal to work hard to prove herself, it may be for naught, as the problematic, systemically oppressive systems prevent her from positioning herself as a person with power who is not to be questioned. Black feminist thought suggests that Destiny sought to

use her power to define herself. By doing this, she identified the goal of pushing to do better and not succumb to the stereotypes held by others.

### **Racism from afar, gender discrimination up close**

While the participants stated they did not experience unfairness based on race or gender when asked directly in a mixed focus group, they were able to enthusiastically name the ways in which gender norms influenced how others viewed their capabilities as career women. Even more interesting were the participants who commented about racial group similarity as a reason for not experiencing discrimination, hence the articulation of fairness. This reflection, like those shared regarding gender, suggests that same-race groups are not capable of being unfair, and instead that other racial groups are the ones that initiate unfair or inequitable treatment.

Gender norms are the “ordinary” ways society expects a gendered body to comport themselves; unspoken is that ordinary is defined as white. The Black women in the study were able to clearly identify the ways in which they were socialized to understand what their expectations were as women first, and then as Black women. Collins would suggest that the hierarchy of womanhood over race is an example of an offshoot of how Black women’s identities were consumed by images of matriarchs and mammies. Over time, the socialization of Black women to take on roles and see themselves in roles that elevate gender continues to permeate visions of self for Black women. They identified the issues of gender norms in conflict with their education and career pursuits. Bianka offered, “Women with graduate degrees in science might hold fewer jobs than men not only because of gender bias but also because of the traditional societal roles that women have held throughout time.” The societal roles she referenced were detailed by participants in the study as taking care of family instead of pursuing a career. Those expectations also centered career opportunities that focused on caretaking and

not careers that have often only been seen as male-only. This perception is supported, again, by Collins' core theme focusing on controlling images in that women are not seen in traditionally male-dominated roles. Destiny also offered:

Gender biases make women feel as though they can't pursue their dreams and passions, and I feel like that is the reason why aren't as many women in higher level fields like science, engineering, or math, because they were taught that they can't be great. I feel like they often quit their dreams and aspirations because society automatically appoints women as the caregiver for their families. Women are supposed to want to have kids and want to be married to a man for majority of their lives, not use their talents to excel.

It seems that the participants were more easily able to identify gender bias and readily make connections to how the bias would connect to the future.

Race, a social construct, is used as a way to group people based on physical characteristics. The participants held their own, distinct ideas about how stereotypes inform how they were seen. For example, Simone shared:

I feel like for most minority races there's that stereotype that they're dumb or lazy. I think that definitely makes it harder, especially with people who agree with the stereotypes, like employers that agree with them and stuff. It may be harder to get a job, and sometimes they don't even realize that they're being racists. Like employers, but they are. I think the best way to deal with that is minorities working together, really.

Simone articulated her perception that most minorities were plagued by the stereotypes about their race, though she had not experienced this firsthand like Tia. Tia communicated her experience, saying:

I think I experienced severe stereotyping, but sometimes people would just assume that I was in the lower end classes or that I wasn't trying as hard or that they couldn't go to me for help because of my race, because they didn't think I was good enough, I guess.

The notion of not being good enough was not new and was associated with a sense of belonging and desire for teachers and faculty to recognize their abilities. Monique offered an example of this when she said:

I do think that it's like not equal. I feel like women have to be extraordinary to be compared to the average male. Like back to this class, I still got an A, but I still wasn't like—there were people that failed the class. I still was getting, like, “Oh, you get it?” I was like, “I get it.” ... I have to be like above average just to, like, compare to someone who's, like, lower than me. Then, like, the people who are at the same level as me automatically are perceived as better. Yeah, it's kinda unfair.

Monique's reflection about needing to work harder but not being recognized for the effort.

Collins would suggest Monique define success for herself. Collins articulates, “Black women have...stressed the importance of self-definition as an art of the journey from victimization to a free mind in their blues” (2009, p. 123). Therefore, Monique would be able to shift the despair of how unfair she perceives credit for her intellect, remember her intelligence, and maintain her effort throughout her educational experiences.

### **Social location**

In considering the four major findings, I recognize that the participants have complicated perceptions of their current social location and what it can or will be in the future. The participants consistently shared the importance of role models. The need to see others like themselves pursuing careers in STEM fields or already being successful remained an important

factor to their own success. Without seeing others, the participants could not always see themselves continuing on their chosen path.

The need to have role models cannot be understated for marginalized populations, and Black women in particular. As a group, they negotiate being doubly-marginalized on a daily basis and do not always have the cultural capital to navigate the spaces that were not created for them. Educators must be attuned to this challenge and be eager to identify role models and mentors to support students. The challenge with this suggestion is that Black women role models are apt to experience cultural taxation, the labor experienced by people of color to mentor and support other people of color at levels greater than men and/or other racially underrepresented women. So, while there is a need for role models, there also has to be a focus on educating faculty and staff on how to effectively support students whose identities likely lead to experiences unlike those who identify as white or male.

