

A Qualitative Study of Support and Transition Experiences for Underrepresented Minority Students in the Rising Doctoral Institute

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Rising Doctoral Institute (RDI): A Qualitative Longitudinal Study of Support and Transition Experiences for Underrepresented Minority Students in Engineering Doctoral Program

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Abstract. This paper explores the impact of the Rising Doctoral Institute (RDI) on underrepresented minority (URM) students in engineering Ph.D. programs in their first year. Developed to address the disproportionate departure of URM students from such programs, the NSF-funded RDI aims to facilitate their transition. Longitudinal Interviews participants from five universities during the 2022-2023 academic year reveal three key dimensions of RDI's impact during their first year as doctoral students: 1) Facilitating Student Well-being, 2) Guiding the Ph.D. Process, and 3) Fostering Community, Belonging, and Identity. The study acknowledges the need for further research while recognizing the Garcia et al. (2020) model's efficacy in cultivating an inclusive university and program environment for URM students. The paper concludes by highlighting RDI's role as a catalyst for supporting the transition and proposing strategic activities to strengthen possibilities for the success of URM students in engineering doctoral programs.

I. Introduction

Reports on graduate education in the US have shown that underrepresented minority (URM) students (i.e., African Americans, Hispanics, and Native Americans) are more likely to depart from the engineering Ph.D. than their majority counterparts. International literature helps illuminate common patterns in which withdrawal from completing doctoral programs yields profound consequences for a wide array of stakeholders, ranging from government managers to higher education institutions and students. In the case of institutions, lower Ph.D. conferral rates are commonly associated with tarnishing the institution's reputation and diminishing its capacity to attract promising students or secure crucial funding (Torka, 2020). These concerns should not be underestimated, given institutions' substantial financial investments in doctoral programs, with tuition payments and grant support funds often insufficient to cover the costs (Barr & McClellan, 2018). Other unfavorable consequences include depleting institutional resources and coursework capacities and causing distress among faculty and advisors who grapple with overloaded responsibilities due to students' departures (Horta et al., 2019).

Moreover, the repercussions of low degree conferral rates extend to the personal realm of doctoral students. As already indicated by foundational literature on doctoral education in the US, withdrawal from a Ph.D. also erodes students' self-esteem, hinders their employability prospects, impedes their career progression (Lovitts & Nelson, 2000), and exacerbates students' financial burdens, increasing their debt and further complicating their post-graduate endeavors (Doran et al., 2016).

Considering the elevated costs of departing from Ph.D. education for institutions and individuals, a group of researchers designed RDI to address this pressing issue. The RDI is an NSF-funded research-based intervention to support URM students' transition into engineering Ph.D. programs. One goal of the RDI is to support multiple institutions in adapting the RDI design to meet their institutions' needs and student populations. Five institutions across the US are, at the time of this research, implementing the RDI at the time of this research, intending to create a more diverse and inclusive community of engineering scholars. To assess how these institutions achieve these goals, the RDI team conducts multiple assessments. This paper explores emergent themes resulting from interviews with RDI participants.

II. Theoretical Background

A. The Rising Doctoral Institute model and prior interventions

The Rising Doctoral Institute was created as a multi-day intervention for URM students entering the first year of their doctoral program in diverse engineering fields. The RDI model was created to support these students' transition into graduate school and assist them in developing skills to comprehend the process better, navigate the difficulties, and adopt strategies to assist them in persisting and completing their degrees.

The first RDI intervention (i.e., pilot) was held in the summer of 2019 and hosted 17 students from various US higher education institutions (Artiles et al., 2021). The sessions were designed based on research demonstrated to improve institution retention efforts for Ph.D. students.

Research illuminated the broader topics covered in this first version of the RDI: 1) included unwritten rules about the Ph.D., 2) time management, and 3) advising relationships. The pilot

assessment suggested that participants valued the fact that it allowed them to meet other students with whom they shared personal characteristics they could connect, which increased their sense of belonging and understanding of their doctoral journey (Artiles et al., 2021).

