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A customized process to document and create consensus between faculty advisors and their engineering graduate students

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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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A customized process to document and create consensus between faculty advisors and their engineering graduate students

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Abstract:

This full paper introduces a custom-developed protocol and process to document and create consensus between graduate students and their faculty advisors during critical points of contention. Stemming from an NSF-funded work, early-stage exploratory study aimed to improve representation and support for Black Ph.D.s in engineering (target population for the project), the authors noted a lack of protocols and processes by which participatory action design research can be used to document and create consensus between a faculty advisor (FA) and their graduate student (GS). To minimize harm to the target population, which already is severely underserved and marginalized in engineering, the authors opted to test this protocol and process amongst themselves and document its outcomes. The research design was participatory research with a collaborative autoethnographic approach to systematically, iteratively, and critically incorporate the knowledge, expertise, experience, propositions, and practices to deepen the experiences of the participants and researchers. This paper specifically focused on the process of developing the protocol. For this, open coding was conducted, and salient topics identified the need to uncover the: (1) hidden expectations about mentoring roles and responsibilities; (2) the need to explore unintended impacts of coercion in the process of research; and (3) the need to explore past, mentoring traumas before starting in a mentoring relationship. To engage in critical conversations and to deeply explore mentoring relationships, procedures must simultaneously situate the perspectives, experiences, and lived realities of both the faculty advisor and the graduate students. This process development hopefully can serve to uncover areas that colleges of engineering and universities can attend to when seeking to sustainably and impactfully support unresolved or poorly managed conflicts between faculty advisors and their graduate students in mentoring relationships. The paper concludes with recommendations and implications.

Keywords: *Faculty advisor, graduate students, mentoring relationships, participatory design*

Introduction:

In the United States, science, technology, engineering, and math (STEM) graduate students departures are reaching staggering percentages (55-64%) [1], [2]. One of the top reasons for graduate student departures center around unresolved conflicts with their faculty advisors [3]. The topic of conflict mediation between graduate students and faculty in higher education [4] and let alone in engineering [5] is underexplored. There is not just a need to identify interventions and strategies to assist internal conflicts between graduate students and faculty within lab environments [7]-[9] but also to document the process by which a conflict resolution is generated.

Furthermore, when it comes to underserved groups in engineering, there are other considerations to take into account in mentoring and advising relationships between a graduate

student and their faculty advisor such as issues of culture, race, and gender [10]-[13]. The purpose of this Full Paper was to document a process of conflict resolution taken upon a faculty advisor and their graduate students in their lab. An added layer of accountability was included inspired by Mondisa's work on situated identities in mentoring [10], [11], Holly Jr.'s Pro-Black engineering education research framework [14],[15], and Gelles's work on ethical mentoring [16]-[19]. This paper presents a novel process by which conflicts could be managed internally between engineering lab as well as introduce new methods by which the research process can be both democratized and affirming of the assets that underserved graduate students and their advisors bring [14].

Background:

Whether formally structured (i.e., advising) or informally structured (i.e., mentoring), national reports [20] point to the dire need for evidence-based practices and research in not just forming productive relationships but meaningful ones for a graduate students' profession. Unresolved conflict resolution continues to be among the top two reasons why graduate students in STEM leave their programs of study [3]. When unresolved conflicts arise in a lab, dysfunction occurs [21]. Dysfunction is typically described as being "unproductive or characterized primarily by conflict [21, p. 45] where the needs of both the faculty advisor and the graduate student are not met [22], [23].

Conflict results in agnostic states between a supervisor and their protégé either through frictions, disagreements, or disputes tied to beliefs or actions resisted or deemed unacceptable by either party [24]. Conflicts can be intrapersonal (internally in an individual), interpersonal (between two people), or intra-group (between individuals in a team), or intergroup (between different people in an organization) [24]. As Villanueva Alarcón positioned [6], not having internal measures by which conflicts can be internally addressed presents "a missed opportunity to retain and equip research teams to promote positive and impactful research productivity" [6, p. 2].

