

Article

“They Don’t Really Care”: STEM Doctoral Students’ Unsupportive Interactions with Faculty and Institutions

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Abstract: Increasing the representation of racially minoritized groups and women in STEM graduate education is insufficient to make STEM fields and academia inclusive and equitable spaces, where all feel supported and thrive. This study was motivated by a phenomenological examination of support for graduate students, focusing on programs that admitted and graduated higher proportions of underrepresented students than their fields. We used negative case analysis to document the interplay of interpersonal and institutional interactions that define what racially/gender minoritized students experience as unsupportive. Guided by an intersectional interpretation of structuration, we uncovered three mechanisms—withholding support, doing racialized and/or gendered harm, and neglecting to take action when students faced known threats/harm—that underlie the unsupportive experiences faced by graduate students of color and women in STEM doctoral education. This typology of unsupportive mechanisms, alongside an understanding of positive types of support, can help practitioners and scholars rethink what constitutes support, moving toward creating equitable and inclusive graduate education.

Keywords: STEM cultures; doctoral education; support; negative case analysis; intersectionality



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1. Introduction

“You know somebody probably just got permission to look at these folders and let some of us in, but they don’t really care about how we’re going to do in the program. They don’t really care about helping us become the best scholars that we can. It is just, you know, sink or swim.”

These comments from Ana, a Latina doctoral student in a leading civil engineering program, speak to a common experience of racially and/or gender minoritized students in STEM disciplines: feeling unsupported. STEM doctoral programs enroll women and Black, Latine, and Native American students at rates far below their proportions of the United States population. Of the total STEM doctorates awarded in 2019, white women earned 25.6% and men 45.3%, Latine women earned 3.1% and men 4.4%, Black women earned 2% and men 2.4%, and Native American women and men each earned 0.2% [1]. Persistent underrepresentation of racially minoritized students, in particular, supports the primary proposition of critical race theory (CRT) in education, that race is an enduring determinant of inequity in US education systems [2]. Moreover, intersectionality, a theory embraced as a tenet of CRT, holds that systems of oppression, specifically but not exclusively ones based on race and gender, operate in conjunction, shaping graduate educational outcomes and experiences [3,4]. This theory highlights that women of color at the intersection of interdependent systems of oppression may be erased or expected to choose between alliances when considering racial or gender dynamics alone, putting them in a double bind [5]. Taking up this cause, Malcom and Malcom [6] (p. 163) note that the challenges faced by women of color in STEM graduate education have evolved from predominantly

“rights versus wrongs” toward “support versus neglect” and “the responsibilities and action (or inaction) of institutions”. Research and national reports recognize that the unsupportive, “sink or swim” culture of STEM disciplines that Ana noted is also a barrier to equity and inclusion in STEM graduate education [7–9].

Perceived faculty support in STEM cultures has significant implications for doctoral student mental health and degree completion [7]. The perceived quality of faculty–student interactions is the single strongest predictor of PhD completion for doctoral students [10]. A recent National Academies of Science, Engineering, and Medicine report, therefore, urges creating more supportive disciplinary and departmental cultures as a priority for improving and broadening participation in STEM [9]. Researchers have begun examining the interactions that students construct as supportive, but more work is needed to understand how to help graduate students to not only survive, but thrive; or, as Ana put it, “helping us become the best scholars we can”.

This paper is part of a larger comparative case study of four PhD programs where Black, Latine, Native American, and/or women students enrolled and completed STEM PhDs at rates significantly higher than their fields. The larger study illuminated that support within these compositionally diverse contexts had academic, psychosocial, and sociocultural dimensions [11]. However, faculty support was uneven, and one department had poor climate for racially minoritized students [12]. This contrast motivated us to systematically analyze students’ narratives about what it meant to be *unsupported*. This paper reports findings from our negative case analysis (NCA).

In qualitative research, NCA is the systematic exercise of identifying and understanding negative (or counter) examples of a phenomenon to strengthen a study and expose potential opportunities for theory development [13]. We contribute to theory about support with a fuller conceptualization of its opposite—unsupportive experiences—as interconnected, multidimensional phenomena. We also clarify directions for organizational growth that may be needed even in departments with improved compositional diversity. Analyzing student experiences with being unsupported in relatively diverse contexts, highlights equity gaps and paths to improving compositional diversity *and* the thriving of Black, Latine, Native American, and women students.

1.1. Racialized and/or Gendered Interactions in Graduate Education and STEM Cultures

Faculty–student interactions are central to academic socialization, and help (re)produce disciplines and doctoral education as institutions [14–16]. A seminal paper by Margolis and Romero [14] reported a qualitative study of 26 women of color doctoral students that examined how the “hidden curriculum” of doctoral education—essential but unspoken knowledge about what has value within a field—is a socialization tool that reproduces race, class, and gender inequality in sociology. Several elements of the hidden curriculum they discussed focused on what is absent or interactions that do *not* occur. Women of color were subtly excluded from prestigious opportunities, for example, and students interested in research on race or gender were marginalized or excluded [14]. More recent scholarship continues to document that adverse interactions with faculty limit women’s access to resources necessary for career advancement in STEM [17].

