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Latine STEM Doctoral Students' Perceptions Regarding Doctoral Mentoring Relationships - A Qualitative Study

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Abstract

This qualitative study was guided by Social Capital Theory (SCT), Social Cognitive Career Theory (SCCT), and Social Cognitive Theory to underscore the impact of contextual factors on Latine STEM doctoral students' motivations regarding their education and career paths. Within the frame of this study, contextual factors refer to mentoring relationships with faculty. The research team interviewed seven Latine STEM doctoral students individually to understand their perceptions and experiences regarding doctoral mentoring and relationships. Data collection occurred between Fall 2018 and Spring 2021 in two historically white institutions (HWI) and a historically Black college and university (HBCU) in the southeastern region of the US as part of a larger study. The interviews were analyzed using interpretative phenomenological analysis (IPA). IPA revealed three themes, describing Latine STEM doctoral students' perceptions around (1) social-emotional needs in day-to-day interactions with faculty mentors, (2) career aspirations and the expectations for acquiring skills and knowledge to become independent professionals, and (3) imprints of gender and culture intersections within the STEM context. Findings discussed the need for radical updates to the STEM culture through redefining mentoring practices.

STEM Doctoral Scene in the United States

Doctoral programs have been recognized as advanced degrees students pursue to deepen their intellectual knowledge and advance their career opportunities. Students willingly enter these programs with a desire to excel in their career paths. In particular, with the increasing emphasis on the fields of science, technology, engineering, and mathematics (STEM), doctoral programs are one of the major pathways to ensure a continuous pipeline for the academic workforce in higher education settings [4], [8], [18], [25]. However, recruitment into these programs does not guarantee retention; statistics show that about 50% of attrition rates in all doctoral programs, and only 12% of all the STEM doctoral program completers are from racially and ethnically minoritized groups [10], [17], [19]. These low completion rates by the minoritized student groups in doctoral programs cause a chain reaction in the STEM faculty pipeline, resulting in a lack of diversity in the higher education workforce [3]. Several studies underline a notable integration issue in the STEM context for individuals with African American, Latine, American Indian, first-generation, LGBTQ, and special needs backgrounds [15]. These groups report feeling invisible and questioned about their scientific competencies compared to their White and Asian peers [15], [32].

Latine Doctoral Students and Cross-Cultural Mentoring Relationships in STEM Fields

Among the full-time STEM doctoral program enrollment in the US context, Latine students, who are citizens or permanent residents, constitute only about 6.9%, despite representing the nation's largest marginalized group (19.5%) [5], [17], [25]. Parallel to the lack of diversity in the STEM student body, the percentage of Latine faculty members in the US higher education system is reported to be around 6% [26]. This number is even more drastically scarce within the

engineering and engineering technology fields, with Latine faculty representing only 4% of the overall faculty [33].

Although studies show that having faculty mentors from similar backgrounds enhances the outcomes for doctoral students, low faculty representation inevitably sets the stage for cross-cultural mentoring in the STEM doctoral context [4], [6], [19], [23], [24]. Cross-cultural mentoring occurs when mentees and mentors come from different cultural or racial backgrounds, in which cases racially and ethnically minoritized doctoral students are more likely to benefit from individualized support and guidance academically and emotionally for completion of the doctoral program and develop self-efficacy as a scholar [4], [6], [19], [23], [24]. In a case study by Sangiago, Latine students in a Hispanic Serving Institution (HSI) stated that they feel supported when their faculty mentors provide them with "an extensive network, knowledge, and resources to connect them with high-impact programs and resources, such as summer research, academic support, and mentoring experiences" [5], [27].

In the Minority Graduate Education Project, Nettles explored Black, Hispanic, and White doctoral students' graduate school experiences [11]. This study found that Hispanic/Latine students were more likely to attend graduate school full-time to warrant assistantship funding and spent more time completing program requirements (e.g., course work, dissertation) with greater social involvement than their Black and White counterparts. This suggests that Latine doctoral students who persist in the program will likely value their socialization processes as well as have a robust commitment to their academic pursuits and success. On the other hand, literature shows that one of the essential determinators behind this commitment is the support and guidance they receive from their faculty mentors [2], [5]. Effective mentoring relationships during the doctoral journey are vital to supporting students toward their full potential, developing affirming academic identities and social dispositions [4], [6], [19], [23], [24].

