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EXAMINING COLLEGIATE BLACK MALES' STEM TRAJECTORIES: THE CRUCIAL ROLE OF THEIR BLACK FATHERS

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Black males' collegiate experiences in science, technology, engineering, and mathematics (STEM) are gaining traction in the research literature. In this work, scholars are utilizing asset-based approaches to examine Black males' experiences in STEM. Asset-based orientations are also being extended to work on, for, and with Black families. Of utmost importance with respect to this article, Black fathers play a significant role in their sons' lives. Thus, considerable attention should be paid to the father-son dyad by practitioners and researchers. This case study examines ten Black male STEM majors' perspectives about their Black fathers. The findings reveal that these Black males described their Black fathers as role models and STEM champions with regard to their STEM pursuits. Recommendations for practice and future research are discussed to advance father-friendly work and ultimately broaden the participation of Black males in STEM.

KEY WORDS: *Black fathers, Black males, case study research, critical race theory, higher education, STEM, undergraduate education*

1. INTRODUCTION

The disproportionate representation of Black* males in undergraduate science, technology, engineering, and mathematics (STEM) programs is a significant problem and is exacerbated by anti-Black racism, the COVID-19 global pandemic, and the rising costs associated with higher education, among other things. Mangan (2022) highlighted the collegiate male enrollment crisis, which indicates that men represent approximately 40% of college students. Black men's enrollment in college has remained at about 4% over the last four decades (Wood and Palmer, 2015). Related to this, Black men account for approximately 2.5% of STEM majors (National Science Foundation, National Center for Science and Engineering Statistics, 2017).

The National Science Board (2020) has brought attention to the "missing millions†" that are needed to fill STEM occupations within the next decade, as STEM jobs are projected to grow by at least 7% here in the United States by 2026. Further, the report suggests that the number of "African American [STEM professionals] must more than double" (p. 9) to be proportional to their representation in the U.S. society in 2030. McGee (2020) has highlighted how systemic racist practices and White supremacist logics

* Black is used throughout this article. In cases where African American is used instead, it is because the author(s) of the cited work has done so.

† Scholars have critiqued the notion of "missing millions," arguing that this phrase is used to encourage STEM majors to serve the nation's interests without regard to their personalized goals, aspirations, and well-being. Dissecting the pros and cons of this language is beyond the scope of this article.

are entrenched within STEM education and have, in turn, kept Black and Brown students out of STEM. And because of the ever-present stereotypes thrust upon Black men in particular, they encounter unique race-related challenges surrounding their STEM enrollment and persistence.

In order to broaden the participation of Black males in STEM, seeds must be planted prior to their arrival on college campuses. Foundational research indicated that home, community, and school settings play a significant role in fostering robust STEM identities for Black males (Hrabowski et al., 1998; Maton et al., 1998). Prior work also indicates that the roles of Black families and parents are crucial with respect to bolstering Black males' STEM identities (Flowers, 2015; Hrabowski et al., 1998; Jett and Davis, 2020). Black mothers and matriarchal figures have been and continue to be influential concerning Black males' lives and education (e.g., Allen and White-Smith, 2018; Copper, 2009), but less attention has been devoted to Black fathers (Grantham and Henfield, 2011; Reynolds et al., 2015).

Unfortunately, societal discourse presents a sobering picture of Black fathers (Johnson et al., 2020; Wilson and Thompson, 2020). Negative stereotypes abound about absent fathers, deadbeat dads, dodgers of (court-ordered) child support, and the like. The Real Dads Network (www.realdadsnetwork.com), the "Black Fathers Exist" brand (Njoki, n.d.), Atlanta-based Fathers Incorporated (Fathers Incorporated, 2021), Chicago-based Fathers Families & Healthy Communities (Fathers Families & Healthy Communities, 2019), and other fatherhood programs have been established to counter these negative perceptions and tell the other side of the story. That is, Black fathers, as expected, work diligently to meet a number of multifaceted roles and responsibilities for their children.

