STATE OF THE ART

The Cumulative and Damaging Effects of Discrimination

Racialized and Gendered Experiences of Black Men in STEM From Elementary School Through Graduate School

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Abstract

This study examines the racialized and gendered experiences of Black men (N = 20) from elementary school through graduate school. The Black men featured in this article are current STEM doctoral students and were asked to reflect on their K-12 and undergraduate STEM experiences as well as their current experiences as graduate students. Findings conclude that Black men, as children and teens, experienced gendered racism in their STEM courses, which included a severe lack of racial representation of Black scientists, leading them to believe that they could not become scientists in their respective disciplines. At the undergraduate level, Black men encountered racial stereotyping and were self-conscious of their gender and race due to being underrepresented in their STEM courses. And at the doctoral level, Black men deal with psychological health issues due to the racism-related stressors they experience on campus, along with feeling compelled to be the spokesperson for Black students at their respective college campuses.

Keywords: Black Males; Academic Achievement; STEM Education; Race-Gendered Experiences; Discrimination; K-12 Education; Undergraduate Education; Critical Race Theory

Introduction

Overall, Black men enrolled in STEM doctoral programs face many stressors due to structural inequalities, negatively affecting their academic achievement and success. Faculty and colleagues consistently question Black men's intelligence levels as scientists, judge them based on their physical appearance, do not provide effective mentorship, and expect them to be the "spokesperson of their race" (Burt et al. 2018; Burt et al. 2019a; McGee and Martin, 2011b; Spencer 2021; p. 8). The disparate and racialized treatment that Black men regularly encounter as graduate students in STEM programs is also present for them at both the undergraduate and K-12 levels. At the undergraduate level, Black men in STEM majors are often ignored across their race and gender, negatively and harshly stereotyped, do not receive adequate academic resources and support, and do not feel they belong due to the relative absence of same-race faculty and peers (Fries-Britt 2017; Lundy-Carter 2013; McGee 2016; Spencer 2023; Strayhorn et al., 2013; Williamson 2010). At the K-12 level, Black boys are oftentimes educated by teachers who hold biased assumptions and stereotypes about their ability to learn and apply STEM theoretical concepts while simultaneously having to combat

feelings of isolation and alienation, which ultimately impacts how these Black boys perceive themselves in their science classes (Berry et al., 2011; Copur-Gencturk et al., 2019; Kane 2015; Wright et al., 2017).

Within the educational discourse, little to no research has examined how Black men enrolled in STEM doctoral programs navigate their racialized and gendered educational experiences from kindergarten through graduate school. The Black male doctoral-level scholars in this study are well-positioned to discuss their current doctoral experiences and former undergraduate and K-12 experiences. They have successfully navigated the United States' educational system and its racist underpinnings. This study particularly focuses on Black men's resiliency strategies given the academic and social stressors they encounter from K-12 education through higher education.

Literature Review

Black Boys in K-12 STEM Education

Attempting to conceptualize and understand the racialized and gendered experiences that Black boys encounter within educational settings generates a disturbing cause for concern. As previous literature suggests, learning science while Black is a problematic and compounded experience for Black children because of the distinct ways they are racialized and socialized in their classrooms (Collins et al., 2019; Lee et al., 2022; Madkins and Morton, 2021; Martin 2012; Martin et al., 2019). These Black students' academic competencies are repeatedly challenged and presumed inadequate, damaging Black scholars' confidence levels and their academic success (Martin 2009, 2012). Dan Battey and colleagues (2018) found that White urban teachers are the least supportive and positive regarding educating and interacting with Black students enrolled in their mathematics classes. One implication for this particular finding is that these negative interactions between White urban mathematics teachers and Black students "may be guided by implicit norms of whiteness around acceptable emotion, cognition, and behavior, leading them to control black students in specific ways" (Battey et al., 2018; p. 478). Black boys have better academic and social experiences while learning mathematics when they have considerate teachers who believe in their academic abilities and help students form positive relationships within science (Burt et al., 2019a; Davis 2014). Additionally, as Louise Archer and colleagues (2015) suggest Black boys are viewed as problematic because of the ways they have been stereotyped, which makes it rather difficult for them to view themselves as becoming scientists.

To that end, White, middle school-aged students have also acknowledged the low expectations placed on Black students in their STEM classes due to racial inequalities within education (Grossman and Porche, 2013). Thus, Black male youth need culturally responsive teaching and mentorship to help them feel supported and affirmed while also increasing their science engagement levels (Davis and Allen, 2020). The educational training in mathematics that Black males receive from their teachers is sometimes tainted or plagued by their teachers' instructional styles and negative relationships with their students (Davis 2014). The narrative of deficiency continues to haunt Black males within STEM educational settings for various reasons. Black males also experience internal distress from being racially stereotyped, which has resulted in crippling self-doubt, psychological tension, and frustration (McGee and Pearman, 2014, 2015). However, some Black males continue to engage in STEM subjects because they enjoy solving problems and are interested in pursuing scientific discovery and because of the support of their teachers and families (Burt and Johnson, 2018; Coleman 2016; Davis and Allen, 2020). Additional research is needed to examine how Black males successfully navigate STEM K-12 educational environments and remain resilient within their educational settings as they prepare for college to major in STEM disciplines.

