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Mixed reviews on diversity initiatives: toward an institutional change model for Black faculty in engineering and computing

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Introduction: Universities across the United States have implemented initiatives to enhance diversity in science, technology, engineering, and mathematics (STEM) fields, focusing on improving outcomes for racially minoritized students. While many diversity initiatives target undergraduate programs, there is a gap in support for STEM graduate students. Recognizing the persistent underrepresentation of racially diverse populations in STEM, the Biden-Harris Administration launched the "Raise the Bar: STEM Excellence for All Students" initiative, aiming to bolster STEM education nationwide. Foundations like the Sloan Foundation have developed pathways programs for STEM students, extending support into graduate school and the professoriate. The success of diversity initiatives often hinges on the participation and endorsement of underrepresented STEM faculty.

Methods: This study investigates the perspectives of twenty-nine Black engineering and computing faculty regarding diversity initiatives within their respective departments. Grounded theory methodology guided the qualitative analysis, enabling a deeper understanding of the racialized diversity management framework. Drawing on institutional racism perspectives, the study aimed to develop a theoretical framework elucidating institutional engagement with and implementation of diversity initiatives in engineering education.

Results: The participants' perspectives on diversity initiatives reflected features of organizational change. Three types of organizational environments emerged: 1) stagnant, characterized by aspirational commitments to diversity; 2) moderate, where underrepresented populations are recruited but expected to assimilate into the dominant culture; and 3) transformational, representing organizations taking significant steps towards creating equitable environments. The narratives of the study participants shed light on the varying effectiveness of efforts to increase the representation of successful Black students and faculty in engineering academia.

Discussion: The findings underscore the importance of understanding organizational contexts and dynamics in shaping the outcomes of diversity initiatives. By delineating the racialized diversity management framework, this study provides insights into the complexities of institutional engagement with diversity in engineering education. Addressing the challenges identified, particularly in environments characterized as stagnant or moderate, is crucial for advancing equity and inclusion in STEM fields. Effective diversity initiatives must go beyond recruitment efforts to create transformative, equitable environments conducive to the success of racially minoritized students and faculty in engineering academia.

KEYWORDS

higher education, diversity, faculty, STEM, institutional change, faculty of color, engineering

Introduction

Nearly four thousand higher education institutions exist in the United States, offering a broad range of degrees and programs of study (National Center for Education Statistics, 2021). Within this higher education landscape, there are efforts to counter the decline of the entry of domestic students into science, technology, engineering, and mathematics (STEM) fields (Bullock, 2017; Slovacek et al., 2019; True-Funk et al., 2021) and implement diversity initiatives aimed at increasing the representation of Black, Latinx, Indigenous, and female students and faculty (Ahmed, 2012; McGee, 2016, 2021; True-Funk et al., 2021). Diversity initiatives in STEM majors and academic careers are typically a combination of programs, policies, and activities that support the recruitment and retention of racially underrepresented students and faculty (Rincon and George-Jackson, 2016; Miriti, 2020; Miles et al., 2022). However, much of this programming ends at the undergraduate degree, offering few programs for STEM graduate students (Rincon and George-Jackson, 2016; White et al., 2023). The gross underrepresentation of racially diverse populations has gained the attention of the federal government for decades. Recently the Biden-Harris Administration launched an initiative called "Raise the Bar: STEM Excellence for All Students" to strengthen STEM education nationwide and to ensure career readiness and global competitiveness for students at all levels regardless of background. The Sloan Foundation has developed pathways programming for STEM students through graduate school and into the professoriate. Many diversity initiatives rely for their success on the participation, endorsement, and implementation of underrepresented STEM faculty (White et al., 2023).

Some describe these STEM diversity initiatives as having their basis in capitalist self-interest (Ridgeway, 2019; Rodriguez and Morrison, 2019), which values competition and individual financial and technological gain. Nonetheless, the recruitment and retention of underrepresented populations into STEM higher education and industry alike raise questions about the systems of inequity acting as barriers to access and opportunity (Briggs, 2017). Research shows that embracing cultural and racial differences create diversity in thought which in turn correlates with innovation and creativity in STEM (Whittaker and Montgomery, 2014; Slovacek et al., 2019), which leads to more competitive products. However, ambiguity around how to best implement and evaluate diversity initiatives in higher education, makes it unclear what types of changes prove effective for institutions as well as how to best support the target populations they attempt to serve (Whittaker and Montgomery, 2014).