Within labs, studies have reported some strategies for conflict resolution and management such as circle time, assertiveness training, and participatory approaches [24], [25]. However, none of the studies detail the procedures or methods used to develop said approaches nor do they document issues of gender and race, that in engineering are particularly underserved [10]-[19].

Theoretical Frameworks:

STEM Mentoring Ecosystems Frameworks

Built upon the Brofenbrenner model of ecological systems [26], Mondisa and colleagues developed a STEM Mentoring Ecosystem framework [13] to better understand what causes mentors and mentees to use some resources, what patterns of mentoring exchanges are productive, and what structures cultivate mentoring interactions.

According to the model, there are several interacting systems within mentoring in STEM [13]. *Microsystems* provide the most direct person-to-person encounters and for graduate students, these interpersonal or intragroup interactions can include peers, faculty, staff, and family. *Mesosystems* include the intergroup interactions between microsystems such as departments, colleges, or schools that serve to support or create conflict with each entity. *Ecosystems* involve networks that influence development at the systems level such as Graduate School, governing boards, and communities. *Macrosystems* involve a broader societal component that involves historical, political, and economic factors for change. Since academic/disciplinary microsystems [13] provide the most direct interaction between a graduate student and a faculty member [13], [24] and this is the space where most conflicts arise [24], this work will focus on microsystems.

As Mondisa and colleagues suggest in their STEM-ME framework, mapping strategies allow scholars and programs to understand the "individual nature and interactions of people to postulate what assets they bring, what vulnerabilities they encounter, and what outcomes subsequently develop within the system" [13, p. 5-6]. Whether the interactions occur in dyads or triads [13], differences in perceptions of what constitutes effective mentoring can vary on both sides of the mentoring "relationship equation" [p. 8]. At the root, these differences if unattended are related to mentoring dysfunctions [13], [16]-[19], [21]-[24].

When considering cultural, racial, gender, and other socially ascribed constructs, literature still presents a bleak picture: most STEM mentoring relationships and programs operate from a deficit-based stance [26]-[30]. Literature suggests that faculty regardless of their race or gender have the predisposition to reply to mentoring requests from White students [26], carry limited understanding of critical mentoring [27], [28], and lack critical consciousness [27], [29] to engage in important dialogues [30] needed for healthy and sustainable mentoring relationships.

Recent work in pro-Black engineering education research (PEER) [14],[15], critical mentoring [21], [28], and building capacity and support for Black Ph.D.s in computer science and engineering [31],[32], have suggested that there is a need to equip faculty and graduate students to "develop a personal and professional critical consciousness about racial, ethnic, and cultural factors that influence success for Black people" [15, p. 629] and other unserved groups in engineering. Holly Jr.'s PEER tenet posits that Whiteness results in fallacious thinking, "whether by ignorance, unwillingness, or inability to perceive due to hypervisible invisibility, predominant conceptions of Whiteness" [p. 5], that Black culture (and other underserved communities) are Monolithic, which engineering education literature in other underserved communities has debunked [33].

Extended to mentoring racial, gendered, and 'othered' communities, it is important to include a critical lens in the process of mapping mentoring relationships. From a critical, liberative, and hidden curriculum lens [6], [167]-[18], [33], [34] centering people and their lived realities is essential in mapping and studying a mentoring relationship [13] found in microsystems [13]. The next framework centers ethical mentoring tenets in the mapping of said relationships.

