

Article

Support without Status: Inequities in Student–Advisor Relational Dynamics between First-Generation and Continuing-Generation Doctoral Students

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Abstract: One of the most important developmental relationships in the doctoral student experience is that of the faculty advisor, and yet we know little about whether and how advisor relationships vary between first-generation and continuing-generation doctoral students. Drawing on qualitative interviews with 83 late-stage doctoral students in biological sciences, we explore differences in student perceptions of their relationships with advisors. Narratives reveal a continuum of relationship types, including strained, evolving, supportive, and equal. In equal relationships, doctoral students feel more like collegial partners working alongside their advisors. While continuing-generation and first-generation students are similarly represented among strained and evolving relationships, first-generation students rarely attain equal relationship status. The presented findings offer implications for understanding how inequality shapes student–advisor relationships, the role of collegiality in doctoral education’s hidden curriculum, and the supports needed to foster equity for first-generation students in graduate programs.

Keywords: first-generation students; doctoral education; STEM education; faculty advisor relationships; cultural capital; inequality



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1. Introduction

Extensive scholarship in higher education explores the experiences of first-generation college students. First-generation in this study refers to students who come from families where neither of their parents (or legal guardians) has completed a four-year college degree (for a discussion of definitions, see [1]). While a considerable amount of research has focused on the unique challenges encountered by first-generation students in undergraduate education [2,3], scholars have less often examined their experiences in graduate school. Given that a third of doctoral students in the U.S. are first-generation college students [4], understanding how they experience the structures of doctoral education can offer valuable insights for supporting their needs, ensuring their successful transition to professional careers, and creating the conditions for more equitable visions of graduate education.

Previous research on graduate education has revealed some of the barriers that first-generation doctoral students encounter in their pursuit of a PhD—including struggling to understand the ‘hidden curriculum’ of graduate school and faculty expectations, self-doubt and imposter syndrome, and social isolation [5–8]. While describing the general challenges experienced by first-generation doctoral students, few studies have more closely examined their specific experiences of core aspects of graduate student life (see a discussion in [9]). In particular, little is known about how first-generation doctoral students understand their relationships with faculty advisors, and how these perceptions may differ

from their continuing-generation peers. Faculty advisors are among the most important relationships that shape doctoral student socialization, identity development, and career preparation [10–12]. Faculty advisors play a particularly prominent role in science, technology, engineering, and mathematics (STEM) fields, where students work in lab settings and confront cultural environments where inequities may be amplified [13–15]. If doctoral students from first-generation families understand the role of their advisors differently, that would raise questions about the structural inequities that mediate the socialization process. Moreover, differences in relational dynamics could have implications for faculty, who may need to employ different mentoring strategies when advising students from first-generation and continuing-generation backgrounds.

The present study explores how first-generation and continuing-generation doctoral students in the biological sciences discuss their relational dynamics with faculty advisors in the later stages of their programs. As role models for how to successfully perform the work of scientific and scholarly practice, faculty advisors, who often serve as students' principal investigators (PIs), play a central role in mediating how doctoral students experience the professional practice of research [16,17], especially at the end of their programs when students are expected to transition from novices to independent scientists and scholars [18]. Doctoral students experience heightened levels of stress and anxiety in the later stages of their programs [19], and first-generation graduate students are particularly vulnerable to increased risks of attrition as they work to cross the finish line [20,21].

Drawing on interviews with 83 fifth-year doctoral students in biological sciences, we find that students characterize their relationships with advisors along a continuum including strained, evolving, supportive, and equal. First-generation and continuing-generation students share similar experiences in strained and evolving relationships. Among more positive relationships, there are nuanced yet important differences. First-generation students often had instrumentally supportive advisors who fulfilled their academic and professional needs, but they rarely built collegial relationships with their advisors. In contrast, a much higher proportion of continuing-generation students expressed growing collegiality and understood their advisors as collaborative partners who felt more like peers with equal status. The existence of relationships that doctoral students describe as equal is notable, and challenges typical conceptions of relational hierarchies and power imbalances that permeate the culture of academia. Furthermore, substantial under-representation of first-generation students with collegial relationships draws attention to more nuanced forms of inequality embedded in the social realities of graduate school's hidden curriculum.

2. Conceptual Framework and Literature Review

This study uses theories of social reproduction, specifically cultural capital and habitus [22,23], to understand the socialization experiences of first-generation students in doctoral education [12]. Socialization theory has been a predominant framework in studies of doctoral education, and especially in American educational contexts [24]. This lens is often used to explore how doctoral students navigate educational milestones and experience developmental transitions across the course of their studies [25]. While scholars of doctoral education have increasingly attended to race and gender inequities in student experiences and outcomes [26–28], they have less often considered first-generation background. Within the landscape of critical approaches to doctoral education, there are a few notable exceptions that have drawn on sociological frameworks to better understand the socialization experiences of first-generation and working-class doctoral students (e.g., [5,29,30]). Following and extending this work, we rely on Bourdieu's [22] concepts of cultural capital and habitus. Through this lens, doctoral education can be understood within a larger social context, one in which educational systems serve as engines of inequality that reinforce inequities in society [31,32].