In engineering and computing, women and people of color are poorly represented in academia, with alarmingly low statistics for Black faculty representation (Robinson et al., 2016). According to data from Yoder (2012), 48% of engineering schools have no Black tenured or tenure-track faculty members, 19% have only one, and 12% have two. The remaining 21% have more than two Black tenured or tenure-track faculty members. The representation of Black faculty is even lower in top-ranked engineering schools. A 2017 study found that only 2% of engineering faculty at the top 50 engineering schools in the United States were Black (Robinson et al., 2016). The overall percentage of Black engineering faculty is 2.6%, and these numbers are stagnant when compared to other racial and ethnic groups (American Society for Engineering Education, 2022). The percentage of Black engineering faculty in the United States is significantly lower than the proportion of Black students in engineering programs, which is about 14%. Among the 774 Black engineering faculty, 293 are full professors, 228 are associate professors, and 253 are assistant professors, making up 2.1, 2.9, and 3.4%, respectively, of all engineering faculty nationwide (American Society for Engineering Education, 2022). The few faculty that are Black in US postsecondary institutions work in settings that are White-normed and exclusionary (Whittaker and Montgomery, 2014; McGee et al., 2022).

While most institutions lack Black faculty, there are some notable exceptions. For instance, Howard University, a private historically Black institution, operates with distinct policies compared to state-supported schools (Ortiz et al., 2019). Historically, Howard University has been successful in addressing the hiring of Black faculty, while state-supported institutions may have additional requirements and procedures for faculty recruitment. Notably, Howard University, being a historically Black university, boasts a significantly higher percentage of Black faculty in the field of engineering. In 2017, 40% of the engineering faculty at Howard University were Black. Studies show that Black faculty from various disciplines report the following challenges: 1) higher levels of occupational stress due to hostile working environments, 2) higher levels of discrimination, 3) that their work is devalued or not recognized, and 4) that they receive less financial compensation in comparison to their peers (Thompson and Dey, 1998; Zambrana et al., 2017; McGee et al., 2021; Louis, 2023).

These conditions are not just experienced by Black faculty, but Black students and other Black STEM professionals experience parallel phenomena. Former STEM students and professionals speak with great agony about the various ways they were pushed out or almost pushed out of STEM (McGee and Bentley, 2017; McGee, 2021; White et al., 2023). Most reference one or more of the following reasons for leaving their chosen fields:

Demeaning racial stereotypes from STEM faculty that place them at or near the bottom of a racialized STEM hierarchy. At the top are international Asians, then international Europeans, next White people and other international students, and at the bottom are Latinx, Black, and Indigenous students, often in that order (McGee, 2021).

Too few students and faculty of color in the STEM disciplines (Palmer et al., 2011; Burt, 2020).

Difficulty with envisioning themselves as part of the STEM workforce given the racially charged academic environments they experience (Palmer et al., 2011; Whittaker and Montgomery, 2014; Burt, 2020; Miles et al., 2020; True-Funk et al., 2021).

Unwelcoming institutional climates and the "revolving door" syndrome of faculty of color (who often serve as role models to students of color); these climates influence Black faculty to leave their institutions, and sometimes academia altogether, because a doctoral degree in STEM—even from a prestigious university—does not save professors of color from stereotypes (Palmer et al., 2011; Eastman et al., 2019; McGee, 2020).

Despite this climate, some Black professors are successful as tenure-track faculty. Their view of diversity initiatives, and their need to target the challenges cited above, is critical to the implementation and outcomes of diversity programming (McGee, 2020). Black STEM individuals in higher education spaces should be aware that they are navigating racist environments that may have diversity and inclusion initiatives that are merely performative. Performative gestures cause STEM departments and institutions to usurp their equity efforts (White et al., 2023).

The outcome of this study was the development of names and descriptions characterizing the environments experienced by Black faculty in STEM departments and institutions when they engaged in reflection. The act of "naming" and labeling of environments can provide entry points into having productive conversations and responses to institutional diversity (Miles et al., 2020). Examining the narratives of Black faculty and their recollections of diversity initiatives within STEM departments and institutions offers valuable insights into implementing changes with a specific focus on the unique needs of Black faculty, who are among the most minoritized. The central question guiding this research study was: How do Black engineering and computing faculty perceive and experience diversity-initiatives in engineering education? To address this question, we employed the diversity management framework (Gilbert et al., 1999; Cao et al., 2003, 2004; Cao and McHugh, 2005), a model derived from business organizational theory, to delineate the features within an organization that contribute to creating and sustaining a diverse environment. Diversity management, defined as an organizational process fostering diversity and inclusion in the workplace, proved instrumental in comprehending how faculty experienced change by identifying and labeling environments. However, it fell short of capturing the historical and contemporary context in which Black faculty, who routinely encounter racism through the implementation of policies and practices, operate. To address this gap, we integrated the diversity management framework with the concept of institutional racism (Bonilla-Silva, 2006, 2020; McGee, 2020). This combination enhances our understanding of institutional engagement with and the implementation of diversity initiatives from the perspective of Black engineering faculty. Institutional racism refers to the policies and practices existing throughout an entire society or organization that result in and support a continued unfair advantage for some people and unfair or harmful treatment of others based on race.