This study transfers this positive energy about Black fathers to the STEM arena. More specifically, this study employs an asset-based approach concerning Black fathers to highlight the crucial role they played in their Black sons' STEM trajectories. In doing so, it draws from critical race theory (CRT) given the race-related nature of this work. The following research question guides the study:

Research Question: How do Black male STEM majors describe the role of their Black fathers?

2. RELEVANT SCHOLARSHIP

This study explores two bodies of scholarship regarding – (1) Black males in STEM and (2) Black fathers.

2.1 Black Males in STEM

Researchers have examined Black men's STEM experiences at the undergraduate (Burrell et al., 2015; Fries-Britt, 2017; Jett, 2021; Moore, 2006; Strayhorn, 2015) and graduate levels (Burt et al., 2018; Henderson et al., 2022; Jett, 2019; Spencer, 2021; Watkins and McGowan, 2022). This body of work has highlighted Black males' agency, persistence, and resilience in STEM, despite the gendered racism thrust upon them, the

hostile STEM environments at predominantly White institutions, and negative interactions with STEM faculty. In all, this body of work advocates for more racially inclusive STEM spaces, emphasizes the importance of peer networks, and calls for more culturally responsive mentors in higher education institutions.

Hrabowski et al. (1998) focused on the status of African American male STEM majors at the University of Maryland-Baltimore County and studied the habits of the highest achieving students enrolled in the Meyerhoff Program. Originally designed for high-achieving African American males, the goal of the Meyerhoff Program is for students to earn undergraduate STEM degrees and then pursue a doctorate in a STEM field. In addition to strong support from family, support structures for Meyerhoff scholars include a summer bridge program, scholarship support, strong academic advising, personalized counseling, peer support (especially via study groups), tutoring, mentoring, research involvement, and STEM role models.

The findings and recommendations from prior work call for more research on Black males' STEM experiences (Hrabowski et al., 1998). Notably, this emphasis is in concert with the growing body of research on Black women's STEM experiences (Ireland et al., 2018; McGee and Bentley, 2017; Nguyen et al., 2021; Prescod-Weinstein, 2020; Rankin and Thomas, 2020; Roby et al., 2022; Rosa and Mensah, 2016). The research literature also reveals that little attention has been paid to the role of Black fathers with respect to Black males' STEM trajectories. In my quest to better understand the role of the Black father, I also consulted the literature on Black fatherhood.

2.2 Black Fathers

Black fathers contribute significantly to the household, greatly impact their children's growth and development, and are heavily involved in their children's lives (Abel, 2012; Ellison and Enriquez, 2021; Harmon et al., 2022; Larnell and Martin, 2021; Ransaw, 2014). Unfortunately, there are barriers to engagement, which include systemic racism that fuels mass incarceration, child support policies, and other punitive policies that threaten Black fathers' livelihoods (Thomas et al., 2022). Black fathers who do not have to overcome these barriers still must grapple with constant societal discourses about alleged lack of involvement, engagement, and relationships with their children (Harmon et al., 2022). To counter these deficit perspectives, there is a growing body of literature emphasizing Black fathers' strengths (Allen, 2016; Bright and Williams, 1996; Cooper et al., 2020; Grantham and Henfield, 2011).

Doyle et al. (2016) examined 30 African American fathers' perspectives on the values they sought to instill within their preadolescent sons. Using grounded theory couched within qualitative methods, the researchers found the African American fathers sought to instill the following five thematic values into their sons: cultural messages, education, respect, responsibility, and modeling. In sum, Doyle et al. expanded our understanding of the developmental strategies and socialization practices of African American fathers with their sons. Moreover, Doyle et al.'s study

presents a strengths-based perspective of African American fathers and indicates that African American fathers play a crucial role during the formative years of their sons' lives.

