



Ready for the Professoriate? The Influence of Mentoring on Career Development for Black Male Graduate Students in STEM

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Through this study, we sought to understand the nature of the mentoring experiences of Black male graduate students in STEM fields. Specifically, the study was guided by the following question: What role does mentoring play in scientist identity development and career development of Black men pursuing STEM PhDs? We used a qualitative approach to collect and analyze data from 16 Black male participants. One-hour interviews were conducted with each participant and each audio-recorded interview was transcribed. A systematic inductive approach was used to analyze the data as transcripts were coded using a multi-step coding process. The data revealed mentoring was connected to race, career development, and scientist identity development. Participants spoke to the influence of racial similarities and differences between them and their mentors. In addition, the student-faculty mentoring relationship was influential for the doctoral students as they (un)realized their potential with regard to aspirations of entering the professoriate and scientific identity development. The data presented offers a unique perspective on the mentoring experience of Black male graduate students in STEM fields, an understudied population.

Keywords: Black males; mentorship of STEM doctoral students; academic career; scientist identity development; race

Introduction

The doctoral student experience is often regarded as training for the academy and inspires deeper interest in becoming a professor. Graduate student socialization, or “the process through which individuals gain the knowledge, skills, and values necessary for successful entry into a professional career requiring an advanced level of specialized knowledge and skills,” (Weidman, Twale and Stein, 2001, p. iii) is one way to define the process of transforming a doctoral student into a faculty professional.

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Scholars in the field of higher education have pointed to numerous strategies that suggest mentoring, which is often involved to some degree within the socialization process, as a central component that enhances identity development for Black graduate students (Taylor & Antony, 2000; Patton, 2009). In their exploration of the development of African American academic professionals, Hall and Burns (2009) drew on identity theories to understand mentoring relationships between faculty members and doctoral students as a part of post-graduate professional preparation. They argued that faculty identity formation was important to successfully socialize diverse students with regard to professional identity, and make doctoral education more equitable.

Global competitiveness for the United States rests on access to science, technology, engineering, and math (STEM) careers for all sectors of society, including groups historically provided limited access to higher education. For example, Griffin, Perez II, Holmes, and Mayo (2010) interviewed African American STEM faculty at Predominately White Institutions (PWIs). The researchers identified specific mentoring interactions and point out “meaningful relationships with faculty led to exposure to important experience that helped [Black STEM students] prepare for careers in academia” (p. 98). Specifically, Griffin et al. identified mentoring interactions that produced the most positive outcomes. These outcomes include:

- the mentor’s commitment to the mentee’s academic success;
- the belief in the mentee’s abilities; and,
- exposing mentees to important career experiences as key in producing Black STEM faculty.

Notwithstanding Black graduate enrollment at Predominately White Institutions (PWIs), Historically Black Colleges and Universities (HBCUs) are the top graduate degree-granting institutions for Black students and some HBCU officials maintain that faculty mentoring and increased student-faculty interactions attract Black graduate students to pursue doctoral studies at the HBCU (Palmer, Walker, Goings, Gibson, Troy, Commodore, 2016; St. John, 2000). While HBCUs are also important institutions for preparing future Black faculty (Perna, 2001), we do not know much about a vanguard group, Black male doctoral students in STEM fields who attend HBCUs nor the impact of mentoring with regard to their identity development. Therefore, the purpose of this study was to addressing the following research question: *What role does mentoring play in scientist identity development and career development of Black men pursuing STEM PhDs?*

Research on Black Male Experiences in Doctoral Education

Many scholars have explored the experiences of Black males in higher education, with particular interest in STEM undergraduate education. To add, some may argue a disproportionate focus on STEM undergraduate education within PWIs. For example, Palmer, Maramba, Gasman, and Lloyd (2013) are some of the few authors whose work deliberately explored the role of minority serving institutions, such as HBCUs in fostering success of Black male undergraduate students in STEM fields. Another example is Day’s (2015) dissertation that quantitatively explored the persistence of Black males in the STEM fields at a Hispanic-serving institution.

While there has been a significant increase in doctoral degree attainment among Black graduate students over the past two decades (Palmer, Wood, Dancy, & Strayhorn, 2014), Harper

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and Wood (2016) noted “very little has been written specifically about the experiences and outcomes of Black male graduate students, especially those in doctoral degree programs” (p. 147). Furthermore, Palmer, Hilton, and Fountaine (2012) add, “Research about the experiences of graduate students at HBCUs is basically nonexistent” (p. 2). One recent volume, titled *Graduate Education at Historically Black Colleges And Universities: A Student Perspective* by Palmer et al. (2016) provides some insight into the doctoral experience for Black males from their firsthand accounts, however, the research in this area is still scant.

Harper and Wood (2016) provided a table that summarizes the eleven dissertations completed from 1993-2013 that focused specifically on the experiences of Black male doctoral students. Out of those eleven dissertations, ten were situated within the context of a PWI. Horn’s (2012) study is the first to focus on the experiences of eight Black males pursuing doctoral degrees within a Hispanic-serving institution. To be fair, the lack of literature on the experiences of Black male doctoral students at minority institutions, especially HBCUs, may be due in part to the fact that most HBCUs are undergraduate degree granting institutions. In other words, only a handful of HBCUs offer advanced degree programs, let alone doctoral degree programs (Carnegie Classification, 2016).