Ethical Mentoring Framework

Ethical mentoring, originally proposed by Johnson [21]-[23], attends to the ethical missteps that occur in a mentoring relationship such as: beneficence, nonmalficence, autonomy, fidelity, fairness, privacy, justice, transparency, and competence. *Beneficence* considers professional interests in a mentoring relationship. *Nonmaleficence* considers avoidance of harm to professional roles and responsibilities of each other. *Autonomy* explores the intentionality behind promotion pathways of independence. *Fidelity* explores how mentors'/mentees' sense of loyalty is towards each other. *Fairness* studies the degree of equal treatment between mentoring parties. *Privacy* aims to avoid revealing sensitive material without consent. *Justice* ensures fair and equitable treatment regardless of cultural differences. *Transparency* involves open and clear communication on expectations. *Competence* offers an established and continued commitment towards skill-building.

Previous work from the first author has shown that when considering race and gender in engineering mentoring relationships, issues of power, communication, and awareness must be attended first [16]-[19]. Research-to-practice strategies have been offered stemming from the first author's work to both identify the mentoring relationship dynamics [16] as well as for conflict management and mediation [6], [18], [35]. In brief, strategies included but were not limited to mediation protocol generation [6], creating an ethics agenda [18], conducting a 'quantifiable' privilege assessment [18], and third space norm sharing [35], among others. This work aimed to implement the essence of some of the mentioned practices to assess and map a mentoring

relationship in a pro-Black research manner [14], [15] that centers people, their assets, and their cultural differences while conflicts in a research process are being resolved.

Methods:

For this study, recommendations from a pro-Black engineering education research approach [14], [15] were used, informed both by STEM-ME and Ethical Mentoring frameworks [13], [24] and using a critical, hidden curriculum lens [6], [16]-[19], [21], [28], [31], [32], [35]. To develop a process to assess and map a mentoring relationship in a microsystem (either interpersonal or intragroup), it was important for the author(s) to contend with their own biases, both hidden and visible, and carefully consider the power dynamics based upon their situated identities [10], [11]. The first step to accomplish this was to carefully consider positionality.

Positionality

This study builds upon a larger study [36]-[40], [45] exploring the mentoring relationships of underserved graduate students and their faculty advisor in engineering, with a particular focus on Black Ph.D. students. 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 an international, South-Asian graduate engineering student, the third author is a U.S. born-Latiné women engineering graduate student, the fourth author is a U.S. born, Black American woman faculty in engineering and the fifth author is a U.S. born, Black American faculty in journalism. The first three authors identify as Brown 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 [14], [15], [41], [42], a two-stage research process was incorporated. In the first stage, the first three authors agreed (with consent from the remaining two authors), to test the process document on their lab. In this way, Black bodies would not be positioned as a subject of research but rather would be positioned as the experts and problem solvers of the design [14], [15]. Second, to avoid the same type of exploitation on the first three authors, the team agreed that the metrics to discuss power dynamics, account for bias, and other markers of dysfunction would be collaboratively, and participatory agreed upon by the first three authors, per recommendations of PEER [14], [15]. This process would be member-checked in two additional steps from a diverse group of graduate students (international and national) and faculty of different races and genders followed by one additional round by the latter three authors. 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]-[40], [45]. Parent and sister journal articles discuss the themes and coding process of the research questions below [38], [45]. An important note is that the primary focus was on the *process* of research to identify hidden conflicts that arose during the execution of this study in trying to answer the research questions and sub-research questions. While the process of consensus was achieved in this work, the strategies and solutions done participatory and collaboratively offer new underexplored areas of research that need to be further explored and studied in the context of mentoring relationships in engineering microsystems [13], via a pro-Black approach [14].

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

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 Design

The research design selected for this study (see Acknowledgement section) was participatory research [47] with a collaborative autoethnographic approach [48] used to systematically, iteratively, and critically incorporate the knowledge, expertise, experience, propositions, and practices which include an iterative process that deepens the experiences of the participants and researchers. This paper will focus on identifying the issues and conflicts that arose, how the team managed them, and extrapolate the topics as areas that are yet to be addressed and studied in the context of mentoring relationships in engineering, via a pro-Black approach [14].

