

Same soup, different bowl: Understanding the mentoring attitudes of STEM doctoral faculty at HBCUs

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As a whole Black, Latine, Native American, Native Pacific Islander, and Native Hawaiian people groups are not well represented in STEM education and in the STEM profession. When considering Black students specifically, evidence shows that despite representing 14.2% of the population [1], they accounted for just 9% of all STEM professionals which includes health related occupations like physicians, and 7% of all bachelor's and doctoral STEM degrees [2]. *The Hechinger Report* [3] suggests that there has been an overall decline in the number of Black students earning STEM degrees from previous years. It is clear Black students are underrepresented in STEM.

For over 150 years Historically Black Colleges and Universities (HBCUs) have played a key role in educating Black students who graduate with a STEM major and enter the STEM profession. Their role has been pivotal in producing Black scientists [4], [5], [6], [7]. Upton and Tanenbaum [7] found that HBCUs, despite being under-funded and under-resourced, were responsible for over 10% of Black scientists with doctorates as many obtained their undergraduate degrees from an HBCU. *SWE Magazine* [8] reported that 27% of Black students with STEM bachelor degrees graduated from a HBCU and "HBCUs account for 21 of the top 50 institutions that educate African Americans who earn doctorates in STEM fields". Even though most Black students who earn their doctorates do so at Historically White Institutions (HWIS), the contributions to the pool of Black scientists at all educational levels made by HBCUs cannot be understated [5], [9], [7]. The lion's share of research around Black scientists has hovered around undergraduate education [7] and we need more study on the doctoral experience. This current study sought to understand perceptions of doctoral mentoring of STEM doctoral faculty at an HBCU. There is limited study in this area.

Theoretical Framework

Anti-Black racism and Critical Capital Theory [10] are employed as theoretical frameworks. Both are well suited for questioning taken-for-granted assumptions about the lived experiences of racialized others and for deconstructing systemic issues influencing common faculty practices. These frameworks conjoin to form a critical race philosophy, highlighting the contextual experiences of STEM doctoral learning. Bancroft [10] developed the concept of Critical Capital Theory describing it as an "integration of critical race theory, forms of capital, and fictive kinship" which speaks to the "shifted but enduring nature of racism within the U.S.". Forms of capital that are valued and honored often reify the status quo and support white supremacist ideology which is decidedly anti-Black.

Bancroft's [10] theorized that the low rate of STEM doctoral graduates and professionals was a function of Critical Capital Theory, suggesting that the low rate "was not an aberration, but rather a product of a system of oppression designed to advantage the economic needs of White elites in the U.S.". Race is a stable predicator in this formulation in which "Forms of capital foregrounds how economic capital functions within the social structures of society to robustly determine an individual's life chances" [10]. Race and racialization must therefore be engaged in

these formulations to adequately capture the social reality of a society historically and contemporaneously structured by racialization.

Critical Capital Theory is explained by theories of anti-Blackness such as Gordon's [11] theory that posits that Black people are seen as inherently inferior and nonhuman beings which are beliefs subconsciously acted on across all sectors of society including higher education. This means that how faculty and peers interact with and understand Black students are tainted by negative stereotypes and ideologies. Anti-Blackness is a theory of racialization specific to how Blackness is seen and understood within humanity through a white supremacist ideology. Anti-Blackness exists in relationship to pro-whiteness, assumption of white supremacy, and acceptance of Black inferiority. It is bred from erasure [12] and misinformation (dismissal of history) and subsuming under multiculturalism - and disinformation (devaluing of culture). Dumas and Ross [13] state a

critical theorization of blackness confronts the specificity of antiblackness, as a social construction, as an embodied lived experience of social suffering and resistance, and perhaps most importantly, as an antagonism, in which the Black is a despised thing-in-itself (but not person for herself or himself) in opposition to all that is pure, human(e), and White.

Black STEM PhDs

Blacks earn just over 5% of all doctorates in STEM fields [14]. Scholars [7] studied characteristics related to Black student persistence to STEM doctorate degrees. In addition to noting the pathway for many to the doctorate began at an HBCU, they indicated that 12% of all Black STEM PhD scientists earned their doctorate from an HBCU. Despite their contributions, the majority of all STEM degree holders at any level graduate from HWIS, which is not surprising given that there are relatively few HBCUs compared to HWIS (107 out of 5300 colleges and universities in the US), and even fewer (21) offer doctorates in STEM. Upton and Tanenbaum [7] also noted that the majority of PhDs earned by Black students were concentrated in biological and biomedical sciences with considerably fewer in other science fields. In many studies, the reporting of Black graduates was an admixture of Blacks from the US and abroad.

