The role demands of Black faculty mentors in engineering

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Denise R. Simmons, Ph.D., PE, F.ASEE, PMP, LEED-AP, is a pioneering leader in civil engineering education and workforce development, currently serving as a tenured, full professor in the Department of Civil and Coastal Engineering at the University of Florida. With over three decades of experience in both academia and industry, Dr. Simmons has continually integrated theoretical research and practical application, demonstrating a commitment to evolving engineering competence in its most holistic sense.

Dr. Simmons's recent research efforts have expanded to include a nuanced exploration of communication within engineering education, specifically focusing on developing agentic communicators. Her studies delve into the complex dynamics of communication within research labs, examining how graduate students experience communication mis-cues and identifying strategies to help both students and their advisors navigate and overcome these challenges. She also investigates how faculty approach their communication with graduate students, the concerns they encounter, and the guidance they provide to cultivate stronger, more effective communicators.

Recognizing that effective communication is foundational to leadership and mentorship, Dr. Simmons emphasizes the role of oral communication in building agency. Her work uncovers how mastering oral communication can empower individuals to assert their ideas confidently and navigate professional interactions more effectively. This focus on agency around communication aligns seamlessly with her broader mission to equip engineers not just with technical skills but with the leadership, mentorship, and communication competencies essential for driving innovation and fostering inclusive growth in the field.

Her groundbreaking contributions to engineering education, supported by nearly $8 million in federal funding and over 100 refereed publications, continue to redefine the standards of excellence in the profession. Dr. Simmons's dedication to empowering underrepresented groups and guiding minority-serving institutions earned her the esteemed honor of Fellow Member in the American Society for Engineering Education in 2023, solidifying her legacy as a transformative figure in both the academic and professional engineering communities.

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The role demands of Black faculty mentors in engineering

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Abstract:

This full research paper discusses the emerging theme of the role demands of Black faculty mentors of Black graduate students in engineering. Building upon an NSF-funded, early-stage, exploratory study aimed at improving representation and support for Black Ph.D.s in engineering (target population), a participatory action design research approach was used to run a focus group with seven Black faculty (Full Professors, Associate Professors, and Assistant Professors) at a southeastern institution of higher education in the United States. During the focus group, participants communicated that their mentoring roles were disproportionately higher compared to majority faculty counterparts. Among the roles by the Black faculty as being needed by their students were modelling awareness, psychosocial support, and professional navigation. Using the STEM mentoring ecosystems (STEM-ME) framework and Goode's theoretical framework of role strain, open and thematic coding were conducted on the mentoring demand experiences shared by the faculty participants. The findings point to a need for institutions to augment their professional development to account for and reduce the multiple mentoring role demands experienced by Black faculty mentors in engineering. The paper concludes with implications for faculty professional development that serves to equitably support the excessive demands put on to Black faculty mentors in engineering.

Keywords: *Mentoring, role demands, Black faculty, engineering*

Introduction:

Black and Brown faculty in engineering face significant burdens when it comes to mentoring in the United States [1]. These faculty often face overwhelming demands due to the expectation to mentor a disproportionate number of minority students [1]. The added and institutional unrecognized support and recognition of their mentoring efforts has been reported to lead to burnout, stress, decreased job satisfaction, sacrificing personal health, and emotional and mental fatigue [1]-[11]. Compounded on this are racial battle fatigues in their academic environments that continue to position them at a disadvantage compared to their White counterparts [6], [9]-[11].

Minoritized faculty (i.e., Black faculty) are "acutely aware of their community's needs and often gravitate towards racial justice efforts and equity causes" [6, p.708]. As such, Black faculty mentors see current and prospective student mentees as an extension of themselves [6]. In response,

Black faculty mentors apply social empathic and equity ethic practices in their mentoring approaches, which builds trust and rapport with students [6]. As a result, Black faculty mentors are flooded with a disproportionate number of requests from students as well as institutions to participate in formal and informal diversity-related service as compared with their White counterparts [6]. However, there is still an overall lack of knowledge of the types of asset-based strategies used by Black faculty mentors [8]-[10] in lieu of their cultural taxation [6] and how professional development can be used to level the playing field to establish more equitable accountability, recognition, and reward systems for these undervalued forms of mentoring [6]. This work will serve to add to the slim but growing literature base [1], [6]-[11] on the topic.