Theoretical Framework

This study was built on a trivet of three theories to better understand and explain individual and contextual factors that determine Latine doctoral students' doctoral mentoring relationships in STEM fields. The first theory is the social capital theory (SCT), which emphasizes humans as social organisms who thrive with access to social networks and connections [34], [35]. Within this study context, faculty mentors are described as the potential social capital for their doctoral students by providing them with mentorship support, guidance, collaboration opportunities, and resources to thrive in the STEM society. In light of Coleman's ideas on SCT [35], the social capital of Latine STEM doctoral students (i.e., faculty mentors) could also potentially create human capital in the STEM academic pipeline, which could contribute to more diverse faculty representation.

Another important aspect of doctoral pursuit and fruitful outcomes stems from the internal motivation and beliefs about self. Lent's social cognitive career theory (SSCT), inspired by Bandura's social cognitive theory, explains individuals' career paths as derived from personal interests, self-perceptions, and contextual factors, such as family and educational context. SSCT defines self-efficacy as an essential driving force for success and confidence in career

expectations, and it cannot be isolated from contextual factors [1], [20], [22]. Because doctoral training involves a steep learning curve for advanced career preparation, self-efficacy development takes a turn throughout this journey due to lived experiences and mentoring relationships within the academic context.

As the foundation of Lent's SSCT, Bandura [1] explained self-efficacy beliefs as the regulators of human functioning through cognitive, motivational, affective, and decisional processes and stated that "a strong sense of personal efficacy to manage one's life circumstances and to have a hand in effecting societal changes contributes substantially to perceived collective efficacy to shape their society's social future." Therefore, Latine STEM doctoral students' improved self-efficacy and career aspirations will accordingly echo in the Latine population in the long run.

From this point of view, doctoral mentoring relationships appear to be one of the fundamental contextual factors that could potentially contribute to Latine STEM doctoral students' self-efficacy and persistence in their program, as well as improved validation within the academic context to pursue their career goals. This study sought the answer to one research question: *What are the perceptions of Latine STEM doctoral students regarding their mentoring relationships?* Overall, the present study aimed to explore Latine STEM doctoral students' perceptions of mentoring relationships with their faculty mentors and discuss how these perceptions could relate to their career choices, particularly paths to the professoriate.

Methodology

This qualitative study is part of an extensive multiple-embedded case study from an Alliances for Graduate Education and the Professoriate (AGEP) grant, a grant-funded project by the National Science Foundation (NSF) [17]. The larger study aimed to explore the dynamics of STEM doctoral mentoring relationships from faculty and racially minoritized student perspectives and improve mentoring practices through institutional change. Data collection occurred between Fall 2018 and Spring 2021 in three universities in the southeastern region of the US: two historically white institutions (HWI) and one historically black college and university (HBCU). In this study, researchers aimed to highlight the experiences of Latine STEM doctoral students regarding their mentoring relationships. The research team collected data through individual interviews with seven Latine students. Demographics of this group consisted of seven students within the 21-30-year-old age range, five women and two men, six students from PWI and one from HBCU, and five first-generation college students.

The interview questions aimed to better understand how the students define mentoring, whether they have a faculty mentor, what their experiences with STEM doctoral mentoring have been like, and whether culture has a role in their mentor/mentee relationships. Each interview took about 50 to 60 minutes. During the initial phase in 2018, the research team started the interviews in person, and during the pandemic, they proceeded virtually on the Zoom platform. The interviews were professionally transcribed by Rev.com and reviewed by the researchers to ensure accuracy.

Data analysis

As a qualitative research data analysis strategy, interpretative phenomenological analysis (IPA) aims to make meaning of the respondents' beliefs and experiences on a particular phenomenon, such as an event, process, or relationship [28], [29], [30], [31]. This study utilized IPA to explore Latine STEM doctoral students' perspectives on mentoring relationships.

Following Smith and colleagues' [31] suggestions on IPA, the data from the Latine STEM doctoral students were analyzed using an iterative analysis process across all cases. Starting with a preliminary analysis with one of the randomly chosen transcripts, the initial codes were gathered under the emerging themes. Following this step, researchers completed rounds of reading and re-reading all the transcripts and re-grouped the codes and themes until reaching meaningful units.

Positionalities

The lead author of this study is a researcher and woman of Western Asia descent, and the second author, a professor of adult education and Principal Investigator for this project identifies as an African American woman. Both authors are conscious of how their intersecting identities—particularly related to gender, race, and ethnicity—influence their perspectives and interpretations throughout the research process. This awareness was actively integrated into each stage of the study, with intentional self-reflexivity and interactions to ensure they report participant experiences authentically and interpret the findings with theoretical triangulation and literature support.