2.1. Doctoral Socialization and the Role of Faculty Advisors

Scholars of higher education have often drawn on socialization frameworks to understand learning and development in doctoral education (e.g., [33,34]). As students proceed through the social structures of graduate school, they learn the skills, knowledge, attitudes, dispositions, and values of their chosen disciplinary community and field [35]. Doctoral education is a progressive developmental journey that cultivates personal transformation over time—from knowledge acquisition, investment, and involvement in the earlier stages of study, to identity transformation and new role commitment in the later program stages [12]. Thus, the later years of doctoral study are an especially important developmental phase, where student trainees begin to make the critical transition from novices to professional scientists [18,36].

In navigating the structures of graduate education, doctoral students participate in a constellation of relationships that facilitate learning and development [37], including interactions with peers, postdocs, professionals, and, in particular, experiences with professors in their field, including faculty advisors [38–40]. Faculty advisors are critical agents of socialization, and their relationships with doctoral students play a primary role in student development across the program timeline [10,11]. The nature of student–faculty relationships influences persistence decisions [41], skill building and career paths [42], and development as independent researchers [8].

While the developmental role of faculty advisors is prominent for all doctoral students, the STEM fields have specific characteristics that may amplify the importance of this relationship. Doctoral students in the lab sciences are often financially dependent on advisors and their professional activities are shaped by their advisor’s research projects and grants [14]. In addition, student trainees tend to work in very close proximity to their advisors within the physical space of the lab and must follow rigid time requirements—often spending considerable hours each day participating in the work of scientific practice alongside their advisors [16]. Thus, in the STEM fields, PhD students’ social and professional worlds are more closely tied to their advisors’ experiences and expectations.

In addition to the importance of faculty advisors, growing research examines the different types of relationships doctoral students have with their advisors, including how inequality mediates student experiences [26,27,43]. Faculty advisors serve in a wide range of developmental roles for their students, including mentors, mediators, supervisors, managers, and role models [44,45]. Beyond academic assistance, faculty advisors also provide psychosocial and emotional support, behavior modeling, and career sponsorship [46,47]. Doctoral students may have negative relationships with advisors who feel inaccessible, transactional, unhelpful, or uninterested [48]. Recent scholarship also describes the role of racialized experiences and sexism in shaping inequitable doctoral student advising, including differences in student perceptions of their advisors [49–51]. Noy and Ray [27] found that race and gender influenced how students understood their advisor’s role, revealing a spectrum of types including affective, instrumental, intellectual, available, respectful, and exploitative. Moreover, in a study of racially minoritized STEM doctoral student advising experiences, Griffin et al. [52] noted that students valued advisors who demonstrated personal care and relational support. Doctoral students’ perceptions of their advisors offer insights into social dynamics that have important consequences for their success, especially for marginalized students who may particularly benefit from closer relationships with faculty [13].

Less common, however, are studies that specifically examine first-generation college students pursuing graduate education [9], and especially their relationships with faculty advisors. While some recent work has problematized socialization models to better account for the structural conditions that shape the experiences of students from marginalized backgrounds (e.g., [30,47]), those frameworks do not adequately account for the unique challenges that first-generation college students may encounter. In order to understand the experiences of the students in this study, we complement socialization with a structural approach by relying on Bourdieu’s cultural tools: cultural capital and habitus.

2.2. Cultural Capital, Habitus, and First-Generation Students

Theories of social reproduction draw attention to the resources, in the form of capital, that provide access to educational institutions and foster success in navigating their requirements. According to Bourdieu, individuals cultivate economic, cultural, and social capital throughout the life course through previous experiences, family socialization, and community membership [22]. Capital is activated through one's habitus, or "web of perceptions about opportunities and the possible and appropriate responses in any situation" (ref. [53], p. 49). Habitus can be understood as the internalization of social structures that shapes attitudes, perceptions, and actions. An individual's habitus creates dispositions towards opportunities and relationships, which may be rewarded based on the larger social context, or field, in which the struggle for resources takes place [54]. In studies of educational systems, habitus has often been used to understand differences in students' expectations and dispositions towards engaging with educational institutions and their agents (i.e., faculty and staff).

As a bounded lens of perception about what is possible in any given situation, habitus is often expressed through socioeconomic status and education. People from the same social class tend to have shared expectations that shape social interactions in mutually beneficial ways [31,53]. Differences in social class impact thoughts, feelings, and behaviors and inform dispositions towards authority [55]. For example, students from working-class backgrounds may tend towards deference, while middle-class students learn entitlement and personal advocacy. These tendencies inspire specific behaviors, inform interactions with authority figures, and influence how individuals believe they should or should not engage in these relationships [56,57]. Bourdieu argued that social institutions, such as schools, expect and reward the cultural knowledge, competencies, and expectations associated with more advantaged social classes [22,23]. Among these tendencies are help-seeking behaviors like asking faculty questions and attending office hours [58,59], actions that require college students to be confident in working directly with those in a position of authority. As a result, students from socioeconomically advantaged backgrounds can more effectively navigate educational institutions and draw on their cultural knowledge to cultivate the kind of relationships that translate into educational success. This process involves the accrual of knowledge, or cultural capital, about how to successfully navigate doctoral education and the hidden curriculum of graduate school in ways that are professionally rewarded [60], including how to interact with faculty advisors and build collegial relationships. While rarely defined explicitly, in a doctoral education context, collegiality has been described as a form of peer learning, a professional relationship, and a symbol of agency as students become active participants in their graduate training [61,62].