Ong and colleagues (2011) defined the double bind as the, “unique challenges minority women faced as they simultaneously experienced sexism and racism in their STEM careers,” (p. 175). Candace articulated her understanding and experiences with the intersection of race and gender:

Especially for females, I know me, I’m black and I’m also a female. Sometimes I feel like—I haven’t really had any personal experience where anything has been negatively said to me, but I’ve been in circumstances and situations where I feel a off energy, where people are looking at me like I shouldn’t be a certain place. Or maybe not that I shouldn’t be there, but it’s weird to be there. Just be prepared, even if you’re a woman and you’re of any race, that you’re gonna be looked at as maybe is she here to take our spot. You

have to work twice as hard sometimes because, until this social setting is changed, it's always gonna be like that.

Like other participants, Candace notes the importance of working harder than others.

While Collins' work focuses on controlling images centering the mammy, matriarch, and whore as the ways Black women were labeled and described. To expand Collins' work, I envision perceptions and descriptions centered on lack of intelligence. Many of the participants communicated their lived experiences or other people's perceptions of their inability and questioning about aptitude.

### **Special Cases**

The participants in this study are not representative of all Black women pursuing degrees in STEM. In fact, these women are exceptional cases – those whose academic excellence afforded them the opportunity to be selected for the STEM Success Program. The affordances – a summer bridge program, dedicated and supportive staff, faculty who opt-in to serve as mentors to the students, opportunities to engage in research, and access to high-profile internships, situate the experiences of these women as privileged. I do not write this lightly, as power and privilege and those who enact them can be the catalysts and perpetrators of the undeniably oppressive systems that often disallow Black and Brown people to thrive in the very academic settings that were not created for them. Interestingly enough, simply because these Black women had access to this program, the challenges they are aware of and often need to navigate remain steeped in racist and sexist ideologies that require attention. While this study did focus on these students, it does not negate the experiences of Black women without structured and calculated support. I will share recommendations regarding this perspective in the next section.

## **Recommendations**

This study's findings offer consistent narratives about the ways in which race and gender are experienced by Black women college students engaged in a merit-based program at a PWI. The following recommendations are offered for a range of constituents, with the understanding that Black women in STEM intersect many groups of people and communities and can benefit from the commitment of others to increase their opportunities to thrive in STEM.

### **Participant recommendations**

The participants in the study would benefit from knowing that their inclinations about how race and gender function in STEM and in society in general are valid and that they can interrupt systems of oppression. Here, I provide three recommendations.

First, educational policy-makers must be educated about the circumstances Black women encounter to implement nationwide professional development for educators and administrators about the unique experiences of students of color to then allow for time in the curriculum for my second recommendation. Second, high school is the ideal place and time for youth to begin to learn about systems of power, privilege, and oppression. Therefore, high school administrators and educators must be equipped to teach and facilitate conversations focused on systemic and institutionalized oppression in our society at large and throughout educational systems. By doing this, youth are introduced to the very concepts they are likely to encounter both in higher education and career opportunities. Third, families must be educated about the future experiences their students may encounter to provide multiple touchpoints where the students hear and subsequently learn how to identify, manage, and hopefully counteract the issues they encounter. This recommendation is particularly critical because if students are able to pinpoint issues

around sexism and racism, there will likely be a more concerted effort to call out the incidents that happen to students of color in educational settings everywhere.

### **Student support system recommendations**

It is important that Black women college students have established support systems when making decisions to pursue degrees that are not heavily populated by people of color or women. Support can come from families or support people who acknowledge the students desires and actively reinforce what the students want. Families and support people have the opportunity to counter what the students may be experiencing in college. Specifically, I would encourage families to be engaged by asking pointed questions about their student's experiences, seeking opportunities to learn basic information about their student's chosen major and future career choice. The questions could be:

1. What drew you to the career path you are interested in?
2. Do you perceive your experiences to be similar to those of your peers from different backgrounds?
3. Does anyone say anything to you that is hurtful related to your racial or gendered identities?

While these questions may be ones that come naturally to families and support people, I recommend that first high school counselors and teachers begin the conversation, which means that they need to be educated and equipped with the right information. Then, bridge program staff can also reinforce, if not begin the same conversations.