Findings

The IPA findings indicated three themes: (1) *humanizing mentoring*, which covered essentially mentees' social-emotional expectations from their day-to-day interactions in their mentoring relationship; (2) the second theme underlined the aspirations to become professors and importance of *teaching how to fish by mentoring* instead of handing the fish to the student because students' ultimate goal is to become independent and successful professionals, (3) and the final theme revealed how *gender and cultural factors intersect in the STEM context,* showing the differing dynamics of mentoring relationships as gendered and cross-cultural factors within the predominantly white and male culture of STEM context. The details of each theme are discussed with the help of student quotes in the following sections. Each participant was given a pseudonym to protect confidentiality.

Theme 1: Humanizing Mentoring

This theme highlighted Latine students' social-emotional needs and expectations from their interactions with their mentors. Student interviews indicated how they seek to feel comfortable when they are communicating with their mentors. Although they acknowledge their mentors' years of experience, depth of knowledge, and limited availability due to juggling several duties simultaneously, some students described their faculty mentor as intimidating because of these factors. In a doctoral mentoring relationship, each faculty member and doctoral student brings their own traits to the table. In the present study, Latine students, as an ethnically minoritized

group, enter the academic context with their personal and cultural characteristics, and they want to be understood and eliminate intimidation and fear factors in their mentoring relationship for more effective outcomes. Because most of the students in this sample were first-generation college students, they shared their unique adjustment process and concerns when it came to professional communication, even learning to write an appropriate email to their faculty mentors. For instance, Natalia, as a first-generation woman student, explained how her cross-cultural mentoring experience was a learning process for both her and her mentor on effective communication:

> He's [my faculty mentor] trying to learn how to not be intimidating. So, every so often, he'll ask me, "Was I being intimidating?" And I'll be honest with him: "Yes, just a little bit, but it's okay. I'm learning now." I'm also the first URM [underrepresented minority] student that he's had. And he's only had three other students before me. They've all been of a higher socioeconomic class; they're all white and very independent, and they're not first-generation. So, they know what they're doing, and I'm like, "It's not the same. I need help over here." And so, he's like, "Oh, okay." We're still learning [from/about] each other. We're learning. (Natalia)

Like Natalia's case, a couple of other students underlined the need for reciprocity when it comes to showing empathy and gratitude in their mentoring relationship. They asserted that the journey is a partnership for both sides, faculty mentor and doctoral student, who work to support each other, and the cards should be played fairly. The students desired regular check-ins to ensure ongoing communication, not just about research and academic issues, but also from a humanity perspective. For instance, Julia explained her expectations:

> It's very important for me that I can establish some sort of connection. I don't necessarily want to say friendship, but in terms of mutual respect that even in a couple of years, you can go back and see each other at a conference and think of yourselves as perhaps colleagues rather than just, "oh, this was my advisor."

Because some of these interviews occurred during the COVID-19 pandemic, new lab rules and shifts and isolated work environments inevitably changed the social-emotional needs of doctoral students. A couple of students mentioned how exposure to COVID-19 caused a big stumble on their lab work whenever they or their family were exposed to the virus. One of the students appreciated the support they received from their mentor. However, Ava shared an incident that was not as understanding and supportive:

> Last week, I was in a car accident, and we were on a grant deadline. I got no time off to take care of that [my car and myself]. There was no, "Hey, take a day, collect yourself, get this organized, and then come back when you're going to be good for the lab, instead of this emotional train wreck mess." (Ava)

Lastly, to humanize mentoring, students asserted that they need the space to be self-advocate with transparency about the issues that they do not feel are right. Natalia said, "If something's not working, the communication style or something else is bothering them, honesty is a big thing." And Olivia's words complement this comment:

> A mentee should be able to articulate what they're going through, [...] Just being able to be vulnerable and ask for help. Even though it's such a hard thing to do. I know people struggle with it. Self-advocacy is really important.

Theme 2: Aspirations to become professors: "Mentoring is about teaching how to fish"

As a well-known fact, doctoral training is a challenging phase that usually involves juggling several tasks and skills to conduct research, publish, teach, complete the program requirements to graduate, learn professional communication, and, last but not least, manage the job market to land a job. Since the ultimate goal is to excel in the career track, acquiring these skills and knowledge is the key to success. However, to tackle these goals, each student stated that they need a role model to become independent professionals in the future. Leo, one of the male students, said, "At the end of the day, I think that you've been around that person for so long, you start becoming like that person" to explain how he perceives his mentor as a role model. Antonio shared his expectations in a similar way:

> What I think would make my mentoring relationships useful would be once I get through graduate school that, I'm as successful as they are, I'm able to navigate this world of writing papers, teaching students, doing math, I can navigate it the same way they do, I can as easily as they do. I would expect to become like them in some way. That would be successful mentoring relationship.

