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"You Didn't Go by Choice!": Exposing Institutional Barriers Leading to Latinx STEM Pushout at a Hispanic-Serving Research Institution

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Abstract: As the Latinx student population grows in the United States, more public research-intensive institutions are becoming Hispanic-Serving Research Institutions (HSRIs). This exploratory qualitative study examines the experiences of Latinx students at an HSRI, particularly in STEM fields where they face underrepresentation and are pushed out. The objectives for this study were two-fold: (1) investigate the institutional factors contributing to Latinx student pushout in STEM at an HSRI and (2) develop recommendations for enhancing Latinx student retention in STEM at HSRIs. Through an investigation at a public four-year HSRI in California, three key themes emerged regarding institutional factors contributing to STEM pushout: (1) a disconnect in theory-based STEM courses, (2) unsupportive and busy research-focused environments, and (3) the psychological toll of a stripped STEM identity. The authors offer recommendations for targeted interventions to genuinely "serve" Latinx students in STEM fields at HSRIs.

Keywords: Latinx; Hispanic-Serving Institutions; research-intensive institutions; R1s; Hispanic-Serving Research Institutions; STEM; pushout

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1. Introduction

In 2023, the Latinx population reached nearly 64 million, or 19.1% of the U.S. population [1]. It is projected that Latinx student enrollment in higher education is expected to exceed four million by 2026, which will surpass the growth rate of any other racial/ethnic group by 10% [1]. As the Latinx population continues to grow, more colleges and universities are reaching the minimum 25% Latinx undergraduate student enrollment threshold to be federally recognized as Hispanic-Serving Institutions (HSIs), which are defined by the Higher Education Act as non-profit degree-granting postsecondary institutions. These institutions constitute 20% (n = 600) of colleges and universities across the United States, including Puerto Rico, and enroll 63% of all Latinx undergraduates [1,2]. The majority, or 60%, of HSIs are four-year institutions (public: 30%; private: 30%), and 40% are two-year institutions (public: 39%; private: 1%) [1]. Of the 600 HSIs in the U.S., 22 are research-intensive, referred to as Hispanic-Serving Research Institutions (HSRIs). The Carnegie Classification of Institutions of Higher Education defines these institutions as Research 1 (R1) institutions with very high research activity that, in a single year, spend at least $50 million on research and development and produce at least 70 research doctorates [1,3]. Currently, 80% of HSIs are concentrated in just six states, with California leading the way with 172 institutions, representing approximately 30% of all HSIs [1], and approximately 19% of R1 HSRI institutions are located in this state [4].

As more research-intensive institutions become HSIs, leading scholars in HSI research have begun to examine the ways these institutions are "serving" Latinx students

in practice [5–8], which is referred to as "servingness" in the HSI literature. According to Garcia et al. [6], "servingness" is a multidimensional and conceptual way to understand what it means to move from simply "enrolling" Latinx students to actually "serving" them. This shift in focus is especially critical at R1 institutions that have historically operated as Predominantly White Institutions, or PWIs, which systematically exclude and deny access to minoritized student populations. Although there are no federal mandates requiring HSIs, or HSRIs, to have specific infrastructures to support Latinx students, R1s transitioning to HSRI status must acknowledge and address the unique needs of Latinx students [9]. Latinx students are most likely to be the first in their families to attend college compared to all other racial/ethnic groups [10] and research has shown that the needs of first-generation college students differ significantly from those of "traditional (the term 'traditional' is commonly used in higher education literature to refer to students who were admitted to the university directly from high school) students" who make up the majority at PWIs and/or selective research-intensive institutions [11–13]—especially in STEM fields where Latinx students continue to be underrepresented [14–16].

Extant literature has identified numerous factors contributing to Latinx student attrition in STEM; however, the experiences of Latinx students in STEM fields at HSRIs remain underexplored, as this is an emerging area of research given the recent focus on HSRIs. Currently, the Latinx population has the highest participation in the workforce and will provide the largest number of new workers in the next decade, yet less than 9% of STEM degrees are awarded annually to Latinx students [17,18], and the number of Latinx STEM doctoral degree holders was at 6% in 2023 [19]. Therefore, increasing Latinx STEM degree attainment is critical as STEM employment is projected to grow 11% by 2031 compared to 5% for all occupations in the U.S. [18]. Furthermore, STEM occupations had wages above the national average compared to non-STEM occupations [20]. Thus, increasing the number of Latinx STEM degree holders will not only improve social mobility outcomes and boost the presence of STEM professionals in the workforce but will also help dismantle barriers that contribute to inequity in STEM education and careers.