While ample studies on undergraduate education have relied on a cultural capital framework [58,63–65], that is less often the case for studies of graduate education. Bryan Gopaul's work is the most significant example of using social theory to understand how inequality impacts the socialization experiences of doctoral students and the role of doctoral education in exacerbating social inequality [30]. His research reveals the important role of cultural capital and habitus in navigating the unwritten rules of doctoral education [29,66]. For example, drawing on interviews with 15 doctoral students in engineering and philosophy, Gopaul found that students struggled to understand the implicit expectations of doctoral study that enabled success in their programs and instead relied on faculty to act as translators [67]. Because habitus includes perceptions that structure possible modes of action, it has important implications for how doctoral students understand and engage with their faculty advisors.

Given that first-generation background, family income, and socioeconomic status are closely interrelated [68,69], existing work on first-generation doctoral students has often drawn on cultural capital and habitus frameworks [5,9,70,71]. Based on semi-structured interviews with 20 first-generation doctoral students across a range of disciplines, Gardner and Holley [5] reported that first-generation students often struggled to understand the "hidden rules" of academic life, including program expectations and how to navigate

academia. In a follow-up paper using a similar interview structure, Holley and Gardner [70] noted that discipline-specific cultures and norms—such as working with faculty advisors—notably shaped first-generation students' experiences.

First-generation students tend to enter graduate school without professional models in their families and generational knowledge that informs expectations of what doctoral study requires [9,72]. Drawing on autoethnographic interviews with doctoral students in music education, Vasil and McCall [6] noted that first-generation students are not always aware of what they do not know. In terms of their expectations of faculty relationships, a recent study of STEM students [8] revealed that first-generation students expected more direct, skill-based guidance, while their continuing-generation peers typically expected greater independence and individualized support. Importantly, the expectations of continuing-generation students were more closely aligned with how faculty tend to think about doctoral student development. Thus, for first-generation students, socializing relationships such as interactions with faculty advisors can play a particularly prominent role in creating a “cognitive map” for how to engage in graduate school [73]. As a whole, doctoral students from first-generation families often have to work harder to understand the unwritten rules and norms of educational practice, including navigating graduate school [74].

Doctoral students from first-generation families also experience imposter syndrome and social isolation, and these challenges are amplified by racial inequities [7,75]. While there are no known differences in representation for first-generation doctoral students by gender, racially minoritized doctoral students are more likely to be first-generation than white students (19%), with Latinx (52%), American Indian/Alaska Native (51%), and Black (41%) students identifying at the highest rates [76]. Using a narrative inquiry approach, Wallace and Ford [75] conducted interviews with seven Black first-generation doctoral students who reported experiencing racialized self-doubt, feelings of invisibility, and a lack of institutional support.

In the present paper, we examine student–faculty relationships in the later stages of socialization. More specifically, we examine how doctoral students describe and understand their advisor relationships during the fifth year—a critical stage when students are transitioning from novices to more independent researchers. While previous research has revealed differences in doctoral socialization experiences by educational background [9,67,75,77], few studies have explored how first-generation students understand and make meaning of their advising relationships towards the end of their programs. We thus ask the following research questions:

1. How do fifth-year doctoral students in biological sciences characterize their relationships with faculty advisors?
2. How do understandings of these relationships vary between first-generation and continuing-generation students?

3. Materials and Methods

3.1. Data Collection

The data for this manuscript are based on the interview portion of a national mixed-methods study of 336 PhD students in the biological sciences across 53 research-intensive universities who began doctoral programs in the U.S. in Fall 2014. Biology is an especially important context to explore given that it produces the second largest number of graduate students in the U.S. among all STEM fields [4]. The biological subfields included represent “bench biology”: microbiology, cellular and molecular biology, genetics, and developmental biology. To recruit participants, we reached out to program directors and department chairs of the 100 largest biological sciences doctoral programs with information about the study and a request to share information with their incoming graduate students. To further diversify the prospective pool of study participants, we also contacted relevant departments in public flagship universities (research-intensive), historically Black colleges and universities (HBCUs), and Hispanic-serving institutions (HSIs). In addition, emails outlining the study and eligibility requirements were shared over several STEM-related

professional listservs. All participants gave their informed consent to participate in the study, and this research was conducted in accordance with social science ethical review guidelines.