Background literature

Brief overview: contextual evolution of diversity initiatives in higher education

Affirmative action, also known as Title VII of the 1964 Civil Rights Act, was introduced as federal legislation to expand employment opportunities for women and marginalized populations underrepresented in the workplace (Hall, 2016). In this context, affirmative action is defined as organizational efforts to ensure that individuals are not discriminated against based on their gender or ethnic group (Crosby et al., 2006). However, during its inception, there was a lack of a clear plan for organizations to implement and sustain equitable hiring practices, necessitating organizations to take on the responsibility of fostering inclusivity (Kelly and Dobbin, 1998; Gilbert et al., 1999; Crenshaw, 2006). In the realm of higher education, affirmative action plans may include goals set by institutions to enhance diversity in their student body, faculty, and administration (Sánchez, 2015).

In response to these limitations, organizations introduced diversity initiatives aimed at fostering more equitable working environments. These initiatives encompass a range of strategies, such as affirmative action policies, mentorship programs, diversity training, and inclusive hiring practices, all designed to promote a more diverse and inclusive workplace. According to Gilbert et al. (1999), initiatives require "major, systemic, planned change efforts," which typically differ from affirmative action plans (p. 64). The creation of positions and offices within organizations to monitor and report on institutional compliance was an early step toward institutional change (Kelly and Dobbin, 1998).

In the late 1980s and early 1990s, businesses implemented a variety of diversity initiatives, including the use of diversity training, often in response to or to resolve civil rights lawsuits. These initiatives aimed at cultivating more inclusive workplaces, fostering understanding among employees, and addressing the broader goals of diversity and equality within the organizational context. Many other professions followed suit to avoid legal complications (Vaughn, 2002). Today, many of these efforts have evolved into climate surveys, bias training, and diversity committees, but too often these efforts are spearheaded by people who do not hold effective decision-making power (Wilson, 2013). While affirmative action focused initially on human resource functions and college admission practices, over the years, assumptions about the value of diversity training have changed (McCuiston et al., 2004). Iverson (2007, 2012) examinations of various institutional diversity plans exposed a discrepancy. While institutions professed a commitment to diversity, closer scrutiny revealed that their dialog, policies, and practices often perpetuated inequitable and oppressive actions, contrary to their proclaimed objectives. In essence, what they purported to be doing in theory did not align with the reality of their actions.

Since its inception, Affirmative Action has faced scrutiny, and more recently, many states have witnessed Supreme Court decisions challenging higher education institutions' use of affirmative action, potentially disadvantaging students and faculty of color. Some states, such as Arizona, California, Florida, Michigan, Nebraska, New Hampshire, Oklahoma, and Washington, have banned public universities from considering the race of applicants (Santoro, 2022). Critics of affirmative action in university admissions argue that it excludes White women and Asian American students, creating the perception that Black, Latinx, and Indigenous students are "taking" their spots (Nelson, 2016; Long and Bateman, 2020). State ballot initiatives like California's Proposition 209 and Washington's initiative I-200 banned or limited the use of race as a consideration in hiring for public employment, including in public education (Coleman et al., 2012). However, research indicates that certain top-tier universities, which admit only a small percentage of applicants, struggle to achieve diversity in student backgrounds in the absence of affirmative action (Santoro, 2022). Contrary to the notion that White women are negatively impacted, studies reveal that White women are more likely to benefit from affirmative action than any other minoritized group (Wise, 1998; Nelson, 2016). This trend holds true across various sectors, including business, higher education, and the public sector, where White women emerge as the primary beneficiaries of affirmative action (Hall, 2016). The discontinuation of affirmative action as a factor in university admissions is anticipated to have lasting repercussions on the participation rates of Black, Latinx, and Indigenous students in certain professions.