In the Fathers and Sons Communication Study, Johnson et al. (2020) examined 27 Black father-son dyads, particularly those from adverse circumstances. Employing qualitative methods, the researchers identified the following themes: "(1) the randomness of violence, (2) the ubiquity of violence, (3) the psychological consequences of violence, (4) the sequelae of arousal, (5) specific strategies for avoiding violence and victimization, and (6) sons' receptiveness to advice from fathers" (p. 6). This study emphasized that Black boys need support and guidance as they navigate challenging circumstances. In addition, it reminded us that Black fathers provide resources and advice through their communication strategies, which serve as assets to their Black sons.

The aforementioned studies have advanced the literature about Black fatherhood and highlighted the strengths of Black fathers. Some studies focus on the fathers' perspectives (Cooper et al., 2020; Doyle et al., 2016), while others include both the fathers and their sons' perspectives (Allen, 2016; Johnson et al., 2020). In other work, researchers explore Black fathers' perspectives about their Black children's educational development during the precollegiate years (Bright and Williams, 1996; Grantham and Henfield, 2011). Although some foundational work explores the impact of Black fathers on their academically successful sons (Hrabowski et al., 1998; Maton et al., 1998), the asset-oriented work centered on Black fatherhood apropos STEM education is scarce. Thus, this article examines Black males' perspectives about their fathers, increases awareness of Black fathers' contributions to their children's educational trajectories in STEM, and offers contemporary scholarship to the STEM collegiate arena regarding this topic.

3. THEORETICAL FRAMEWORK

This case study uses CRT (Bell, 1992, 1995). Birthed in legal studies, CRT has since expanded into education research (Ladson-Billings and Tate, 1995). CRT has five foundational tenets that serve as hallmarks that drive this theoretical perspective and serve as an analytic framework. First, CRT asserts that "racism is normal, not aberrant, in American society" (Delgado and Stefancic, 2000, p. xvi). Second, CRT adheres to interest convergence, which reinforces the idea that the dominant culture advances racial justice and other race-based initiatives when it serves their interest (Delgado and Stefancic, 2001). Third, CRT asserts that race is orchestrated as a social construction (Ladson-Billings, 2013). Fourth, CRT explores the intersectionality of various identities and constructs such as race, gender, class, and sexual orientation to explore how these intersections make for broader understandings of those constructs (Delgado and Stefancic, 2001). Finally, CRT utilizes voice to serve as a counternarrative to the dominant discourse surrounding racial groups and validates voice as experiential knowledge (Dixson and Rousseau, 2005).

In short, CRT is used "as a way to link theory and understanding about race from critical perspectives to actual practice and actions going on in education for activist social justice and change" (Parker and Lynn, 2002, p. 18). Critical race theorists offer a counterperspective to the disparaging narratives about marginalized groups to advance racial justice. Given that, this study offers a counternarrative regarding Black males in STEM as well as their involved Black fathers. Particularly, CRT is used to amplify participants' voices to combat racial inequalities in STEM. And for this area of research regarding Black males and Black fathers, CRT provides analytic tenets to link their race-related issues to STEM education.

4. STUDY DESIGN

4.1 Author Positionality

I am a Black man whose research agenda explores Black men's collegiate experiences as STEM majors. In short, I am committed to studying, documenting, analyzing, and disseminating scholarship that leads to more equitable STEM opportunities for Black males. I earned an undergraduate degree in mathematics, and mathematics education is my primary discipline. As a mathematics education researcher, I have used CRT to better understand Black men's racialized experiences in the mathematical sciences‡ (see Jett, 2019, 2022a). Thus, my personal, educational, and professional experiences have led me to this area of research on Black males in STEM.

My father, who completed some semesters of college, had a significant impact on my STEM trajectory. For example, one memorable experience was when I interned at the National Aeronautics and Space Administration (NASA) Ames Research Center. My research mentor was an astronomer, and the team was working to discover extrasolar planets. During the summer internship, we were assigned portions of an astronomy text to read, and my dad read it as well. In addition to completing the internship's research requirements, I also had to complete a book report on the *entire* text for my dad, share my written report with him, and engage in a Q&A session with him about what I learned. This example is one of many in which my father bolstered my STEM identity and explicitly maps onto the goal of this manuscript to underscore the crucial role of Black fathers in this domain.