Doctoral students participated in this study throughout the course of their programs and into career entrance. Each year, participants completed a survey about their experiences in graduate school. In addition, a sub-sample of survey respondents participated in semi-structured interviews each year (average length of 45 min) to capture more details about their specific experiences—including skill development, professional intentions, and important relationships within and beyond their doctoral programs. Using theories of graduate student socialization as a guide, follow-up questions asked students to elaborate in particular on their ongoing relationships with faculty advisors.

3.2. Interview Participants

The present article is based on interviews with 83 doctoral students in the summer after their fifth year of graduate study, including 61 continuing-generation students and 22 first-generation students. See Table 1 for gender and racial/ethnic distributions for continuing-generation and first-generation students. The under-represented racial-ethnic minority (URM) category includes students who self-identified as Black, Latinx and American Indian, as the sole or one of multiple racial-ethnic categories. The over-representation of URM students within the first-generation sample is consistent with national trends [76].

Table 1. Participant demographics by generational status.

	Continuing-Generation	First-Generation
Gender		
Women	44 (72%)	14 (64%)
Men	17 (28%)	8 (36%)
Race/Ethnicity		
URM	10 (16%)	10 (45%)
Non-URM	51 (84%)	12 (55%)

3.3. Analysis

This is a descriptive qualitative study based on identifying themes and patterns within the text of long-form narrative interviews [78]. Qualitative methods center on processes of meaning-making that individuals enact to make sense of their experiences [79,80]. We relied on a grounded approach to data analysis, shaping core concepts inductively through close readings of interview transcripts [81]. Inductive approaches stress the importance of language and ways in which participants' words reflect deeper understandings and dispositions. This methodological lens is particularly effective for understanding how people draw meaning from lived experiences and interactions in social structures such as educational institutions [82].

All interviews were conducted virtually, recorded, transcribed, and coded using De-doose qualitative analysis software (version 9). An iterative approach to data analysis was employed given limited research on this topic and our interest in understanding differences between first-generation and continuing-generation students' advisor relationships in the later phases of doctoral study. We focused on questions related to student–advisor interactions and relationship development, including the following: How has your relationship with your faculty advisor changed or evolved over the past year (if at all)? Can you tell us more about the nature and quality of that relationship? In addition, follow-up questions focused on the role of faculty advisors in student success and career development. Throughout the interviews, students were encouraged to talk openly about relational dynamics with their advisor, including reflections on their perceived role in the later stages of the doctoral program.

We began with open coding to identify descriptive topical areas in student responses followed by axial coding to organize the key characteristics of different advisor types [83].

After initial rounds of coding, we relied on selective coding to clarify important characteristics among the responses and ensure consistency. All three authors reviewed the codes and revised the codebook throughout the analysis stage [84]. During this process, sets of descriptive codes began to emerge that clustered around four different types of relational dynamics. Strained relationships were marked by interpersonal challenges, and included descriptions such as ‘conflict’, ‘tension’, and ‘negative emotions’. Evolving relationships were defined by positive changes and language of transition, and included descriptions such as ‘working past challenges’, ‘improvement’, and ‘getting better’. Supportive relationships were characterized by general satisfaction and instrumental support, and included descriptions such as ‘good relationship’, ‘contentment’, and ‘professional support’. Lastly, equal relationships were described as collaborative partnerships with shared collegiality, and included language such as ‘collaboration’, ‘validation’, ‘colleagues’, and ‘peer status’. These groups reflected different relational dynamics doctoral students described during their experiences with advisors in the fifth year of their programs. After identifying the four relational dynamic typologies, we compared distributions for first-generation and continuing-generation students.

3.4. Trustworthiness and Positionality

The role of the researcher is an important methodological consideration in any research process, and this is particularly salient in the social context of qualitative work [85]. Following the interpretivist tradition, we aimed to strike a balance between our own preconceptions and the language of participants. To ensure trustworthiness and reliability [86], multiple team members completed an initial round of coding independently and created analytical memos focusing on themes, patterns, and concepts within the student narratives [84]. We then met multiple times as a full research team to compare notes and engage in collaborative dialogue towards reaching consensus on core themes [87]. In addition, we followed peer debriefing protocol throughout this process to discuss our interpretations and refine them over time [88], and the codebook was generated collaboratively. Team-based qualitative research analysis is a social process that requires ongoing interaction between researchers to ensure rigor and transparency in making sense of the data [78].

We also acknowledge our own preconceptions as participants in this project and grapple with this subjectivity in order to explore the meaning embedded in the experiences of others. While this meaning is distinct from our personal beliefs, our perceptions are necessarily shaped by our own lived experiences. As scientists, we are attuned to the characteristics of a methodologically rigorous research process, but our positionality is operating in tandem. It is especially important to note that all three authors were first-generation college students and hold experiential knowledge that is particularly relevant to the context of this project. This unique perspective may have aided in understanding the lived experiences of the first-generation students in this study. At the same time, this vantage point may have made it more challenging to interpret the data without expectations about student experiences. In addition, all authors are social scientists and as such occupy a different cultural landscape than the STEM disciplines, and thus may not be as attuned to particular aspects of student experiences in the lab sciences.