Both Leo and Antonio, two male students, aspired to become professors as their faculty mentors. Other students emphasized the importance of individualized guidance and feedback with an acknowledgment of their racial/ethnic background in achieving their career goals. Relatedly, Julia shared her appreciation for her attentive mentor for providing her with resources and support to enhance her career path:

> As soon as she [my mentor] finds opportunities that involve, for example, any kind of diversity fellowships and stuff like that, …[she's] immediately shooting them in my direction. […] always making sure that there are opportunities that she can find to help me, not just being a Hispanic female, but also being first generation. She's very attentive to those kinds of opportunities and makes sure that I am at least aware of them. (Julia)

Theme 3: Intersections of gender and culture in STEM fields

This theme mainly developed from the women students' perceptions and experiences around gender, representation issues, and comments on the inattentive STEM context. It is important to restate that out of the seven students, the sample consisted of five women students. Thus, the majority of these women students shared their struggles with gender bias in a white male-dominated STEM context. For instance, Ava talked about the domesticated duties that are expected from women students in the lab context:

> I've noticed this in more than one lab. […] We're also in charge of doing the dishes and taking out the trash because the men in the lab just don't do it. So, it seems like there's this expectation that women handle all of the housework of the lab, and we're the ones who get called on in a pinch.

In addition, women students emphasized the challenges of lacking women colleagues, professors, and authority figures in the field. As mentioned earlier in the literature review, students seek professors with shared backgrounds who they feel are more relatable and to improve their sense of belonging. For instance, Luna was upset about hearing speculations that she received a scholarship only because it was a program available for Latine women students, not because of her skills and potential, saying, "You are working so hard to get in a position, but then when you are in the position people just think that you're not supposed to fit in that position." This represents quite a paradoxical incident that challenges demographically minoritized students.

As an extension of these gender-related perceptions, some of the female students discussed the inattentiveness to cultural validation and propensity for colorblindness in the STEM fields. Olivia said, "We're very numbers, and we don't really look at that kind of bias." Because familism is a central value and norm in the Latine culture that prioritizes familial needs over individuals, it is not surprising that female students also elucidated their struggles in balancing academia and the *familism* culture of their Latine heritage. Latine communities tend to emphasize the importance of family connections in the form of solid bonds and collective effort to support the extended family rather than a nuclear family [3], [12], promoting taking familial responsibility, interdependent decision-making with respect and consideration for family members, and protecting their family. As the participants of the present study come from the familism culture, the "strong value of family and family history, parental admiration and respect, a desire to repay and pay forward as well as resilience and willingness to persevere" is in their personal agenda in addition to their academic goals [3], [5]. Relatedly, Ava shared experiences of tackling both her house chores and academic responsibilities. Olivia shed light on the conflict between academic and familistic expectations more in-depth in the following quote:

> I'm not just a student 100% of the day. There are my other values, my other responsibilities. I'm very passionate about my family. This is my strongest value. And it's not rare. It's not unique. It's typically common for people of color to have a strong familial background. It's only different to people who don't experience that. And so, having to explain all of that, it's just annoying sometimes. I don't want to have to explain why my family is important and significant and impeding my academics. It's kind of just a given. Like, these are the other things that I carry in my bag. But at the end of the day, I'll get my work done. And so, if that's what you want me to focus on, that's what I'll talk to you about.

In contrast to the women students' perspectives on gender, culture, and STEM intersections, the two male students were neutral regarding their experiences around culture and diversity in their lab and relationships with their mentors. Leo said their mentoring relationship was strictly work-related, while Antonio said there were no insensitive conversations among the other doctoral students in the lab environment, which was not the case for Natalia. Her quote also echoed the above-mentioned colorblindness in the form of a lack of cultural responsiveness in the STEM context:

> Right now, in our lab setting, we have a variety of cultures working together, and it's really interesting how some people tell jokes or take jokes and sometimes, I've even seen it go bad with somebody who tells the joke that just should not have been. Not at all. […] it could be harmful where you're not aware of the people that you're working with and their culture and what's disrespectful, or what shouldn't be said or what shouldn't even be thought about.

Overall, the findings indicated that Latine STEM doctoral students are individuals who have social-emotional expectations from their faculty mentors, including continuous communication, empathy, reciprocal respect, and validation of their cultural values. In addition, each doctoral student has career aspirations that require autonomy and professional independence in the future, and they seek to acquire the skills and knowledge to be strong candidates for their desired careers. Thus, they need sustained guidance and feedback in a bias- and intimidation-free academic context.