Black Men Enrolled in STEM Undergraduate Programs

As Black men transition to college, they are again subjected to various forms of discrimination. Across their gender and race, they are often stereotyped as students who are only able to attend college because they received an athletic scholarship, instead of as intellectuals (Hayes 2013). As a result, Black male students in STEM programs question their racial identities due to their double consciousness concerning how they view themselves versus how society views them (Hayes 2013). However, many Black male students attempt to disprove stereotypes held against them by excelling in STEM precisely to exceed people's expectations of them (McGee and Martin, 2011a). Black men also engage in self-advocacy as STEM majors to ensure they receive the academic and social support they need to excel given the racial discrimination they experience in the academy (Spencer 2023).

The racial devaluation experienced in these circumstances is a by-product of STEM culture because of how Black students are treated in STEM degree programs, which causes them to question their abilities and whether they belong (McGee 2016). Therefore, Black students employ an arsenal of strategies, including stereotype management, to deflect racial microaggressions (McGee 2016). Interestingly, one Black male high school student decided he did not want to pursue a STEM degree program because "he did not want to spend his career in a field where proving himself and forms of bias were 'too much' and that he wanted to carve out a more racially affirming career path" (McGee 2013, p. 33). Black students pursuing STEM undergraduate degree programs must be affirmed and supported. Tonisha B. Lane (2018) found that Black STEM majors' science identities are validated within research environments where they do not have to prove themselves or deal with other racial microaggressions.

Due to how some Black men are disparately treated at predominantly White institutions (PWI), some Black male STEM majors believe that if they attend historically Black colleges and universities (HBCUs), they will receive more academic and social support (Boyd-Sinkler 2021). Generally, HBCUs offer more support to Black students within STEM disciplines by providing an enduring sense of belonging, helping students achieve their academic and professional goals, offering effective mentorship, and motivating and inspiring students (Jett 2013; Winkle-Wagner and McCoy, 2016). Overall, the published literature is replete with research highlighting how Black men are impacted by the burden of race-related stress in STEM degree programs. Additional research is needed to explore how Black male graduate students prove themselves resilient to institutional problems in their undergraduate and K-12 experiences. These students were likely to encounter racism and sexism across the educational spectrum but persevered nonetheless.

Black Men Enrolled in STEM Graduate Programs

Black men enrolled in STEM graduate degree programs report that they are belittled, judged, and deemed unintelligent and inept due to their racial background. Thus, they question whether they belong in their degree programs (Burt et al., 2017; Burt et al., 2018; Jett 2011, 2019). Black men are pressured to represent their entire race, place high expectations on themselves, and believe their faculty advisors and colleagues surveil their every move in their STEM doctoral programs (Bush 2014; Spencer 2021). They also strongly dislike being severely underrepresented in their STEM graduate programs and thus suffer from acute isolation and alienation (Bush 2014). To help reduce the psychological effects of racial microaggressions inflicted upon them by their faculty advisors and peers, Black men enrolled in engineering graduate programs may deflect or normalize this particular behavior (Burt et al. 2019a). In addition, Black men respond to racial

discrimination by "being both arrogant and humble simultaneously, [which] is a survival tool and mechanism that Black men […] utilize to liberate themselves psychologically from the exhaustion and toxicity of the racism they encounter in their programs" (Spencer 2021, p. 14).

In addition, Black men remain resilient while pursuing their graduate-level education due to the support of their peer groups, within and outside of the academy, and their family members (Burt 2019b). Some Black male graduate students also engage in positive self-talk and rely on their spirituality to motivate themselves to complete their degree programs (Burt et al., 2019b). Overall, very few studies have examined how Black male STEM doctoral students have navigated, negotiated, and resisted various forms of *cumulative discrimination* from kindergarten through graduate school. For the purposes of this study, *cumulative discrimination* is defined as the prejudice that Black men have experienced throughout their educational trajectories. Additional research is needed to unravel the dynamics, challenges, and barriers they encounter and the tools they have utilized to succeed in their graduate degree programs.

Critical Race Theory Within the Context of STEM Education

To investigate how Black men enrolled in STEM doctoral programs have protected themselves against the cumulative effects of racism from their K-12 educational systems through graduate school, I utilize Critical Race Theory (CRT) to elucidate their overall academic and social experiences. CRT is a theoretical framework that examines how marginalized and oppressed communities have historically been impacted by the effects of White supremacy (Crenshaw, 2011; Delgado and Stefanic, 2017; Rollock and Gillborn, 2011). CRT emerged in the legal studies field and has been disseminated and applied to other academic fields of study, including STEM education, which offers a nuanced and complex understanding of how race and racism intersect within society (Bullock, 2017; Ford et al., 2010; McGee 2020; O'Hara 2020; Vakil and Ayers, 2019). Overall, an increased awareness of Black male scientists' racialized and gendered experiences is needed to ensure that secondary and postsecondary educators and administrators understand Black boys and men's unique stressors. This would include navigating and negotiating being in predominately White spaces that do not support or uplift them as emerging Black scientists.