In 2021, a second intervention reached 34 participants from different universities nationwide.

This activity was online due to universities being closed as per COVID-19 measures. Following this effort, the RDI team invited administrators from five institutions to implement the RDI workshop in 2022. This time, the original topics delved into five topic areas that should be addressed during the workshop: 1) Doctoral program management, 2) Advising and interpersonal relationships, 3) Day-to-day strategies for graduate school success, 4) Being minoritized in graduate school, and 5) Life post Ph.D.

In 2022, five US institutions implemented RDI based on general guidelines provided by the RDI team but adapted to local conditions and student populations.

B. Critique of socialization model for graduate students of color

We employed Garcia et al. (2020) reconceptualized model of socialization to frame the experiences of this group of URM students in engineering doctoral programs. This model is, in turn, grounded on Critical Race Theory (CRT) and Community Cultural Wealth (CCW) and was originally intended to analyze the socialization of Latinx¹ students. According to Garcia and colleagues, this framework is helpful to acknowledge that university environments are

¹ The term Latinx here is employed as in the original study, and it is defined as "a gender inclusive term for people who self-identify as having racial and ethnic roots in Latin America, South America, Mexico, and parts of the Caribbean. Latinxs are connected by colonization, geography, and culture, yet they are a heterogeneous and complex group of people." (p. 55)

challenging spaces for racially minoritized students due to racial discrimination, normative standards that are not inclusive to people of color, and overt racial incidents. Garcia et al. (2020) revised the model to shift away from a deficit perspective, recognizing the diverse forms of cultural wealth these minoritized students bring to higher education. The model also emphasizes the importance of higher education institutions in fostering an inclusive environment that embraces and amplifies these unique racial and ethnic perspectives.

For this study, this framework allowed us to elicit through interviews and explore through thematic analysis how RDI-supported URM students reflected on various aspects of their individual development and their perceptions about the value of the RDI workshop. This study aims to broaden the applicability of the existing model beyond its original focus on Latinx students, reaching out to a wider range of underrepresented minority (URM) students.

C. Literature Review

Challenges and Experiences of Doctoral Students During Their First Year

Scholarship on doctoral education underscores the critical importance of understanding the experiences of first-year doctoral students, particularly focusing on factors influencing retention and persistence (Golde, 1998; 2005; Lovitts, 2001). Subsequent empirical studies have further underscored the role of the first year for persistence, particularly in STEM fields, where gender and racial minority populations tend to present more barriers (Bostwick & Weinberg, 2022; Lott et al., 2009).

The first year is also considered a crucial transition during which students evolve from outsiders to insiders in their academic departments and disciplinary communities (Golde, 1998; Weidman

et al., 2001). Challenges during this period include adjusting to a new environment, managing coursework, balancing personal and academic life, and adapting to evolving expectations (Gardner, 2009). Studies also have revealed challenges faced by underrepresented minority (URM) students during their first doctoral year, including feelings of isolation, conflicts with academic culture, and encounters with racial microaggressions (Felder et al., 2014; 2015; Ramirez, 2014; 2017; Watkins & McGowan, 2022).

During the first year of doctoral studies, scholarship highlights the importance of faculty advisors and doctoral peers. Faculty advisors, for instance, are often referred to as the most important support during the initial phase of doctoral studies as they influence students' understanding of cultural values and offer essential guidance (Sweitzer, 2009; Weidman et al., 2001). Peers play a multifaceted role in shaping the doctoral experience (Bostwick & Weinberg, 2022; Devos et al., 2017; Polmear & Simmons, 2020).

Racial Minority Doctoral Students in Engineering

The existing body of research on doctoral students in engineering, particularly those hailing from marginalized backgrounds, sheds light on the pervasive challenges and oppressive conditions they frequently encounter within and outside the campus. This complex landscape is characterized by explicit instances of racism and sexism, as highlighted by studies conducted by Beasley and Fischer (2012), McGee (2016), and McGee & Bentley (2017).