4.2 Case Study Research

Within the qualitative research tradition, this project employed the case study methodological approach (Merriam, 2007). Case study research "is an empirical inquiry that investigates a contemporary phenomenon (the "case") in depth and within its real-world context, especially when the boundaries between phenomenon and context may not

‡ I have also begun to explore other theoretical frameworks, such as Black masculinity theory, to examine Black men's experiences in the mathematical sciences (see Jett, 2022b).

be clearly evident" (Yin, 2013, p. 16). Case study researchers investigate real-life occurrences to better understand, explain, and promote public awareness about the cases (Merriam, 2007).

This case study came from a larger qualitative study, funded by the National Science Foundation (NSF), investigating Black male STEM majors' experiences at different institution types. The institution selected for this study is a research university within an urban setting in the southeast. It boasts about its phenomenal success with undergraduate teaching and is one of the consistent top producers of Black graduates in the nation. Therefore, the institution's locale makes it ripe for attracting Black male students in and surrounding the metropolitan city.

Ten Black males were included in this case study. To participate in the study, participants had to self-identify as a Black man, be in pursuit of an undergraduate degree in a STEM field, and have maintained at least a 3.0 grade point average during their collegiate studies. Data collection methods included a demographic survey, student-selected artifacts, and a face-to-face semistructured interview (Patton, 2015). After data collection, *episode profiles* (i.e., individual memos to depict each case) were created to chronicle each and every participant's story, which served as the first step of analysis (Maietta et al., 2021). Then, deeper, thematic analysis began with explicit attention to their experiences in light of the five tenets of CRT. Of note, this institution was selected for this case study given the unique role the participants' Black fathers played with respect to their development as Black men and STEM scholars.

4.3 Participants

The ten Black males in this study were enrolled in various STEM undergraduate programs and majors. This institution does not have an undergraduate engineering program, which explains why there are no engineering majors represented within the study. There is an engineering pathway, however, offered at the subsidiary campus. The engineering pathway leads to an associate's degree and is used to transfer into an engineering program at a neighboring institution. Table 1 lists the participants' self-selected pseudonyms and provides some information about their STEM trajectories.

Table 2 depicts information about the fathers of the participants. Evidence of fathers' involvement was noted as any type of home-based or school-based involvement. For the purposes of this article, only STEM-related data regarding the fathers' involvement are shared. Also, Leroy was categorized as tangential because he talked about his grandfather's influence and involvement in his life. Ace and Ken did not provide any evidence of their fathers' involvement specifically, but they shared that their families were supportive of their STEM pursuits.

The third column of Table 2 lists the educational level of the fathers of the participants. Although three fathers completed college, this information should not be used to stereotype these Black men based on educational level. Participants from the larger

TABLE 1: Participants' information

Participant	Major	GPA	Classification	STEM career goal
Ace	Computer Science (CS)	3.51	Senior	Development engineer
Bob	Chemistry	3.93	Senior	Medical doctor
Denzel	Psychology and Biology	4.03*	Sophomore	Psychiatrist
Isaac	Mathematics	3.21	Senior	Data analysist or actuary
James	Biology (Biomedical Sciences)	3.40	Senior	Dermatologist
Ken	Biology	3.95	Sophomore	Professor or industry professional
Kim	Chemistry	3.50	Senior	Industry professional
Leroy	Computer Science (CS)	3.00	Senior	Software engineer or data specialist
Thomas	Computer Information Systems (CIS)	3.24	Senior	Chief technology officer
Zed	Physics	3.81	Junior	Physicist

*Denzel's GPA is above the traditional 4.0 GPA threshold because he made an A+ in a few courses, and an A+ generated more quality points in the calculation of the GPA.