3.5. Limitations

While we offer important insights about student–advisor relationships and inequalities based on first-generation status, a few limitations are worth noting. Interview questions addressed changes in student–faculty relationships over the past year, but the interviews were cross-sectional and not longitudinal. We are thus not capturing how student–advisor relationships may change throughout graduate study. Given that we interviewed students toward the end of their PhD programs, we are likely capturing most of the collegial relationships, although it is possible that additional students would develop collegial relationships with their advisors as they progress through their doctoral program. In addition, while we acknowledge students’ gender and racial identities, we intentionally amplify their

first-generation backgrounds for the purposes of this study. We did not approach this study with the intention to explore within-group variation when students held multiple marginalized identities, and the small number of racially minoritized students prevents us from exploring intersectional experiences. We recognize that first-generation students are not a monolithic group, and the role of intersectional identities in doctoral advisor relational dynamics is an important area for future research. Finally, advisor relationships are central to doctoral education across fields, but the specific dynamics described in this study may manifest differently in graduate contexts outside of the lab sciences.

4. Results

Analyses of students' relationships with faculty advisors revealed a spectrum of relationship types, including strained, evolving, supportive, and equal, that are summarized in Table 2. Moreover, the results indicated that first-generation and continuing-generation students were similarly distributed among strained and evolving relationships. However, there were significant differences among more positive relationships, with first-generation students much less often discussing relationships in which they were treated as equal or seen as colleagues (see Table 2). We begin by briefly highlighting similar experiences and then focus on examining key differences in more depth.

Table 2. Distribution of participants by relationship type.

Relationship	Description	Cont-Gen	First-Gen
Strained	Relationship with interpersonal challenges	30% (18)	23% (5)
Evolving	Relationship with recent improvements	21% (13)	23% (5)
Supportive	Instrumentally supportive relationship	23% (14)	45% (10)
Equal	Collegial partnership with shared status	26% (16)	9% (2)

4.1. Similar Experiences in Strained and Evolving Relationships

Nearly half of all participants noted relationships that were strained or evolving. Strained relationships were defined by conflict and tension with advisors, while evolving relationships were notable for a focus on recent improvement. Similar proportions of first-generation and continuing-generation students experienced these relationship types. The presentation of results mirrors that distribution and includes quotes from both first-generation and continuing-generation students.

4.1.1. Strained Relationships

Strained relationships were characterized by challenges. Often, students with strained relationships described navigating situations with their advisor that involved conflict and escalating emotions. In general, these relationships were defined by interpersonal conflict. As Claire, a white continuing-generation student, noted,

There was definitely some, I don't know if you'd call 'em fights, but my PI obviously wasn't happy that I started being very ambitious and motivated and plugged in to get this paper published, and then I just finally crashed and hit a wall.

When talking about her faculty advisor relationship, Claire emphasized mounting tensions that boiled over into conflict. Many of the students with strained relationships emphasized negative or hostile interactions. Hazel, a white first-generation student, shared similar thoughts when discussing her advisor relationship. She focused on interpersonal conflict and managing the stress of these experiences:

Yeah, it was really bad. She was very verbally abusive, tried to sabotage me and stuff. She was just not a good person. She's an amazing scientist but not a good person. . . I would break out in hives I was so stressed out.

Brandon, a white first-generation student, noted how his advisor's behavior resulted in frustration, saying, "He wants me to develop this abstract, in preparation for that, which, at times, is difficult, because I'll prepare something, and he won't really look at it, and say that, 'You need to go work on this'. Sometimes, it's a little frustrating there". As a whole, students with strained relationships focused on conflict and emotionally challenging interactions as defining features of their advising experience. Experiences with negative interactions were echoed by Amelia, a Latinx continuing-generation student, who described arguments with her advisor, noting, "We've had a few—not—kind of, I guess, more antagonistic conversations lately. I mean not like yelling matches or anything, but we've had some arguments".

4.1.2. Evolving Relationships

When discussing interactions with their faculty advisors, another group of participants stressed experiencing recent improvements in relationships that were evolving. Among doctoral students who affirmed evolving relationships, they described certain characteristics that defined those developments. Evolving relationships were characterized by working through challenges and associated improvements in relational dynamics. For example, Carter, a white continuing-generation student, reflected on a strengthening relationship that required putting past challenges behind:

I think it's actually improved a lot, my relationship with my PI. We had some troubles to start off at the beginning of my career, but I think we've kind of put those past us. I've gotten over, just I guess, growing pains, per se. Actually, I think it's going pretty well.

Carter's response emphasized changes as his relationship continued to develop over time. This tone was echoed by a number of participants, who focused on evolution as growing pains in their advisor relationships. Elaine, a first-generation student who identified as Latinx and Asian, expressed a similar sentiment, focusing on improved relations that were notably better than in the past, "It's gotten a lot better. We got new students in the lab, and I was the only person training them and stuff. I feel like she realized my value, I guess. Relations between us got better".