Theoretical Framework:

STEM Mentoring Ecosystems Frameworks

Mondisa and colleagues [8]-[10] adapted from Bronfenbrenner's ecological systems model in the context of mentoring in STEM. This model is called the STEM Mentoring Ecosystems (STEM-ME) [8]-[10] and it is being used to help scholars and administrators understand why mentors and mentees use certain resources, what makes mentoring exchanges effective, and what structures support mentoring interactions. The STEM-ME model identifies many STEM mentoring interaction systems:

- **Microsystems**: Direct, person-to-person interactions, such as those between graduate students and their peers, faculty, staff, and family.
- **Mesosystems**: Interactions between different microsystems, like departments and colleges, which can either support or conflict with each other.
- **Ecosystems**: Networks that influence development at a broader level, such as Graduate Schools, governing boards, and communities.
- **Macrosystems**: Larger societal factors, including historical, political, and economic influences.

When considering race, gender, and other social factors, research shows that many STEM mentoring programs in academia operate from a deficit-based perspective [19]-[25]. McGee and others [6] recommend that to minimize the Black (along with other intersecting identities) cultural tax that is put on faculty in their service roles, it is important for institutions to both expand who does these types of service on students while providing a much-needed relief to service work conducted by Black faculty mentors that oftentimes goes uncompensated, unacknowledged, and unrewarded. Furthermore, professional development of faculty colleagues who may be unaware of how Black and Brown and other underserved faculty bear the brunt of such invisible mentoring and service efforts, is needed so that other faculties can "help share responsibility for increasing equity and minimizing racialized bias on campus" [6, p.726]. To level this playing field, it is important to understand the mentoring demands caused by this level of unrecognized service put on Black faculty mentors in engineering. For this, we need to understand how mentoring role strains work.

Role Strain Framework

McGree et al., [6] conducted a nationwide study of 39 Black faculty members in computing and engineering to explore the types of diversity-related service asked from these faculty members (whether directly or indirectly) and its impact on their overall professions and well-being. One of their findings identified an "invisible narrative perpetuated by the university that placed the

responsibility of assisting Black students with psychosocial and academic support squarely on Black faculty" [p. 725]. This mentoring role strain is not fully understood but Goode's role strain theory may help shed some light on the matter.

Goode's role strain theory [26], when applied to higher education [4], has explored the different challenges, pressures, conflicts, and sacrifices that individuals make when trying to fulfill multiple role obligations simultaneously. These can include but are not limited to work-life sacrifice, not being promoted, burnout, and meeting the competing demands of teaching, research, and service [1]-[12], [21], [26]. Research has shown that role strain can negatively impact faculty members' job satisfaction, mental health, and overall productivity [26]-[30]. The additional burden of addressing racial and gender disparities in their mentoring relationships further intensifies their role strain [31]-[33]. Studies suggest that systemic changes that are equitable are needed to provide better support and resources for minoritized faculty members, ensuring their well-being and the success of their mentoring relationships [31]-[33].

Strategies to mitigate role strain include institutional support, such as providing flexible work arrangements, offering professional development opportunities for all faculty to raise awareness of inequitable service demands, and fostering a supportive work environment premised on recognition and rewards for invisible work [26]-[33]. To our knowledge, role strain has not been directly applied to mentoring in engineering although related work has been conducted by scholars seeking to better uncover the roles of Black faculty mentors in STEM and the service roles they play for students and the administration [6]-[10]. This full research paper will begin to uncover what demands and strains look like for Black faculty in engineering when they engage in mentoring practices in higher education for their Black graduate students. Also, we will uncover some of the implications to professional developers of faculty in academic environments.

Methods:

This exploratory study is informed both by STEM-ME framework [10] and Goode's Role Strain framework [26]. This paper builds upon a larger study [34]-[39] exploring the mentoring relationships of underserved Black Ph.D. students and their faculty advisors in engineering. This paper particularly focuses on Black faculty advisors of Black Ph.D. students in engineering.