Studies consistently report welcoming, supportive, and nurturing environments as the reason for HBCUs' success in contributing to the representation of Black people in science [7], environments that were less focused on competitiveness [4]. Research [15] indicated that "HBCUs embody the best practices for educating students who are marginalized in other learning environments" and found that HBCUs "better foster[ed] academic and social integration in science and engineering among Blacks than PWIs" [7]. Further that study [7] reported Black students have better relationships with peers and faculty, suggesting that HBCUs' approaches were more relational, encouraging peer to peer and student to faculty relationships. This was encouraged by same-race and same sex mentorships, resulting in less negative racialized gendered experiences and less competitive atmospheres. HWIS are castigated as overall having less welcoming and supportive environments [4].

While much research has been conducted at the undergraduate level relative to Black students in STEM at HBCUs, it was difficult to locate literature exploring Black PhD students in STEM at

HBCUs. McGee et al. [16] is a notable exception. Though not the primary intention of the research, they offered some perspective on Black PhD students in STEM attending HBCUs. Like the undergraduate counterparts, Black PhD students face stressors related to discrimination and prejudice, experience isolation and inability to see themselves reflected in STEM disciplines. They expend energy on combatting the ill effects of racialization that could be better directed toward their studies. “If Black doctoral students in STEM fields perceive racial bias, especially from the people directly responsible for ensuring their success, they may develop and employ self-protective mechanisms to combat implicit and explicit forms of racism” [16]. This study [16] speaks of unrelenting stress initiated by racism and the need to work twice as hard to avoid stereotype threat. They echo the importance of mentors and role models as necessary components for successful socialization into both their doctoral education and their STEM discipline. Faculty mentors and the faculty, in general, particularly those White and Asian making up the majority of all STEM faculty, often hold, even if unconsciously, negative perceptions of Black students that translates into inequitable treatment, loss of opportunities, and inadequate preparation and socialization. Black PhD STEM students face psychological, intrapersonal, structural, and institutional barriers to success.

In spite of what appears to be accepted truths, such as HBCUs offering more culturally affirming experiences, Studies [16, 17] found that Black PhD STEM student experiences at HBCUs were not substantially different from those at PWIS. One study in particular [17] discovered that little empirical research exists on the quality of support structures available for graduate students at HBCUs in STEM academic fields, particularly mentoring. Increased understanding would provide essential framing necessary for developing more effective mentors at HBCUs, especially given that there are limited numbers of Black faculty in STEM, even at HBCUs.

Research Design

Qualitative case study methodology allows for the study of phenomenon that is complex, producing descriptive data that help to make sense of lived experiences by focusing on how, what and why of the phenomenon [18]. Research [19] situates case study within a constructivist epistemological paradigm and [18] suggests that case studies can be descriptive, exploratory, or explanatory, exploring a single case or multiple cases. Within and cross case analysis can be conducted within multiple case studies. The larger study from which this report is drawn used a multiple case study design with embedded cases. This report represents one embedded case – STEM doctoral faculty at a HBCU in the Southeastern region of the United States. This NSF AGEP sponsored social science research project explored the dispositions, skills, and knowledge of eight STEM faculty at a HBCU. Attitudes towards culturally liberative mentoring were explored.

The target population was faculty in STEM doctoral programs at an HBCU. Convenience sampling was used as participants were faculty from STEM departments participating in an institutional change program sponsored by an NSF AGEP award. An email was sent to the faculty requesting their participation. Faculty were not required to participate in the research study and choosing to not participate did not impact their eligibility to participate in the institutional change program. Eight faculty agreed to be interviewed, seven men, and one woman. Two Black Americans, one White American, four Asian and one Black African

(international) faculty. A range of STEM disciplines including life, physical, mathematics was represented.

Qualitative interviews were conducted as they allowed for exploration of perceptions and experiences, providing an opportunity for the faculty fellows to tell their stories. Rich descriptions were gathered through the use of a semi-structured interview protocol. Interviews were audio recorded and transcribed by a professional transcription service. The interviews averaged 60 minutes.