The purpose of this timely exploratory qualitative study was to investigate the factors contributing to STEM pushout among Latinx students at an HSRI in California. Specifically, the objectives for this study were two-fold: (1) investigate the institutional factors contributing to Latinx student pushout in STEM at an HSRI, and (2) develop recommendations for enhancing Latinx STEM student retention at an HSRI. The guiding research question for this study was as follows: "How do institutional factors contribute to STEM pushout among Latinx university students enrolled at a Hispanic-Serving Research-Intensive Institution?"

2. Literature Review

This review aims to deepen understanding of how institutional factors can push Latinx students out of STEM majors and how campus elements affect student experiences in STEM. We provide a brief review of the STEM campus climate and learning environment literature, including (1) the lack of racially diverse faculty in STEM, (2) racial and gendered microaggressions in STEM, (3) competitive STEM environments, (4) gatekeeping courses, and (5) traditional STEM pedagogy. Additionally, we included the literature on research-intensive universities and STEM to provide context of HSRI campus elements impacting Latinx student attrition in STEM.

2.1. Lack of Racially Diverse Faculty in STEM

Researchers have called attention to the lack of racially diverse faculty in STEM fields and its impact on the retention of future diverse scientists [21–23]. Prior research has pointed to the critical role of diverse faculty in the persistence of Latinx students in STEM and associated faculty mentorship with higher grades for Latinx science students [24,25]. For instance, Bensimon et al. [26] described the critical role of Latinx faculty as institutional agents in supporting Latinx students in STEM through mentorship and advocacy. Morales et al.'s [27] research on racial concordant faculty mentors, when students and fac-

ulty have the same racial/ethnic background, demonstrates that having the same racial mentor increases intent to pursue graduate school. Additionally, the findings from Garcia and Flores [28] and Perez et al. [29] demonstrate that Latinas in STEM desire to have diverse faculty in STEM for mentorship and to access STEM resources.

2.2. Racial Microaggressions in STEM

The latest critical STEM education literature points towards the various racial microaggressions experienced by Latinx students in STEM environments [30–32]. Racial microaggressions are subtle, verbal, and non-verbal assaults towards People of Color that occur in everyday environments like the workplace or classroom [33,34]. McGee [31] examined Black and Latinx students' responses to racial microaggressions, such as negative racial assumptions and biases on their intellectual aptitudes, and how they navigated indifferent faculty that allowed microaggressions to occur in the STEM classroom. Garcia [32] further described the racial microaggressions felt by Latinx students in STEM from their peers and faculty who questioned their intelligence in a STEM classroom and laboratory by asking about their SAT scores. Additionally, stereotype threat is another form of racism encountered in STEM environments, primarily experienced by Students of Color. Stereotype threat is when people feel at risk of confirming stereotypes about their social/racial/ethnic group [35]. Latinx students in STEM have experienced stereotype threats when forming small study groups in their STEM courses and feel that their presence and contributions are devalued by white and Asian faculty and peers [36]. Another form of racial microaggressions is the underrepresentation of diverse students in STEM environments, which leads to diverse students doubting their STEM identity through a hyperawareness of their racial/ethnic background [37]. Similarly, Jones [38] and Dewsbury [39] described moments when Students of Color in STEM recognized their marginality in the STEM classroom when they were "the only ones". Additionally, Latinas in STEM experience gendered racism by having to prove themselves to their male peers and feeling silenced because of their identity as Latinas in male-dominated STEM fields [7,40,41].

2.3. Competitive STEM Environments

In addition to the microaggressions occurring in the STEM environment, the competitive climate is another key institutional barrier impacting Latinx students' departure from STEM. Prior research has demonstrated that the STEM learning environment promotes competitiveness and includes negative interactions with peers and faculty [42,43]. For instance, Newman [44] described how STEM faculty contribute to "cold and competitive" STEM environments by telling students that most of them will fail in STEM courses. Flores et al. [36] described how the exclusionary STEM culture is fomented by STEM faculty through faculty patronizing attitudes encountered by Black and Latinx STEM students when they asked STEM faculty questions on foundational concepts, and they would respond, "we do not have time for that, next". Also, Flores et al. [36] described how faculty created an academic hierarchical system in the classroom by grouping students into the "struggle corner" and the "guys [who] are going to be operating on you", representing a hierarchy of two groups of students, those that are academically struggling in the course and those that will advance to medical school. Furthermore, many scholars point to how competitive STEM environments contribute to the lack of sense of belonging of Latinx students [45–47]. For instance, Latinx students encounter a culture of hyper-competition through strict assessment practices [45]. Additionally, Latinx students who encountered competitive STEM environments were more likely to disengage from curricular and co-curricular activities in STEM departments [46]. In HSI campuses, similar negative peer and faculty interactions are experienced by Latinx students in STEM classrooms despite the mission of Latinx "servingness" [7,36,48].