Research Methodology

Life History Interview Approach

This study consisted of twenty semi-structured life history interviews with Black men currently enrolled in STEM doctoral programs in the United States. The life history research approach is "an individual's internalized narrative rendering of his or her life in time, entailing the reconstructed past, perceived present, and anticipated future" (McAdams 2001; p. 475). The interview protocol consisted of a chronological list of questions to elicit rich and thick descriptions. It began by asking the research participants about their STEM educational experiences in elementary, middle, and high school. The second section of the interview protocol addressed their STEM educational experiences as undergraduate students. The third and final section asked research participants to share narratives of their current experiences as STEM doctoral students.

Through the research participants' personal accounts of their lived experiences, they were able to reflect on how their race and gender impacted them on their education journeys toward the STEM doctorate from an academic, social, and psychological

standpoint. Institutional Review Board approval was secured before beginning these interviews. Telephone interviews were completed over four months, with research participants also completing five-minute demographic questionaries. After completing the first coding round on the first twelve interviews, I returned to the field to interview an additional eight research participants to determine whether any new topics would emerge. I undertook this step because "this dynamic relationship between data collection and analysis enables the researcher to check if preliminary findings remain constant when further data is collected" (Lazenbatt and Elliott, 2005, p. 50). I did not identify any new topics emerging from the data analysis through the additional eight interviews. I anticipated that the participants might discuss non-school-related factors that played either a positive or negative role in their STEM education experiences. However, their school experiences were the most present factor that impacted their race-gendered experiences in STEM at the secondary and postsecondary levels.

Research Participants

The selection criteria to participate in this study consisted of choosing currently enrolled STEM doctoral students who self-identify as Black men and were at least eighteen years of age. At the time of this study, the research participants attended PWIs (N = 17) and HBCUs (N = 3) for their STEM doctoral education. The research participants were pursuing doctoral programs in the following academic disciplines: engineering, mathematics, physics, computing, and the biological sciences. Each research participant received an undergraduate degree in a STEM discipline, with most students pursuing their degree programs at PWIs. The research participants currently attend higher education institutions in all four regions of the United States, while most students attend programs in the eastern and southern regions. Most of the Black men identified as middle class (N = 12), followed by low-income (N = 8). The average age of the research participants is 30. An alias was provided for each participant, and their degree programs are not listed in the findings section due to the severe underrepresentation of Black men enrolled in STEM doctoral programs. Accordingly, I utilized multiple measures to help protect the participants' identities.

Recruitment Measures and Data Analysis

To recruit research participants, I emailed faculty and university administrators to distribute my recruitment email to eligible participants. After some of the research participants completed their interviews, I asked them to inform other eligible students about my study (snowball sampling). I also sent recruitment flyers to national and international STEM conferences that circulated my study on email listservs, posted information about the study on numerous social media platforms, and attended graduate student workshops and events to identify additional doctoral students. Each participant received a $20 gift card after completing the study.

Semi-structured, in-depth qualitative interviews were conducted with Black men in STEM doctoral programs. During the interview process, I followed a detailed interview protocol to guide myself and the research participants to ensure that I covered multiple topics. However, because the interview guide is semi-structured, I asked open-ended follow-up questions to further understand certain topics discussed during the interview. This approach allowed the participants to freely discuss other significant topics of interest that emerged during the interviews. After the interviews were transcribed, I uploaded the transcripts into Dedoose software. I then conducted a grounded theory analysis to examine

the research participants' educational trajectories from K-12 education through their graduate education.

T. Marshall Egan (2002) suggests that grounded theory is used to generate new theory based on conducting interviews or ethnographic observations as an example. Before starting the qualitative data analysis process, I began "with an awareness of the context of the research by considering such factors as cultural, social, organizational, and interpersonal influences" (Egan 2002, p. 282). This process assisted me in thinking about how to approach the data analysis process and remain flexible because the findings may fluctuate considerably across the participants. After this process, the research participants' interview transcripts were analyzed in order to interpret any connections between the interview transcript data Charmaz 2012). As a result, I was able to determine how the research participants' narratives were similar and dissimilar, including how they were similar to previous scholarship published on Black men and boys' STEM educational experiences in secondary and postsecondary education. This process of labeling and categorizing data consisted of breaking down the data "by asking simple questions such as what, where, how, when, how much, etc." (Pandit 1996, p. 7). While analyzing each interview, I wrote memos about each participant to understand their experiences, including specific topics that "stood out" during the interview process (Charmaz 2012).

Once I had analyzed all twenty interviews during a second and subsequent third round of coding, I reached data saturation because no new themes had emerged (Faulkner and Trotter, 2017). I then applied CRT to the analysis of the findings to uniquely contextualize and situate the participants' lived experiences, which primarily address issues of race and racism while pursuing their education. To improve the validity and credibility of this study, I utilized the process of triangulation by including multiple data sources (e.g., qualitative interviews, demographic surveys, and published scholarship) to examine Black men's educational trajectories from kindergarten through graduate school (Cho and Trent, 2006; Golafshani 2003). Before starting the study, I regularly reviewed published scholarship to better understand the experiences of Black men and boys in STEM courses and degree programs. I also compared my findings with previously published scholarship to assess the similarities and differences with my research.