TABLE 2: Participants' information about their father

Participant	Evidence of father's involvement	Father's level of education	Socioeconomic status
Ace	No	High school	Middle class
Bob	Yes	Master's degree	Upper-middle class
Denzel	Yes	Some college	Middle class
Isaac	Yes	Some college	Middle class
James	Yes	Master's degree	Middle class
Ken	No	N/A	Lower class
Kim	Yes	High school	Working class
Leroy	Tangential	N/A	Working class
Thomas	Yes	Some college	Upper-middle class
Zed	Yes	Master's degree	Working class

study reported that more of their fathers had obtained a college education, with many of these fathers having STEM careers themselves. Thus, the participants from this case study provide a more compelling case because they were not benefactors of this STEM capital. The last column indicates the participants' self-reported class dynamics during their childhood and upbringing. Similarly, readers should not stereotype participants based on class dynamics.

5. FINDINGS

Two overarching themes were generated from the analysis of data – (1) Black fathers as role models and (2) Black fathers as STEM champions. In this section, I expound upon each theme.

5.1 Black Fathers as Role Models

Black fathers as role models was the most prominent theme in the collected data. Role models exemplified the types of behaviors, practices, and attributes that these Black males admired and sought to emulate. One participant who viewed his father as a role model, Bob, shared:

> *I kind of like look at myself and I'm just more grateful for being in that type of environment, for having a father who umm, paid the price so that you know, I could do well, and I could have somewhere to go in life. (Bob, chemistry major)*

As Bob indicates, he is grateful for the type of environment in which he was reared. More specifically, he mentioned that his father "paid the price," which suggests that his father has worked hard to ensure Bob's success. He continued:

> *Having my dad and my parents be able to pay my way through college, you know, it's kind of like I haven't actually had to deal with like money per se as far as like, you know paying for things here and there. (Bob, chemistry major)*

Bob expressed that having his parents pay for his college education has caused him to not have to deal with the burden of financing it. He mentioned his father first, thus expressing how his father has served as a role model in this area within the family dynamic.

In another case, Kim, who is also pursuing a degree in chemistry, elaborated on his father serving as a role model. He remarked:

> *Like he's a role model…like my dad…but you know my dad isn't in the same field as me. My dad hasn't had any of the opportunities I've had, so I don't really see it as a competition kind of thing. My end goal is just be the best person I can be in terms of academia, or even research, or even whatever I am but still being who I am. That's really just the end goal… keep my Blackness and still be successful. That's really it. (Kim, chemistry major)*

During his interview, Kim likened his father to being his role model, but he explained that his father is not in the same field (or a STEM field for that matter). He rationalized that this is because his father has not had the opportunities with which he

has been presented. In the end, Kim wants to both be the best he can be as he pursues his STEM career and simultaneously stay true to his racial identity.

As one last thematic point of illustration, another participant verbalized that his father was a role model. James acknowledged:

> *My dad is like a role model. Yeah, I would say it seems like he knows everything okay, umm in terms of making the best moves career-wise and just you know, future planning. Umm, definitely that's where my dad is best, so I look up to him in the way kind of like, oh how he knows kind of where to put your next foot, you know where to take your next steps, that kind of thing. (James, biology major)*

In his narrative, James exaggerated that his father knows *everything*. He took it back a little and pinpointed that his father provides the best guidance with respect to making smart career moves that could benefit him for the long haul. Out of all the participants, James had the most to say about his father. He concluded his interview with the following advice:

> *Have an end goal. That's what my dad has been preaching to me lately. Have an end goal. Because it's one thing to like say you're going to do something, but if you don't have an end goal, you might just end up anywhere. You know, I'm saying you could just end up anywhere. But if you have your end goal, it could be multiple goals, whatever, but as long as you have something to go towards and you go there, you won't just be blowing in the wind. I guess you can say, you know, so that would be my advice—have an end goal. Go for science with an end goal. (James, biology major)*

As James's interview attests, his father has been "preaching" to him about having an end goal. James likened that advice to the STEM arena. In doing so, he closed out his interview encouraging other Black males to pursue a scientific career with an end goal—advice he received from his role model, his father.