### **K-12 educator recommendations**

Participants in this study communicated they did not necessarily have any challenges in high school; however, their initial narratives were not complete. Many of the participants shared



the need for better communication from counselors and teachers about their ability to succeed in STEM. I recommend that teachers and administrators remain alert about how they communicate to Black women about their potential to pursue STEM in college. The slightest microinvalidations can cast doubt in the minds of students and remain as they attempt to follow their STEM dreams and goals. As such, the K-12 educational systems would benefit from training to learn about the very actions and communications that sometimes invalidate students' desired pursuits and contribute to students managing the doubt placed in their minds by someone who they likely trusted.

The educational system in the United States, overall, requires overhaul, as the inclusion of such a training into the already full teacher schedules would be difficult. I recommend, however, that schools be recognized or perhaps rewarded for their out-of-class training teachers and administrators engage in to be more effective in supporting students. Teachers do carry a heavy burden to educate our future leaders, often with low pay and few resources.

### **Faculty recommendations**

Similar to K-12 educators, faculty at universities also require attention. Literature points to the fact that norms are set by faculty who are white men. The ways in which whiteness pervades educational norms are critical to remember, as recommendations for faculty mean disrupting the very systems that were made to maintain power and privilege for a particular group. This is not to say that all educational systems and the people in them desire to maintain the power that protects them, however, it is pervasive enough that is represented in literature about STEM programs and PWIs more broadly.

Since STEM is occupied by mostly non-people of color, faculty must engage in culturally responsive pedagogy, which highlights the need to engage with increasingly diverse student

populations (Gay, 2010). By being culturally responsive, faculty have the opportunity to first engage in their own learning about the students they serve, as the numbers of students of color continue to rise and Black women continue to out-enroll Black men in particular. So, given the continued shifts around historically underserved and racially diverse students entering college, it is crucial for there to be acknowledgement and a plan to be prepared. This preparation, specifically, means identifying opportunities to embed culturally diverse examples in lectures, labs, and research opportunities. Too, faculty have the opportunity to educate students about how diversity is represented in their particular field, the importance of diverse perspectives to strengthen the field, and how they, as budding scientists have the opportunity to either maintain status quo or lead efforts to broaden participation in STEM. The diversity of thought is increased as demographics continue to shift.

### **Bridge/academic programs**

Educators who wish to increase persistence and retention of Black women within STEM majors through summer preparatory programs would do well to increase their understanding of the experiences of Black women. More importantly, by providing opportunities to be in community with one other by hosting identity-specific connection opportunities or workshops to be in communication about their STEM experiences. By identifying and building community, Black women students will have an increased opportunity to discuss their experiences. When participants identify unique challenges (i.e., not being chosen for groups; being perceived as not intelligent enough succeed in STEM programs) program staff must be ready to address them by first validating the students' experiences and then determining how to move forward. Black women in the program also need to know that they will be supported by program staff meaning

there need to be explicit communications about what's possible to experience and how to address what happens.

### **Future Research**

This study built upon the modest literature that has been written on the experiences and needs of Black women in STEM. While the participants cogently expressed their experiences in relation to the pursuit of STEM degrees and careers, a number of questions remain unanswered, with rich opportunities to expand upon the present study. I recommend that future research directions include: (1) conducting individual interviews to follow up on how race and gender influence participants' pursuit of and success in STEM, (2) creating a study that tracks participants' experiences throughout an entire year, using the summer bridge as a baseline for understanding concepts related to race and gender, and (3) understanding how the ecological model can be applied to the participants' experiences in various spaces (i.e., the classroom, program expectations, and social engagement).

This study utilized data from focus group transcripts and responses to written prompts centered on race and gender, which were gathered as part of a larger, longitudinal study. As such, I was not afforded the opportunity to individually interview or follow up with participants. Therefore, in future research, I suggest that students be interviewed individually to collect richer data on their experiences. For all of the advantages of focus groups, they typically can only allow for a brief glimpse into any one participant's thoughts, and this, unfortunately, can leave a lot to question.

In addition to individual interviews with the students, I suggest a group of students be followed throughout an entire year with four connection points at the beginning and end of each semester. By following this design, researchers can gain a richer understanding of how Black

women navigate their day-to-day lives as college students and if their initial perceptions about race and gender shift over time as they develop their STEM identity. This is important, as an examination of their experiences over time can provide a more nuanced understanding of their experiences and perceptions as individuals and groups.

Finally, researchers would benefit from a better understanding how different systems (space and place) influence students' interaction with others and how these interactions impact success. For example, it would be helpful to provide a detailed description of each of the contexts in which the students engage, and ask questions that uncover the unique experiences in each of those contexts. By doing so, researchers would be able to describe the various contexts in which students generally thrive, and the ones in which greater attention is needed to educate the faculty, staff, or students who interact with Black female students pursuing STEM studies and careers.