Research Process Overview

During the entire research, from conception to execution, the first three authors engaged in a series of conversations as the research process was conceived and initiated. Example talking points included attending to bias, power dynamics, cultural awareness, context, and macro-to-micro perspectives for social action as described in more detail in Table 1. An estimated 53 hours were spent on critical conversations alone to brainstorm and discuss the research process (as tabulated in calendared, labeled meetings with discussion topics). This time *did not include* additional discussions with external graduate students, faculty, and advisory board members for member-checking or hours spent generating ideas and protocols for analysis.

Given that the first three authors are faculty advisors with their graduate students, a set of expectations to handle inequitable power dynamics was discussed. Agreed-upon rules included:

- ***Rule 1.*** Meetings would be mutually agreed upon during times that benefit all parties while minimizing stress and mental health triggers (e.g., not in an exam week or travel week);
- ***Rule 2.*** Meetings and pertinent discussions would be held in Zoom, with the video feature OFF, to minimize any coercion stemming from facial gestures or in-person presence of the author/participants;
- ***Rule 3.*** Every author agreed to take turns in the discussion and time would be kept ensuring equal distributions of thoughts and ideas shared;
- ***Rule 4.*** Every meeting would include an AI companion for summary and note-taking to verify if bias or power dynamics was captured by a 'neutral' technological party [17], [18];
- ***Rule 5.*** Every author/participant would propose up to 5 research questions with accompanying interview questions which would be discussed, adapted, and agreed upon equally amongst the group;
- ***Rule 6.*** Interview transcripts would be de-identified and each research question was randomized using https://randomizer.org/ so that every coder could review a wide array of perspectives and perspectives;
- ***Rule 7.*** Entries would be critically explored and questionable, biased, coercive, or other forms of deficit views would be marked by the coders for further discussion;

- ***Rule 8.*** The initial set of research questions and initial draft codebook would be taken through several rounds of member-checking by different representatives including but not limited to graduate students and faculty in engineering inside and outside the home institution of the authors; based on feedback, the research team committed to re-do study or make modifications;
- ***Rule 9.*** Any consensus-building strategies for a given conflict would be properly documented;
- ***Rule 10.*** Throughout the whole process, participants took a respectful (yet critical) stance where no judgment would be taken upon each other as they engaged in the research with an agreement that no retaliation or repercussions would occur as a result;
- ***Rule 11.*** All agreed that interpreting the realities and roles of the graduate student and the faculty advisor in the mentoring relationship was key to ensuring a sustainable, healthy, and mutually beneficial mentoring relationship.

After an initial set of interview questions were agreed upon, the authors performed an initial round of coding a Research Process Notes document and a draft codebook were summarized. The first three authors shared both the draft codebook, the interview questions and responses, and an explanation of the process to an external advisory board of 3 faculty members outside of the home institution and 3 graduate students outside of the home department. Also, findings were discussed with internal representatives (both faculty and students) at the choosing of each of the involved authors. These individuals were asked to identify potential areas of concern, misunderstanding, power dynamic imbalances, and bias. The recommendations were synthesized and used as talking points for the next round of critical conversations. Individuals were asked if they wished to be acknowledged, anonymized, or not mentioned; each provided a different response (see Acknowledgement section).

From the recommendations provided by the internal and external representatives, it was deemed that the interview questions needed to be refined to include a more epistemological perspective. The research questions and accompanying interview protocols were refined once more and the process was repeated. The second round revealed more robust evidence for reliable and valid (content) questions and processes following Table 1. As a result, the second round of interview questions was used and the resulting codebook, categorization, and theming were conducted as described in other publications [38], [45]. Also, in all areas where points of contention arose, we documented it, along with its resolution strategies for consensus. The latter became the primary source of data for this paper.