5.2 Black Fathers as STEM Champions

Another prominent finding was centered on Black fathers as STEM champions, which constituted the second theme. For the purposes of this case study, I define STEM champions as Black fathers who expose, advocate, and work to ensure that their sons make headway vis-à-vis their STEM education. Thomas, whose father was a STEM champion, divulged some background information regarding what led him to pursue a STEM major:

> *Before I came to college, I was thinking about what I would want to major in when I was coming to [institution]. And my father was talking to me about all*

the potential that technology had, and I was like hey, I'll try it out. (Thomas, CIS major)

Thomas conveyed that his father educated him about the potential opportunities that are available to those who pursue tech-related careers. As a result, he decided to explore them and ultimately chose a STEM pathway. Also, out of all the participants, Thomas was the only one who had a father (or a parent in general) in a STEM profession. More pointedly, his father had a career in information technology (IT). Thomas made some connections to this later in his interview:

I would say I had experience working with computer hardware because of my dad. He's been with IT support for like 30 years, so he has all this experience, and he's always bringing these cool gadgets home and showing me all these different things, like how to fix a network or an issue with a computer or a service. So, I would work fixing wireless connections for our household, or either it was working around a lot of computer hardware just testing different things out. (Thomas, CIS major)

Not only was Thomas's father in IT, but he had a decades-long career in the profession. As a result, Thomas was exposed to computer hardware in his home and benefited from his father's experience in a STEM field. This also resulted in some home-based hands-on experience working with computers, which made STEM real for Thomas and propelled his STEM knowledge in the process.

Bob avidly spoke about his father as a role model, as presented under the first theme. He also discussed how his father championed entrepreneurship, and I return to Bob here to show how this manifested in STEM. Communicating his future plans to obtain a Doctor of Medicine (MD), Bob explained:

I plan to take the MCAT and do well in and get into medical school and then my long-term goals are to get an MD and get a residency in whatever specialty I'll be involved with, which depends on what I choose, but I want to umm, become similar to my dad's role. He's an executive manager of a home tour agency. I want to also, like, own clinics not just on the medical side, but also on the business side, so I can be able to manage different clinics or hospitals also. (Bob, chemistry major)

With aspirations to attend medical school and own a clinic after attaining a STEM degree, Bob is heavily influenced by his father. He wants to follow a similar, albeit personalized, pathway with respect to the business acumen that his father possesses. That is, in addition to the medical side of owning a clinic, he wants to effectively manage the business side. Bob confessed: "I kept taking classes and learning all my strengths and weaknesses and talking to my dad," which helped shape his STEM goals.

In one final example, James is another participant who elaborated about his father as a STEM proponent. With respect to his STEM aspirations, James revealed:

> *My dad used to work in pharmaceutical sales, and he would call on dermatologists. So, I got exposed to that field through him. And he went to one of these conferences, and he brought back this poster. It's just a poster of the skin, uh, diagram, you know sections and then different types of lesions you can get on your skin, different things like that. I thought it was pretty cool. And I know it's weird to kind of, you know, like skin I guess, but from that day on I pretty much wanted to be a dermatologist. (James, biology major)*

As James expressed, his father's work as a pharmaceutical salesman provided him with inside knowledge about this field. By giving him a poster demonstrating knowledge about skin, James's father planted a seed for him to learn more about skin. More specifically, this defining moment served as a springboard for James to learn about the STEM field of dermatology. As a result, he has decided to pursue a career in conjunction with this branch of medicine.

6. DISCUSSION

This case study examined how Black male STEM majors described the role of their Black fathers. It showed that these Black male collegians described their fathers as role models and STEM champions, which is consistent with prior work (Flowers, 2015; Gordon et al., 2013). These central findings provide an extension to work that positions Black fathers *only* as providers and protectors. By extension, this study *also* positions them as nurturers of STEM development. The fact that these fathers were positioned in this manner underscores their crucial impact on their sons' STEM trajectories, and this study's findings are consistent with the research literature regarding the impact of Black parents generally and fathers particularly in their children's lives (Hrabowski et al., 1998; McGee and Spencer, 2015).