Table 1
Dissertations on Black Male Doctoral Students, 2014-2016

Author	Year	University	Dissertation Title
Krystle Hunter	2015	Nova Southeastern University	<i>Searching for Support: A Phenomenological Study of Black Male Graduate Students at a Predominantly White University</i>
Paul Stewart	2015	University of Southern California	<i>Invisible Men: The Underrepresentation of African American Males in Doctoral Programs</i>
Antonio Bush	2014	North Carolina State University	<i>These are My Keys to Success: The Experiences of African American Male HBCU Graduates in STEM Doctoral Programs at PWIs</i>

The above mentioned study by Bush (2014) is of particular interest for our study. In short, Bush’s findings revealed (a) participants expected the social and academic challenges of *onlyness* (Harper, 2013) that Black male doctoral students typically experience and (b) participants often mentioned being one of few Black graduate students, which led to feelings of isolation. However, Bush’s (2014) study did not purposefully explore the influence of mentoring and career development for these Black male doctoral students.

Conceptual Framework

To properly situate this study, we propose the following model to illustrate how we best conceptualized the relationship between mentoring, career development, and scientist identity development among Black men pursuing STEM PhDs. Specifically, our conceptual framework draws attention to gaps in the literature regarding the multifaceted nature of Black males in doctoral education, especially within STEM fields.

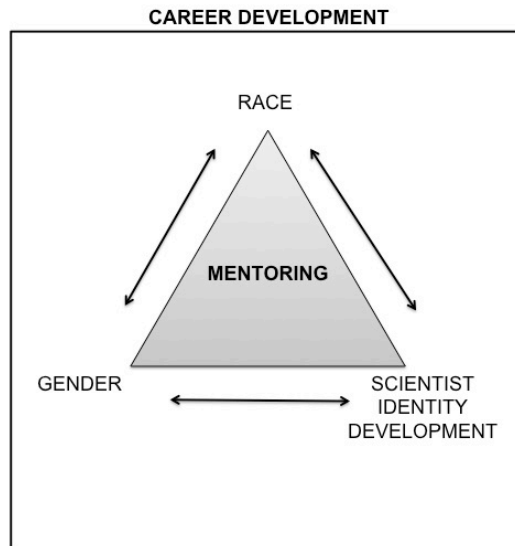


Figure 1. *Conceptual Framework*

Simply put, we argue that (1) scientist identity development lives at the intersection of race and gender; (2) that mentoring is a central and most essential factor; and (3) ultimately this could influence career development for Black male doctoral students in STEM fields. Arguably, several other propositions may follow from the model. This conceptual framework purposefully served as a guide for our review of the literature.

Review of the Literature

Career Development

Career development is traditionally conceptualized as professional growth through work-related learning, particularly through a defined sequence of jobs or sequence of phases in the chronology of one’s career. Career development is both objective and subjective. The subjective aspect of an individual's career development consists of an individual's own perspective on the set of experiences that make up one's career (Hughes, 1958; Van Maanen & Schein, 1979). Thus, the subjective career development focuses on how people personally experience work and their careers (Evetts, 1992). Schein (1984) points out that elements of the internal career stem from the personal and group identity structures. The internal career also varies with individual, groups, and contexts.

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The changing nature of the workplace, expanded racial/ethnic diversity in society and the workforce, and increasing globalization of work through technology and communications innovation, have led scholars to point to the lack of research incorporating race and diversity in career development (Alfred, 2001; Brook & Cluris, 2007). Alfred (2001) postulated that “The study of career development . . . must incorporate the phenomena of race, identity, and culture to examine how they influence the developing career” (p. 112). Cox (1993) proposed an internal and external dimension of career, internal including personal and group identity, and external including competencies, roles, and expectations defined by institutional and societal cultures. In examining group identity to understand behavior among African Americans in work organizations, Cox (1993) found that African American identity has been socially constructed with a unique influence of the history of slavery and racial segregation, which contributes to a group identity including a sense of community, likeness, and common purpose.

Career development as a socially-constructed learning process is the perspective which analyzes the interaction among individuals, and between individuals and their organizational environments. Symbolic interactionism emphasizes human interaction that forms human conduct (Attinasi, 1989). Symbolic interactionism considers the individual’s background as active in shaping present and future behavior in daily life. Individual processes include interpretive perspectives that focus on the perceptions a person has toward career development experiences and knowledge. The social setting includes structures both within and external to the graduate department such as the laboratory and the workplace beyond campus. The structures of these settings transmit the content knowledge, skills, and norms of the academic profession or the industry professional to graduate students.