Research documenting the pervasiveness of graduate student experiences with everyday racism suggests that it may be endemic to the culture of doctoral education. Through a critical race analysis, Gildersleeve et al. [18] explored how experiences with racialized incidents from 22 graduate students, mostly in education programs, evoked a common narrative among students, captured by the question, “Am I going crazy?!” The authors argue this narrative “represents the tentativeness, insecurity, and doubt that can be projected onto doctoral students of color. It also represents the active engagement with struggle and resiliency” [18] (p. 100). Another qualitative study of doctoral students of color, with a larger sample and more disciplinary variation, documented that even vicarious experiences with racism can cause “negative emotional and psychological reactions” as well as the realization of racism as “normal” in graduate education [19] (p. 233). Graduate students

from various disciplines have to divert energy from thriving in their educational pursuits to survival strategies in order to manage negative experiences related to their identities [15]. For example, women in biological sciences may strategically select lab rotations as a way to avoid hostile working conditions, prioritizing this need over identifying the best fit for their scholarly interests [16].

Without awareness of how everyday interactions may reproduce racism and patriarchy in STEM culture, faculty in these fields may overlook or deny their role in perpetuating systemic inequities. Through a historical structural analysis, McGee [8] argues that “racism operates in the experiences, ideologies, practices, and policies of STEM” higher education (533). Despite this context, scientists see their work defined by objective methods and the application of inherent talent and devotion [20]; therefore, they may be less attuned to the social dynamics of their work, including stereotypes and practices that negatively affect equitable access, advancement, and belonging [7,21]. Yet, Black students in STEM routinely “experience interactions with both faculty and peers that are based on racial stereotypes” [22] (p. 10). Research has revealed the social isolation that Black men and women graduate students in STEM face, such as through exclusion from study groups, that can create barriers to persistence [23,24]. In addition, gender bias and disparities are actually more common in disciplines that think of their work as objective [25]. A study with women graduates of biomedical doctoral programs found that faculty interactions in graduate school led them to conclude that their values as women conflicted with academic norms [17]. Cultural beliefs in STEM are, therefore, consequential not only for how everyday interactions play out, but also how STEM identities develop and how field-wide inequities persist or change.

In scientific disciplines where research occurs in the field or behind the closed doors of labs, weak accountability creates conditions in which gender-based harassment and assault go unchecked [7,9,26]. A study of 28 women in physical science and engineering doctoral programs found graduate education to be dominated by a ‘masculine culture’ that alienates women through tokenization, aggressive communication, emphasis on competition over collaboration, and overt sexism and sexual harassment [27]. Combined with concerns about work–life balance, these interactions may have contributed to more than a third of participants changing their career plans over the seven-month period of the study [27].

A major component of faculty–student interactions in graduate education comes through formal and informal faculty mentorship. Graduate students of color and graduate women of color, in particular, find it difficult to obtain high-quality mentoring relationships due, in part, to severe under-representation of racially and/or gender-minoritized faculty [28]. For instance, in a study of eight African American women graduate students across a variety of disciplines, the shared experiences and understandings available in race and gender matched mentoring allowed for the development of trusting personal relationships that helped them navigate academia [29]. Such broad-ranging and deeply supportive relationships have been connected to “othermothering” traditions within the African American community [30], providing insight into the complex social exchanges that can occur within the graduate education mentor–mentee relationships of Black professors and Black doctoral students [31]. These studies and other research also document the importance of building trust as part of supportive faculty–graduate-student interactions, including some that involve the intricacies of cross-racial relationships [32]. When interactions acknowledge racism and sexism and normalize struggle as part of academic life, for example, they can empower graduate students to attribute the challenges they face to deficiencies in STEM doctoral education rather than to personal shortcomings [11]. High-quality faculty mentoring can also support Black doctoral students’ academic career aspirations, reduce stereotype threat, and enable them to navigate conflicts between personal and professional norms [33].

To summarize, racialized or gendered interactions within faculty–student relationships have received increasing attention over the past decade, but few studies specifically focus on the context of graduate education [12,34,35]. Persistent marginalization of women

of color in STEM has led scholars to call for empirical studies that interrogate institutional environments and faculty–student relationships [36,37]. Our work helps respond to these needs.

1.2. Theoretical Framework: Intersectional Structuration

We conceptualize unsupportive faculty, student, and institutional interactions in graduate school through an intersectional interpretation of Anthony Giddens' [38,39] theory of structuration. This framework broadens the conversation about support in doctoral education, proposing that racialized and gendered interactions may not be limited to dyadic faculty–student relationships, but also include interactions with doctoral programs and the broader institution of doctoral education. Intersectionality complements structuration because, although issues around diversity and inclusion are growing concerns in higher education, analyses have been limited by a tendency to focus on race, gender, or other unitary categories of social stratification in isolation [40]. We combine theoretical insights from intersectionality and structuration to analyze experiences with doctoral faculty and programs that make racially and/or gender minoritized graduate students feel unsupported.