Theoretical framework: diversity management through the lens of institutional racism

For this study, we propose to leverage the integration of two frameworks, namely the diversity management framework and the concept of institutional racism, to offer a more comprehensive understanding of the challenges faced by Black engineering faculty in the context of diversity initiatives. The diversity management framework, centered on fostering diversity and inclusion in the workplace, has proven invaluable in recognizing and categorizing environments where faculty experience change. However, it falls short in capturing the historical and contemporary context within which Black faculty navigate the impact of policies and practices rooted in racism. To bridge this gap, we have merged the diversity management framework with the concept of institutional racism (Bonilla-Silva, 2006, 2020; McGee, 2020).

Institutional racism encompasses policies and practices that permeate an entire society or organization, perpetuating unfair advantages for some and unjust or harmful treatment of others based on race (McGee, 2020). While the diversity management framework, originating from business management, aids in analyzing the perspectives of Black engineering and computing faculty on diversity initiatives in higher education, it lacks a critical race analysis that exposes how systemic racism acts as a structural impediment to diversity management initiatives.

Even with the infusion of critical perspectives (see Cao and McHugh, 2005), the framework did not fully account for racism or provide a racialized understanding of the experiences of Black Americans in the United States. Although the diversity management framework effectively labels environments based on characteristics, it is crucial to align our understanding of racism with criticality. As critical scholars of race, specifically focusing on Black individuals in STEM environments experiences, we propose augmenting the diversity framework with the critical perspective of institutional racism. This type of racism is deeply embedded in the rules and regulations of a society or organization, and its integration illuminates the socio-historic context of the systemic inequity prevalent in engineering education and practice (Eastman et al., 2019).

The diversity management framework

An organization is a social construct designed for a specific purpose, characterized by managerial elements that define the relationships and roles inherent to its structure. In this context, it's pertinent to acknowledge that departments within higher education institutions can be regarded as distinct organizations (Cao et al., 2003). The diversity management framework is a conceptual tool used to understand and analyze efforts to manage diversity within organizations, particularly in the context of workplace environments (Gilbert et al., 1999). It provides a structured approach to examining how organizations address issues related to diversity and inclusion. While specific details may vary, the framework typically involves categorizing organizations based on their approaches to diversity management (Cao and McHugh, 2005).

Cao et al. (2004) applied the diversity management framework to describe diversity efforts and institutional change in a higher education institution. They drew on Cox and Blake (1991) descriptions to categorize how institutions implement diversity initiatives:

Monolithic organizations

In this type of organization, the commitment to diversity is limited and often confined to affirmative action plans. There may be minimal efforts to go beyond basic compliance.

Plural organizations

Plural organizations actively recruit and promote individuals from diverse backgrounds. However, these individuals are often expected to assimilate into the dominant culture, and the organization may not fully embrace their unique perspectives.

Pluralistic organizations (espousing affirmative action)

These organizations emphasize affirmative action efforts but may fall short of implementing initiatives that truly integrate individuals from diverse backgrounds. The focus is on meeting specific diversity targets rather than fostering a comprehensive and inclusive environment.

Multicultural organizations

Multicultural organizations appreciate and leverage differences among their workforce as a source of competitive advantage. They aim to create inclusive environments that embrace diversity both in terms of attitudes and structural integration.

The framework serves as a lens through which researchers and practitioners can analyze the effectiveness of diversity management initiatives within organizations. It recognizes that diversity efforts go beyond mere representation and should involve creating inclusive cultures where individuals from different backgrounds feel valued and can contribute fully to organizational success.

Institutional racism in STEM higher education

In 1967, Stokely Carmichael and Charles V. Hamilton introduced the term "institutional racism" in their work "Black Power: The Liberation Politics." They highlighted that while individual racism is often overt and discernible, institutional racism operates more subtly, making it less perceptible. This form of racism, deeply embedded in the United States, operates at macro-, meso-, and micro-levels, perpetuating a racial hierarchy that privileges White individuals and marginalizes others at a larger scale systematically (Bonilla-Silva, 2006; Phillips and Lowery, 2018).

Institutional racism, drawing on critical perspectives of structurally endemic racism (Morton and Nkrumah, 2021). Within higher education, institutional racism encompasses systemic practices, policies, and structures that disproportionately disadvantage Black individuals (Branch-Brioso, 2009). It manifests in discriminatory practices, unequal opportunities, and biased policies affecting academic success, representation, and overall well-being (Sue, 2010). These manifestations include admissions processes, resource allocation, curriculum design, and campus culture, contributing to educational disparities and sustaining historical inequities (Museus et al., 2015). Effectively addressing institutional racism requires

TABLE 1 Racialized diversity management framework.