Constant comparative data analysis method [20] was used. This inductive process, originating within grounded theory methodology [21], [20] is often used in qualitative research analysis. In this study the process was implemented as follows: close read of transcripts, keyword open coding, categorization of assigned codes reflecting noted patterns, and development of representative themes that responded to the research question.

Research Findings

The research findings indicate that STEM doctoral faculty mentors at HBCUs express attitudes about mentoring that are not all that different from their HWIS counterparts. The culture of science tended to blind them from the culture of people and they tended to hold deficit views or color-blind views of domestic Black students, having minimal awareness of how culture inhibits or facilitates a positive learning experience for Black students. When the faculty were asked to discuss mentoring, most immediately discussed aspects related to doing science and completing the dissertation. This was similar to findings from other cases within our case study research [22]. There was great intentionality on detailing how they help students to become scientist. While there is nothing wrong with this and attending to those aspects are certainly necessary, only one faculty without prompting highlighted attending to the cultural racialized aspects of their students. A couple talked about moving beyond science to include more personal issues as part of their mentoring approach, but only one named race as a salient factor without prompting. This suggest that hegemonic science identity development is the primary concern of the faculty interviewed. It also highlights color-blindness as part of the default approach to thinking about mentoring, they mentor toward the idea of universal STEM identity. They do not see color, they only see science. It was only with prompting later in the interview when asked about the role of culture in mentorships that some discussed the issues of difference based on cultural backgrounds. Many still indicated that they just work with the students as individuals, few discussed the ways in which the identity markers of their mentee influenced how they approached mentoring or were able to talk more importantly about how those markers of identity influenced the experience of the racialized students, particularly those who were Black. This absence was striking as it suggested that like STEM mentors at HWIS, race did not matter enough. All students were treated the same.

Discussion

Some reseachers[4] tout the importance of same race mentors as a way to mitigate racial disparities in STEM but Black PhD students even at HBCUs have few opportunities to select and be engaged with same race mentors as most of the STEM doctoral faculty are White and Asian.

HBCUs are advantaged in being able to meet the needs of Black students because of the presence of Black faculty who share the Black students' culture and may better appreciate the import of their racialization [6]. "Studies reinforce the impact of shared cultural experiences, understanding the role of racism and discrimination on opportunities, and the socio-cognitive benefits of being exposed to highly educated Black people" [6]. Our study's participant demographics reflect typical STEM faculties: few Black American faculty. It is not surprising that STEM faculty attitudes at HBCUs seem to mirror those at HWIS, attitudes that constrict how Black bodies are seen and understood. Black PhD students do not get the same level of exposure at HBCUs to Black faculty as instructors or mentors as do their undergraduate counterparts.

The importance of social capital housed at HBCUs was an important contributor to the success of Black students who attended HBCU and later attained doctoral degrees [5]. This researcher [5] connects social capital with agency and the power to make choices, suggesting that this social capital is a form of critical capital as described by Critical Capital Theory [10]. This social capital is evidenced in the curriculum, in the campus community, and in relationships like mentoring. "This developmentally powerful environment provides students with a sense of psychological well-being and cultural affinity, while also nurturing academic and social relations" [5]. Like other researchers, [5] highlights the significant role of mentoring relationships, relationships characterized as supporting, understanding, and culturally responsive. The inability of many participants in this study to articulate meaningful ways that culture, race, gender, and other markers of identity influenced mentorships calls into question the ability of HBCUs to offer a qualitatively different experience to Black PhD students. One study [16] "anticipated that their [Black PhD students] engineering and computing experiences would be vastly different because HBCUs are seen as culturally affirming, [but discovered that] their experiences in the engineering and computing departments were eerily similar to those of students in other institutions".

HBCUs have a proven track record in nurturing and cultivating talent in Black undergraduate students. So much so that those learning experiences serve as a launchpad into STEM careers and STEM doctoral attainment. But the data from this study as well as from others [16] should push researchers to be more critical of the HBCU STEM doctoral experience for Black students, pushing them to consider the ways in which the structures of anti-Blackness and Critical Capital Theory associated with HWIS are existing and functioning at HBCUs. In order to enhance the learning experiences of Black STEM doctoral students at HBCUs, the Black student experience at HBCUs must be deromanticized. Understanding the impact of anti-Black racism even within an environment historically and predominantly Black is imperative. Recognizing the ways in which anti-Black attitudes are insidiously present in faculty attitudes and practices and in environments perceived as friendly and supportive for Black students highlights opportunities for STEM faculty development that can move toward a more culturally liberative framework.

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