Positionality

For this paper, all authors identify as having intersectional identities and currently being underserved in engineering. The first author is a U.S.-born, Latiné woman faculty advisor, the second author is a South Korean, international graduate student in science and engineering education, the third author is a South Asian, international graduate student in engineering education, the fourth author is a U.S. born, Black American woman faculty in engineering and the third author is a U.S. born, Black American faculty in journalism. The first author identifies as Brown or Yellow and the remaining authors identify as Black.

Throughout the study, positionality took into consideration the power dynamics and often exploitation and delegitimization of Brown and Black participants in engineering education research [1]-[11]. As such, the lead authorship team discussed at length the distribution of tasks and leads as well as the member-checking process that included but was not limited to use of an advisory board and external accountability checks with graduates students involved. In this way, multiple rounds of accountability would be put into place at the start, progression, and end of the research process.

Research Questions

This paper is part of a larger NSF study [36]-[39]. The overall research questions were connected the first research question, specifically the first sub-research question from the perspective of the faculty advisor.

RQ1. What factors influence underserved [Ph.D. graduate student(s)/faculty advisor(s)] as they engage in mentoring relationship?

Sub-RQ1. What does it mean to be a [Ph.D. graduate student/faculty advisor] in a mentoring relationship in your field?

Sub-RQ2. How does hidden curriculum influence the role of a [Ph.D. graduate student/faculty advisor] in a mentoring relationship in your field?

RQ2. What does it mean to address issues that may arise in a mentoring relationship between a Ph.D. graduate student and faculty advisor in your field?

Research Paradigm and Interpretive Framework

This study is positioned from an epistemological philosophical perspective within an interpretivist framework [40]-[42]. This allowed a relationship of trust to be formed between the researcher and the participant in where knowledge-making happens during the interaction among people, practices, and artifacts in a context [42]. More specifically, constructivism was selected to maintain an open and flexible view of the construction of faculties' realities [42].

Research Design

The overall research design selected for the larger study was participatory research [40], which is a process used to systematically, iteratively, and critically incorporate the knowledge, expertise, experience, propositions, and practices by the participants and researchers.

Participants

For this exploratory work and in response to sub-RQ1, a focus group was conducted during Fall 2024 with a group of nine Black engineering faculty in the college of engineering at a southeastern institution in the United States. These individuals were conveniently recruited as they reside in the same home institution as the authors. Originally, the recruitment was sent via email for a previously collected list of existing faculty that met the following criteria: (1) were an existing faculty in the college of institution as the authors; (2) had a demonstrated, positive track record of research, teaching, and service; and (3) are known to be successful mentors of Black Ph.D. students in engineering or computer science. From the emailed invitation, nine faculty responded but due to scheduling conflicts, only seven faculty participated in the study containing a pre-survey and focus group. This study primarily focuses on the focus group portion as the survey data is currently being analyzed for future publications.

The seven participants were 2 full professors, 2 associate professors, and 3 assistant professors, all in the tenured or tenure-track lines. Out of the seven faculty professors, five self-identified as women. For all participants, pseudonyms were included to protect their identity. For pseudonyms, Greek god/goddess pseudonyms were selected using gender-neutral names to signify

the elements to further protect and minimize the identification of the faculty respondents by the intersections of race and/or gender.

Research Method

The methods for this exploratory work were open-ended surveys followed by a focus group. Analysis for the survey entries are underway and this paper primarily focuses on portions of the focus group discussions, particularly those that revolved around mentoring demands.

In general, focus groups sizes range from 4-10 participants where 6 is considered the ideal number of participants due to their confirmatory capabilities and the moderation management of the sessions [40]. The focus group questions primarily focused on the faculties' experiences around mentoring Black Ph.D. students in engineering and/or computer science. The focus group questions had a discussion guide centered around key talking points and was semi-structured, with an open-ended and flexible approach based on the direction that the participants discussed several of those talking points. Talking points for the focus group discussion centered around:

- Strategies that would highlight how they mentor their Black Ph.D. students successfully;
- Challenges experienced as they mentor their Black Ph.D. students compared to their majority faculty counterparts;
- The types of roles they play as they mentor their Black Ph.D. students;
- Input into what they believe institutions of higher education should do to help support their mentoring roles

The first author served as a moderator for the focus group. As a Latiné, Brown woman faculty in engineering she was considered a both a neutral party a researcher with multiple experiences in communication and group facilitation [43], [44]. To minimize social desirability bias [43], since the topics may be personal or sensitive, several measures were taken:

- **Indirect questioning:** This strategy was used to guide the focus group discussion using neutral phrases such as "in general", "from what is known", "what should be done if" in a roundabout manner where participants were asked about general perspectives rather than what one person does specifically.
- **Group discussion:** For the topical areas, general group discussions took place where participants could share their opinions or resources that they believed would help with information sharing for the attendees. In this way, they were all positioned as experts carrying assets rather than deficits [44].
- **Options for anonymity of responses:** Participants were given the choice to participate or enter responses online in electronic form or in-person on paper during the discussion.
- **Guarantee total confidentiality:** At the beginning, during, and end of the focus group, participants were told that confidentiality would be maintained and were given the option to omit all or part of their responses at any time during or after the focus group.

The focus group duration was 90 minutes in length in a noise-reducing, private environment with minimal distractions and interruptions to your participants. If unanticipated interruptions occurred, a note of the event was annotated by the moderator.

Research Quality and Verification Critical Considerations

Research quality was conducted using the Q3 for interpretive, qualitative research in engineering education framework [45] and research verification was conducted using Morse et al.,

framework [46]. This process was discussed in a different publication [47] but in general, theoretical validation, communicative validation, pragmatic validation, ethical validation, and process reliability was conducted. Verification strategies included methodological coherence, sample appropriateness, data collection concurrency, theoretical and thinking development and these were considered and iteratively tested prior to conducting this study.

Results and Discussion:

For this section, as indicated earlier, the focus is on the role demands as communicated by the Black faculty mentor participants in the focus group. The themes generated to date only focuses on the role demands expressed and does not reflect the entirety of the group discussion. The survey and additional analysis are still underway. However, the sub-theme findings around *the main theme of mentoring role demands,* was deemed important to share for this exploration.

Sub-Theme 1: Modelling Awareness Role Demands

This sub-theme came across from most of the participants where they shared that modelling did not just occur professionally or technically but also personally. To role model, Black faculty mentors expressed having a self-awareness of what they choose to model and the reasons for the modelling in the mentoring relationships to their graduate students. One of the participants shared that

> *"I don't want the student to be a cookie cutter image of me. I am not trying to create little [Nessois], I want them to be themselves and thrive in their own identities […]. However, there are certain behavior that I model to all my students, such as a work-life integration, etc."* *Nessoi, Assistant Professor*

> *"Modelling respect and resilience […] showing them the model of work ethics in the lab"…* *Hemera, Assistant Professor*

Black faculty mentors are expected to enact a heightened level of self-awareness of their professional roles in the context of their work environments [48], [49] and what the expectations should be for the graduate students [50]. This form of modelling awareness also requires a heightened recognition of the ethical implications of mentoring and its impact on the students' well-being and professional formation [15], [16].

Finally, modelling awareness unconsciously enacted the behaviors, attitudes and actions that the Black faculty mentors wished their own administration would recognize in them [8]-[10] while at the same time setting up those recognition expectations in their graduate students. In this way, they are debunking the hidden curriculum of their professionalization [51] while providing needed social capital to transform their working landscape in the future [52].

> "*…Yes, I do make sure I am a role model for all students, but I don't want them to move as I do. This is because there are times when may not speak up for certain issues (as a Black pre-tenure faculty member) and I have to choose my battles. However, I want my students to know that they can speak up and have a voice, so I don't want them to do as I do…"*
>
> *Nessoi, Assistant Professor*

"… Group meetings that start with wins/losses and 'name one thing that is positive since we last met'…" *Nyx, Full Professor*

Sub-Theme 2: Psychosocial Support Role Demands

It is important to note that while the topic of gender was not included in the sub-themes, four out of the five women faculty participants provided this psychosocial support role demand in response in their mentoring experiences. Men primarily focused on technical and competency skill development as well as the roles of sponsorship and networking.

Psychosocial support, according to the respondents, involved emotional, personal, and interpersonal guidance aimed to augment student's self-confidence and personal growth. This also involves helping individuals navigate cultural, social, and personal adjustments.