2.4. Gatekeeping Courses

In addition to STEM climate issues, some scholars have focused on the STEM classroom, including gatekeeping courses or "weeder courses". Gatekeeping courses are foundational courses in STEM with a high enrollment of students and are taught in a lecture-based format. These gatekeeping STEM courses are known in the literature to contain many grades of Ds and Fs and are graded on a curve [49]. Gatekeeping courses are critical courses for students as they are usually prerequisite courses in STEM departments to enter and advance in STEM majors [49]. Prior research has shown that STEM gatekeeping courses prevent Latinx and Black students from advancing in STEM majors [50,51]. Other scholars have pointed out how critical STEM gatekeeping courses are for Latinx students because they discourage interest and persistence in STEM fields [52,53].

2.5. Traditional STEM Pedagogy

STEM pedagogy uses "traditional pedagogy", such as lectures and note memorization, and lacks student engagement and interaction. Prior scholars have shown that active learning and engaging classroom assignments create a greater sense of belonging for Students of Color in STEM [54,55]. In HSIs, Latinx students encounter similar STEM departments with traditional pedagogies despite an institutional mission and focus on "serving" Latinx students. For instance, Covertina et al. [56] noted that an HSI STEM introductory course contained unengaging activities such as worksheets and attendance-taking, contributing to Latinx students' disengagement in STEM. Also, scholars McGee and Bentley [57] and Rendón et al. [58] described the lack of cultural connection and social justice in the STEM curriculum experienced by Latinx and Black students, who subsequently turn them away from STEM. Additionally, the latest literature on STEM pedagogy is inclusive of culturally relevant pedagogies, such as the inclusion of Spanish and opportunities to connect personal and family experiences in STEM courses and the inclusion of diverse authors in course readings [59]. STEM pedagogy has been furthered examined in HSIs through the implementation of innovative course programming that embraces culturally relevant pedagogies [60,61], faculty training that addresses faculty implicit bias and epistemological beliefs, and faculty training on critical and gender theories to improve STEM pedagogy [62,63].

2.6. STEM in Research-Intensive Universities

Research-intensive universities have a very high amount of research occurring on their campuses and include missions and values that center research productivity. The latest research on STEM teaching-focused faculty at research-intensive universities has shown the pivotal role of teaching-focused faculty in easing the responsibility of teaching in the STEM department, curriculum innovation, and student support [64,65]. Additionally, STEM undergraduate research programs are another area of research infrastructure in research-intensive universities. Gin et al. [66] compared the departure of students from undergraduate research programs across various institution types and found that students enrolled in R1s were more likely to depart from an undergraduate research program due to a lack of time to engage in research and a lack of principal investigator faculty support. Also, first-generation Students of Color in a research-intensive, predominantly-white institution desired multicultural centers and finding community [11]. The latest research on HSRI campuses examines these institutions as a pathway for Latinx faculty and postdocs [67,68]. The latest reports on HSRIs examine "servingness" in a public campus system in California [4] and the growth of HSRIs nationwide, along with the STEM student success initiatives at HSRIs [69]. Thus, this is a timely study given the lack of research on the growing number of HSRIs and how the research context in an HSI may impact the departure of Latinx students in STEM.

3. Materials and Methods

3.1. Institutional Context and Demographics

This qualitative exploratory study was conducted at a large public four-year research-intensive university in California, which was designated as a Hispanic-Serving Institution (HSI) and Asian American Native American Pacific Islander-Serving Institution (AANAPISI) in 2015. This university was one of the first members of the Association of American Universities (AAU) to become an HSI. A total of 23,070 undergraduates were enrolled during the 2018–2019 academic year when this study was conducted [70]. Approximately 42% of all undergraduates during this year identified as first-generation college students. The racial/ethnic composition was as follows: 30.6% White; 25% Hispanic/Latino/a; 24% Asian; 12.4%; International; 4.3% African-American; 2.5% Domestic Unknown; 0.9% American Indian; and 0.3% Native Hawaiian/Pacific Islander. With regards to the number of new and continuing undergraduates (n = 9140) in STEM fields during the 2018 fall term, the three largest racial/ethnic groups in these fields were as follows: White (30%); Asian (27.8%); and Hispanic/Latino/a (21.1%) [70].