Delving deeper into the discourse surrounding underrepresented minority (URM) engineering graduate students, the literature underscores a concerning reality for Black students within this academic domain. Notably, there is a prevailing sense of unwelcome within engineering communities, where these students perceive a palpable lack of support compared to their peers.

This phenomenon is attributed to the stark underrepresentation of racially and ethnically diverse students and faculty of color in academia, a factor elucidated by studies conducted by Burt et al. (2018), McGee et al. (2019), McGee & Bentley (2017), and Torres et al. (2010).

III. Purpose

This research study explores the impact of the Research Doctoral Initiative (RDI) on participants throughout their first year of the engineering doctoral degree program. The investigation is based on the experiences of seven individuals representing the five research-intensive US universities.

The guiding question for our research is: What were participants' perceptions about RDI being helpful throughout their experiences during their first year of the engineering doctoral degree?

The study delves into the prospects of enhancing Engineering Education and boosting the persistence and completion rates of URM students while simultaneously promoting equality for all students. It also underlines the obstacles and opportunities students encounter during their initial year of training. It also highlights the significance of programs such as RDI in ensuring the success of doctoral education and inclusivity for all students.

The significance of this study also relies upon the longitudinal perspective to explore students' perceptions over their first year. Understanding the first year's perceptions and experiences is relevant as this period is crucial in Ph.D. students' persistence and will contribute to learning more about URM doctoral students in engineering fields, which has been shown in scholarship to be crucial in the persistence of doctoral students.

In practical terms, this research focuses on enhancing the sustainability of RDI workshops, specifically those planned for implementation in the fourth and fifth years of the NSF-funded project. The objective is to make tangible contributions that will fortify these workshops' long-term effectiveness and impact within the broader framework of the project's goals and objectives.

Also, this study advances the literature on the applicability of the conceptual framework to underrepresented minoritized (URM) students in doctoral programs in engineering fields.

IV. Methodology

We employed a qualitative research design to learn from participants' perceptions of RDI's impact on their experiences as first-year Ph.D. students in engineering. For this purpose, we conducted semi-structured, longitudinal, individual interviews with RDI participants during their first year as Ph.D. students from 2022 to 2023. We interviewed, in total, seven individuals hailing from the five RDI partner universities. The data set consisted of 28 unique interview transcripts from monthly interviews. We recruited participants from those who responded to the survey at the RDI workshop's start and expressed interest in monthly interviews. They contacted via email and asked for their consent to participate. The interviews were then recorded on video. In order to protect the confidentiality and anonymity of the participants, pseudonyms were assigned to each individual mentioned in this study.

Participants came to their Ph.D. directly after completing their bachelor's, and six of seven were

identified racially as Black. In terms of ethnicity, most participants identified as not Hispanic or Latino. Most students in this sample identified as female. The students in the group had diverse educational backgrounds based on their parents' or guardians' level of education. Only one student had completed high school, while the rest had pursued higher education. Of the three with some college experience, only one graduated from a university. The other three participants mentioned that their parents or guardians had completed a master's or a professional doctorate. Refer to Table 1 for participants' demographic information.

Table 1

Demographic Data for Study Participants

Pseudonym	Race	Ethnicity	Gender
Amelia	Black	Not Hispanic or Latino	Female
Chloe	Black	Not Hispanic or Latino	Female
Grace	Black	Not Hispanic or Latino	Female
Lucas	Black	Hispanic or Latino	Male
Mia	Black	Not Hispanic or Latino	Female
Olivia	Black	Not Hispanic or Latino	Female
Samuel	White	Hispanic or Latino	Male

Regarding their research experience before enrolling in the Ph.D., all participants reported prior research experience, and five out of seven indicated participating in publications or academic writing during their prior research activities.