"Never missing an opportunity to celebrate or tell them [graduate students] or tell them they have done a great job […] I literally say "keep up the good work" after every meeting." *Ourea, Associate Professor*

"Cultural activities in [hometown]…and social activities […] with no academic focus…normalizing counseling and well-being strategies" *Hemera, Assistant Professor*

"…individual meetings where we start out discussing how they are doing before discussing research " *Pontus, Assistant Professor*

According to the literature, psychosocial support roles tend to be an "invisible narrative perpetuated by the university that placed the responsibility of assisting Black students with psychosocial and academic support squarely on Black faculty" [6, p. 725]. However, literature does suggest that this invisible narrative results in different gender-based expectations in mentoring [53] where women are expected to engage in more close and personal relationships regarding student contact whereas men compartmentalize relationships partly due to perceived visibility and surveillance from others to minimize the likelihood of accusations of inappropriate relationships with female students.

Sub-Theme 3: Professional Navigation Role Demands

All faculty expressed supporting students to navigate both educationally, on the job market and beyond. However, doing so requires a long-term commitment to mentoring, which augments exponentially the mentoring demands of a Black faculty member. One of the faculty participants expressed concern about the navigation of a Black Ph.D. students after graduation and how oftentimes that Black faculty mentor must fill the gap professionally of what their previous faculty advisors and the administration failed to do.

… "the problem is they [Black Ph.D. students] aren't getting appropriate mentorship […] Ph.D. programmatic things […]. Then, later when they [Black Ph.D. students] are done, they [faculty advisors] think, OK, they [Black Ph.D. students] are done. They [Black Ph.D. students] don't get the follow-through mentoring through promotion. It's not been sufficient mentorship, sponsorship level for our [Black] folks. And so, that is why I stay so busy because I'm filling in gaps that the advisors were supposed to do."

Chronos, Full Professor

"…acknowledge community needs and supports (financial and otherwise)…offer strategies to navigate job decisions and challenges…" *Pontus, Assistant Professor*

"…sharing my journey, things I had to navigate as a Ph.D. student…being vulnerable, sharing what goes right and what did not" *Hemera, Assistant Professor*

It is known that Black faculty taxation is a phenomenon reported in the literature [6] where these individuals receive a disproportionate number of requests from students as well as institutions to participate in formal diversity-related service as compared with their White counterparts. However, the dimensions and extent of this taxation to the mental and overall well-being extends beyond the trajectory of a traditional Ph.D. timeline to extend to their professional lives beyond. Furthermore, career preparation involves even aspects of helping students metacognitively think about how to think of a career and doing so in ways that may uncover Black faculty mentor's vulnerabilities. These complex and intertwined narratives are barely beginning to be explored [8]-[10] and their impacts are not fully understood.

Sub-Theme 4: Battlefront Role Demands

Faculty participants expressed a strong commitment towards ensuring that they are holding the lines for other Black Ph.D. students and faculty by putting themselves on the battlefront in different academic arenas. This form of racial, gender, and other forms of battle fatigue [1], [6]-[10] has been shown to disproportionately provide not just a mentoring but a battlefront burden for those who are willing to stand up for equity and what is right for their Black Ph.D. students.

"…so many people [Black folks] drop out because it can be adversarial for our students. So, I need to be an ally and a sponsor. I have to block for them [Black faculty and students] and fight for them [Black faculty and students]. It's not always easy, and they [Black faculty and students] don't know it's a lot of the things that I'm doing to protect them [Black faculty and students]. I find that [Black folks not being aware of the battles fought] to be important and they [Black faculty and students] don't need to know. But that is a role that I have to play because a lot of times they [Black faculty and students] don't think they belong here [in academia] I've heard…" *Chronos, Full Professor*

"…as a Black student there are cultural and social situations that arise in professional settings that students should be aware of and better understand […] including potential bias or societal stereotypes…." *Boreas, Associate Professor*

Literature reports that racial and other forms of battle fatigue for people of color results in individuals who are physically and emotionally spent [55]. On the other hand, literature has shown that creating these forms of counter-spaces is one of the most critical support networks in aiding the navigation and successful progression through and beyond a Ph.D. program [56]. The question to ask is, "*What is the right balance and how can institutions support Black faculty?".* The next section discusses some implications and recommendations as it pertains to faculty professional development in higher education and particularly engineering.