Another point of consideration is that only one participant, Thomas, had a father who was in a STEM field. Even though the other fathers were not in STEM fields, they still championed for their sons to pursue these areas. Related to that, none of these Black males were reared in upper-class households. However, they were still provided with resources to propel their STEM learning, such as the tech gadgets in Thomas's home and the poster of the skin in James's case. Overall, these findings reject the notion that Black boys do not have role models and STEM champions within their homes and simultaneously confirm that upper-class households are not the end-all and be-all for STEM success.

Regarding the theoretical framework, CRT provides an analytic frame for this case study. The first tenet underscores the normalcy of racism (Delgado and Stefancic, 2000). As previously mentioned, racism infiltrates the narratives about both Black males and Black fathers, demonstrating the centrality of racism in society. As such, Black boys and men must work

to counter these deficit, societal racialized discourses. In STEM, racist practices manifest via unfair gender-based policies, opportunity gaps, and the like, as noted earlier. The second tenet of interest convergence asserts that White people approve efforts, initiatives, and policies when it serves their interest (Delgado and Stefancic, 2001). There was not any evidence of this second tenet found regarding the focus on Black fathers; however, aspects of interest convergence were noted in a related study with these participants (see Jett, 2021).

CRT's third tenet emphasizes the social construction of race (Ladson-Billings, 2013). As mentioned, social constructions attempt to position Black fathers as being inactive parents, being in arrears on child support, and being unconcerned with their children's academic outcomes. The participants' constructions of their Black fathers dispelled these racist myths and deficit-centered stereotypes of Black fathers and positioned them as role models and STEM champions, which is a hallmark of the asset-based literature (Allen, 2016). The fourth tenet addresses intersectionality, which evinces a broader understanding of the intersections of constructs (Delgado and Stefancic, 2001). Throughout this article, the intersections of race and gender have been made apparent, and the inclusion of the class dynamics via Table 2 and Bob's counternarrative extends the work on Black men traditionally centered only on race and gender (Jett, 2021; Strayhorn, 2015). The last tenet uses voice to serve as a counternarrative, and the participants' voices subvert majoritarian narratives about Black fathers.

To recap, the findings in this case study suggest that Black male STEM majors described their Black fathers as role models and STEM champions. Their descriptions answer the research question guiding this case study. Moreover, CRT's five tenets encapsulate the essence of this theoretical frame and advance race-conscious analyses of Black men's narratives, perspectives, and experiences.

6.1 Limitations

A few limitations from this case study warrant brief mention. One limitation is that this study only included Black males' perspectives; therefore, their fathers' voices, experiences, realities, and visions for their sons are missing from this work. Another limitation is that this study took place during these ten Black men's time as college students. Longitudinal data could have captured their in-the-moment formative experiences more systematically, especially with regard to their perspectives about the role of their Black fathers during their K–12 schooling years. A final limitation is that this study only included Black male STEM majors. While this is a STEM-based study, Black males pursue baccalaureate degrees in many non-STEM areas as well. As such, Black fathers' influences extend beyond the STEM ecosystem. In spite of these noted limitations, this study provides fruitful recommendations for practice and research.

6.2 Recommendations for Practice

Recommendations are derived from both the study's findings and the research literature given the small volume of asset-based work regarding Black fathers. A practical recom-

mendation is to recognize and value the strengths that Black fathers bring to their Black sons' lives. The ongoing COVID-19 global pandemic has forced us to better utilize Black parents as resources, and Black fathers are in a prime position to serve as role models and STEM champions, as evidenced by this case study's findings. For instance, James appreciated the strengths of his father and commented on the importance of his father's consistent reminder to have an end goal.