3.2. Participants

To recruit participants for this study on Latinx undergraduate students' experiences in STEM majors at an HSRI, the first author and principal investigator of this study contacted undergraduate advisors across various departments (e.g., Chicana/o Studies, Engineering, Communication, and Psychological and Brain Sciences) and requested to have the recruitment email sent out to students via department mailing lists. To be eligible for the study, participants needed to identify as upper-division Latinx undergraduate students who were either enrolled in STEM majors or had switched out of a STEM major. Additionally, some participants were recruited using a snowball sampling technique, where the principal investigator asked existing participants to refer others who met the study's eligibility criteria [71]. In total, 13 participants volunteered for this study. Of the 13 students, 8 had transitioned to non-STEM majors and were included in this analysis that sought to understand the institutional factors that resulted in Latinx student pushout from STEM.

All the participants in this study graduated top of their high school class and outperformed their peers in their STEM courses. Additionally, all identified as first-generation (the authors characterize "first-generation college students" as individuals whose parent(s)/guardian(s) have not attained a bachelor's degree from a four-year institution in the United States) Latinx college students. Of the eight, seven participants were women. The participants self-identified as either Mexican, Mexican-American, Latinx, Chicanx, or Peruvian. One of the participants self-identified as undocumented. In terms of academic majors, four participants were enrolled as pre-majors in mathematics or mathematics and statistics, while the remainder pursued majors in biology, biopsychology, and psychological and brain sciences (see Table 1). Most switched out of STEM in their third and fourth year, which is when their experiences were captured. Additionally, the majority switched to Sociology and/or Chicana/o Studies majors.

Table 1. Participant demographics and academic background.

Participant	Self-Identification	STEM Pre-Major	STEM Pushout	Non-STEM Major
Adriana	Mexican	Biology	Second Year	Sociology
Alissa	Mexican	Financial Mathematics and Statistics	Third Year	English
Cecilia	Latina	Biopsychology	Second Year	Chicana/o Studies
Jasmin	Chicanx	Mathematics	Third Year	Chicana/o Studies
Lisset	Mexican	Mathematics	Third Year	Sociology
Lydia	Latina	Financial Mathematics and Statistics	First Year	Sociology and Chicana/o Studies
Mario	Mexican	Psychological and Brain Sciences	Second Year	Spanish
Sandra	Peruvian	Psychological and Brain Sciences	Third Year	Sociology

3.3. Data Collection and Procedures

This study was designed as an exploratory qualitative research study, aiming to understand complex phenomena through the perspectives and experiences of participants. Using an exploratory study design allowed for a more open and inductive approach to data collection and analysis, allowing the findings to emerge naturally from the data [71]. A semi-structured interview protocol was used to ensure consistency across interviews while also allowing the principal investigator to explore topics in greater depth and accommodate diverse perspectives [71]. The interview protocol focused on several key areas to comprehensively understand the factors leading up to Latinx student STEM pushout at an HSRI.

First, the protocol examined participants' pre-college academic performance in both STEM and non-STEM subjects. This included exploring their high school coursework, grades, and any extracurricular activities related to STEM fields. The goal was to assess their initial preparedness and interest in STEM disciplines before entering college. Second, the protocol delved into the selection of their initial STEM major and their subsequent performance in related courses. This involved understanding their motivations for choosing a STEM major, their experiences with the curriculum, and their academic achievements and challenges within those courses. By doing so, we aimed to identify patterns or difficulties that might have influenced their academic journey. Third, the interviews explored interactions with STEM faculty, graduate students, and staff. This section focused on the nature and quality of these interactions, including mentorship experiences, availability of academic support, and the overall academic environment. We sought to understand how these relationships impacted the participants' sense of belonging and academic success in STEM fields. Finally, the protocol addressed the decision-making process associated with their departure from STEM to a non-STEM major. This involved discussing the factors that contributed to this result, such as academic difficulties, lack of support, and overall thoughts and feelings associated with this process. By exploring these areas, we aimed to gain insights into the critical moments and considerations that shaped the academic trajectories of the participants.

Participants were invited to interview in their third or fourth year to provide a retrospective reflection on their academic experiences. This timing allowed for a comprehensive assessment of their journey through the program, offering insights into their decision-making processes and the challenges they faced throughout their studies. Each interview was conducted on a one-to-one basis with the principal investigator in person or virtually via Skype or Zoom. Prior to starting, participants were informed of the purpose of the study and of their rights as participants. Participants who were interviewed in person signed a consent form, and participants who were interviewed virtually provided their verbal consent. Each interview ranged between 45–75 min, and all participants received a $15 Amazon Gift Card for their time. To protect their identity and maintain confidentiality, pseudonyms were assigned to all participants. Each interview was audio recorded and transcribed verbatim.