Evolving relationships were defined by notable improvement and working through challenges towards healthier relationships. When discussing the characteristics of her faculty advisor relationship, Allie, a white first-generation student, focused on how coming to terms with personal differences spurred healthy evolution in the relationship, saying, "I think they evolved. They definitely evolved. I kind of just accepted that he is the way he is and I am the way I am, and I didn't cower—or not cower". Relationships in flux shared similar characteristics—they stressed relational improvements in the later years of graduate study that often required navigating the growing pains of relationship building.

4.2. *Inequality across Supportive and Equal Relationships*

Among more positive relationships, we identified two distinct types. Some students had generally supportive relationships with their advisors that met their basic expectations of academic and professional support in a doctoral program. A smaller group of students described a transformational shift in how they related to their faculty advisor. More specifically, they focused on increased collegiality and a sense of partnership—they felt more like equals than students. While we observed similarities between first-generation and continuing-generation students in strained and evolving relationships, more positive relationship types revealed notable inequalities. Equal relationships were much more prominent among continuing-generation students than first-generation students, who were more likely to report generally supportive relationships. The discussion of results reflects this difference, emphasizing first-generation student quotes in the section on supportive relationships and continuing-generation student quotes in the section on equal relationships.

4.2.1. Supportive Relationships

Supportive relationships were characterized by general satisfaction and a focus on academic and professional support. Students often stressed how their relationship with their advisor had not changed much over the past year—these relationships were supportive and static. Logan, a white first-generation student, noted little change in a generally “good relationship”, and focused primarily on how his advisor continued to provide professional support:

I would say they haven't really changed that much. I guess I've asked for a little bit more professional advice, postdoc advice, stuff like that. Whereas, I always got professional advice, but I think maybe in the past we weren't really talking in definitive terms. . . I think he is supportive in all research-based questions. . . we have a good relationship.

Logan's language is emblematic of generally supportive relationships: they were satisfactory and largely the same as in years past. When asked how her faculty advisor relationship has evolved or changed over the past year, Stacey, a Latinx first-generation student, noted a similar sense of stasis, “No. I don't think so. I mean if I'm not mistaken, I mean, my PI and I have had a good relationship since I started my program and that hasn't changed at all”. This perspective was shared by Josh, a white continuing-generation student, who stressed general contentment and lack of significant changes in his advisor relationship: “I would say not much has changed over the past year. We still have a good relationship”.

Students with supportive relationships often highlighted their advisor's focus on academic and professional support. When describing her advisor relationship, Emma, a white continuing-generation student, emphasized instrumental support:

Good. Very supportive. . . she'll just come into the grad student office sometimes and chat with us, and—or we'll do the same. We'll just pop into her office if we just wanna chat about something. She's great about giving feedback and supporting my research and stuff. . . it's a good relationship.

Madison, a white first-generation student, used similar words when reflecting on interactions with her advisor, who was supportive of her career goals:

Our actual relationship together, I would still say is pretty strong. He's definitely there when I need him to be and offers a lot of great advice and support. I will say he's been very encouraging of a lot of the things I mentioned in the last question of career development, career exploration.

Madison's response is generalized and affirmative—summing up the relationship as overall “pretty strong” while focusing on professional assistance. Her words express a general satisfaction with instrumental support that was echoed by other students. A white first-generation student named Camille used similar word choices to characterize her advisor relationship, “It's strong, and it's really, I guess productive and supportive. . . I would say it feels like a pretty strong relationship, and I'm happy to be in the situation that I'm in”.

When talking about her relationship over the past year, Elizabeth, a white first-generation student, expressed a similar sentiment and noted her advisor's support of professional opportunities:

There's been some bumps in the road, but overall, I think we have a good relationship. She and I get along really well personally. She's been pretty supportive of me. She's supportive of my plans to apply for this fellowship, and—I don't know, I feel good.

Anthony, a white continuing-generation student, used parallel words when talking about his advisor relationship. Overall, he characterized the relationship as good and supportive while expressing a general sense of contentment, following a common thread among supportive relationships:

I have a generally really good relationship with my PI. I think she's been very supportive and happy with my progress, the progress that I've made. I mean, there's been very few, in this last year, disagreements. We're pretty generally on the same page. . . she's been very supportive and very—yeah, we've had a good relationship this past year.

In these and other examples, it was evident that students' supportive advisor relationships were defined by instrumental support and minimal developmental changes in the later stages of doctoral study. As a whole, students in supportive relationships used positive—and generalized—language in articulating the nature of relational dynamics with their advisors.

4.2.2. Equal Relationships

In contrast to generally supportive relationships, some students talked about experiencing a transformative shift in how they related to their advisors. These students often used language that implied a newfound sense of shared status with their advisors, including characterizing the relationship as one of collaboration between equal partners. As Emily, a white continuing-generation student, expressed when describing how she now related to her advisor in a fundamentally different way,

I think what has shifted or changed or evolved is that I am not seeing him so much as an authority figure or a superior or a PI, if you will. I feel that he is my colleague, and consultant, and advisor. He's here to have somewhat a drawing board for me when I need someone to talk through how to do things or if I'm getting stuck, he'll help think through it with me. I definitely feel like we are evolving more to this place of equals than any type of hierarchical position in the relationship.