Research Quality and Verification Critical Considerations

Throughout the entire process, the Q3 research quality for qualitative research framework [37] and Morse's verification of reliability and validity for qualitative research [44] were used and discussed extensively amongst the first three authors and corroborated by the remaining three authors. Q3 quality is a "process-oriented model that maps five fundamental validation constructs and the notion of process reliability across the progression of a qualitative inquiry" [43, p. 200] while verification "is the process of checking, confirming, making sure, and being certain" [44, p. 17]. A summary of the quality and verification metrics used is summarized in Table 1.

Table 1. Summary of quality and verification metrics collected and critically adapted for this study

Aim	Strategy	Original Description	Critical Adaptation to Study Context
Q3 Quality	Theoretical Validation	Considers the "fit between the social reality under investigation and theory generated" [43, p. 401].	[…] the fit between the ***contexts and realities of the participants' lived and social*** realities and ***the historical, political, economic, and other systemic theories generated for action*** [13]-[19], [21], [24], [28], [31], [32], [35].
	Communicative Validation	Considers the "integrity of the interlocking processes of social construction with the relevant communication communities" [43, p. 401].	[…] relevant communication communities ***with a cultural awareness and curiosity to deeply learn the contexts the communication derives from*** [46]
	Pragmatic Validation	Considers the " compatibility of theoretical constructs with empirical reality" [43, p. 401]	[…] theoretical constructs ***with the empirical, historical, social, cultural, political realities of participants for social action*** [14]
	Ethical Validation	Concerns the "aspects of integrity and responsibility throughout the research process" [43, p. 401]	[…] integrity, ***bias, power dynamics, and responsibility*** throughout the entire research process ***every step of the way*** [14].
	Process Reliability	Involves the "mitigation of random influences on the research process" [43, p. 401]	[…] random influences ***and the accountability of such*** **on the research process** ***every step of the way*** [14].
Verification*	Methodological Coherence	A continual, iterative verification process to ensure that the research question, data, analysis, goals, and methods are congruent throughout the research process [44]. Thus, "methodological coherence does not exist when generic qualitative inquiry is conducted […] investigator limits analysis to themeing or categorizing), or when the researcher violates the method, they purport to use" [44, p. 20].	[…] systemically considers **the** ***macro to micro perspectives*** [13] ***and centers participants in the entire research process*** [14]. ***This will ensure both methodological coherence and participant authentic alignment and centering in said methodology*** [14], *[15], [34]* ***so that social action is truly impactful*** [14].
	Sample Appropriateness	Consists of participants who best represent or have knowledge of the research topic to saturate the data. Seeking alternate participants is essential to ensure validity by indicating aspects of the developing analysis less than obvious [44]. Thus, "one of the most common mistakes is […] investigators saturate their participants (that is, repeatedly interviewing the same participants until nothing new emerges) rather than saturating data (that is, continuing bringing new participants into the study until the data set is complete and data replicates)" [44, p. 20].	[…] participants ***whose intersecting identities are centered and intentionally increased in representation to have knowledge of the research topic to saturate the data, with a mindfulness towards avoiding simplistic Whiteness*** [15], ***treating, or viewing participants as Monolithic*** [15], [33], [41].
	Data Collection Concurrency	Process of collecting and analyzing data concurrently to attain a "mutual interaction between what is known and what one needs to know. This pacing and the iterative interaction between data and analysis is the essence of attaining reliability and validity." [44, p. 18]	[…] concurrently ***with participants in an anti-deficit manner*** [13], [14] to attain a mutual interaction […] and ***the social actions to take*** [14].
	Theoretical Thinking & Development	Thinking theoretically requires macro-to-micro views continually being careful to not make cognitive leaps, constantly (re)-checking […], building a solid foundation of […] outcome of the research process, rather than […] as a fixed framework [44].	[…] (re)-checking and rechecking ***with participants*****,** and building […] ***and aimed for social action*** [14].