Another practical recommendation is to generate father-friendly systems and policies. For example, the data in Table 2 show that a few of the fathers had completed some college education. In other words, these Black fathers were not able to finish their collegiate education for whatever reasons. This particular finding hits home for me because my father discontinued his college education because of a dire need to support his children. Thus, an implication is for parenting resources to be of assistance to fathers as well. Stated differently, practitioners should learn from the promising practices that have been implemented to assist mothers and adapt them, as appropriate, to address the needs of fathers. Said practices could assist Black fathers with completing their college education and radically transform their families' lives.

6.3 Recommendations for Research

What is needed most in the literature is father-centered research, especially work that uses theoretical frameworks such as CRT to foreground race-conscious analyses. Similar to Cooper et al. (2020) and Doyle et al. (2016), researchers could interview Black fathers to ascertain how they engage in father-son STEM activities and form father-son dyads. Further, this study's findings point to a need for scholars to design studies that explore both Black males' K–16 STEM educational experiences and their fathers' influences on their STEM trajectories. Based on the varying socioeconomic statuses found among the participants in this case study, future work should also investigate Black fathers' parenting practices, approaches, and structures across income differentials. In doing so, researchers should also include Black men who serve in "tangential" fatherly roles (i.e., grandfathers, stepfathers, godfathers, etc.), as noted in this case study, to better understand their roles in Black males' STEM development.

Prior research also provides some promising areas for adding to the asset-based literature concerning Black fathers. For instance, McLeod's (2020) study examined help-seeking posts among Black fathers in a Facebook group and found that the number one type of advice sought centered on raising children and child development. Future work could explore Black fathers' help-seeking behaviors with respect to their children's STEM education, especially in light of the increasing demand for STEM talent (National Science Board, 2020). This future line of research would lead to a better understanding of the STEM-related dimensions of Black fathers' parenting practices and bolster the in-home learning that continues to occur as we grapple with the COVID-19 pandemic. Additionally, such scholarship could promote help-seeking behaviors among Black fathers and unearth the types of things Black males learn from their fathers about

STEM education. Taken together, these recommendations could help to promote the success of Black fathers and Black males in school, in life, and in STEM.

6.4 Scholarly Contribution

As noted, researchers have expanded the knowledge base regarding Black males' experiences in STEM (Burt et al., 2018; Jett, 2021; Strayhorn, 2015). This study contributes to this growing body of literature on Black males in STEM. It also adds to the work being done to highlight the assets and strengths that Black fathers bring to their families and communities (Harmon et al., 2022; Wilson and Thompson, 2020). Collectively, it presents a positive message surrounding both Black males and Black fathers.

Previous work has explored Black fathers' influences during their children's early childhood years (Bugg et al., 2021; Wilson and Thompson, 2020). Prior scholarship has also examined Black fathers' perspectives to ascertain how they instruct their children about race and racism (Cooper et al., 2020; Johnson et al., 2020). However, comparatively little is reported in the literature about their children's experiences beyond the early childhood and adolescent years. Therefore, this case study bears some fruit with respect to establishing links to Black fathers' parenting efforts and their Black sons' academic success beyond the K–12 schooling years.

Importantly, this study adds to the literature by exploring Black males' perspectives at the collegiate level concerning their Black fathers' influences and providing theoretical connections to the CRT knowledge base. The STEM education focus could be insightful for parents, educators, and researchers. Given that, this study advances the STEM education literature regarding Black males' connections to these paternal lessons that influence their STEM postsecondary and career aspirations using CRT.

7. CONCLUSION

This case study used CRT to examine Black males' STEM experiences and the crucial role of their Black fathers with respect to their STEM trajectories. The study's critical findings indicated that these Black fathers served as role models and STEM champions. As such, these Black males were heavily influenced by their fathers. In all, this study adds asset-based knowledge to the literature about Black fathers and offers praise for them, which is exceedingly rare within societal discourse and the research literature. My hope is that this work lends support to the Black males who are persisting in their undergraduate STEM programs and the Black fathers who helped them to set their STEM trajectories in motion.

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