Brooks and Clunis’s (2007) review of the literature on career development and mentoring identified informal mentoring relationships provided employees more career-related support from mentors and higher salaries (objective career development) than protégés in formal mentorships. Peers provided important psychosocial support and career development for those without conventionally defined mentors. With respect to gender and race, male mentors enhance career experiences of minorities (Daley, 1996). Thomas (1999) identified powerful taboos in cross-race mentoring. While White men seem to be the most powerful mentors in terms of helping protégés access organizational rewards, White male mentors are the most elusive for racial minorities to find. Brooks & Cluris (2007) report the two most powerful taboos identified were (a) a White male superior with a Black female subordinate (White men historically having unlimited sexual access to Black women) and (b) a Black male superior with a White female subordinate (the historical prohibition against a Black man sexually approaching a White woman).

Alfred’s (2001) study of the career development to full professorship of five African American women tenured faculty at PWIs made two findings on mentoring. First, power of knowledge about the academic culture was “enhanced through their role as teaching and/or research assistants through supportive mentor relationships. Early interactions with significant members of the culture gave a competitive advantage for developing competencies necessary to successfully meet academic cultural expectations” (p. 119). Second, the mentoring relationships developed during the graduate school experience contributed positively to the academic cultural socialization; facilitated cultural knowledge and role expectation; and contributed to visibility within the profession.

Scientist Identity Development

Guy's (2013) review of the literature on Black male persistence in STEM education is relevant to an inquiry on identity construction with consideration of the intersectionality of science, gender, and race. As one strategy for coping and succeeding, Guy suggests that Black males draw on "supportive interactions outside of their same-race peer groups, and that these interactions are critical for developing a sense of belonging" (p. 22) in science. Furthermore, he recommended that identity is an empirically valid and promising approach to understanding the factors that lead to Black male students' success in science. A stable premise is that Black male students may abandon academic achievement because the possible self-identities developed fail to match academic or professional identities. Complementary with Guy's research, significant findings from Oyserman, Gant, and Anger (1995) suggest Black males look at others in the academic environment to create a *self*-protected from negative feedback and they were less balanced in their views of expectations and fears of negative outcomes in relation to academic performance. In sum, the findings from these studies point to the significance of possible self-identity and warrant closer examination of Black male graduate scientist identity development.

There are two critical terms for understanding *scientist identity* in the context of Black male persistence—self and other. In Guy's (2013) exploration of scientist identity, identity congruence was the metric by which scientist identity formation was measured. Identity congruence speaks to the space between how Black men see *themselves* and how they see other scientists. Considering the historical underrepresentation of Black men in STEM (National Science Foundation [NSF], 2012), *other* most often refers to the stereotypical idea of *scientist*, which is buttressed by a continued underrepresentation of not only Black scientists in industry, but also by a dearth of Black STEM faculty (Zambrana, Ray, Espino, Castro, Cohen, and Eliason, 2015). Within the scientist stereotypes framework, the relationship between self and other, as well as implications for incongruence between these two terms, colors the current objectives, of analyses.

Scientist stereotypes are perpetuated when racial and sexual diversity are not fully embraced by both industry and academia. Scientist stereotypes are likely rooted in early visual and verbal representations that draw heavily from a homogenous group of White male dominant characteristics, thus leading to descriptions of scientists that are distinctly Eurocentric. Over 50 years after Mead and Metraux (1957) thoroughly described stereotypical representation of scientists in their research, parallel visual representations of diabolical scientists with wildly unkempt head and facial hair, wearing white lab coats and thick glasses, are ubiquitous. Stories about mad scientists plotting to take over the world are also ubiquitous. Chambers (1983) speaks to the formation and pervasiveness of indicators of scientist stereotypes, which he specified are initially measurable in children by the second grade. These stereotypical indicators of scientists get more complex from that point on, with children adding additional indicators of scientist stereotypes with each progressive year of schooling up until a point where they match adults with between 4-5 concrete science stereotype indicators (e.g., white lab coat, beards and glasses, blowing up equipment, and plotting to take over the world). Plainly, Black men might find it harder to see themselves in the aforementioned descriptions of others.

For Black men studying STEM, a barrage of negative stereotypes regarding academic preparation and proficiency also colors their academic experiences (Harper, 2006) and perpetuates a narrative that Black men lack the necessary skill and academic prowess to compete on the global STEM market. Deficit-focused narratives do nothing to solve the problem of Black

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male underrepresentation. Rather, such narratives further highlight the widening gap between how Black men are being conditioned to see themselves in relation to others. It is with this in mind that the current analysis seeks to be transformative, such that a heavy reliance on negative racialized narratives is counter-productive and offers little by way of solutions.

Race & the Professoriate

Before moving forward it is imperative to provide the reader with our rationale of using the term *Black* rather than *African American* for this study. The term Black refers to individuals who have ancestry from Sub-Saharan Africa. According to Ross-Gordon (1990), “Blacks cannot be seen as a monolithic group, since African and West Indian immigrants and Afro-Hispanics bring their own cultural backgrounds and educational need, distinct from those of African Americans who have lived in the US for many generations” (p. 6). These two terms are used interchangeably in the literature, although it is acknowledged the term African American was not an accurate label for some of our participants within this study.