Research Positionality Statement

My identity as a Black woman, including my personal experiences in higher education, influences how I make sense of the collected data. Before and during the data analysis process, I reflected on and journaled about my biases and assumptions as a researcher. Some of these biases and assumptions included my perceptions of how Black men who attend PWIs in contrast to HBCUs fare academically and socially within their STEM degree programs. I also contemplated how my biases and assumptions would affect the data analysis as the research participants have unique experiences that differ from mine. Given that Black men are not a monolithic group, I was also "careful not to assume that being Black…made [me an] expert on [my] participants' experience" (Burt et al., 2018, p. 981). Thus, I actively participate in an ongoing process of learning and unlearning to challenge my biases and assumptions.

Study Limitations

This study has several limitations. Although this study illuminated the structural inequalities Black men encounter in STEM from elementary school through graduate school, this study was conducted amongst a small number of research participants. Thus, the findings

should not be considered a representative sample of all Black men's academic experiences. In addition, it is possible that certain information about the participants' experiences, collected when they were doctoral students, could have been forgotten over time, given that this study relied heavily on recollections of their experiences that span back to elementary school.

Findings

The K-12 STEM Education Experience for Black Boys and Teens

Previous literature indicates that the role of teacher and family support helps Black boys cultivate an early interest in STEM courses and develop a positive STEM identity (Berry et al., 2011; Burt and Johnson, 2018). However, for the purposes of this study, many participants first became interested in science, given their fascination with and admiration for cartoons and other televised shows that captured their attention at very young ages. This led many of them to pursue a scientific career encompassing their passions and interests. The following excerpt from Arthur describes how he became interested in science as a child:

> [At] a very, very young age, I remember when I was watching Power Rangers as a kid. [I was] looking at megazords and rockets and [saw] jet engines and stuff. I've always had a fascination with flight, so, at a young age, I had the chemistry kits and the telescope [to] look at [the] stars. I mean I don't know if there was a time I wasn't interested in science, but I definitely know I started very, very young.

While some students discovered that they enjoyed learning about science as children, others did not realize that they enjoyed it until they reached high school. Marquell became interested in a scientific career as an emerging biologist in high school. He participated in a magnet program where he observed other students "working with chemicals" and developed and cultivated friendships with them. Within this magnet program, Marquell became part of a learning environment dedicated to helping him succeed as an emerging scientist because "I had a really awesome teacher who taught very well [in the subject of] biology." Other students, such as Alexander, said, "a lot of my teachers were encouraging. I remember, actually, my favorite teacher was very supportive of [me pursuing a scientific career]. She taught me AP [Advanced Placement] calculus, as well as trigonometry." Clarkson, another Black scientist, believes that he had a well-rounded education because he grew up in the suburbs, unlike some of his Black peers who attended urban K-12 schools and may have become "lost in the shuffle." Clarkson said:

> I come from the suburbs. I come from a situation where my teachers had an ample amount of time to give me. Not only did they have enough time, but I was … in the "suburbs," but I was in the suburbs in AP classes, so I was already in a smaller class setting. So, I wasn't in a situation to where I was lost in the shuffle, if you will. And this goes back to my bias. My own personal bias [is] that…in the inner city, [those students] have lower standardized test scores, [live in] high crime type areas, and that type of setting. I have an opinion that as [a] society…those type of students are not cared for in the same way that kids from the suburbs are. I was in a situation to where I came from the suburbs and I think I had a built-in advantage because of that.

Clarkson's statement situates the academic and social problems some Black students experience as K-12 students attending inner-city schools. Clarkson believes that Black

students who attend urban K-12 schools "are not cared for in the same way that kids from the suburbs are." He believes that Black students from urban schools struggle to succeed because they exist and operate within low-income neighborhoods with high crime rates and that their classroom teachers do not care for or value them as scholars. Although Clarkson believes that suburban schools are better suited for Black boys, other scholars have found that Black boys still suffer academically and psychologically from unsupportive classroom teachers as students attending suburban schools (Battle 2017; Gordon 2012; Ispa-Landa and Conwell, 2015; Lynn et al., 2010). Overall, Black boys must receive academic and emotional support to fulfill their educational and personal goals. Black boys need to be aware of the possibilities that exist for them and that they, too, can become scientists.

Although all the Black students were interested in becoming scientists as early as elementary school, some did not believe in the possibility of becoming scientists due to a lack of racial representation. Denzel from Mississippi was the valedictorian of his high school graduating class. Denzel discussed the lack of Black scientists he had access to growing up as an emerging scientist. As a result, Denzel questioned whether he could become a scientist:

> Like I said, I was a valedictorian [in high school]. I wasn't a slouch. I always worked hard at [science] all day. At that time, I didn't really know what I could [become]. There weren't, like, mathematicians or scientists or anyone just roaming around where I thought I could do that. And I felt like, yeah, I just didn't know really what it meant for me to be successful in the math and science field at the time.

Denzel is like many of the other students featured in this article. Denzel did not grow up around scientists within his respective field who could teach him how to become a scientist. Denzel also did not grow up seeing television shows or films that featured Black boys as scientists saving the world or conducting scientific experiments. For this reason, Denzel grew up unable to fathom that he could become a mathematician because of the lack of Black mathematicians "roaming around." Another student, Richard, never imagined or pictured becoming a scientist because he believed that only White men were well suited to become scientists. Richard explained:

> Well, some of the reasons I thought that maybe I wouldn't [be able to become a scientist] is because I didn't see very many scientists that looked like me. Also, the image of who I thought did science was particularly White men 'cause that's what I saw most in the media, cartoons, and other things like that. You didn't really see a lot of people of color doing science, so I was worried that I wouldn't have a successful career in science.