Structuration emphasizes individual interactions as a basis for the interplay of systemic and agentic social activity [38]. Giddens argues, “structure only exists in and through the activities of human agents” [39] (p. 256). According to his approach, structure is both a medium for and an outcome of patterned social actions, which constrain and enable subsequent actions. Giddens defines agency as the ability to choose among actions, including inaction, regardless of any possible outcomes. The duality of structure (i.e., its capacity to both constrain and facilitate agency) allows for the fact that individuals may also create new shared meanings through their interactions [38].

One critique of structuration is that it presupposes a “disembedded and dehistoricized individual” agent in a placeless and timeless structure, unencumbered by constructions of race and gender [41] (p. 146). Intersectionality theory augments structuration by stipulating that multiple power dynamics operate in conjunction through individual and institutional interactions among differently positioned actors [5]. Intersectionality is a theoretical and political project “to bring the often hidden dynamics at the intersections of race, gender, and other social constructions] forward in order to transform them” [42] (p. 312). For example, it recognizes that faculty and graduate students are temporally and spatially embedded in historical contexts dominated by anti-Blackness and cisheteropatriarchy, and that this embeddedness affects their interactions [43]. We propose that exploring the deeply embedded experiences of systemic racism and cisheteropatriarchy in STEM doctoral education creates potential to interfere with these systems in transformative ways.

Our intersectional interpretation of structuration examines the racialized and gendered implications of unsupportive interactions of students with faculty, with graduate programs as organizations, and with graduate education as an institution. Individual faculty–student and institution–student interactions occur within existing rules, standard practices, and resources that collectively normalize certain patterns of behavior, creating what we recognize as culture. Microaggressions and norms that privilege whiteness and cisheteropatriarchy are so common in the STEM education, for instance, that people come to associate them with the disciplinary cultures of science [44]. Organizational norms and policies, therefore, can be thought of as tools that may shape tendencies toward or against racial and gender equity in student interactions with faculty and their programs. In organizations that require training in cross-racial and cross-gender mentoring for new faculty, for example, one can anticipate that faculty are more likely to bring knowledge and skill to interactions with minoritized students. Similarly, patterns in the everyday interactions among faculty, students, and their programs normalize practices and can influence organizational policies and culture. An intersectional structuration framework dispels the notion that racially and/or gender biased interactions are isolated incidents meaningful only to individuals; instead, they help constitute the institutions of STEM and doctoral education, regardless of their compositional diversity. Guided by this framework,

our research sought to understand mechanisms that underlie unsupportive interactions in STEM graduate education.

2. Methods

Our data are from a multi-institutional comparative case study of four selective STEM PhD programs at public research universities that enroll and graduate larger proportions of women and students of color than their disciplinary averages. The larger project goal was to uncover how these PhD programs reached levels of diversity others struggle to achieve. We sampled public research universities in states with affirmative action bans to highlight strategies for increasing the enrollment of minoritized students that would be available regardless of the status of race-conscious admissions. The role of support emerged as a critical condition of program cultures and student experiences. Phenomenology, the examination of individual experiences with a given phenomenon to understand its essence and variation across cases, guided our conceptualization of support [45]. The ethnomethodological tradition analyzes how the meanings of constructs (e.g., support) are not singular or fixed, but co-created through interactions, which are shaped by the sociocultural dynamics of a given social context [45,46]. This approach was well suited to examine how (1) faculty-student interactions in compositionally diverse STEM PhD programs may be related to the program's power dynamics, policies, practices, and disciplinary culture(s), and (2) how student experiences with support are best understood in the light of both individual and institutional interactions. That larger study provides the foundation for this paper.

About two-thirds of the student participants in our sample, including all the Black and Latine participants, described salient *unsupportive* experiences. This striking finding compelled us to undertake this NCA examining individual and institutional interactions [13]. NCA systematically examines data that does not conform to the primary narrative uncovered by a study [13], which makes it useful for developing theory to explain the exposed gap. While the larger study revealed dimensions of support in graduate education [11], a smaller but important portion of data revealed a secondary story of unsupportive experiences. Making sense of the gap between the expectation of support in these diverse programs and the reality of unsupportive experiences contributes to our goal of helping PhD programs become not only more diverse, but also more equitable and inclusive.

2.1. Data

Data are from four STEM PhD programs in two US universities, one located in the Midwest and the other on the West Coast. Chemistry and psychology programs were selected to represent pure disciplines, and applied physics and civil and environmental engineering to represent applied disciplines. The broader project included individual interviews and focus groups with faculty, staff, and students. Department personnel recommended the 29 student participants based on involvement with department diversity, equity, and inclusion efforts, a pertinent element of the larger study. This paper centers data from the 23 individual interviews conducted with 17 students (focus group data were not included because transcripts did not code individual speakers, which would have been necessary for intersectional analysis). As Table 1 below shows, the sample includes two Black women, two Black men, three Latina women, seven white women, two white men, and one woman who did not identify her race.

Interview data were collected by a racially/ethnically diverse research group in two cycles, one year apart. Student interview protocols in year one covered wellbeing, sources of support, mentoring, perceptions of climate, perceptions of competitiveness within the program, and strategies for coping with experiences of sexism and racism in graduate school. One- to two-hour follow-up interviews probed deeper into student experiences with their faculty and programs over time, as well as unsupportive experiences that surfaced in initial interviews.