Organizational category	Description
Stagnant institution	The institution has an aspirational commitment to diversity. It has only an affirmative action plan or a diversity statement. Policy changes are minimal, or adverse. These institutions may count Black faculty without many present
Moderate institution	Underrepresented populations are recruited but are expected to assimilate into the dominant culture. These institutions attempt to maintain their structure. The retention and recruitment efforts can focus on supporting the individual without dramatic change to the institution. Black faculty are present but cannot participate as their authentic selves
Transformational institution	The institution has made significant steps toward creating an equitable environment. Differences in people are appreciated and viewed as assets. The institution reflects critically on areas that need to be changed for institutional health and for maintaining equity. Black faculty are present and feel comfortable participating as their authentic selves and are appreciated

confronting and dismantling these systemic barriers, fostering a more inclusive and equitable learning environment for Black individuals.

In the context of STEM higher education environments, institutional racism has been applied to scrutinize its presence in postsecondary STEM departments (Malcom and Malcom, 2011; Baber, 2015). Exclusionary practices continue to shape the educational experiences of Black students and faculty in STEM (Gasman et al., 2008; McGee et al., 2022), subjecting them to a racial hierarchy that upholds whiteness, masculinity, and middle-class knowledge (Leyva, 2016; Gholson and Wilkes, 2017). We have integrated the diversity management framework with a critical understanding of institutional racism, leading to the revision of organizational categories (see Table 1).

Methods

This study is part of a larger three-year research project to shed light on the barriers and opportunities facing Black engineering doctoral students, postdocs, and faculty that included qualitative interviews, focus groups, and surveys. We analyzed interview data we collected from 29 tenure-track Black engineering and computing science faculty at 15 schools of engineering who discussed diversity efforts they experienced (see Supplementary Table A1 for demographic information and pseudonyms). Interviews were semi-structured, lasting from 45 min to 2½ hours. The interviews were audio-recorded, professionally transcribed, and analyzed in Nvivo©, a computer-assisted qualitative data analysis platform licensed by QSR International©. The primary analysis team consisted of two Black faculty (one who was a postdoctoral researcher at the time of analysis), one doctoral student, all of whom identify as Black women, and a master's student who identifies as an Afro-Caribbean man. All participants were given pseudonyms for this study.

Grounded theory guided our qualitative analysis since we were gaining an understanding of the racialized diversity management framework (Charmaz, 2006). Our interview protocol focused on the underrepresentation of Black engineering faculty members, but some participants also referred to diversity efforts that target graduate student diversity as a means of diversifying the professoriate. When asked why the percentage of Black faculty in engineering remained stagnant at 2.6% in contrast to the growth shown for other underrepresented minorities, many of our participants reported a broad range of experiences with institutional engagement around diversity initiatives (i.e., personal experience of faculty and faculty hiring practices). They reported both positive and negative experiences with diversity initiatives, showing how diversity initiatives can either be supportive or rendered ineffective in engineering and computing academia. We selected this pattern for closer analysis and reviewed the 29 transcripts for participant references to diversity in engineering and computing science. We discovered two categories in our analysis: 1) Faculty referenced diversity effort, which typically had a name or label, or 2) General efforts that were not specifically titled or labeled but the faculty member could describe the characteristics of an effort.

The qualitative research method of analyzing data using a pre-defined codebook is known as closed or deductive coding (Pearse, 2019). It is a deductive method with the goal of comprehending data through theory-informed methods, in this case, the racialized diversity management framework (Table 1). Participant references to diversity initiatives were categorized as descriptions of stagnant, moderate, or transformational institutional change according to the descriptions in Table 1. For this research, we defined STEM departments as "organizations," and institutions as large organizations comprised of a collection of smaller organizations. Our closed coding analysis was successful when the data could be coded based on pre-determined codes. The authors coded data separately and met weekly to review coded data. When the data codes were not in agreement we deliberated until we had a consensus on how to proceed.

We combined our characterizations of participants' perceptions with the organizational categories that describe institutional responses to diversity initiatives. We applied one or more organizational categories to each participant's reference to a diversity initiative based on the category descriptions in our conceptual framework. To answer our research question, we explored the aspirational relationship between participants' perceptions of diversity initiatives as positive, negative, or neutral consistent with how they appeared to be categorizing institutional change as stagnant, moderate, or transformational.