Several Black men as boys questioned to what extent they could become scientists in their respective disciplines. Black boys' interests and pursuits in science also led them to be racially underrepresented in their classes. For example, Mason was the only Black student in his physics class in high school. He shared:

> I was the only Black male that I knew [enrolled] in physics [classes] in my school…so I'm kind of used to being the only one or one of the every few African American students, so I felt like [that] didn't really affect [my] education that much from noticing that I was very different from the rest of my classmates.

Mason did not struggle with being racially underrepresented in his physics classes. He became accustomed to being racially underrepresented while attending a predominately

White high school. However, Mason notes that he was "different from the rest of my classmates." This particular expression from Mason suggests that he noticed he did not look like the other scientists in his physics class, which led him to question why there were so few Black students in certain mathematics and science courses. Previous literature reports that Black students encounter many academic and psychological stressors when they are racially underrepresented in their classes (Carter 2007; Ispa-Landa and Conwell, 2015). For example, Black students within predominately White educational environments are often required to be the spokesperson for the entire Black race, which typically engenders feelings such as culture shock and hyper-visiblitity yet hyper-invisibility simultaneously (Johnson-Bailey et al., 2009; Torres, 2009). Some of the Black men featured in this article were racially underrepresented in their high school STEM courses and thus believed that they could not become scientists, nor did they have direct access to Black scientists who could mentor them. Nevertheless, they continued to deal with acute isolation and alienation as they transitioned to college. They also experienced a lack of racial representation amongst other racialized stressors from faculty and their peers while pursuing their STEM undergraduate degree programs.

The STEM Undergraduate Experience for Black Men

Previous literature indicates that Black men enrolled in STEM undergraduate degree programs encounter faculty advisors and students who negatively affect Black men's academic success and well-being (McGee 2016; Spencer 2023; Strayhorn et al., 2013). The Black men featured in this article dealt with a gross amount of social and racial inequality as undergraduate students. They lacked a sense of belonging due to the intersection of their gender and race. For example, Samson discussed the difficulties he faced having to tell his peers about the precarious ramifications that exist for students of color who do not have teachers who look like them. Samson said:

> My weakness [as an undergraduate student was] definitely having a dissimilar background than the people around me both in terms of my peers and also my faculty. I mean…sometimes people may not understand the importance of that because they might be like, "oh, it's science; it's math, right? What does you not being able to relate to the teacher have anything to do with testing your performance and all of this stuff?" Well, it does because it affects your personality, [and] it affects your mood. It affects your desire to even want to be there, you know?

Samson still remembers the severe isolation and alienation that shaped his academic experience as an undergraduate STEM major. As a Black man in STEM, Samson did not understand why his peers failed to consider or recognize that his racialized experiences differed from their own as White and Asian students. Samson perceived that his peers did not have to question their social identities because they share the same race and gender as most of the faculty and other students at their PWI. Having faculty members who share their students' backgrounds is essential for Black STEM majors because they feel inspired and motivated, which helps them acquire a strong sense of belonging at their respective institutions (Gasman and Nguyen, 2019).

Samson is adversely impacted because being racially underrepresented in his STEM courses affects his mood and performance. For this reason, Samson feels required to prove that he can become a scientist that is not inept or unintelligent. Black men enrolled in engineering undergraduate degree programs must acquire a prove-them-wrong typology to help protect themselves from faculty and students who continuously

undermine their intellectual abilities and competencies as scientists (Moore et al., 2003). In this same manner, Samson and other Black men had to learn about some of the inherent barriers for racially underrepresented students pursuing a STEM degree program at a PWI. Other racialized issues that some of the students in this study experienced included discussing affirmative action policies with their non-Black peers who held strong beliefs against affirmative action policies.

Samson grew tired of his non-Black counterparts asking him whether Black or Hispanic students received admission into top-ranked educational institutions due to affirmative action policies. Samson speaks to the systemic racism that Black students have encountered on both a historical and contemporary basis within the ivory tower:

> I'm very aware of the state of Black and Hispanic [people] and the minority struggles within the academic system. People ignore it and they laugh at me. They ask me [about] affirmative action [and] they ask me if we lowered the bar, and if you look at slavery, that's a pretty low bar. We're forgetting about hundreds of years of slavery and how that negatively affects Black people. And whichever way I go, I shake your hand. I sit in your class and I'll listen to you as opposed to pointing my hand at you. That's a pretty low bar. You're breathing pretty fucking easy, and people don't want to accept that, so you're like, "the field is even and everyone is able to get into a good school." And that is just not true. If you look at all of the stats, it just doesn't make sense that the playing field is even, and we should test people and let the best ones in. It's just a horrible idea. That has stuck with me the entire time. In my undergrad, I took my tests and fought my battles, but the notion of, "this is unfair," has always stuck with me the whole time.