Implications and Recommendations:

While this work is still in its exploratory stages, the findings to date showcase a unique and complex landscape for Black faculty mentors in engineering [6], [8]-[10]. The many hats and mentoring role demand that they carry cause mental, emotional, personal, and professional taxations that are too numerous to count. At the same time, there are actions that universities can do, particularly in the domain of professional development to support this bright and talented group of faculties in engineering:

- **Recommendation #1: Institutionalize invisible mentoring rewarding mechanisms.**

  From the findings and from national reports [1], there is a lot of unrecognized and unacknowledged mentoring that Black faculty mentors in engineering face compared to White faculty counterparts when advising Black Ph.D. students and other underserved students. Simply keeping numerical tabs and individual development plans is not enough to support Black faculty from the over-commitment requests for mentoring. Institutions should institutionalize these forms of recognition in other ways such as student-nominated mentoring awards that include mentoring quality questions on examples of 'how the mentor has supported them?' and not just the quantification of the mentoring. For these forms of recognition and reward systems to take place, there equally needs to be professional development from the institutions, the colleges, and departments on what constitutes a quality research mentor and how they can support advancing the mission of the university. Establishing a continuous communication and cultural expectations of quality mentorship is a responsibility of all institutions.

- **Recommendation #2: Professionally develop faculty on the importance of post-Ph.D. mentoring support.**

  Faculty advisors should equally be trained to understand the differences between advising and mentoring and as it pertains to the career trajectory of Ph.D. students. As one of the faculty participants stated, it is not enough to graduate with a Ph.D. students but also to equip them for their next professional stages and roles. This form of mentoring involves a committed time dimension were mentoring does not just stop at the Ph.D. degree completion but continues throughout the life of the mentee. At the same time, it is important for institutions not to put the onus on just faculty but to involve their Alumni not just in outreach, panels, and fund-raising events but to also include them more embedded *throughout* the mentoring of students' careers and of others. Strategic partnerships could be created with different Alumni Relations and Donor Relations groups to bring back Alumni to speak about their career trajectories but also to offer these Alumni continuing professional development support and certifications on mentoring to ensure a mentoring continuum is institutionally started and maintained.

- **Recommendation #3: Include the Graduate School to partner on professional development of graduate students as well as Human Resources for faculty.**

  Other institutional partners could be strategically consulted on the professional development of White and majority counterpart allies. For example, Human Resources could be a partner to Faculty Affairs offices where faculty are trained on the importance of equating the mentoring load as well as discussing the services that institutions can offer to support the faculty. The Graduate School, for example, could support in the training of majority graduate students to become allies for underserved graduate students and the mechanisms of how to speak up when they witness mentoring inequities.

Creating dual mechanisms of recognition, support and accountability are essential to ensure that Black faculty mentors in engineering and other disciplines within higher education are seen, valued, and elevated. It takes a village to build a community but if the village is devoid of resources and proper structures, it becomes another meeting place at best.

Limitations:

This exploratory study is only a snapshot in time of the lived experiences of Black faculty in engineering and does not fully capture the complexity of the mentoring experience nor the role demands of the faculty. Also, the experiences of one Black faculty mentor are not the same as another as Black communities are not Monolithic.

Also, this study was conducted at a single institution of higher education, using convenient sampling, and a single discipline. As such, care must be taken to make sure that the strategies are not generalized across all institution types and disciplines. Rather, a more contextualized approach is needed to fully attend to the unique needs and contexts of its faculty population.

Finally, the data sources of the survey responses are currently being analyzed and this added response may provide additional insights and context to the findings presented here. As such, readers are cautioned that the findings may not fully encapsulate the full context of the quotes shared. Future work will expand upon the added data results.

Author Contributions:

We used NISSO's Contributor Role Taxonomy (CRediT) [56] to delineate the roles of each author: IVA (funding acquisition, conceptualization, methodology, project administration, supervision, validation, visualization, data curation, formal analysis, writing-original draft, writing- reviewing and editing); MY (conceptualization, methodology, visualization, validation, data curation, formal analysis, writing-reviewing and editing); NG (conceptualization, visualization, validation, data curation, writing-reviewing and editing); DRS (funding acquisition, project administration, writing-reviewing and editing); JM (funding acquisition, project administration, writing-reviewing and editing).

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