Findings

In this section, we provide a synopsis of our findings along with descriptions of the three types of organizations: stagnant, moderate, and transformational. In the twenty-nine participant interviews, we identified forty-seven references to diversity initiatives. The number of references does not equal the number of participants because $n = 9$ participants made multiple references to diversity initiatives in their interviews. Of these forty-seven references, $n = 26$ references (55.3%) described positive participant perceptions, $n = 19$ references (40.4%) described negative perceptions and $n = 2$ references

(4.3%) described neutral perceptions. The Black faculty remained hopeful towards developing equitable STEM higher education environments. Participants' perceptions of diversity initiatives coordinated with certain features of organizational change towards or away from inclusion. Many of the Black faculty described working in transformational departments and institutions, however, they often juxtaposed this with previous negative and even traumatizing experiences.

When applying our deductive coding of institutional categories to the participants' references to diversity initiatives, we were able to apply the categories to $n = 40$ (85%) of the 47 references to diversity initiatives. Seven of the references were participants naming an initiative or commenting on an initiative generally in a way that did not support the application of an institutional category. For example, Dr. Benson mentioned how a diversity initiative helped expose him to more Black students in the academic pipeline but did not describe how that initiative or experience might facilitate diverse hiring practices for engineering and computing science faculty. Within the forty references to which we applied our selective coding, we identified $n = 6$ (15%) descriptions of stagnant institutions, $n = 18$ (45%) descriptions of moderate institutions, and $n = 16$ (40%) descriptions of transformational institutions.

Stagnant institutions – superficial commitments towards the inclusion of Black faculty

Six participant descriptions in the stagnant institution category describe institutional contexts where few strides have been made towards diversifying the engineering and computing science professoriate or where changes have adversely affected the recruitment of Black faculty. All participant descriptions of stagnant institutions were related to institutions or departments that were doing nothing substantively to diversify their students and faculty further racially. These institutions may have Black faculty that they rely upon, but they have collected little to no data to understand the experiences of Black faculty. For example, Dr. Appleton described a patronage system for hiring faculty that is rooted in racism and that disadvantages Black faculty.

> One of the things that we have historically [had] within organizations, [is] a hiring system that was… called the "good old boy network." And in that good old boy network, once you are in an organization, you could know a given person, tap that person, say, come on in, interview, and you can get in through that sort of system. Because of the abuses of the past, today's hiring protocols are much more rigid… [There are still not] large numbers of underrepresented minority faculty available in any pool or search.

Dr. Appleton highlighted a hiring system rooted in racism, favoring candidates with connections. Despite efforts to make protocols more rigid, the change did not facilitate the inclusion of Black faculty; instead, it perpetuated their exclusion. The institution's attempt to address diversity challenges inadvertently continued to disadvantage Black applicants due to the limited availability of underrepresented minority faculty in the candidate pool. The intended diversity enhancement through protocol shifts resulted in continued stagnation, with only a few Black faculty members remaining, while others were effectively funneled out of the applicant pool. The other five participants expressed concerns similar to Dr. Appleton's. They also pointed to the lack of underrepresented populations in the applicant pools combined with institutional hiring practices that are not intentional about attracting and interviewing them. Dr. Franks pointed to policy change during the presidency of George H.W. Bush that opened trade with China and relaxed visa requirements for Chinese students and scholars. Dr. Franks is referencing The Chinese Student Protection Act (1992) where he noticed an increase in the representation of Chinese nationals in engineering and computing sciences in the United States (Feldgoise and Zwetsloot, 2020). It had long-term effects on the engineering department at Dr. Franks' institution. He noticed that most of the faculty were Asian internationals and these faculty worked predominantly with Asian students and occasionally with African international students, but never with African American students. Dr. Frank felt this placed African American students at a disadvantage since students are required to have a faculty advisor.

These exclusionary practices make it more challenging for Black students to have a willing and equitable faculty advisor. Dr. Franks suggested that this requirement could also be contributing to the low representation of African American students at the Historically Black Institution because students had few faculty they were able to work with. Although the change in government policy did support diversity in engineering and computing science, there is much room for growth for the systematic inclusion of African Americans.

Dr. Walker shared a narrative of systematic exclusion in hiring that eroded organizational efforts toward diversity and inclusion for both faculty and students:

> The search committees and the decisions about who gets hired are not African Americans, because they are not there to begin with. And my observation is that people tend to be biased toward individuals like themselves. So, if I'm an African American, and there are two people or three, four people in a search, and one is an African American and everything else is equal, I'm more likely to choose the African American. If a White male is Department Chair and the same thing happened to him, more likely he'd choose the White male… So [when it comes to] the underrepresented student, graduate student to begin with does not get selected. And if you do extra things to bring in underrepresented students, they still have to be selected by their faculty members to be mentors and advisors. And so, if they are there and do not get selected, they'll have a hard time graduating. So sometimes… the environment for success is not there to help the student to move forward.