Samson's conversations with his non-Black peers regarding affirmative action policies underscore the racialized difficulties that racially underrepresented students experience first-hand while enrolled as undergraduate students. Previous research indicates that Black women enrolled in graduate school believe that White faculty and students perceive that Black students are admitted based on affirmative action policies only (Williams-Johnson et al., 2005). Samson even mentions that his peers believe that affirmative action policies lower the bar or standard for other students. However, he incorporates in his conversation with peers how the role of slavery has adversely impacted Blacks and their educational attainment. Samson notes how the sheer legacy of slavery has resulted in no formal exposure to schooling, amongst other long-term or historical social inequalities (Bertoochi and Dimico, 2012; Gundaker, 2007).

More precisely, Samson argues that the education system has never been made equal for Blacks nor other marginalized populations. At both the K-12 and postsecondary education levels, researchers and educators have reported that Black students are mistreated due to the significant role of systemic racism (Dancy et al., 2018; Dumas, 2016; Marorga and Picower, 2017). When Samson is told that affirmative action policies are "unfair," the word "unfair" provokes his anger at the fact that others view his existence, as well as other Black and Brown students' existence, on campus as "unfair." Samson has worked very diligently to earn high grades in his STEM undergraduate courses, mentor underrepresented students in college, and serve on several committees dedicated to diversity and inclusion in STEM. However, he suffers from psychological taxation and fatigue from fighting "battles" based on this notion of unfairness given affirmative action policies.

The challenges faced by most Black men at PWIs are foregrounded by the experiences of Black men at HBCUs who do not face the same challenges. Among those Black male students who attended HBCUs for their undergraduate STEM education, they never

discussed experiencing acute isolation and alienation or a critical lack of racial representation. A student named Brian mentioned that "…my undergraduate experience might be a little off because I went to an HBCU…so I didn't feel ostracized or isolated. It was very supportive." Students like Brian had the same race as his faculty advisors and colleagues and thus did not have to question whether they belonged at their respective HBCU campuses. And they regularly saw Black scientists on campus, reinforcing the idea that they, too, could become scientists. HBCU campuses help Black men succeed academically due to the support structures and systems in place to help them thrive (Palmer Davis and Maramba, 2010). Timothy adds his perspective on pursuing a physics degree at an HBCU:

> …I guess adding the perspective [as] a Black male in STEM [is needed]. Yeah, so I went to [HBCU State University] for [undergrad], like a historically Black college. So, really everybody in my class was also Black…I mean, we had a couple female students as well, and that's another diversity issue in and of itself…because there should really be [much] more opportunities for young [Black] female students to get acquainted with STEM. So, I mean, as far as being a Black male, it wasn't really a thing when I was an undergrad. It was more so, I think, when I got to [PWI University] and it's like, "Okay, I'm the only one in my class." So, there is a little of like…I don't want to say culture shock, but just kind of readjustments that happened when I came to grad school, but as far as like undergrad, that wasn't really a thing that I came across. It didn't seem like it was a big deal, I guess.

Timothy's first quotation indicates that he did not have to reflect much on the intersection of his Blackness and maleness because he existed and operated within a particular academic community that centered and uplifted his multiple and interlocking social identities. Attending an HBCU allowed Timothy to be around other Black scholars and intellectuals. As Timothy states, "everybody in my class was also Black." Timothy also mentions that Black women are underrepresented in STEM degree programs at his respective HBCU, which signifies that STEM pipeline discrepancies exist between Black women and men at HBCUs.

 Nevertheless, HBCUs have graduated large percentages of Black female and male college students pursuing STEM undergraduate degree programs (Gasman et al., 2017; Perna et al., 2009). Timothy did not begin to think much more deeply about his gender and race within academic spaces until starting his graduate education at a PWI. No longer at an HBCU, Timothy experienced culture shock that resulted in a readjustment period. During this readjustment period, Timothy had to learn the ins and outs of navigating predominately White educational spaces, leaving him mentally fatigued and severely isolated and alienated. This same level of culture shock that Timothy experienced was also evident for Clarkson and many other Black men at PWIs. Clarkson shared his undergraduate experience in STEM:

> That's an interesting question because there's the STEM side of college, like pursuing the degree, and then there's the other stuff, like I'm Greek [a fraternity member], so I enjoyed every bit of being Greek, and that has its own identity and then there's the engineering side of it. And some of it crossbred with each other because a lot of my friends are in engineering ended up being Greek as well, but I would say it did prepare me for the workforce in that there [were] few Black people in engineering at the time, so the concept of diversity was non-existent. My perception at the time was that there were not as many international students either, and so I did feel like a minority. I can look at my skin and I can tell that I'm a minority, but it felt that way as I was going

through engineering school, through the engineering department, but I balanced that out with the activities with my frat brothers.

Clarkson's quotation suggests that he had to balance multiple social identities that extended to his engineering and Greek life identities. Being enrolled as a Black man at his respective educational institution, Clarkson learned how to successfully navigate and negotiate predominately White educational spaces, which he felt prepared him for the workforce before pursuing his doctoral degree program. He states that "the concept of diversity was non-existent" in his engineering program and that looking at his "skin" constantly reminded him that he was a racial minority. However, through his membership in "Greek" life, Clarkson found the support he needed to thrive as a Black scientist. Shaun Harper (2006) found that Black men enrolled in college value being a part of their fraternities because they receive social support and are held accountable by their chapter brothers to ensure they maintain stellar grades and join on-campus leadership organizations. Despite such potential areas of support, many STEM departments do not address the academic and social issues that enrolled Black male doctoral programs experience (Spencer 2021). This and other types of "institutional racism in educational settings often goes unnoticed" because "the practices that breed institutional racism are part of day-to-day operations that are widely accepted without consideration of how they privilege certain groups while oppressing, marginalizing, and silencing historically marginalized groups" (McGee 2020, p. 634).