Table 1. Participant Disciplines and Demographics ($n = 17$).

Discipline	Pseudonym	Self-Identified Race	Self-Identified Gender
Applied Physics	Jasmine	Black	Woman
	Damian	Black	Man
	Grace	white	Woman
	Jennifer	white	Woman
	Josh	white	Man
	Mary	unidentified	Woman
Civil and Environmental Engineering	Elena	Latina	Woman
	Diane	white	Woman
	Claudette	white	Woman
Chemistry	Campbell	white	Woman
	Valerie	white	Woman
	Jason	white	Man
Psychology	Danielle	Black	Woman
	Terry	Black	Man
	Andrea	Latina	Woman
	Ana	Latina	Woman
	Courtney	white	Woman

2.2. Data Analysis

In the findings below, we present data specifically about feeling unsupported that represents experiences from about 70% of the students sampled, including all the men and women of color. Mary and four white participants—Grace, Jennifer, Diane, and Jason—did not express or describe feeling unsupported by faculty or their programs.

Within the data initially coded “lack of support”, we applied the constant comparative method’s open and axial coding [47]. We analyzed interview transcripts inductively to identify types of interactions (e.g., no academic support, absentee advisor, or lacking validation) in which students felt unsupported and circumstances that framed those experiences. In a second round of analysis, we combined codes related by mechanisms (e.g., withholding support), which led to the three major themes presented in the findings. Finally, reflecting on these themes through the intersectional structuration framework allowed us to identify racialized and/or gendered interaction patterns across themes. The framework also attuned us to relationships between individual and institutional levels of analysis within the themes.

2.3. Trustworthiness and Researcher Positionality

We sought trustworthiness through strategies that included collecting and triangulating multiple forms of data from interviews, focus groups, and documents; diverse sampling; data collection at multiple time points; and intercoder reliability checks in data analysis. The researchers—white, Black, and Latina, all women—who collected data engaged in structured and unstructured reflections during interview debriefings and team meetings about our positionalities in relation to interview dynamics and the data yielded. We drew on our shared (e.g., women in social sciences with many years studying STEM contexts) and distinct (e.g., Latina and white) positionalities to challenge and corroborate each other’s interpretations of the data, another mode of rigor and trustworthiness. The first author developed the theoretical framing and led analysis, with minor contributions to data collection. The second author developed the larger study from which this paper is drawn, contributed to data collection, and supported analysis. We acknowledge the emotional labor that this paper, born out of racially and/or gender minoritized graduate students’ unsupportive experiences, required of both participants and researchers. We hope our work honors this labor by eliciting positive action to create more intersectionally equitable institutions of doctoral education, science, and academia.

2.4. Limitations

This study has two noteworthy limitations. First, although intersectionality guided analysis of the data, it was not a guiding framework in the site and participant selection, nor in the data collection of the larger study. Our sampling frame and interview protocols might well have yielded more data about marginalizing experiences if intersectionality had been part of the original formulation of the study. Relatedly, although our sample of students is diverse, it does not include students who identify as Native American or gender non-binary. Therefore, participants do not represent the full spectrum of students whose support, or lack thereof, goes under acknowledged. Still, the practical significance of our study provides future scholars and practitioners with tools to examine how (un)supportive mechanisms in both interpersonal interactions, as well as via institutional practices and policies, may unfold for other populations.

3. Findings: Withholding Support, Harmful Conduct, and Neglecting to Act

Across the four PhD programs in this sample, three mechanisms underpin how students' felt unsupported in their interactions with faculty and their programs: withholding support, racialized and/or gendered harmful conduct, and neglecting to act when students faced specific threats or harm. Below, we illustrate these mechanisms in student experiences, revealing that even in STEM PhD programs with improved compositional diversity, complacency and complicity are commonplace, which students like Ana perceive as: "They don't really care".

3.1. "Sink or Swim": Withholding Support

The most common theme in the data involved students feeling left to "sink or swim" in their graduate education without sufficient support. The absence of support was revealed most saliently by student experiences with faculty withholding advice/mentorship, academic support, and validation—all of which the larger study revealed as critical components of support [11]. These individual experiences of withholding support contribute to the broader structuration of individualism in STEM culture. While the culture of individualism prevalent in STEM can negatively affect anyone, it may be especially challenging for students from backgrounds that include a marginalized race, gender, or status as a first-generation college student.

3.1.1. Insufficient Advising and Academic Support

Students frequently expressed a need for clarity about faculty expectations and advice, and they could flounder without adequate advising or academic support. Valerie, a white woman, plainly stated, "knowing that you are doing exactly what is expected of you, I think provides support. I mean I would want that. And my advisor doesn't really give clear expectations". Valerie explicitly names transparency in faculty expectations as a form of support. Campbell, another white woman, relayed that her advisor refused to provide support: "Through some of the early years I learned fairly quickly that his response would be like, 'I already have my PhD. Figure it out'". Frustrated by this refusal from her advisor, Campbell wondered aloud: "If I'm not going to get support from anybody, what is the point of being here?" Such advising absences were common and could alienate students to the point of considering withdrawal.