Emily's words illustrate a common theme among students in this category. Many of them understood the advising relationship in more expansive ways beyond sources of instrumental support, focusing instead on the meaning and impact of collaboration with their advisors as professional peers. For example, Mary, a continuing-generation student who identified as Latinx and white, discussed interactions that felt increasingly collaborative and collegial, which enabled her to participate more fully in the scientific process with her advisor on a higher level:

. . . I think we're also able to talk at a little bit of a higher level about my science where we come as two equals to the conversation now instead of her mostly advising me on the things that I should do. I feel our relationship this year has gotten a lot stronger in which we're able to work off of one another instead of having more of a primarily advisory role.

Reflecting on interactions with her advisor over the past year, Mary emphasized a pivot from seeking guidance towards a relationship with more mutually shared input.

Doctoral students with equal relationships often experienced an identity evolution—from seeing themselves primarily as students to feeling more like professional peers working alongside their faculty advisors. This perspective was shared by Kyle, a white continuing-generation student, who said the following when asked about his advisor relationship, "I think they evolved more so to be more of a colleague relationship more than like a PI and graduate student". Here, Kyle noted a transition that changed how he related to his advisor and, in the process, his own identity as a scientist. When elaborating on her experiences, Tara, a white continuing-generation student, shared a similar perspective, noting an important shift from receiving information in the graduate student role to participating in scientific work with her advisor in a more collaborative way:

Because as opposed to being taught something by my mentor, we were as colleagues working through this new information. I think that part of our relationship really changed in that instead of coming to him and asking for just tell me

what you think, it was more of a discussion between the two of us. . .it really felt more like a partnership than it had in the past.

A number of students in this study connected status changes to increased engagement with their advisors in a more collegial way, for example, participating in scientific discussions on the “same level” as their advisors. This was emblematic of Anna’s experience, a white continuing-generation student, who shared the following about interactions with her advisor, “I feel like in this last year, her and I have been somewhat on the same level, I would say. I’m very respected as being in my fifth year. . .so, my ideas mattered, and my contributions were more important”. Morgan, a white continuing-generation student, used similar language, discussing how working more closely with her advisor has shaped her overall relationship and growth as a scientist:

I think in the past year, because I’ve grown so much as a scientist, we have maybe a more—like seeing each other on the same level type of relationship. We had to work together directly a lot more ‘cause she’s presented some of my work, and of course, working together to get it written up. I think I described this last time a little bit. She definitely has favorite students in the lab, and I don’t know if I’m one of them, but I think that we’ve definitely developed a closer relationship in the past year. . .I think she just relates very differently to different students.

Molly, a white first-generation student, similarly discussed cultivating a closer relationship with her advisor, including working together on professional projects that strengthened collegiality:

I think that this past year, I’ve gained a lot more respectability and respect, because the times that we have met and discussed things one-on-one have been because of bigger accomplishments, like I’m going to a conference. I’m working on this manuscript. I’m addressing revisions. I’m scheduling my defense. Those types of conversations made it feel more collegial.

This transition towards increased collegiality was shared by other students with equal relationships. David, a white continuing-generation student, summed up his relationship by describing an evolution from graduate student status to participating in elevated discussions that enabled him to identify more as a peer with his advisor, saying, “I think maybe if anything there was just a lot of growth in terms of the way in which we discuss more—we became more as peers discussing and much less graduate student, [advisor] relationship”.

While first-generation students often understood their advisors as sources of general support and professional guidance, they rarely experienced changes in perceived status and how they related to their advisors. Continuing-generation students more often understood their advisors as professional colleagues, reflecting growth in mutual status that enabled them to participate in science in a different way.

5. Discussion

Although previous scholarship has explored some of the general challenges experienced by first-generation students in doctoral programs [5,6,9,75], prior research has rarely attended to their relationships with faculty advisors. In particular, little is known about how perceptions of the advisor relationship may differ for first-generation and continuing-generation students. We address this omission by drawing on interview data with 83 doctoral students in the biological sciences. The findings reveal a continuum of relationship types, including strained, evolving, supportive, and equal. First-generation and continuing-generation students described similar experiences among strained and evolving relationships. However, among more positive relationships with advisors, nuanced yet important differences emerged. First-generation students were over-represented among generally supportive relationships that met instrumental needs in the doctoral program, while continuing-generation students were over-represented among equal relationships where students felt more like collaborative partners.

The presented findings extend prior work on graduate student socialization [12,89] and the role of faculty advisors in doctoral student development [10,35]. The role of the faculty advisor is particularly prominent for doctoral students in the later stages of socialization, where advisors mediate entrance into the profession, helping usher students through the transition to being fully independent scientists. The presented findings demonstrate that students may experience different relational dynamics with their advisors based on their educational background. Continuing-generation students were more likely than their first-generation peers to cultivate collegial partnerships with their advisors. These partnerships served as markers of perceived status and scientific growth, and enabled doctoral students to embody a professional role through collaboration with their advisors on an equal playing field. These results highlight the value of examining not just whether faculty advisors are supportive of doctoral student success, but also unpacking the specific relational dynamics that shape how students interact with—and learn alongside—their advisors.