3.4. Data Analysis

To ensure that this inductive approach was maintained throughout the analysis, the principal investigator carefully listened to each audio recording and cross-referenced them with their corresponding transcript. Each team member then listened to the audio files and cross-referenced them with the assigned transcripts to ensure accuracy and fidelity to the original content. To facilitate systematic analysis, a two-cycle coding method was utilized [72,73]. In the first cycle, meaningful tags were assigned to "chunks" of data, allowing for a preliminary organization of the information. This initial coding process ensured the identification of prominent topics, issues, or concepts within the dataset. The second cycle involved a focused examination of the coded data, enabling the team to identify and collectively deliberate on the preliminary codes.

To ensure rigor and credibility, the research team convened regulatory in virtual meetings held biweekly over the course of five months to deliberate on the preliminary codes, engaging in rigorous discussions to refine interpretations and identify emerging themes. Through this collaborative process, the researchers aimed to minimize individual biases and validate the preliminary findings. Additionally, the regular meetings provided an opportunity for ongoing discussions, comparison of interpretations, and collective decision-making, thus enhancing the reliability and trustworthiness of the analysis. Through this meticulous process and investigator triangulation, the team gained a comprehensive understanding of the underlying meanings and narratives, identifying three prominent themes that best-explained pushout across all participants [74].

4. Results

From our analysis, three prominent themes surfaced that addressed how institutional factors contributed to pushout in STEM among Latinx students enrolled at a Hispanic-Serving Research Institution, including (1) a disconnect in theory-based STEM courses, (2) unsupportive and busy research-focused environments and (3) the psychological toll of a stripped STEM identity.

4.1. Disconnect in Theory-Based STEM Courses

Participants expressed difficulty connecting to their STEM course material, which hindered their academic progress and led to disengagement from their fields of study. For example, all four of the participants in this study who were pursuing math-related majors struggled with the level of abstraction and theoretical nature introduced in their math courses at their R1 institution. Below, Jasmin explained how she struggled with the theoretical concepts introduced in Math 8, which was the final course in the mathematics pre-major series:

> Math 8, it's a theory-based class, and since I was so used to doing computation throughout my whole education, this class was like literally proving theories. So it was just like a different direction. I didn't know anything. I never thought that math would [involve having] to write down and prove stuff, so I freaked out.

Jasmin's experience with Math 8 highlights a significant challenge faced by students transitioning from high school-level math focused on computational approaches to theory-based approaches introduced at R1 institutions. The abrupt shift to an abstract mathematical style at the R1 university, without adequate scaffolding, led to feelings of inadequacy and being overwhelmed, as evidenced by Jasmin's statement that she was "freaking out" about the course content. Lisset shared a similar experience in Math 8:

> . . .that class was more proving theories and stuff like that and I was like, 'Oh, the class before this was literally about finding the surface area of an integral' so I didn't like it and I kind of was nervous because. . .I was taking Math 8 in my third year. I thought, 'Oh shoot, my fourth year's going to look like this? 'What am I doing? I don't like this.'

For Lisset, the sudden shift from applied problem-solving to learning about theoretical proofs at an R1 was an extremely challenging transition. Moreover, Lisset realized that she did not enjoy this new approach, leading her to conclude that she did not want to remain in a major that could potentially require the completion of more theory-intensive courses that she disliked. Another participant, Lydia, had a similar experience in her math major:

> It's just that when I thought about math, I thought it was going to be numbers. . . actual numbers and this class was more about theory, which I didn't even know math theory was a thing. . .So I would try to understand the problem but it wasn't the problem that they were worried about it was more like the theory behind the problem and I couldn't...I couldn't understand. In my high school, we didn't talk about theory. . .I think that's what really threw me off even taking it the second

> time...I was like, 'we are still talking about theory, where's the math, where's the numbers?'

Lydia's experience highlights the mismatch between students' expectations of their math majors and the content of university-level math courses at an R1. Despite taking the course a second time, Lydia shared her frustration when she stated that she just "couldn't understand" or grasp this new and foreign approach to math. According to all three participants, their high school experiences primarily focused on computational aspects of math, with little exposure to theoretical concepts or proof-based problem-solving. This lack of exposure left participants ill-prepared for the transition to research-driven math approaches that emphasized theoretical underpinnings—leading to feelings of anxiety, confusion, and frustration.

In addition to being turned off by theory, another huge source of pushout was the lack of connection to the course material. For example, Sandra, a pre-psychological brain sciences major, shared that starting in her first year, she visited her Educational Opportunity Program (EOP) advisor twice per quarter because she was concerned about graduating on time due to her ongoing struggle with trying to connect with the course content in her pre-major. EOP is a program that focuses on serving students who are income-eligible and first-generation undergraduates. Below, Sandra shared the advice she received from her EOP advisor about continuing in her pre-major:

> One of the things she said was, 'I know you want to do this, and I know you're gonna do it for your family at this point because you don't like the major, but don't let that stop you from being your best. You obviously do better and like the courses that have to do with critical thinking and not math and not science and not periodic tables. . .that stuff, it's not interesting to you.'