**Note: While we acknowledge procedural validation from the Q3 framework [43], Morse et al., verification strategies [44] provide a mechanism by which tenets of pro-Black engineering education research can be systematically embedded so that we "eschew conventional research methods in favor of democratizing the research process and affirming the intelligence of research participants in pursuit of transformative exploration" [14, p. 631] while centering the participants throughout [34].*

Results and Discussion:

For this section, as indicated earlier, we will focus on salient topics discussed during the research process that arose between the faculty advisor and graduate students as they discussed studying the mentoring relationships of Black faculty mentors and Black Ph.D. mentees in engineering. This process ascribed to the 11 rules mentioned earlier in Methods and was informed by Villanueva Alarcón et al., hidden curriculum pathways work [6],[34],[35],[49],[50]-[52] to guide how both parties internalized awareness, ignite personal motivations, and perceived action.

While not explicitly written in the topics below, the authors suggest including *for Mentoring Relationships from a Pro-Black Engineering Education Research Approach"* after each topic title as these present opportunities for new research areas unknown in this scholarly space.

Topic 1: Hidden expectations about roles and responsibilities

During the research process, there were a lot of conversations on the roles and expectations of a mentor and a mentee, and more specifically on professional and personal boundaries in a mentoring relationship. A consensus was created when both parties agreed on the need for an expectation meeting that included this talking point during a graduate student's onboarding.

> *"A faculty advisor's role is to provide support, direction, and constructive criticism to help guide the student's development as a scholar."* Graduate Student 1

> *"I look at my advisor as a guide that will help me through the PhD process […] it is reassuring when your advisor is understanding, supportive, and empathic towards you and any challenges that you might encounter. […] As a student, I should feel free to discuss my research, courses, academic progress, professional development, and career aspirations with my advisor. Personal issues are allowable if they are impacting work, but the primary focus is usually on academic matters."* Graduate Student 2

> *" […] I think a Ph.D. advisor and their student may need to discuss what personal or professional boundaries they do not wish to discuss since everyone's line is different. For example, when do you cross the line, and when do you not cross the line?"* Faculty Advisor

Although not written, several conversations arose that transcended the micro-to-macro perspectives of mentoring [13]. For example, a great deal of discussions centered on the role of the graduate student in the mentoring relationship. This point led to a series of conversations about the grant-writing business, the purpose of graduate student hire for grants, what institutions expect of research, and the realities of what a student can and cannot pursue aligned to their research interests. It was clear from the conversations that there is a systemic disconnect between what mesosystems like colleges of engineering communicate to graduate students during onboarding and what they learn with a faculty member in the mentoring relationship.

> *"I attended the orientation for incoming Ph.D. students and there was very minimal importance placed by the college of engineering to have a good mentoring relationship. It was mentioned in passing that if you encounter roadblocks with your advisor that you should sit down and have a conversation with them. If the conversation does not lead to any solutions, then the student should reach out to the advisor and try again, indefinitely. They provided no mechanism to improve or build a quality mentoring relationship with your advisor. It was shocking because talking to students in peers in STEM departments, mentoring relationships with their advisors do have some turbulence but there is not mechanism at the college level to aid in that."* Graduate Student 2

The conversation then springboarded on the spectrum of available resources, affordances, and support for Black and Brown international graduate students and how issues of race and gender have been experienced across different levels of the colorism scale [53].

Topic 2: The need to explore unintended impacts of coercion in the process of research

During the early stages of the research process, transcriptions were critically verified for sources of bias, power, coercion, and other similar factors. Upon the review process from one of the external faculty and graduate student members, it became clear that one of the graduate students wrote the transcripts with great reservation. It was evident that the students felt the need to 'please their advisor' by writing what they considered would be approved by the advisor. This type of social desirability bias and perceived coercion became a point of lengthy discussion amongst the research team.

Among further exploration, and with permission from the graduate student, we uncovered that the student had experienced a difficult previous mentoring relationship during their master's degree in their prior home institution. The student explained how both culturally and professionally, there was an expectation of a graduate student being a 'peon' of sorts and that any voice, idea, or communication from the student was discouraged.