We employed an inductive approach to data analysis. The first cycle of codes identified general ideas related to the RDI workshops. We then proceeded to the first cycle of coding (Saldaña,

2021); we used holistic coding, usually suitable when researchers researcher already have a preliminary understanding of the aspects they wish to explore within the data. This method involves organizing the text into overarching topic areas, serving as an initial strategy to comprehend the content comprehensively (Bazeley, 2007). For a second cycle of coding, as proposed by Saldaña (2021), the authors collapsed the original number of first-cycle codes into a smaller number, assessed the data again, and determined that longer text segments were more appropriately represented by a single key code rather than multiple smaller ones. Also, the second cycle codes grouped independent codes into new revised conceptual categories. As a result of the data analysis process, the researchers identified 21 interview excerpts explicitly discussing how the RDI workshop impacted doctoral students throughout the 2022- 2023 academic year. The analysis resulted in students' responses coded as those discussing the impact of RDI were grouped into five broad thematic patterns. In the results section, we discuss these themes and illustrate the specific situations experienced by participants.

V. Results

This section presents the key findings derived from longitudinal data from URM students in their first year as doctoral students in engineering disciplines. These students, who participated in Rising Doctoral Institute (RDI) workshops, represent five US research institutions. The workshops took place during their first year as Ph.D. students, specifically during the school year 2022-2023.

During the monthly interviews, the interviewer actively prompted an examination of how RDI influenced first-year doctoral students. Interestingly, we observed a natural development of connections between students' experiences and their perceptions of RDI's impact. We also noted that while discussions on RDI's influence persisted throughout the academic year, a notable shift

occurred in the second semester, specifically in January and February. Participants were more inclined to engage in open discussions about the impact during this period.

It is important to note that the available data was insufficient to understand better the factors contributing to the increased visibility of discussions regarding RDI during the second semester. Despite this limitation, the continuous expression of opinions throughout the year suggests a consistent and ongoing consideration of RDI's impact by doctoral students throughout their first year.

We discovered that the impact of RDI lies in its ability to introduce the relevance of three key dimensions of their doctoral journey in the initial year: 1) RDI as a facilitator of student well-being, 2) RDI as a compass to the Ph.D. process, and 3) Sparking conversations on community, belonging, and identity.

Furthermore, findings show less prominent themes around awareness of identity issues, specifically gender, race, and ethnicity. Also, the participants' critical perspectives on the workshop's content and format provided insights into potential avenues for enhancing its influence on their first year as doctoral students.

We applied our theoretical framework to contextualize the overarching themes, providing insights into the challenges faced by underrepresented minority (URM) engineering students within the university environment. Likewise, the framework proved valuable in pinpointing the pivotal role interventions, such as RDI, can play in fostering an inclusive environment by introducing these topics and motivating their discussion and reflection. This approach acknowledges and amplifies the unique racial and ethnic perspectives that URM students contribute to higher education.

1) RDI as a Facilitator of Student Well-being

Overall, participants like Mia described their first-year experience as doctoral students as a time that involves challenges related to managing stress, stimulation from competing demands and high expectations, and potential burnout. While demanding responsibilities and a hectic schedule, the importance of emotional well-being becomes evident through the insights shared by Mia: “There was one activity that one of the faculty speakers gave us to do... emotional checks on how we're feeling and when we feel like we're overwhelmed or overstimulated.” This quote illuminates a proactive approach to self-care provided during the RDI workshop, acknowledging the need for moments of reflection and recognizing when one is on the verge of burnout. The subsequent quote delves into personal experiences of recognizing the signs of overstimulation, emphasizing the value of taking breaks, and highlighting the significance of open communication with a support network. These reflections underscore the crucial role emotional checks and maintaining connections with others play in navigating challenges and preserving one's mental well-being.

I've used them [the emotional checks] a couple times, but I think there were days that I definitely felt like I was just go for the past four days. And then me picking a break for a second because I took a nap and I woke up and I was like, "Oh, I have been very overstimulated. I am just going to take a break now and not do anything", instead of just keeping going and then getting burnt out and then not being able to do anything at all.