Within the US, Black full-time instructional faculty in STEM fields comprise less than 10% of total full-time instructional faculty, with the majority of instructional faculty comprising of White and Asian faculty at 73% and 17% respectively (NSF, 2014). The stagnating diversity among doctoral programs in the STEM fields (NSF, 2014), coupled with the underrepresentation of Black faculty in academia illuminates the increased likelihood of Black male doctoral students in STEM participating in a cross-race student-faculty mentoring relationship.

Scholars have explored the influence of race and mentoring at the doctoral level (Alston, 2014; Barker, 2011; Gillon and Place, 2012; Johnson-Bailey & Cervero, 2004; Palmer et al., 2016). In Barker’s (2011) research on cross-racial mentoring in doctoral education, race as currency was a significant finding in that “the notion of race as currency was a way faculty used to describe how race served as leverage or liability for Black doctoral students” (p. 82). Specifically, some faculty mentioned how they perceived race as a leveraging tool with regard to securing employment and opportunities for their students due to increase external funding opportunities targeted to recruit and retain Black doctoral students, and ultimately prepare future Black faculty. While this was the position of some faculty members, other faculty members considered the race of their doctoral student mentee as a disadvantage and potential liability to their mentee. The faculty members worried that their students’ professional identities and productivity would be questioned because of their race. Hence, Black doctoral mentees felt the pressures of overperforming compared to peers of other races (Barker, 2011).

Methodology

Using a qualitative approach, this study sought to explore the nature of mentoring as an influence on the career development and scientist identity development of Black male graduate students in STEM fields. The following research question guided this study:

What role does mentoring play in scientist identity development and career development of Black men pursuing STEM PhDs?

Selection of Participants

Steele's (1997) "academic vanguard group" informs the definition of high-achieving for this study. As other articles in this special journal issue examine, (STEM) schooling P-20 and beyond remains the domain in which Black males are both underrepresented as high-achievers and stereotyped to underperform. Steele (1997) described vanguard group members as "those with the skills and self-confidence to have identified with the [STEM schooling] domain" (p. 614). Thus, Black males in STEM doctoral programs are the vanguard group among African American males in education, individuals who themselves judge schooling positively given their persistence throughout the educational pipeline. Further identification with the domain is evident in participants' self-selection to selective STEM fellowship programs. It should be noted that participants for the current investigation were drawn from a pre-existing, structured, large-scale postdoctoral fellowship program situated in one of the Department of Energy's seventeen National Laboratories, Oak Ridge National Laboratory, and managed by the Oak Ridge Associated Universities (ORAU). The postdoctoral fellowship program that the participants were drawn from is highly competitive, thus providing another effective metric for the participants being labeled as a high-achieving, vanguard group. It should also be noted that, as per Steele's definition for vanguard groups, these high-achieving Black men are most vulnerable to the impact of negative stereotypes regarding their academic abilities in STEM.

Steele (1997) offered educational strategies to reverse the stereotype threat that depresses underperformance in the vanguard, using what is termed "wise schooling practices" (p. 624). Such techniques have been shown to help students and lead to significantly enhanced academic achievement. Mentoring in doctoral education by others who have themselves overcome stereotype threat received some attention in the literature (Taylor & Antony, 2000), though not with particular focus on gender or STEM as a discipline.

Given the paucity of African American males available overall, we drew on a combination of sampling strategies, opportunistic and purposeful. Opportunistic sampling allowed our research team to take advantage of new opportunities during the data collection (Patton, 2015). Two of us had access to recruit Black males in STEM doctoral programs because of professional positions we held at a national research lab and in a professional association for HBCU graduate institutions. Given the time and resource constraints for our data collection through interviews, we recruited and interviewed as many participants as we could identify through lists obtained from ORAU and through referrals from HBCU graduate deans. IRB approvals were obtained for all recruitment, data collection, and analysis activities.

Merriam & Tisdell (2015) tell us, "a purposeful sample is selected precisely because the research wished to understand the particular in depth, not to find out what is generally true of the many" (p. 254). With this in mind, sixteen Black males who were in pursuit of a PhD in a STEM field were interviewed in spring 2014 in an effort to gain a deeper understanding of their experiences with mentoring throughout their doctoral studies. Table 2 offers a comprehensive participant profile, which identifies participants by pseudonyms to maintain anonymity.

Data Analysis

With regard to data analysis, a systematic inductive approach was used to analyze the data. According to Miethe and Drass (1990), the goal of qualitative comparative analysis is to analyze the data in a way "that allows for heterogeneity within groups and that defines categories

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in terms of configurations of attributes” (p. 10). Transcripts were coded using a multi-step coding process (Alston, 2014, 2016) that included the following analytic techniques: (a) Initial & Process coding, (b) Values coding, and (c) Versus coding (Saldaña, 2016). Lastly, to achieve trustworthiness by minimizing threats to credibility, transferability, dependability, and confirmability, the strategies of providing thick, rich description and achieving triangulation were incorporated to ensure this research was carried out with integrity (Merriam & Tisdell, 2015).