Students also had to contend with not receiving academic support. Josh, a white man, described prior experiences where asking questions about things that one did not understand was respected, and was surprised to discover a different norm with faculty in his program:

I went to [a professor's] office many times to discuss things with him. And towards the end of the semester, he ended up suggesting that I drop the class. I think everyone else in the class knew: don't stand up and ask questions.

When Josh's professor proposed dropping the class, Josh felt his learning strategy was unsupported. Additionally, Andrea, a Latina, recounted struggling through a course on her own despite making requests for additional support: "They should have offered some tutoring support, like not specifically to me but just have this as an option. This is known to be a course that gives some people trouble. They should anticipate that". Andrea and other students wanted support with known academic challenges to be made available without singling out students served or assuming the populations that might benefit, which risked perpetuating racist and patriarchal stereotypes. Whether through interactions with advisors or instructors, students from majority and minoritized backgrounds felt unsupported in STEM graduate education when desired forms of guidance denied or taken for weakness.

3.1.2. Students' Unmet Need for Validation

In addition, students described withholding support via a lack of validation due to limited or poor-quality interactions with faculty. For example, as a Black man, Terry expressed desire for recognition from the one Black man on faculty in his program: "I'm not necessarily being any nicer to you, but I do see you. You're not invisible to me". Terry's comments speak to a minimal need for validating recognition from, if not necessarily deep relationships with, faculty of color in order to feel supported. Similarly, Damian talked about the lack of same background role models as a factor in how one manages independence and support seeking:

You learn you have to be independent. But are you independent or are you trying to do this on your own because you don't see anyone around who looks like you that you think you can approach for help if you need it?

Damian's reflection reveals that working independently is not fully a choice for everyone in STEM programs due to the underrepresentation of Black scholars. After acknowledging the complexity of his situation, Damian lamented his limited options: "the fact that I don't see people who look like me that I can approach to ask; it is more skewed towards [that]". For Damian and many graduate students of color, a lack of faculty of color prevents them from experiencing validation from same background mentors.

Moreover, students of color expressed the need for validation from faculty of all backgrounds. Danielle, a Black woman, stated: "That is another issue that many students of color face. Maybe for other students, like, generally people are assuming they are competent. . . but for me I have to show and prove it". As an example, Danielle mentioned that a path in neuroscience was closed off to her because the white professor overseeing the lab specializing in the area did not respond to her inquiry to get involved. For Danielle, validation would take the form of responsiveness from faculty in one's department and consideration for research opportunities expected of STEM graduate students. Eventually, in hopes of gaining validation from faculty, Danielle spread herself thin starting new research projects. For Danielle, the need for faculty validation as a student of color was felt as an additional burden that she had to overcome to earn support, particularly from white faculty, that may be freely given to white students.

The mechanism of withholding support created difficult experiences for students, especially so for racially and/or gender minoritized students. Withholding mentorship and academic support led a few white students to feel unsupported generally. However, racially minoritized students who had similar experiences bore the additional labor of worrying about how their race may have played a role in their unsupportive interactions. This burden of disentangling racialized-gendered bias from unsupportive experiences was more complicated for women of color, whereas the gender bias in one white woman's unsupportive interactions was clear to understand. Also, Danielle and other students of color also desired the psychosocial support of validation, which may be particularly necessary in racially hostile program climates or STEM cultures. In all of these instances, doctoral students perceived STEM faculty as withholding the support they needed to do their best.

3.2. Harmful Conduct: Racialized and/or Gendered Microaggressions to Harassment

Beyond faculty withholding support, STEM graduate students in three of four programs reported harmful interactions with faculty and programs ranging from racialized and/or gendered microaggressions to sexual harassment. Unsurprisingly, students felt unsupported in these experiences of racialized and/or gendered harm. Our findings suggest that generally unsupportive and genuinely hostile climates are not only outcomes of accumulated racialized and/or gendered harmful interactions, but they also normalize negative interactions, fueling conditions that allow such interactions to occur.

3.2.1. Perpetuating Racism and Sexism

Microaggressions and other discriminatory interactions with faculty occurred in labs, offices, and other program settings. As is typical of many microaggressions, not all of these interactions were obviously racialized or gendered, nor clearly intentional. For example, during a lab, Terry's professor "almost yelled at me for doing a bad job", which stood out to him because, "I saw her deliver very similar content in a very different way to my [white] classmates". The effect of this demeaning interaction lingered for Terry who understood that he received differential treatment than his white peers. In addition to his own experiences, Terry recalled that, "somebody made some inappropriate comments to [a Black woman] about her hair". As he continued to talk about racialized and/or gendered microaggressions happening to others, he noted, "it is vicariously traumatic". Terry's experiences highlight the presence and impacts of both one-on-one instances of microaggressions, as well as racist incidents that occur in the larger program.