In this situation, the strong relationship Sandra had formed with her EOP advisor helped the advisor recognize that Sandra thrived in courses where she could actively engage with the material, unlike the traditional pedagogical approaches typical in R1 STEM courses where students are expected to be passive recipients of information. The advice her EOP advisor provided resonated with Sandra, making her realize that she no longer wanted to force herself to endure any more STEM courses. Furthermore, Sandra's EOP advisor acknowledged her concern about possibly disappointing her family by switching majors but emphasized the importance of finding fulfillment in a field where she could thrive. This conversation led Sandra to conclude, "You know what, you're right. . . I need to do it right". For Sandra, "doing it right" meant switching to a major she both enjoyed and found meaningful.

Another participant who realized she did not enjoy her pre-major courses was Adriana, a pre-biology major. Adriana failed several of her pre-major courses and was placed on academic probation in her first year. She shared the following:

> I had to tell myself, 'this is not for me, I do not like this at all, I am miserable'. . .I did better in sociology, I got a B, and I took Chicano Studies, and I got a B. I was like, 'okay, I like these courses', I was interested in them, I connected with them, and I knew what was going on. . .I love to write. I like writing, and I really liked one of the books that we read in that class—I finished it in one day! I was like, 'Why am I doing something that I know I'm not good at?'

Adriana's reflection highlights the profound impact of aligning academic pursuits with personal interests and strengths. She described her experience in biology as "miserable", which contrasted sharply with the enthusiasm she expressed about Sociology and Chicano Studies courses, where she earned Bs and found the material engaging and relatable. Her comment, "I like these courses, I was interested in them, I connected with them, I knew what was going on", underscores the importance of students resonating with their coursework, which was absent in her biology courses.

Finally, Lisset shared how the course material in mathematics was not "meaningful", and she questioned how her major would help her make a greater impact in the world:

> I wasn't learning anything; to me, it wasn't anything meaningful, and I think that's the disconnect. . .I liked it, but it wasn't meaningful. . .I started realizing that's not what I wanted to do at all. I want to have a job where I feel I'm making more of an impact. I know you probably can still make an impact as a data analyst.

According to Lisset, she "wasn't learning anything meaningful", and she ultimately aspired to pursue a career where she could make an impact. For many of the first-generation Latinx college students in this study, pursuing a career where they could make an impact in their communities or the world drove them to persist in higher education. While Lisset understood, on some level, that mastering statistics and data analysis could enable her to potentially make an impact in the world, she was not exposed to the real-world applications of this type of knowledge or the types of careers she could pursue that would enable her to apply these skills in a meaningful way.

4.2. Unsupportive and Busy Research-Focused Environments

Participants also shared unsupportive exchanges and interactions they had with faculty, graduate students, and staff that contributed to their STEM pushout. All participants shared that they experienced a lack of "care" from institutional agents and felt neglected in their "busy" research-focused STEM departments. The sections below focus on faculty interactions, followed by graduate student and staff interactions.

4.2.1. Dismissive Interactions with Research-Focused Faculty

The majority of the participants shared that the faculty they interacted with were not approachable and "did not care" about students, which resulted in feeling "unwelcome" in STEM at the research university. For example, Jasmin, a former math and statistics major, shared the following when asked about her experiences interacting with faculty:

> I honestly feel like the professors here don't really care about their students. . . they're here to do their own research, and that's pretty much it. . .a lot of [professors] were just like, 'here's your test' that's it, like, 'we are not going to discuss it,' like, 'that's the grade you got.' I never went to the office hours. If they don't care what I got on the test, what makes me think that going up to them [that they're] going to want them to help me, so I was just like, 'no, I am not going to go to office hours.'

According to Jasmin, "professors here", referring to the R1 institution, tended to be cold and dismissive with students, which conveyed the message that faculty were not genuinely invested in their students' success; rather, they were focused on their own research and academic pursuits. It became clear to Jasmin that professors did not prioritize teaching and students' learning. These types of exchanges sent a clear message to students, specifically that professors at R1 institutions were not there to help them, which led Jasmin to conclude that there was no point in trying to attend office hours. As a result, Jasmin refrained from engaging with faculty outside the classroom altogether—further alienating her. Another participant, Mario, a psychological and brain sciences pre-major, shared how he perceived his interactions with faculty:

> They didn't always come off as the friendliest or the 'I want to help you' type. They would verbally say, 'Come into office hours if you have any questions, and we will help you,' but it never felt. . .genuine or 'I'm here to try to help you be a better student or person,' or whatever vibe that I got from the departments that I've been in after that, and that's just the faculty. . .