The six participants identified institutional lack of diversity as a limiting factor in increase diversity among engineering and computing science faculty. Dr. Walker's account underscores a systemic exclusion in hiring that contributes to the perpetuation of underrepresentation, particularly for Black faculty. His narrative reveals how the absence of diversity within search committees influences hiring decisions. In environments lacking African American representation, biases tend to favor individuals similar to the existing committee members. This perpetuates a cycle where, even when efforts are made to increase diversity, underrepresented candidates, including Black faculty, face

significant hurdles in being selected. The institutional environment, as described by Dr. Walker, poses challenges for the success and advancement of underrepresented individuals, ultimately impacting the numbers of Black faculty within the institution. While the faculty perceived organizational commitments to diversity as superficial, their narratives align more closely with the stagnant category the challenges they describe reveal a systemic stagnation in diversity efforts. To truly diversify the candidate pool, institutions must move beyond minor adjustments in hiring practices.

Moderate institutions – recruitment with the goal of assimilation of Black faculty

Most of the settings participants described were consistent with what we called "moderate institutions." Respondents in such institutions saw small incremental progress toward diversity. However, these efforts did not have longevity, nor did they lead to lasting change defined as an environment where Black faculty felt comfortable participating as their full authentic selves. For example, Dr. Hewey did not describe a diverse initiative, but he did describe the lack of a sense of community in his institutional setting. He described his undergraduate HBCU as having a strong community where he felt a sense of connection. He was then able to re-create that sense of community as a doctoral student at a predominately white institution, but he leveraged student organizations and the community outside of the institution in order to receive support. As he reflected on his experience, he compared his perspective as a student to his current experience as a Black faculty member:

> In terms of faculty, I do still feel the isolation sometimes, because in terms of African American men across the three programs within one department, there are really two of us, and the other one is a senior [faculty member]… I think there's just a difference in interaction between faculty members and even how we interact with students. And I still rely on kind of [the] same, similar strategies [from my graduate school experience]. I am collegial with people in my department, I make sure that I connect with other faculty in other departments and even other colleges.

Despite strong interaction with his colleagues, Dr. Hewey feels isolated within his department. This contrasted with the faculty in our sample who are working in transformational institutions. None of them described feeling isolated even if they were the only Black person in their department. If Black faculty are present but have feelings of isolation the environment is not transformational.

Dr. Higgins believes accountability and buy-in are very important in executing effective diversity initiatives. He feels that leadership, like "deans and chairs," should be held accountable for maintaining diversity efforts that include retention and support of underrepresented faculty. He said:

> If the goal is to diversify your faculty, then you cannot afford to have any faculty of color having to go through the usual games that people play through the tenure process. So, like I say, if people ask me, "What's it like to be a tenured professor, or be on tenured track?" It's like having a job and pledging a fraternity all at the same time, where doing your job is necessary, but not totally sufficient for entrance into the club. Right? And so, for me, everything was cool and copasetic until I hit. So, what's Gandhi say? You know, first they laugh at you, then they ignore you, then they fight you, then they… then you win.

In this instance, Dr. Higgins conveyed a negative perception of being part of a diversity hiring initiative. He found himself in an environment where he perceived a lack of support for him and other underrepresented faculty members. This study revealed that 40.3% of Black faculty held unfavorable views of diversity initiatives. Despite environments that aimed to surpass mere affirmative action measures, these faculty members did not feel entirely included and often sensed the need to assimilate. They reported experiencing environments that lacked collegiality and support for underrepresented faculty members, with described efforts having minimal buy-in or support from their peers and leadership.

Transformational institutions – diversifying toward disruption and fully inclusion of Black faculty

Participants' descriptions of transformational institutions were characterized exclusively by their positive perceptions of how STEM departments and institutions can foster inclusivity. Although descriptions of transformational institutions appeared in 40% of the institutional references to diversity initiatives, only three reference described the participant's current institution. When asked what his institution is doing to foster diversity, Dr. Wright described an academic setting and a department that had commitments to inclusion which were often reinforced. Dr. Wright reported:

> Based on interactions that I've had with administrators here, I'm convinced that everyone—the decision makers—are focused on creating the right environment where you can have [diversity]. Not just in terms of faculty, but also in the student body as well. I think, I'm convinced that everyone here is focused on making it a comfortable and welcoming environment for their fresh faculty. That's certainly been my experience. Definitely… all my interactions with the Dean of the College of Engineering [have] been fantastic, supportive, diverse… and for me personally, I think from day one.