Table 2

Research Study Participants’ Demographics

Student	Age	Institutional Affiliation	Academic Discipline	Race/Nationality of Mentor	Gender of Mentor
Joseph	35	PWI	Environmental Science	Black/African American	Male
Alex	39	PWI	Physics	White/American	Male
Kaleb	24	HBCU	Biochemistry & Cancer Biology	Indian	Female
Michael	28	HBCU	Microbiology/ Immunology	Indian	Male
Thomas	34	HBCU	Toxicology	Black/Guyanese	Male
James	36	HBCU	Industrial & Systems Engineering	Black/African American	Female
Stuart	56	HBCU	Toxicology	Black/Egyptian	Male
Ray	45	HBCU	Mechanical Engineering	Asian/ Middle East Asian	Male
Marlon	29	HBCU	Energy & Environmental Systems	Black/Ghanese	Male
Jacob	41	PWI	Food Science	Asian/Chinese	Male
Shaun	31	PWI	N/A	Black/Nigerian	Male
*Timothy	37	PWI	Systems Engineering	Black/African American	Male
Oren	26	PWI	N/A	Black/African American	Female
Quincy	24	PWI	Chemical Science	White/Canadian	Female
*Terrance	55	PWI	Computer Science	Black/African American	Male

*Nationality of the Black doctoral student is African

Trustworthiness

In an effort to achieve trustworthiness (Merriam & Tisdell, 2015) and minimize threats to credibility and transferability the strategies of maximum variation, member checking, and triangulation were implemented. Collectively, these better ensure integrity in the analytical process and reflect our ethical practices. Consistent with qualitative approaches, we the researchers served as the primary instruments of collecting, analyzing, interpreting, and presenting the data from this study.

Maximum variation. We purposefully sought diversity in the selected sample for this study “to allow for a greater range of application of the findings by the consumers of this study” (Merriam & Tisdell, 2015, p. 259). While our participants shared the commonality of being Black, male, and doctoral students in STEM fields, there was variation among the sub-areas of study in STEM. Disciplinary variation with STEM included engineering, health sciences, and environmental sciences among others. Participants’ HBCU experiences included bachelors graduates attending PWI doctoral programs and also HCBU-bachelor recipients attending HBCU doctoral programs as outlined in the Table 2.

Member checking. We conducted member checks wherein we solicited feedback from the participants to ensure their sentiments were captured accurately. According to Maxwell (2005),

This is the single most important way of ruling out the possibility of misinterpreting the meaning of what participants say and do and the perspective they have on what is going on, as well as being an important way of identifying your own biases and misunderstanding of what you observed. (p. 111)

This measure to ensure trustworthiness provided us the opportunity to confirm the accuracy of our data collection. In part, this contributed to the accuracy of our interpretations of the data and helped us to focus the data analysis process.

Triangulation. According to Merriam & Tisdell (2015), “from an interpretive-constructive perspective...triangulation remains a principal strategy to ensure validity and reliability” (p. 246). For this study, triangulation was achieved using multiple data sources and multiple research data analysts. First, regarding data sources triangulation, multiple interview transcriptions were incorporated in the analytic process. Second, the three of us analyzed the data. At this point, it is imperative to highlight a unique discovery that was birthed out of the data analysis process and adds to the body of literature on trustworthiness, and in particular triangulation.

While many scholars have operationally defined triangulation (Lincoln & Guba, 2013; Merriam & Tisdell, 2015; Patton, 2015) all of them focus on three specific types of triangulation: (a) multiple sources, (b) multiple methods, and (c) multiple theories. Of course we agree with these scholars, but we argue that multiple positionalities should also be considered within the effect use of triangulation to ensure trustworthiness. In addition, this is especially important with regard to the exploration of marginalized, underrepresented, and or disenfranchised groups and the researcher must consider her or his positionality as the analyst. Now to be clear, positionality is not to get confused with the researcher’s identity.

For instance, we as analysts recognize our positionalities in that each of us identify as Black, hold doctorate degrees, and work at HBCUs. One of us is an administrator within the

graduate college of the university, one of us is a tenure-track faculty member within the behavioral sciences, and the other is a tenure-track faculty member within the field of adult and higher education. As collaborative and interdisciplinary scholars, we are positioned uniquely within the space of the HBCU and have different perspectives on doctoral education and mentoring. To add, one of us is a Black female and her positionality as a Black female contributed significantly to triangulation with respect to analyzing data that exclusively explored the experiences of Black males. According to Baszile (2006), “The ontoepistemological in-between allows Black women a ‘peculiar angle of vision’ as we offer a potential element of critique within various communities by challenging the reification of Blackness around maleness” (p. 200). Scholars have regarded the triangulation of theories as an effective measure of trustworthiness and credibility because it supports the epistemological soundness of the data analysis (Lincoln & Guba, 2013; Merriam & Tisdell, 2015; Patton, 2015). All things considered, is of importance that our positionalities did not color our analysis of the findings as we shared similar interpretations of the data. With this in mind, we argue that the triangulation of positionality is also an effective measure of trustworthiness and credibility because it also supports the ontological and epistemological soundness of the data analysis process.