For Mario, verbal attempts to encourage students to come to office hours did not feel "genuine". As with Jasmin's experience, STEM faculty were perceived as showing a lack of commitment to supporting students' academic and personal growth. Additionally, Mario's comment that faculty never offered to help students "be a better student or person" indicated his desire for holistic mentoring and advising that extended beyond classroom

content. Mario then referred to faculty wanting to help students as a "vibe" he had only experienced in non-STEM departments. Similarly to Mario, Lydia referred to the dismissive attitudes she experienced within the math department as a "vibe" she felt:

> [This university] has probably the worst math department. . .the vibe you get when you go [there] like nobody really reaches out to help you. . .I went to office hours, and sometimes [the professor] wasn't very approachable. It was just kind of like, 'What's your question? Oh, that's not really a good question.' He said it wasn't really a good question, 'those are questions for like your TA, that's not for me to answer.'

Lydia's account further sheds light on how students in R1 STEM departments often find themselves without adequate support from professors, who frequently direct students to teaching assistants (TAs). This practice is rooted in the hierarchical nature of these institutions, where faculty are primarily focused on research and scholarly activities and delegate teaching tasks to their TAs. Instead of answering Lydia's question, this professor made it clear that it was the TAs, rather than the faculty, who were responsible for the direct educational needs of undergraduates at the R1. These types of exchanges were not just confined to in-person or verbal communication; however, Cecilia, a pre-biopsychology major, shared the types of emails she would receive from faculty, "I think the professors are hella intimidating in STEM. . .sometimes they send emails like, 'Oh do you want to fail your final?,' and for you to read that email. . .you know. You never felt safe in STEM". For Cecilia, not only did she find the professors at the R1 intimidating, but she also viewed the types of emails they sent as threatening. Overall, the sentiment of not "feeling safe in STEM" at this R1 research university was a recurring topic of conversation among participants.

Additionally, the absence of supportive STEM environments hindered the participants' willingness to seek help or engage with faculty. This perceived lack of genuine support from faculty contributed to participants' negative experiences and ultimately impacted their academic success and sense of belonging in STEM. For example, Lisset, a math major, tried to utilize the professors' office hours in an attempt to build relationships and inquire about graduate school, but instead of receiving information and guidance, she encountered the following:

> [Professors] were kind of surprised that I was even asking questions [about grad school], and I was just a little bit discouraged because I was looking to just get [insight], 'How did you become a professor? What made you get into this route' and they were kind of not really helpful.

As a student with graduate school aspirations, Lisset naturally thought professors at an R1 institution would be able to provide her valuable insights into the process of applying and pursuing graduate school. Instead, Lisset encountered "surprised" reactions from not one but multiple professors, which eventually had a cumulative effect on her and "discouraged" her from seeing herself as someone who could pursue an advanced degree in math. In other words, her graduate school aspirations were extinguished.

4.2.2. Discouraging Interactions with Busy Graduate Students and Staff

As aforementioned, these types of negative interactions did not stop with faculty. Participants also had negative interactions with STEM staff, graduate student tutors, and teaching assistants (TAs) who are responsible for providing students in large lecture courses at R1s with supplemental instruction. Below, Jasmin shared her experience with her math TAs and STEM tutors in the tutoring center:

> I really didn't like a lot of my TAs. . .they would always underestimate people, even though they probably didn't do it intentionally, pero, even little words hurt; whatever you say, people are going to take it the other way. . . I would also [go to the tutoring center], and then sometimes, they don't mean to, like, say stuff, pero a veces se sale. . .Sometimes they'd be like, 'You really don't get this?' and it's just like, 'I really don't get this; when I say I don't get this, I mean I don't really get

> this.' So it makes you feel bad for yourself because it might be simple to them, but it's hard for me, and you are just underestimating my ability for saying, 'You really don't get this.'

According to Jasmin, both TAs and STEM tutors had the tendency to make disparaging comments and remarks to students that would "hurt". Participants cited numerous instances where they encountered this type of behavior from both these types of institutional agents in STEM at the R1. Jasmin's attempt to find additional instruction and support from tutors in the tutoring center backfired as she was instead met with the same attitudes her TAs exhibited, which in Jasmin's case not only made her "feel bad" but placed the blame on her for not understanding the coursework. Additionally, Jasmin's remark that the tutor was "underestimating" her ability implied that she believed she was capable of learning the content, but the tutor failed to use different pedagogical approaches to help her grasp the content. Instead, Jasmin perceived a sense of superiority, which is often rewarded in hypercompetitive STEM environments at R1s.