Faculty were not always so subtle with their comments. Courtney's first advisor, a man, maligned her undergraduate education: "My faculty mentor told me that he accepted me as his back-up student because he wasn't sure whether [Ivy-League admittees] would come and he just really needed a student". She added, "I never felt embarrassed about [attending a women's college] until he pointed it out and then chastised me for not being confident". Courtney felt unsupported by her advisor's open prejudice about women's colleges and his assumption that people who attend them are inferior. Relatedly, Jasmin shared an experience with her advisor, also a man, where she felt her hard work to master material was undermined. When Jasmin met with him to confirm her understanding, instead of supporting her efforts to learn, this advisor questioned whether she "really" understood what she was saying or "just" spoke from memory. Jasmine also noted this same advisor making racist remarks such as, "That's the problem with Black students; you guys get on fellowships and think you can stay here forever". For Black women like Jasmine, some harmful interactions, including the comment above, are clearly racialized, while others, such as questioning her comprehension, may be more difficult to identify as specifically racialized, gendered, or a form of both. Such ambiguity could create additional stress if Jasmine tried explaining why this comment was inappropriate to a program leader unfamiliar with intersectionality. Faculty doubting Courtney and Jasmine's abilities to do STEM graduate work, combined with disparaging remarks about women and Black students, reinforces racist/patriarchal marginalization that previous research has shown to threaten students' sense of belonging in STEM [21].

Sometimes department leaders and sponsored activities contributing to a negative racial climate that students found unsupportive. For example, Danielle declared that "the values of the majority of the faculty and the leaders, like the chair of the area, are anti-diversity", noting in particular that the chair made public remarks consistently over years that were "unrepentantly hostile". Other participants described instances in which programs alienated students of color through fumbled or inequitable attempts to promote diversity. Jasmine noted that her department used photographs of current students of color, including her, to promote a new bridge program before it launched. After being approached at a conference about this program in which she was not involved, Jasmine expressed concerns that the program was creating, "this perception that all the minority students in the program were now bridge students, and somehow they came in lacking". By

misappropriating photographs of doctoral students of color without their permission, the department promulgated misleading racialized representations that reinforced stereotypes, risked damaging Jasmin's reputation, and contributed to an unsupportive climate.

Women and men of color and white women described personal and indirect harms from their STEM programs' perpetuation of racism and patriarchy. These graduate programs, despite their compositional diversity, could be profoundly unsupportive environments for students understood to embody that diversity.

3.2.2. Sexual Harassment

In two of four programs, women participants disclosed that their advisors sexually harassed them behind closed lab doors. For reasons that may relate to physical, mental, emotional, and professional wellbeing, those who have experienced sexual harassment may be uncomfortable discussing it openly or confidentially on record; this was the case with all but one participant in our sample. Only one participant, Courtney, chose to discuss with us the details of her experiences with sexual harassment and navigating its aftermath. Therefore, both here and in the following section, we focus on her case. Although this approach does not capture the *extent* of harassment in these programs, it allows us to describe in detail the *complexity* of her tribulations as a function of both individual and institutional interactions.

Courtney connected her response to her advisor's harassment with their relationship's power dynamics: "In fact my old advisor, he sexually harassed me and that was part of why I didn't want to work with him anymore, but I was too afraid to leave for the consequences for my career". Under any circumstances, sexual harassment creates an unsafe environment for the survivor and others who may witness it or become additional targets. In addition, the power that Courtney's advisor held over her career imbued the relationship with fear—a far cry from support. The interpersonal interactions described above constitute a type of harmful conduct that clearly deserves special attention. And, through an intersectional structuration lens, sexual harassment is also an institutional problem that should be understood within the larger contexts of power dynamics, norms, and policy processes that allow such "incidents" to occur and persist. Inaction—both individual and institutional—is the third mechanism driving unsupportive experiences, for which we continue with Courtney's ordeal in seeking support as a survivor.

3.3. *Complicity and Complacency: The Core of Institutional Neglect and Inaction*

The third mechanism we found provoking unsupportive experiences was neglect, which vividly reflects the broader pattern of complacency in these STEM programs and may lead to complicity in student attrition. Our participants described faculty and programmatic inaction in the face of known threats to student wellbeing, especially involving sexual harassment and negative climates that contributed to student departure. Experiences of institutional complicity and neglect constrain student agency while also enabling harm to individuals and the broader community via vicarious experience and negative climates.

3.3.1. Institutional Complacency around Sexual Harassment

In addition to the actual experiences with sexual harassment that participants in our study disclosed, survivors felt unsupported by the institutional policies and practices for addressing harassment within their STEM programs. Courtney elaborated in a follow-up interview about weak institutional support when attempting to file a harassment complaint. In her first interview, which was closer to the time she reported these incidents, Courtney felt that her program provided sufficient support by helping her change advisors. However, Courtney later returned to her school's Title IX office out of concerns for her career, recalling, "Little did I know there is a 90-day period with which you have to file your sexual harassment claim from the date of the incident or you no longer have protection from the University". During the later interview, Courtney expressed disillusionment that administrators, including the department chair, head of graduate studies, and an administrator

in the Title IX office, did not have her best interests in mind when encouraging her not to file a formal complaint. “Who are we trying to make comfortable?” she asked upon reflection about disappointing experiences with the actions taken by various authorities. Her case demonstrates how a series of individual interactions, with an advisor and other institutional representatives, can become experienced as a weak system of support when one needs it the most.