The conversation resulted in an exploration of the previous and current mentoring experiences and a discussion amongst the research team on the importance of disengaging from prior mentoring traumas through mental, emotional, physical, and spiritual healing. The graduate student felt at ease and indicated feeling supported by this new mentoring relationship and team.

Topic 3: The need to explore past, mentoring traumas

We deemed it important to continue the conversation stemming from topic 2 to focus on mentoring traumas, particularly for Black and other underserved communities in engineering. Academic bullying, hazing, toxicity, and other forms of harmful working conditions has been reported in the literature and among national reports [20], [21]. However, what is less understood are the types of experiences and the sensorial triggers to these experiences to uncover what are the outcomes and impacts of said mentoring approaches.

During the research process, two stories were shared: one of a graduate student and one from the faculty advisor. Both involved different types of trauma triggers, and both meaningfully shaped the experiences with mentoring thereafter. For the graduate student, the incident involved mental, physical, and emotional harm whereas for the faculty advisor, it involved mental and emotional aspects. For both, a healing process and a safe space had to be created for everyone to be in a position to trust another mentor/mentee again. In respect of the graduate student's wishes, only the faculty story will be shared:

> *"Mentoring for me had to be in the forefront […] my first Ph.D. mentoring experience ended up not being the best experience. Not necessarily because I was not committed to the mentoring relationship, but because the student was not. That led me to reflect on what mentoring means. It just so happened I was recruiting my second Ph.D. student at the time. They had just come out of a very difficult mentoring relationship with a previous advisor. Both of us were very hurt, scared, and confused. We weren't sure if this new mentoring relationship we were forming would hurt us more in the long run. So, we had a critical conversation and discussed what mentoring meant to us. We decided to work on a paper on mentoring. This led to many projects on mentoring throughout my career and continues to be part of my work today."* *Faculty Advisor*

Implications and Next Steps:

There are many implications for this work but the main takeaways for this paper are:

- We need more pro-Black and micro-to-macro focused engineering education research, especially in the domains that impact student wellness and success;
- We need more critical conversations and studies that hold accountable not just the findings but the process of research too;
- Moving the needle is uncomfortable but necessary to move past conflicts and achieve consensus between a faculty advisor and graduate student mentoring relationship.

The intended next steps for this work involve flipping the narrative backward and rotating the roles of the authors of this paper to uncover intersectional elements of race and ethnic backgrounds in a mentoring relationship, a deeper exploration of faculty advisor perspectives of mentoring Black Ph.D. students, and a better understanding of the mentoring experiences of Black and Brown, U.S. born and non-U.S. born graduate students.

Limitations:

There are a few limitations in the study. The first one is self-selection. All authors who engaged in the process willingly participated in the critical conversation. This may not be the case in all scenarios based on an individual's disposition towards being conflict-averse or not. The second limitation is the nature of the existing mentoring relationship. The first three authors that engaged in this process have a respectful and positive relationship. Not all research groups operate in this manner, nor have the same level of trust built. The third limitation is the small sample size which limits its transferability. However, the researchers hope to introduce a participatory, collaborative process tested on themselves first to showcase what can be possible with a STEM-ME and pro-Black approach [13], [14], from a hidden curriculum lens [6],[34],[35],[49],[50]-[52]. Finally, as Morse and colleagues states [44], "Verification strategies may be problematic in pilot studies where data are thin. Recall, however, that the purpose of pilot studies, if used in qualitative inquiry, is to refine data collection strategies rather than to formulate an analytic scheme or develop theory" [44, p. 20]. We contend that this refinement process is necessary to study and hold accountable, especially when centering the lived realities and experiences [34] of Black and other underserved graduate students, and engineering.

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); NG (conceptualization, visualization, validation, data curation, writing-reviewing and editing); IV (conceptualization, methodology, visualization, validation, data curation, formal analysis, 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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