Findings

Three main themes emerged in this study: (a) Difference Between Academic Advisor and Academic Mentor, (b) Unseen and Underrepresented Black Men, and (c) Seeing Myself in My Mentor.

Difference Between Academic Advisor and Mentor

Although in some cases they may be the same person, again, there remains the need for clarification and distinction of and between the dissertation or doctoral advisor/supervisor and the doctoral faculty mentor. It was fascinating how the participants had varying conceptualizations of the roles of an academic mentor versus an academic or research advisor. For example, when Ray was asked what he thinks makes for a good mentor he responded:

A good mentor is someone who has enough wisdom, they’ve collected enough wisdom to know what the different learning styles of a person are and then how to help that person to identify his weaknesses, so that they can develop a path to strengthen those weakness and then to help that person to identify what their strengths are. . . . So you can’t mentor someone if you don’t know what his needs are . . . a mentor must want to help.

However, when Ray was presented with a follow-up question of what motivated him to cultivate a relationship with his mentor he replied,

My honest belief is, it was more so about the funding he [his mentor] could receive if he has not just an additional student, and also not just a native-born American student, but you know a third level is with my being Black. So I think a decision was more around what my demographics were versus the relationship that should be desired.

Ray elaborated and shared:

I didn't really feel like the guy I was [being mentored by] receiving was focused. As far as academics are concerned, I felt like there was a lack of stability in the advisement that I was receiving. So when I had to develop a plan of study, the plan of study that was developed was not realistic, . . . but he was still initially listed on my plan of study because of his advisement. So as research advisement, the guidance was very erratic, unpredictable and lacked focus. I didn't feel like I had a clear direction on what my plan was and what steps I'd need to take to accomplish the plan.

To add, Alex, another participant, stated "I don't think it's quite to the point of me saying that getting a good advisor is like getting the lottery, but there is an element similar to that." In these cases, their responses illuminated how they anticipated participating in relationships with good mentors but they truly had *not so good* academic advisors who did not necessarily match their definition of a "good mentor."

In another example, Shaun expressed similar sentiments with regard to his thoughts of a good mentor and he believes it is "someone with realistic expectations and who works in realism and has knowledge outside of his base, is willing to adapt, is willing to grow . . . someone who is completely honest and has follow through." All in all, Ray and Shaun both admitted how their expectations of mentoring was not met and resulting in a lack of mentoring from their perspective. Ultimately this mystified conceptualization of mentoring has added to the discouragement of some participants with regards to entering the professoriate after graduation.

Unseen and Underrepresented Black Men

Gender emerged as a factor within and outside of mentoring in the eyes of the study participants. The social and educational contexts within with participant lives unfold were among the ways STEM doctoral students addressed gender. In particular, the HBCU education setting was mentioned. Kaleb pointed out that the number of African American males in his program was "alarming," and for emphasis added, "there are not even Black males in the HBCU." It is admittedly unclear whether the reference to HBCU is for the specific institution at which he was enrolled as a PhD student, or for HBCUs in general. Regardless, it is well-documented that African American women have significantly outnumbered Black male enrollments at the HBCUs and in higher education more broadly for several years.

Stuart, who was a doctoral student at a different HBCU, proudly talked about becoming a college professor as his "number one mission in life," was to "change the current status of Black men in our society." When asked whether his attendance at recent conference on Black males in education he indicated that wanted to see for himself whether others were interested in "the whole absence of Black males in science." Another participant who talked about the absence of African American males in his postsecondary experience mentioned he specifically wants to be an HBCU professor. Thomas related:

My experiences in my biology department and natural science department since my undergrad I think I've had maybe some four African American male professors. And most of them are just the age where they are about to retire and it's very important for these young black guys to have someone that looks like them that they can relate to. You have a lot of foreigners [in STEM], you have a lot of Caucasians, but—like the larger

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society—you don't have a lot of African American males. So some African American males . . . should have someone to look at and relate to, because you might have a good Caucasian professor, but you can't relate to him the same way, you just can't.

Participants' gender identity as black men in STEM is characterized by lack of numerical presence, which they interpret as absence in science communities in the general society, and with equal poignancy on the HBCU campus.

Gender also emerged as a topic within mentoring relative to strategies black males need to succeed in STEM. Thomas, a fourth year doctoral student, related advice his Black African mentor gave him:

He just told me as a young African American man you have to sometimes work twice as hard and you have to be able to be professional at all times and to understand that people are watching you. You may not know that they are watching you but they are watching you. [Be] very careful and mindful of everything you do because you never know who is looking at you.

Similarly, James went on to speak to the mentor's gender with respect to the gender matching that of the protégé:

I would say that students I have noticed who are same gendered [as their mentor] . . . have had much closer relationships to their advisors when they have a lot of the same interest . . . like sometimes the mentor will spend extra hours working in the labs, work on things or something like that.