### **Ongoing reflexivity**

While I have focused on faculty, staff, and students as the benefactors of this research, there are, indeed, others who can benefit from understanding the experiences of Black women in STEM. Therefore, before concluding this dissertation, it is important for me to expand upon my reflexivity after having completed this research. At the start of this research, I held some ideas about the participants and their experiences that have evolved throughout the research process. As a Black woman who initially pursued a STEM degree, I reflected on the very experiences the participants had in juxtaposition to mine. I thought that given the decades that have passed, that there would have been significant changes in how students of color are supported in STEM. In fact, as a college student, I also did not have any role models who looked like me or faculty encouraging me to persist. Unfortunately, an optometrist I spoke to about his work, while at an

appointment to get a new prescription for my glasses, dissuaded me from pursuing the career, saying it was boring. While I did not use that experience as the sole determining factor for why I did not pursue the degree, it weighed heavily on my decision.

### **Conclusion**

Black women are often described in a hashtag as #BlackGirlMagic, are exalted to save politics, and expected to be strong in the face of pain. And, all the while, Black women are one of the fastest growing underserved and under-resourced groups in higher education at the undergraduate and graduate levels. Despite the challenges faced by this particular demographic, there remains strong interest in Black women to pursue and succeed in STEM, as noted by the participants in this study. How, then, can theory, policy, and practice be improved or strengthened to continue to open doors for Black women? As the calls to broaden participation in STEM continue, there needs to be a wealth of opportunities for K-12 educators to nurture the desires of Black women to pursue degrees in STEM, with intentional connections to what their experiences may be like in college. Further, colleges and universities must reconsider the ways that norms are perpetuated, particularly from a white-centric and male perspective.

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## Appendix. IRB Notification



**PennState**

**Office for Research Protections**  
 Vice President for Research  
 The Pennsylvania State University  
 205 The 330 Building  
 University Park, PA 16802

814-865-1775  
 Fax: 814-865-8699  
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### NOT HUMAN RESEARCH

**Date:** July 11, 2018

**From:** Courtney Whetzel,

**To:** [Talia Carroll](#)

Type of Submission:	Initial Study
Title of Study:	An Examination of the Range of Beliefs Held by Academically Talented Undergraduate Black Females about Race and Gender in Science, Technology, Engineering, and Math at a Predominately White Institution
Principal Investigator:	<a href="#">Talia Carroll</a>
Study ID:	STUDY00010005
Submission ID:	STUDY00010005
Funding:	Not Applicable

The Office for Research Protections determined that the proposed activity, as described in the above-referenced submission, does not meet the definition of human subject research as defined in 45 CFR 46.102(d) and/or (f). Institutional Review Board (IRB) review and approval is not required.

The IRB requires notification and review if there are any proposed changes to the activities described in the IRB submission that may affect this determination. If changes are being considered and there are questions about whether IRB review is needed, please contact the Office for Research Protections.

This correspondence should be maintained with your records.

# Talia K. Carroll

Curriculum Vitae  
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## EDUCATION

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### Doctor of Philosophy in Higher Education

Minor: Sociology

The Pennsylvania State University - University Park, Pennsylvania

### Master of Education in Adult and Higher Education

Emphasis: Student Affairs/Administration

The University of Oklahoma - Norman, Oklahoma

### Bachelor of Arts in English, Minor in Spanish

The University of Oklahoma - Norman, Oklahoma

## EXPERIENCE

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**Director** – Marcus Garvey Cultural Center  
University of Northern Colorado – Greeley, CO

August 2015 – Present

**Co-Director** – Summer Research Opportunities Program  
Office of Graduate Educational Equity Programs

April 2013 - August 2014

## SELECTED PUBLICATION AND PRESENTATIONS

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**Carroll, T.K.** & Flynn, G. (2018, March). Leading with Purpose: Developing and Implementing Frameworks for Culture Center Success. Pre-conference workshop facilitated during the NASPA conference in Philadelphia, PA.

Williams, M. S., Burnett, T. J. B., **Carroll, T. K.**, & Harris, C. J. (2016). Mentoring, Managing, and Helping A Critical Race Analysis of Socialization in Doctoral Education. *Journal of College Student Retention: Research, Theory & Practice*, 1521025116657834.

## HONORS AND AWARDS

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- Jean Schober Morrell Award for Leadership in Student Affairs, University of Northern Colorado, 2019
- Gates Millennium Scholar – Inaugural Scholar, 2000
- Ronald E. McNair Scholar – University of Oklahoma, 2004

## SERVICE & ACTIVITIES

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### Editorial Board Experience

- Editor, *Higher Education in Review* (2013 – 2014)
- Consulting Editor, *Higher Education in Review* (2012 – 2013)
- Student Board Member, *American Journal of Education* (2012 – 2013)