The case is particularly telling because of the long-term perspective it provides. Even though program and university officials believed Courtney and took initial steps to address her concerns, administrators’ responses to the allegations of sexual harassment fell short with respect to communication of crucial policy information, which ultimately prevented her from filing a formal complaint. Sexual harassment in graduate education is a serious problem for academia as a community and individual actors to address. As Courtney’s story illustrates, how these issues are handled matters greatly for whether students who have endured such experiences feel supported, or not, in bringing them to a timely and empowering resolution. A program’s response to allegations of harm or concerns from students, whether about harassment or program climate, is a crucial element of institutional support that may have implications for wellbeing and retention as shown below.

3.3.2. Institutional Complicity in Negative Climates and Student Attrition

Some students identified their STEM programs as complicit in maintaining negative racial/gendered climates due to inaction when faced with known problems. Elena, a Latina, characterized her program and STEM more broadly as spaces where “[Race and racism] kind of permeates everywhere but there aren’t the tools to really discuss it; and you’re not allowed to discuss it”. She noted that the lack of permission and tools to discuss race and racism in STEM education left her feeling unsupported when racist incidents occurred. Relatedly, Courtney recounted how faculty failed to address graduate students making anti-Black statements during a program-sponsored event: “I think they’re just worried that, ‘if I say anything, it might also be racist’. Or, ‘If I don’t confront this perfectly, it will implicate me’. And somehow that outweighs the benefit of saying something and restoring the climate”. Both students described STEM environments where ignorance excused inaction instead of prompting the development of racial literacy. These and other students wanted faculty and departments to replace non-responsive aggrandizement of diversity with reflexive anti-racist actions.

Finally, participants discussed how inaction manifested in failures to retain racially minoritized students and those with chronic health issues. Jasmine stated, “in one particular year, that three Black [women] were pushed out of programs”. Jasmine recalled, “it was the lack of an advocate”, for one student who struggled with courses and finding a good lab fit; that, for another student, “reviews weren’t great” after she struggled with classes and a medical leave; and in the third case, that “the department put a few hurdles up” when she was trying to return from a leave. Jasmine’s comments suggest that the program consistently failing to support these Black women amounted to institutional neglect. The connections to mental health cannot be ignored, although it remains a largely taboo topic in academia and ableism is deeply engrained in STEM education as well [48,49]. For Jasmine and her peers, silence and inaction from faculty and programs around mental health and other chronic illnesses undermined students’ attempts to persist through such challenges.

Students felt unsupported when faculty and programs failed to address racially and gender biased incidents or support the retention of students they admitted. Students held faculty and programs responsible for contributing to a negative climate, in part because they allowed known climate issues to continue uninterrupted. In addition to withholding support and harmful actions, neglecting to acknowledge or disrupt harmful student experiences left students feeling unsupported.

4. Discussion

In this negative case analysis of support, we closely examined experiences of feeling unsupported among PhD students in STEM programs that had better than average compositional diversity. Participants who are racially/gender minoritized described interactions with individuals, especially advisors, and with institutional structures, such as PhD program practices or university policy. Feeling unsupported manifested through a range of interactions that can be categorized into three mechanisms: withholding support, doing harm, and failing to act. A lack of support through these mechanisms hold potential for adverse consequences in wellbeing, retention, and future student recruitment.

Connecting intersectionality and structuration in our analysis elicited findings that help complement the established literature on microaggressions [50] by attending to the significance of seemingly minor interactions. These perspectives capture the co-constitution of individual action, organizational norms and policy, and the larger interdependent social systems of racism and cisheteropatriarchy. This study is one of the first to center how interactions with graduate programs—not just the people within them—are consequential in graduate education. We found that students' interactions with individual faculty and graduate program environments, policies, and practices were interdependent, reinforcing or challenging one another. Everyday negatively racialized and/or gendered interactions in STEM doctoral education aggregate to create lived experiences of marginalization and understandings of STEM disciplines and academia as racist cisheteropatriarchal enterprises. Our data suggest that the specific needs of students dealing with mental health challenges should be considered in relation to ableist and other oppressive systems in an intersectional approach to support [9]. These experiences powerfully shape students' agency, motivation, and perceived future as emerging scientists.

Unsupportive interactions perpetuate STEM doctoral education as particularly harsh for students of color. Consistent with evidence from Margolis and Romero [14] about how silences or absences could shape the narratives of graduate education for women of color, we found students' silences analytically useful. Whereas a few white students, mostly women, shared experiences of being unsupported, all the men and women of color in our sample faced these challenges. The unsupportive individual and institutional interactions that we found were often racialized and/or gendered (e.g., microaggressions, sexual harassment, neglecting bias incidents) and more consistently affected men and women of color than their white peers.