These strategies take on special importance for sustaining a presence in STEM when Black males' presence is marginalized.

Seeing Myself in My Mentor

Many of the participants mentioned race influenced their mentoring relationship and their professional aspirations. It appears for the majority of participants, race was significant in their mentoring relationships as they academically and professionally developed as scientists. As we spoke with them, we were constantly reminded of how participants saw little to no professors who looked like them within their academic unit. For example, Joseph was the only participant who participated in a same-race, same-nationality, same-gender mentoring dyad. When Joseph was asked what makes a good mentor, he responded:

Personally somebody who understand what it is for me to be me and understand the things that I have been through, and yeah as I talked about before my mentor was also one of my fraternity brothers. So we have that in common. We have that bond already established and him being an African American male, having two doctoral level degrees and maybe an African American male seeking to get my first masters, second masters and eventually my own doctorate, he has already experienced the things that I want to go through and he may help me navigate this journey called life.

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In the case of Stuart, he participated in a same-race, but cross-nationality, mentoring relationship as his mentor was an Egyptian male. He described his interactions with his mentor as a “father-son, brother-brother type of interaction” and he and his mentor as racial minorities understood they “were working from a deficit, with limited resources and as a result, they need to be proactive in everything they do.” So, it is very clear that they both were critically conscious about their race as they participated in their mentoring relationship.

Additionally, when Stuart was asked to describe and consideration that he has given to taking a faculty position at an HBCU after completing his degree, he told us:

I don't think I would have it any other way. If an Ivy League predominantly White school, recruited me and asked me to teach, I think I would probably choose the HBCU because of what my goals are in life and how I see Black struggle. I think I would have – that would sell myself out, because then I'm just a hypocrite, I could be bought, when I could be actually teaching Black kids. I can only say that and most likely I would have turned it down if there were the two options, I would choose to work with [a] HBCU. Am I encouraged? I'm all for it. Whatever I can do to help change the current status of Black men in our society, I – that's – that will be my number one mission in life.

From a different perspective, Alex participated in a mentoring relationship with a White American male yet spoke about the importance of interacting with people who look like you for one's professional development. For example, when Alex was asked what immediately comes to mind when thinking about race and mentoring, he stated:

So in – from a strictly academic point of view, yeah, that might as well means – well usually White males. But there are other types of interactions and support that one can get from senior scientists if you have the chance to meet them. And they can provide support in other ways so there are more advanced seasoned people in science who are minorities and specifically are Africans-Americans. It's just that with most of my academic career, they haven't exactly been in my field, so it's not a direct level of academic advice that they provide. It's a more general type of guidance.

In other words, Alex, like other participants in the study, sought additional mentoring, support, and guidance from individuals of whom he saw his reflection with regard to race and professional development.

Discussion

One obvious question that emerges from an analysis of the data is whether African American male mentorship for other African American males proved to be distinct. Out of the entire set of dyads in the study only one included such a match. There is ample information and several measures that indicate that same race/gender mentoring is not required for effective mentorship and career development (Alfred, 1995; Alston, 2014, 2016; Barker, 2011; Cox, 1993). Many participants reported that they were satisfied with their mentors and the mentor role in preparing them for the next professional step through psychological encouragement or networking resources. Many non-African American male mentors also showed sensitivity to understanding the plight of societal stereotypes of African American males' achievement in and

outside of postsecondary education. Harper (2013) eloquently defined *onlyness* as “the psychoemotional burden of having to strategically navigate a racially politicized space occupied by few peers, role models, and guardians from one’s same racial or ethnic group” (p. 189). To add, not only is this typically the case for Black male doctoral students attend PWIs, “Onlyness is an inescapable reality for many doctoral students of color in particular fields” (Harper & Wood, p. 147), but also this was consistently the case with our participants affiliated with STEM fields at HBCUs. Put differently, our data confirm the difficulties faced in changing the status quo: African American males in STEM are acutely aware of their minority status as *others* or *outsiders*. For instance, as doctoral students and post-docs they feel they would be motivated even more to pursue possibilities in STEM if they saw other African American males. In essence, this notion of *onlyness* is real within the space they occupy as Black male doctoral students in STEM fields, regardless of the demographic classification of the institution.

It is necessary for the term ‘doctoral faculty mentor’ to be troubled within the context for this study. Doctoral programs in the US frequently equate a doctoral faculty mentor with dissertation supervisor/research advisor. Functionally, there are clearly areas in which the former terms overlap; however, these terms that are often used interchangeably and can be seen to have differences in meanings. The data illuminates how there are various conceptualizations of the roles and responsibilities of mentors. Many of the participants expressed a sense of disappointment with their mentoring relationship, in that their expectations were quite different from their realities while participating in a mentoring relationship. In addition, the findings also are consistent with Barker’s (2011) notion of race as currency. Such as in the case of Ray, the role of race as leverage was a perspective shared among the participants because having a Black male mentee was at times directly connected with receiving external funding for research. While faculty mentors may see this as an asset, the participants explained how their mentoring experiences suffered when race appears to serve as currency.