Discussion and Implications

The findings of this study implied that Latine STEM doctoral students' perceptions of mentoring experiences are determined by intersecting factors of communication, emerging professionalism, culture, and gender. Supporting Lent's SSCT and Bandura's definition of self-efficacy within the broader societal context, the STEM doctoral mentoring relationships appear to be the social capital and determinants of Latine students' self-perceptions regarding their academic identities and future career trajectories [1], [9], [21], [34], [35].

In the sample of seven Latine STEM doctoral students, first-generation and women students made up the majority of the sample in this study (n=5) who attended HWIs. Collectively, they shared their struggles regarding adaptation to the academic context, intimidation, and finding relatable interactions. These findings align with a recent metanalysis study [21], which showed women's perceived support systems and barriers were negatively and more strongly correlated in STEM careers than their male counterparts. Parallel to this study, Cidlinská's [36] findings showed that one of the significant barriers in front of women STEM scholars' careers tends to be childcare duties, which could drastically change their career progress; for this reason, early career researchers (postdoctoral) sought a woman mentor who could relate to their "motherhood" experience and career challenges. This finding implies enhancing exposure to women role models is needed to strengthen the support systems and improve women's self-efficacy in STEM.

Relevant studies describe Latine students as significantly more resilient, socially engaged, and invested in the time spent on their doctoral program tasks compared to their counterparts [11]. Their persistence is also partially rooted in their familial expectations—to improve the quality of life of their family by pursuing a STEM career and showing their gratitude for the familial support they received over the years [3], [5], [12], [13]. On the other hand, statistics show that first-generation students are overrepresented in racially and ethnically minoritized, low-income populations, which requires attentiveness to these students, showing empathy, respect, and

individual mentoring practices to support them effectively. The present findings align with the relevant literature [13], [16].

A successful doctoral journey and career advancement in academia do not happen in isolation, especially for historically marginalized populations. It requires a collective effort among doctoral students, faculty members, research collaborations, and even close relationships such as family and friends. The importance of contextuality in human and career development is emphasized in several theories [1], [20], [22], [34], [35]. The literature consistently found that racial/ethnic match between mentor and mentee, as well as higher representation of diverse faculty groups on campus, have a positive impact on retention rates and degree completion, contributing to racially/ethnically minoritized student's success [14], [24]. A recent meta-analysis by Lent and colleagues tested the pathways to STEM career choices, incorporating the SSCT model [21]. Their findings suggested more positive expectations regarding career outcomes when individuals interact with people who are racially and ethnically similar. In other words, when an individual is surrounded by people from similar racial and ethnic backgrounds, their outcome expectations for a career path in STEM appear stronger. However, considering the low diversity in the faculty population, matching student-faculty backgrounds would be quite a rare coincidence in STEM doctoral programs. For this reason, it is essential to underline *culturally liberative mentoring* as an essential implication to make cross-cultural mentor/mentee interactions more effective by fostering a culture of inclusivity and equity.

Liberative, as a concept, refers to "any theory, action, or effort contributing and related to bringing justice in the world. It requires one to intentionally and actively change the status quo to bring positive change to result in justice" [7]. Culturally liberative practices and dispositions are action-oriented and aim to shake and shift the traditional power dynamics and norms to create hospitable environments for everyone. To achieve this cultural liberation in the STEM context, it is fundamental to support faculty members with multidimensional professional development activities. Providing the faculty with resources and training to advance their understanding would improve the doctoral program context and help racially and ethnically minoritized students to have an affirming view of their identity within the academic context. This way, instead of getting lost in the leaky graduate pipeline, students could develop the skills and knowledge to be independent professionals and achieve their career pursuits. With culturally liberative mentoring practices, Latine scholars could successfully feed the faculty pipelines to diversify the STEM fields in higher education settings. Furthermore, institutionalizing faculty development and evaluation metrics to create transparent and culturally liberative grounds is essential. Reconsidering faculty hiring processes in more intentional and inclusive ways to meet the needs of all students would increase representation and retention in STEM doctoral programs.

Lastly, this study is not without limitations. The study was limited to Latine STEM doctoral students from three universities in a southeastern region of the US. Although the researchers heavily focus on the cultural aspect of the Latine students in the STEM context, the conclusions cannot be generalized to all Latine STEM doctoral students. Remembering that each institution, department, and relationship has unique dynamics is essential. For future research, the objective

of this inquiry could be expanded beyond STEM fields, capturing Latine students and other racially minoritized student populations from different fields to enhance the literature.

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