Mia then delves into a crucial aspect of fortifying her well-being during her doctoral studies by recognizing the importance of establishing boundaries in the academic realm. Acknowledging the challenges outlined in the initial description of the first-year experience, Mia stresses the importance of smoothly combining work and personal life. She underscores the significance of crafting a personalized routine that accommodates her demanding research schedule and fosters a genuine work-life balance. Doing so aims to cultivate a sense of normalcy in her daily life, contributing to her physical and mental well-being.

Our data also suggests that RDI's impact is distinctively linked to facilitating substantive conversations with students, motivating them to cultivate healthier habits in navigating the academic rigors of doctoral studies. As an example, Amelia emphasizes the value of fostering nurturing relationships within academic spheres with that goal in mind. Specifically, she highlighted the resonance of philosophy with her faculty advisor towards academia. She emphasized how both strive to maintain a well-rounded life outside their professional responsibilities by setting boundaries on their academic workload.

2) RDI as Compass to the Ph.D. Process

Our analysis suggests that RDI has been, for some participants, an invaluable resource for students pursuing their doctoral program in engineering. It allows them to explore the intricacies of their journey on a profound level from a disciplinary perspective. The lessons include an overall understanding of the procedural aspects and the myriad of emotions inherent in this process.

Mia reflected on the importance RDI speakers posed on students building and maintaining a strong external support network. In Mia's opinion, ensuring students have an emotional support system is not just about creating the students' well-being but also about recognizing that the doctoral process is based on evidence. This complex journey requires intellectual rigor and can pose physical and mental challenges. Students can feel lost and confused during this intricate expedition, where emotional connections with external support become crucial. These bonds act as guides that help individuals navigate the inevitable unknowns and provide a vital lifeline amidst the complexities of the endeavor.

I probably would say the biggest lesson that I've carried with me from that, at least for this past month we're probably one, making sure I stay in touch with family even though it feels like I'm really busy and communicating how I feel.

Amelia emphasized the importance of having a clear map outlining the steps of a Ph.D. journey, as it provides a structured understanding of the process. She highlighted the value of visualizing key milestones, such as selecting a Principal Investigator (PI) and establishing timelines for significant tasks. Amelia stated that deciding when to choose a PI, setting deadlines for completion, and other essential aspects were crucial to making progress and building a sense of achievement. She also added that having a clear picture of the steps required to achieve the ultimate goal was useful in strategizing the priorities and providing clarity and direction. In this context, Amelia emphasized that the real challenge was navigating a complex path, especially considering the diversity of fields involved. Finally, the participant highlighted that a map that breaks down the journey into yearly segments that align with the typical five-year structure of most engineering programs can be extremely helpful.

Ultimately, RDI was instrumental in fostering students' awareness of communications with the department and the institution. Grace's experience illustrates this impact: "So because of that RDI, I was definitely more aware of the emails and the flyers I would receive." In this way, Grace suggests that RDI has the potential to play a crucial role in enhancing students' communication with diverse individuals and organizations within the program and institution, highlighting the value those may have in supporting their success. Simultaneously, it suggests that RDI can catalyze the promotion of student engagement in activities that align with their interests and preferences.

3) Sparking Conversations on Community, Belonging, and Identity

In addition to fostering communication among students, their program, and the institution, participants acknowledged the role of RDI in facilitating discussions about their identity as underrepresented minority (URM) individuals within higher education. The RDI workshop was a relevant platform for raising this awareness, cultivating proactive behavior, and providing valuable networking opportunities for resources and organizations dedicated to minorities on campus. Grace succinctly summarized her experience:

I don't remember what the session was called, but they talked about different resources and organizations for minorities on campus. (...) And so, I think that one really stuck out in just the different resources that are available.

In this way, Grace recalled a session recounting the various resources and organizations tailored for minorities at the university that were available. The participant also reported that the newfound awareness prompted the participant to seek out these, particularly those centered on minority grants relevant to her pursuits. While she may not have attended numerous events hosted by the two organizations specifically geared toward black students in the graduate department, Grace appreciated the chance to connect with individuals outside her major who also shared her identity as a black woman.