Within the field of adult education, scholars have argued that, with regard to adult development, members of the African diaspora—Black folks—become aware of their common identity and cultural interests and eventually develop a critical consciousness for self-ethnic reflectors (Colin, 1989). Northrup, Gay, and Penn first told us:

Portraits of many successful men and women of their own race [and] engraving illustrating Afro-Americans progress [to be] introduced [as] object lessons of the great advancement of their people, impressing them with the fact that they must educate and elevate themselves. If they would attain success in life. (1896, p.iv)

In the case of the Black males in our study, our data is congruent with Colin’s (1989) three distinctions about the influence of self- ethnic reflectors with regard to adult development:

- the Black male PhD students in STEM fields recognized how their individual well-being and scientist identity development is inextricably connected to the advancement of all Black males, especially ones within STEM fields;
- the Black male PhD students in STEM fields demonstrated their agency by committing to entering the professoriate and serve in a capacity to contribute to the advancement of all Black males, especially ones within STEM fields;
- the Black male PhD students in STEM fields are dedicated to participating in a movement for the advancement of all Black males, especially ones within STEM fields.

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To that end, it appears race was critical to the participants' professional development and often considered as they prepared for their careers after graduation because the deficit of Black males exists in multiple arenas of STEM professional settings and in higher education as a whole.

Relevant to this study is Polite and Davis' (1999) proposition of the importance exemplary and symbolic role models play in African American male identity development. Exemplary work models are associated with career aspirations, "someone in a vocational area in which the [Black male] is interested, and value models were ones that provided motivation, direction, and hope for the future through doing the right thing, or demonstrating what is worthwhile in life" (p. 72). In the eyes of the participants, not every African American male needs another African American male to inspire him to pursue a STEM career, but for those who do have such inspiration the prospects are few. Moreover, there is some uncertainty in the minds of Black male doctoral students that other-race/gender mentors can relate to them the same way an African American male mentor could.

For Polite and Davis (1999) symbolic models are other Black male cultural heroes (i.e., civil rights, sports, hip hop) who espouse certain values and ideals. The ideals that were of most importance for participants in the study with regards to gender were the uplift of Black males in society through professional achievement and giving back to the Black community through entering the academy in the HBCU. However, even on the HBCU campus, STEM environments do not appear welcoming by way of being spaces in which African American males find role models with their demographic. In their eyes, gains made in enrolling African American women in higher education, in and out of STEM and hiring of non-African American faculty at the HBCU has made the absence of Black males in STEM more apparent (Lundy-Wagner & Gasman, 2011; Slater, 1994). Yet since there are so few African American males available to mentor it is not clear what those the possibilities might be. Constructive learning perspectives suggest that the lack of experiences with other African American males in STEM weakens the prospects for a diversity of knowledge and participation from Black males to interact with one another and with others to enrich the learning context.

Implications for Research

The findings of this study yield recommendations for future research on the topic of mentoring and career development of minority graduate students in STEM fields. There is opportunity for future research on minority graduate students in STEM fields, including but not limited to:

- Mentoring and career development of Black female graduate students in STEM fields,
- Institutional differences (HBCU vs. PWI) with regard to formalized mentoring programs for minority graduate students in STEM fields who aspire to enter the professoriate,
- Administrative leaders' perceptions of mentoring and career development of minority graduate students in STEM fields,
- Cultural sensitivity and professional development for faculty mentors in STEM fields; and,
- Quantitative explorations focusing on mentoring and career development of minority graduate students and faculty in STEM fields.

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As the academy becomes more diverse with regard to cultural characteristics (race, ethnicity, gender, etc.), it is necessary to further explore the influence of student-faculty mentoring relationships on the career development of minority graduate students.

Lastly, we would like to highlight a unique methodological feature from Horn's (2012) study that was previously mentioned within the literature review. Specifically, Horn was a participant observer (Patton, 2015) within his study. We intentionally bring this to the attention of the reader because perhaps more Black male doctoral students should consider the role of participant observer or co-researcher as there is limited literature that explores the experiences of Black male doctoral students.

Implications for Policy

While the findings from this project align with others that show mentors do not necessarily need to be same race/gender as mentees, it also highlights the persistence underrepresentation of faculty of color—in particular African American males—in the STEM professoriate. The recommendation from researchers examining male students of color in STEM at PWIs, HBCUs, and MSI is applicable specifically for African American males in STEM doctoral programs: “Programs are needed within higher education that recruit and retain an adequate representation of faculty of color at every institution as this is necessary to keep pace with a rapidly changing multicultural and pluralistic student body” (Toldson & Esters, 2012, p. 53). At the federal level, agencies including the National Science Foundation and the National Institutes of Health could foster collaborative research efforts among higher education institutions that employ the largest number of African American male STEM professionals, faculty members, etc. As our research and that of others has shown, increased opportunities for Black male mentor-mentee relationships is limited, but in high demand through the eyes of the doctoral students. Scientist identity development would, then, seem to be inextricably linked with STEM parity and increased visibility of Black men in STEM.

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