Weak accountability structures, particularly regarding harassment, enable harm and uphold a culture of negligence within STEM graduate education. Adding to Garcia and Johnston-Guerrero [51], racially *and* gender biased incidents cause harm that is exacerbated when STEM faculty and program leaders fail to redress them through transparent and timely actions. Yet, absentee advising or program leadership coupled with demeaning, harassing behavior has, in some places, become legitimized as a necessary part of the STEM graduate school experience under discourses of "independence" or "rigor" [52]. In turn, institutional inactions (e.g., silence about the manifestations of racism) can enable and provide cover for harmful individual behaviors. Faculty clearly need to rethink current STEM norms around the provision of minimal academic and psychosocial support, and recognize the necessity of sociocultural support, as part of graduate education socialization.

4.1. Implications for Practice

By focusing narrowly on compositional diversity in STEM doctoral education, faculty and administrators make only superficial and unsustainable change, instead of the deep transformation of STEM culture that is needed. These changes begin with normalizing the expectation that STEM faculty develop equity-minded mentorship practices along with an understanding of intersectionality [53]. Professionals with this knowledge will likely be better equipped to create anti-oppressive cultures and support PhD students from historically marginalized backgrounds [54].

Negative case analysis surfaced important and challenging narratives surrounding the construct of support—an idea that generally has positive discursive connotations. This approach allowed us to document a range of unsupportive experiences. It also provided a window into how we might meaningfully enact systems where students conclude that faculty and graduate programs really do care. Our data make clear that support and care are more than individuals being nice. Support is creating infrastructure that enables safe passage to the PhD—reducing precarity and harm, while enhancing protections and resources. Our data suggest that support means having organizational structures in place that ensure accountability for harmful conduct, protections when students experience mistreatment, and mechanisms to scaffold re-entry following health leaves. For leaders, then, support means developing policy, practice, and courage to take corrective action when negative racialized and/or gendered incidents of many sorts occur. As the higher education sector isomorphically moves toward embracing the “happy talk” of diversity, inclusion, and representation, our research provides a fuller, more honest picture of how these rhetorical goals are experienced and might be more meaningfully pursued.

We also note hope for the future of STEM through the graduate students who called out their peers’ unsupportive experiences with racist cisheteropatriarchy (e.g., against a Black woman because of her hair) or disregarded racism (e.g., ignored anti-Black comments) even though they were not targets in these particular interactions. We urge STEM faculty and administrators to support their doctoral students, in part, by taking on this responsibility and reassessing their own and colleagues’ interactions with students. One promising practice involves equity pauses, wherein practitioners intentionally pause to reflect on how program policies and practices may create unintended absences of support, harm, or neglect that perpetuates institutional oppression [54].

In working towards intersectional equity with data-driven and mission-oriented intentionality [55], faculty and administrators need not only make top-down policy changes or engage with bottom-up advocacy. They should proactively reexamine the institution of graduate education, as it is (re)created moment-to-moment and from the inside out [7]. In some cases, this re-examination will require negotiation of cultural norms, such as bringing the scope of interactions faculty perceive as appropriate to their role into alignment with students’ need for validation. In other cases, the adequacy of reporting and accountability structures needs reassessment. For example, we advocate the development and enactment of policy that addresses equity from an intersectional perspective.

4.2. Implications for Research and Theory

We undertook this research to expand theory about graduate student support and inclusive STEM graduate education as an extension of research that found doctoral students in compositionally diverse STEM programs experience support through academic, psychosocial, and sociocultural dimensions [11]. Our findings about withholding support dovetail with programs not providing one or more of the previously identified dimensions of support, while the findings about doing harm and inaction extend our understanding of how one may fail to support students. Attention to inequitable access to STEM graduate education will not bring about long-term gains without concomitant attention to the culture of STEM graduate education, particularly the ways that the everyday interactions that constitute culture may be at odds with the needs of students from historically excluded groups [8,9,28].

Findings may be useful for future research, particularly the conclusion that individual and institutional behaviors are mutually reinforcing and that unsupportive experiences unfold in multiple ways. Withholding one or more dimensions of support, doing harm, and inactions at individual and institutional levels make up a typology of mechanisms that likely have theoretical generalizability beyond the participants and sites in our study. Although the specifics may vary, the unsupportive forms of interactions we identified are undoubtedly present throughout higher education. Scholars could use our conceptual mechanisms by which students experience being unsupported as a starting point to better

understand the impacts of practitioner practices or program policies and environments. Future scholarship on student support would also benefit from drawing on intersectionality in research design, informing site selection, sampling criteria, and data collection. Finally, researchers may also employ this study's insights about interdependence in individual and institutional interactions to illuminate the reproduction *and* transformation of STEM disciplines and departments via doctoral education.

5. Conclusions

While research on the nature of support elicited its academic, psychosocial, and sociocultural dimensions [11], this negative case analysis uncovered three mechanisms (i.e., doing nothing, doing harm, ignoring harm) whereby students were not provided these supports and worse. We also documented that the dimensions and mechanisms of support should be considered at interrelated individual and institutional levels. Our study improves understanding of the systemic, cultural, and institutional changes in STEM doctoral education that are necessary to improve student wellbeing and sustain equitable outcomes for women, Black, Latine, and Native American students. All STEM doctoral programs, including ones that are successful at recruiting and admitting racially/gender minoritized students, will benefit from developing the skills and knowledge of intersectional equity required to reform or develop policies, reinvent norms, and foster supportive environments accordingly.

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