Amelia emphasized that RDI played a role in addressing another aspect of her identity — specifically, how individuals develop into their roles as doctoral students and interpret their perceptions about self-value as emerging scholars and academic performance.

I will say, I know I'll keep this brief, but I know, I think maybe the first session I talked a lot about feeling a sense of imposter syndrome. And I feel now, I think I finally feel comfortable being a graduate student because I think I was so obsessed with not knowing and just feeling lost, not knowing anything. But now I realize nobody knows anything. And I think there was this quote about a PhD, a journey, and they're like, "As long as you have resilience." 'Cause even the fifth years, they're like, "I still don't know what that is." And of course they know way more than I... They could probably get the answer way more before I could. But I think it just made me realize that that's the point of being a scientist or engineer is that you never fully know. So, feel good about that.

VII. Limitations

This study presents limitations that need to be addressed. Throughout our research study, we conducted interviews with participants based on their availability. This approach resulted in varying numbers of interviews each month. One significant limitation we encountered was the potential for the overrepresentation of more available participants, which could have created a biased sample. Conversely, participants with busier schedules or specific life circumstances may have been underrepresented. Unequal interview frequencies also presented challenges in data analysis, such as accounting for exact distributions and comparability. However, because of the qualitative nature of our research, it is crucial to interpret the results as a broad overview of the temporal frame of students' experiences during their first year in their Ph.D.

This research aimed not to claim broad generalizations about URM student populations attending RDI workshops. Instead, it aimed to gain insight into the individual experiences of first-year students and their perceptions of the various impacts that RDI may have had on them.

VIII. Conclusions

Our research has revealed the impact of the RDI program during their first year of doctoral studies and a better understanding of their well-being, the complexities of the Ph.D. process, and community, belonging, and identity in the context of the engineering fields at this initial phase. These dimensions coincide and build on prior research, highlighting the relevance of these facets in the experiences of first-year doctoral students with similar difficulties.

However, we acknowledge the need for further research to gain a more comprehensive view of the program's impact. Future studies should delve into the perspectives of coordinator team

members, speakers, and individuals closely associated with each RDI workshop. At the same time, this research should focus on the specific workshops and sessions' goals due to the execution being guided by their unique institutional conditions and student populations. Therefore, a more diverse and contextual analysis will contribute to a nuanced and holistic assessment of the RDI program's impact.

While the theoretical framework effectively contextualized overarching themes, its application proved limited to illuminating common challenges faced by racially minoritized students, as indicated by Garcia et al. (2022). This limitation arose from our insufficient data, which did not adequately support the framework's utilization in addressing issues related to racial discrimination, non-inclusive normative standards for people of color, and overt racial incidents.

On the other hand, our research has successfully demonstrated the framework's efficacy in exploring and recognizing the potential and beneficial role of interventions, such as RDI, in cultivating an inclusive environment for underrepresented minority (URM) doctoral students in engineering. RDI workshops contribute significantly to raising awareness, fostering communication, and providing valuable resources for URM students in the academic environment by introducing and encouraging discussions and reflections on pertinent topics.

This study underscores the pivotal role of RDI in not only elucidating discussions surrounding the identity of underrepresented minority (URM) individuals within higher education but also in amplifying its impact towards a more tangible and transformative goal. We contend that the strength of RDI extends beyond mere facilitation, positing that it stands as a catalyst for effectively communicating the individual and collective value inherent in joining minority affinity groups to fortify the success of URM students. Thus, we propose elevating activities to a more strategic level to bolster this connection. For instance, direct engagement with incoming doctoral students and active participation in specialized sessions can be optimized to foster

community building. Moreover, the arrangement of purposeful social events and the establishment of structured peer mentorship programs will serve as tangible manifestations of RDI's commitment to shaping an inclusive and supportive environment for URM students.

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