Dr. Wright expressed satisfaction with the efforts of his institution and felt immersed in an inclusive, supportive institutional context within his department and the university more broadly. Dr. Wright felt he had the ability to contribute to and see a change in his institutions. He felt able to assist in these transformations, working within his department as his authentic self while feeling validated. Dr. Wright goes on to describe how the Dean of Engineering is very supportive of cultivating a positive cultural climate, which he deemed important for him as a new faculty member. Dr. Evans echoes Dr. Wright's experience. Dr. Evans is in a department that is interested in the perceptions of Black faculty, seeking to gain their insight into the institutional climate. Although Dr. Evans's experiences are positive, he also compares it to his international positions. He states, "[The] United States is way behind in that area [of diversity]… We have faculty retreats where we talk about things like this. Like how to

promote the department, make it better." Dr. Evans felt the retreats were a good way to create a space to listen to the faculty on the topic of diversity.

Dr. Davis describes his institution as a place where all the faculty are involved in many different initiatives that they feel are important for recruiting underrepresented faculty, and more importantly, retaining them by cultivating a supportive environment. However, Dr. Davis stressed the importance of the university having "flexible hiring lines that basically [go] out and recruit faculty, African American, or any member of the underrepresented groups and women." He believes that flexible hiring lines provide his institution more options to increase the diversity in their faculty.

Discussion

This study detailed three types of organizational environments 1) Stagnant institution, where the institution has an aspirational commitment to diversity which can be noted by simple affirmative action plans or generic diversity statements with little is in place to cultivate equitable environments. 2) Moderate institutions, where underrepresented populations are recruited but are expected to assimilate into the dominant culture. The institution desires to maintain its structure which has racist policies and practices. 3) Transformational institutions, which are the ideal environment to foster healthy faculty conditions, this institution has made significant steps toward creating an equitable environment. The institution reflects critically on areas that need to be changed for institutional health and for maintaining equity.

This paper provides the needed language for departments and institutions to name their environment. There is power in naming, by giving something a name it makes it real and can be communicated about. For example, at a faculty meeting, a department chair could ask, "What would be needed in our department for it to become transformational? The naming of an environment is a tool that can provide a clearer and more detailed dialog within engineering and computing departments. Efforts must move beyond counting the number of Black faculty (stagnate institution) towards accepting and working to fully include Black faculty in healthy ways (transformational).

It can be difficult to process and accept that racism will be the default operation in an institution unless it is collectively and constantly worked against. In addition to creating equitable and healthy work environments, this will also have a direct impact on the student body and ultimately produce more equity-focused engineers and computer scientists.

Conclusion

There is no doubt that the country's demographics will continue to change, but, for Black engineering and computer science faculty, this ripple effect is not guaranteed to reach higher education. To significantly increase the number of Black STEM professors in academia, change agents must address several factors and forces within the academy. To address the numerous factors that have hampered progress in diversifying the professoriate, campus leaders, consortia of institutions, and national organizations must collaborate and work independently to develop novel strategies to increase the number of transformational environments where Black faculty are engaged and valued in the transformational efforts.

This research provides a rare description of institutional efforts towards diversity in STEM departments and institutions from the perspective of Black faculty. However, this study has its limitations, primarily in fully comprehending the complexity of Black faculty members' experiences. The broader research study from which this study draws did not initially aim to investigate diversity initiatives specifically, yet these initiatives emerged within the narratives of participants. Subsequent research endeavors could explicitly explore diversity initiatives, examining their direct impact. Such research could contribute to the development of a survey tailored for departments, enabling a more comprehensive self-assessment of their respective diversity initiatives. The goal of our research was to provide descriptions for the type of institutional environments Black faculty have experienced. This research suggests that STEM departments and institutions consider using as a model the transformational organizations, as defined above, where Black faculty can thrive and not merely survive. We suggest that departments and institutions gage what type of environment they currently have. Is it stagnant and only taking diversity efforts as far as affirmative action, not accounting for unwelcoming and hostile working environments? Or is the environment more progressive and transformational? Within higher education each STEM department has its own culture. It is important to look within and across each department to ensure every area is transformational.

Data availability statement

The data analyzed in this study may not be readily available as it is in the form of qualitative interview results. Requests to access these datasets should be directed to https://www.r-rights.com/.

Ethics statement

The studies involving humans were approved by Peabody College Vanderbilt University IRB. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

MM: Conceptualization, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. EM: Data curation, Formal analysis, Funding acquisition, Resources, Supervision, Writing – review & editing. PB: Data curation, Formal analysis, Investigation, Software, Writing – original draft.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2024.1324389/full#supplementary-material

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