The STEM Graduate Experience for Black Men

Previous literature indicates that Black men enrolled in STEM graduate-level degree programs experience academic and psychological stressors that adversely impact their academic success and achievement (Burt et al., 2018; Burt et al., 2017; Spencer 2021). Elijah describes the racism he regularly encounters on his campus: "It's a lot. Basically, it's like somebody opened Pandora's Box for the most part." While Elijah felt that his doctoral program admission was a gift because he would be able to pursue his dreams of becoming a computer scientist and college professor, the discrimination and torment he encountered in his degree program, coupled with occurrences of police brutality against "Black people in America," caused him nothing but stress and anxiety. A student named Kenny discussed the social problems (e.g., anti-Blackness) that Black students endure on his college campus that are directly associated with the Black Lives Matter social movement:

The social [and] cultural things going [on] in America…affects me very personally. When Black Lives Matter started happening, you started having people putting All Lives Matter all over campus and [that Black] people are thugs and deserve to die and [students started] hanging nooses. We started having hate crimes and hate speech. That stuff affected me and I feel like a lot of my peers didn't have to deal with that because that's not [something] they have to worry about and so it's not directly tied to [their] class work. But it's still a huge part of your holistic health, mental [health], [emotional health], and if that's not all in tune, you struggle. I think that definitely hindered me.

Kenny struggled to maintain his psychological health and well-being and also worked to remain up-to-date concerning his graduate education and research trajectory due to the hate crimes and offensive and dangerous rhetoric that plagued his college campus. Kenny believed that for some of his non-Black peers, "that's not something that they have to worry about, and so it's not directly tied to [their] classwork." This particular expression made by

Kenny underscores the fact that Kenny understands that his non-Black counterparts are not affected by the deeply embedded racism and discrimination that adversely impacts Kenny and other Black students at their educational institution. Although Kenny works very diligently to improve the campus climate for Black students and other marginalized populations on campus, "one of my mentors told me [that if I] spend all of [my] time [doing social justice work] that they'll look at you like a fool when you didn't finish your PhD. At some point, you have to say no and recognize this is not just your fight and [when] it's totally your fight." Kenny's mentor wants to ensure that he completes his doctoral program. However, Kenny's mentor fails to understand the psychological impact Kenny and other Black students experience. Therefore, Kenny has to pick and choose his battles regularly.

Other Black male doctoral students such as Kenny desire to educate their educational institutions about the Black student experience to ensure that Black students no longer encounter various forms of racism and discrimination on their college campuses. Stanley states:

> I have this urge to pick [up] the mantle to educate people about what it means to be a minority in these spaces. So, I've had the opportunity to sit in on hiring committees or faculty meetings. And like I said, our school is pretty diverse but you can still see remnants of like a single way of thinking to a very male-dominated way of thinking or a very White male-dominated way of thinking. So, I think…being a Black male in these spaces is [difficult] along with being an academic and doing good work. It's partially having to educate people about the Black experience. And so, like I said, I'm still grappling with whether that's fair or not, or whether it's something that I think every Black academic should expect.

Stanley desires to educate the higher education administrators, faculty, and students about the academic and social experiences of Black students. He actively participates in hiring committees and faculty meetings to discuss issues of racism and discrimination in the department and suggest best practices for ensuring that the department promotes diversity, inclusion, equity, and social justice. However, Stanley grows tired of constantly speaking up about racism and discrimination against colleagues with a "very male-dominated way of thinking or a very White male-dominated way of thinking." This deficit frame of thinking among the faculty and students within his department causes Stanley to question to what degree or extent he can be an agent of change in spaces that are not dedicated nor committed to becoming educated about the Black student experience.

Lamar Johnson and Nathaniel Bryan (2017) recommend that educators "listen to the complexities of Black males' stories" because they need to "observe and understand firsthand who Black men are, what Black men represent, and the Black lived experience(s)" (p. 174). Black men's voices in the academy need to be heard, uplifted, and continuously supported. Black men's lived experiences matter, and non-Black teachers and educators must learn about the academic, social, and psychological experiences of Black men and boys using a non-deficient lens. When their experiences are left unnoticed, students such as Stanley continue to grapple with how Black academics are treated and whether Black academics should expect to be mistreated in academia. For this reason, Stanley questions whether he should pursue a career in academia as a college professor and research scientist because he believes that he will encounter various forms of racism and discrimination. In a concerted effort to cope with the psychological effects of racism, Black men must constantly remind themselves that they are worthy of being at their respective educational institutions. Carson, another Black scientist, discusses how he maintains his psychological health and well-being in predominately White educational spaces:

Typically, I'll notice [my Blackness because my institution] doesn't necessarily have a predominately Black space. I think that one's thing I actually notice my Blackness and my manhood once I get into those spaces. When it comes to…but you know, still with the institution, I am now dealing with it and having the confidence and having the strength to say even though I am a minority, I am still worthy. I'm still capable of doing these things. I think that's a unique experience as a Black man.