In addition, this study contributes to understanding the various ways that inequality shapes student experiences in graduate education, and, in particular, experiences with faculty advisors. A few previous studies have used theories of social reproduction to explore first-generation students' experiences in doctoral programs, emphasizing the cultural and social challenges they encounter in graduate school [7,8,30,67,70,71]. Previous research has also noted how other marginalized identities, including race and gender, mediate doctoral student socialization experiences with advisors [13,27,90]. We extend this body of research by using cultural capital and habitus to understand differences in student–faculty relationships between first-generation and continuing-generation students. First-generation students rarely understood their advisors in ways beyond sources of authority and resources for instrumental support, while continuing-generation students more often saw their advisors as collegial partners, engaging with them as equals in the scientific process. To understand these patterns, social reproduction theory provides a valuable lens that centers structural inequality. Differences in cultural capital interact with habitus to shape perceptions of what is possible, expected, and rewarded within the social contexts of education [22,66]. These cultural forces operate in graduate training, where dispositions toward authority and mentorship mediate doctoral student socialization and development. First-generation college students enter the cultural world of doctoral education with a set of learned preferences that are marginalized and must manage mismatches in behavior and expectations that emerge through relational inequities [8]. The presented findings reflect the nuanced spectrum of challenges and cultural capital reservoirs that shape student experiences in PhD programs.

While cultural capital and habitus provide a compelling lens for understanding the observed differences, it is possible that other differences between first-generation and continuing-generation students contribute to these patterns. The most likely alternative explanation is a difference in career goals: if continuing-generation students are more likely to aspire to academic positions, it may follow that they would be more likely to build collegial relationships. However, that is not the case for the students in this study. In reviewing career expectations, we found that both groups of students were almost evenly split between academic and non-academic career paths—with 52% of continuing-generation students and 50% of first-generation students expecting to pursue an academic career.

6. Implications

Mentorship is a core aspect of faculty life and doctoral advisors perform a variety of roles in guiding students through their programs [44,51]. Student–faculty relationships contain implicit power imbalances [91], and relational dynamics have important consequences for student development and professional socialization. As key agents of socialization, faculty advisors should actively support and cultivate robust relationships with their doctoral students that provide opportunities for collaborative partnership. These relationships are especially important for first-generation doctoral students, who rarely feel like partners. Faculty should emphasize the importance of working together on scientific problems and

engaging in deeper discussions about research with their doctoral advisees. These kinds of pedagogical approaches and practices reflect the language of students with more equal relationships in this study, who often focused on participating in 'higher level' scientific discussions with their advisors.

In addition, higher education institutions need to take seriously structural changes that support more equitable experiences for first-generation doctoral students. First-generation students may not expect or understand how to cultivate collegial relationships with faculty. For first-generation students in pursuit of a PhD, reimagining more equitable support means actively demystifying the unwritten expectations of doctoral education that foster success, including interpersonal dimensions such as building collegial faculty relationships. Success in graduate school requires students to understand the tacit rules of educational practice—or 'hidden curriculum'—that underlie expectations for how to perform the doctoral student role in ways that are professionally rewarded [92,93]. Graduate programs should create and institutionalize initiatives that make transparent the hidden curriculum of doctoral education. They could, for example, develop courses, workshops, and programming designed to make visible the cultural knowledge and social expectations of pursuing doctoral study, and especially the role of relational dynamics in socialization. In addition, universities could create more opportunities for peer socialization and collaboration among doctoral students, providing first-generation students examples of different ways of engaging with faculty. By intentionally creating more spaces where graduate students across different educational backgrounds can work alongside faculty together, doctoral programs can empower first-generation students to understand their faculty advisors in more expansive ways beyond being sources of instrumental support. Serving the whole graduate student requires actively engaging with individual student's needs, unique experiences, and overall sense of wellbeing as integral components of supporting doctoral student success [94]. Holistic support in doctoral education needs to take into account the unequal social playing field and specific cultural barriers that first-generation students encounter when navigating the interpersonal dimensions of faculty mentorship. Considering different dimensions of inequality is especially crucial in settings of STEM doctoral education and the lab sciences, where cultural pressures are often amplified and exacerbate inequities in student experiences [15], and where first-generation students are significantly under-represented [95,96].

Faculty advisors mediate student development throughout the graduate school journey and into career entrance. Scholars have noted that structures of doctoral student socialization can exacerbate existing inequalities and amplify cumulative advantages [30]. The patterns observed in this study have implications for hampering equity in doctoral education by stratifying access to certain types of socialization experiences occurring at the level of social relations. If first-generation doctoral students rarely see themselves as colleagues and partners to their advisors, they may be less likely to pursue academic career paths or be less equipped to succeed in scientific roles that mirror their faculty advisors. Exploring, and rectifying, differences in how students with marginalized social identities understand and engage with core aspects of doctoral education, such as faculty relationships, is critical for advancing equity in graduate education.

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