Carson becomes more conscious of his race and gender while existing and operating within predominately White educational spaces. His race and gender are at the forefront of his mind within these educational spaces because he is racially underrepresented. Carson has had to reprogram his mind to recognize himself as capable of completing his doctoral program. All the Black men featured in this article have had to prove their intelligence and scientific acumen as scientists, cope with the effects of racism, educate their departments about the Black student experience, and maintain their psychological health and well-being. To make matters worse, they deal with these same issues as undergraduate students at PWIs. Some students who attended PWIs as both undergraduate and graduate students have typically experienced various forms of racism and discrimination for a minimum of eight to ten years within postsecondary contexts. And for those students who attended HBCUs for their undergraduate education and PWIs for their graduate education, some of these Black men have typically experienced racism for a minimum of four years at their respective educational institutions.

Among the students who attended HBCUs as undergraduate and graduate students, they did not discuss dealing with any forms of racism and discrimination, proving their intelligence, or educating their departments on the Black student experience. Attending HBCUs for the duration of their postsecondary educational experience, Black men featured in this article did not have to question whether a STEM degree program or career was out of reach. They continue to have higher education administrators, faculty mentors, and peers who support and uplift them as scientists. This level of support from higher education administrators, faculty, and students at HBCUs does not mean that some Black men in this study did not receive this same type of support from PWIs. However, most Black men at PWIs experienced various forms of racism and discrimination, which caused them stress and anxiety.

Conclusion: The Educational Trajectories of Black Men in STEM Education

This study aimed to examine the racialized and gendered experiences of Black men that spanned from elementary school through graduate school. The findings reported that some Black men as children and teens had supportive Black and non-Black teachers and school administrators who motivated and supported them to pursue a scientific career. As K-12 students, many Black students became fascinated with the thought of becoming scientists. They watched cartoons and other television shows that cultivated their interest in science. However, some did not believe they could become scientists due to a lack of racial representation of Black scientists or Black characters on TV shows and cartoons that were young Black males. As high school students, they also discussed being racially underrepresented in their high school AP STEM classes and felt "different" across their gender and race. As a result, they became accustomed to being racially underrepresented and identified ways to cope with the isolation they encountered as undergraduate and graduate students within "racially politized" environments (Harper et al., 2011, p. 190).

At the undergraduate level, Black men enrolled in STEM degree programs had to combat many stressors. For example, their faculty and peers failed to acknowledge the

academic, social, or psychological issues that negatively affect Black male STEM majors across their race and gender. In addition, they have to prove themselves as emerging scientists, are required to discuss affirmative action policies with their peers, and have to contend with declining psychological health and well-being (e.g., anger, frustration, sadness, etc.) from the chronic racist attacks that run rampant on their campuses. Amongst the Black men that attended HBCUs for their undergraduate education, they had supportive faculty mentors and were not racially underrepresented within their STEM degree programs. More substantively, Black male STEM majors at HBCUs did not have to attempt to balance their multiple social identities within unsupportive and invalidating academic environments. Altogether, HBCUs serve as an institutional pillar of equity and inclusion for Black students to succeed in STEM degree programs (Ghebreyessus et al., 2021; Lockett et al., 2018; Perna et al., 2009).

The issues Black men faced at the K-12 and undergraduate levels were also present for them at the graduate level. As doctoral students, the Black men featured in this article deal with cultural stereotyping, such as the myth of Black anti-intellectualism wherein they have to prove themselves as scientists, are constantly reminded of their race and gender, and understand that they may never be seen as "actual" scientists. Black graduate students engage in the emotionally taxing process of working twice as hard to prove their intellectual abilities within academic environments because they must "combat the persistent, complex, barrier of being seen as a problem or as one who does not belong in that environment" (McGee et al., 2019; p. 29). On top of this, Black men were advised by faculty advisors and colleagues who did not believe in their success as emerging scientists.

The educational inequalities Black men encounter from kindergarten through their doctoral education have overwhelmed them as they determine whether they should leave the field or stay. In this way, "Black racial misandry permeates the presumed safe spaces of [K-12 education and] academia—the…classrooms, hallways, meeting rooms, libraries, and computer labs—where Black male students are targeted and negatively engaged" (Smith et al., 2016, p. 16). Overall, CRT was applied to this study because the pathway to a career in a STEM field begins as early as elementary school for children. The racial prejudice within STEM education serves as a critical reminder that we must increase Black boys' representation in gifted classrooms, advanced placement and honors STEM courses, and their enrollment and subsequent graduation from STEM undergraduate and graduate-level programs. If we (e.g., researchers, educators, and policymakers) do not collectively fix the educational disparities that Black men and boys experience, they will remain underrepresented in the STEM pipeline. When we do not address educational inequities for Black men and boys, we repeatedly signal to them that their education does not matter. Therein, educators and school administrators must collectively attempt to encourage, sustain, and advocate on behalf of Black men and boys. Future research should more closely examine Black boys' and teens' experiences in their STEM courses to understand their racialized and gendered experiences and how that shapes their experiences as undergraduate and graduate students. In addition, future research should also assess the factors that lead Black men to pursue careers in either academia or industry in STEM, given their race-gendered experiences.

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