Another participant, Adriana, shared a common occurrence she encountered with TAs in biology:

> In Bio, it was just like, 'Okay, you have a question? Okay, this is how you do it, okay, figure it out; I'm not going to do it again because all these other kids still have to ask questions,' and I was like, 'Oh my gosh, okay, okay,' you know?

In this excerpt, Adriana's TA showed a lack of personalized attention and concern for whether or not she understood the course content. The comment, "I'm not going to do it again because I have all these other kids that still have to ask questions", exemplifies the busy nature of this STEM environment. Additionally, the TAs comment conveyed a feeling of being overwhelmed and overworked, which resulted in an eagerness to rush off undergraduate students. Furthermore, such incidents highlight a concerning trend where teaching appears to be of minimal importance to TAs overseeing large weeder courses.

Participants had similar encounters with STEM department staff who are responsible for advising and overseeing the academic progress of students. According to the participants, undergraduate advisors and staff were also dismissive, not helpful, and, in a couple of instances, discouraged some of the participants from persisting in their STEM majors. For example, Lisset shared the discussion she had with the math undergraduate advisor:

> The lady kind of discouraged me. . .She basically looked at the classes I've taken, and she was like, 'Well, you didn't really do as well as normally we expect students to do; you get like an A or two, but your other classes are in the B and C areas, even when you retook a math class you didn't do much better.' She was like, 'Maybe math and stats is not for you; I would recommend you to get a new major.'

This depicted interaction exemplifies a failure on the part of some STEM advisors to adequately support Latinx students. Rather than providing constructive solutions or directing Lisset to campus resources, this advisor hastily told Lisset "to get a new major". Moreover, this advisor compared Lisset's academic performance to that of other students instead of viewing Lisset as an individual and tending to her respective needs. Finally, Mario described his overall impression of the psychological and brain sciences department:

> We were a very busy department, and that's kind of the feel that I got from the entire department. They live in this space where they are too busy for everything. . .it never feels personalized. . .it just kinda feels like you are a nuisance to them.

As articulated by Mario and referenced by the rest of the participants in this study, the prevailing culture in STEM departments was one of a constant state of busyness. Instead of receiving individualized attention as a student in the department, Mario perceived his presence to be a "nuisance" to members of the psychological and brain sciences department who did not have time to advise, mentor, or help him persist in the major, leading to his pushout. Mario continued:

> When I worked with the orientation program and had to meet with [representatives from the psychological and brain sciences] department, the first thing they would tell us is, 'Tell them not to come to our office. If they want to come during the summer, tell them not to. If they want to come during their first quarter, they shouldn't come to our office hours, tell them to email us first to make an appointment, and then we'll get to them.

As conveyed in the instructions Mario received, the department's busy environment and preference for minimal student interaction highlight a critical gap in the educational experience of Latinx students. The emphasis on limiting student interaction further reinforced the idea that R1 STEM faculty and staff viewed students as a "nuisance" and burdensome.

Furthermore, participants continually referenced the notion of feeling distant from members of their STEM departments, especially when they compared and contrasted the interactions they had with STEM versus non-STEM staff. For example, Alissa, a financial statistics and math pre-major, shared the following exchange she had with undergraduate math advisors, "Sometimes they're just sitting there and waiting for you to ask them a question. [They might ask] 'How's it going? Alright?" According to Alissa, this rushed and impersonal approach vastly differed from the more approachable style of advising she received outside of STEM. Alissa continued, "My new advisor, she's like, 'Oh tell me, what courses do you like?' So, I've been able to tell her all my courses, and we have a full-on conversation, where in math, it was like, 'Okay, this is what you're doing here'". As Alissa observed, STEM advisors were less personable and did not attempt to build relationships, learn the interests of, or engage students. Instead, the STEM advisor's approach was to rush students in and out of their offices and have them follow a pre-prescribed curriculum. In other words, STEM advisors wanted students to follow the same path rather than an individualized plan tailored to the students' needs, which would require relationship-building and time to develop.

Similarly, Adriana shared her experience with advisors in the Educational Opportunity Program (EOP) and compared these experiences with those she had in STEM:

> I never really liked [going to my department's advising office]. I would just go to Letters and Science. . . and I went to EOP. . .EOP, they were more, I don't know, nicer or more like, 'Okay, what are you doing? What are your steps you're taking? Why do you want to do it? What are your goals?' [In biology] they weren't like, I don't know. . . not intimate, I don't know how to explain it.

As demonstrated by Adriana's experience, EOP advisors were personable and took the time to get to know her and her interests before making any recommendations, which can be attributed to the program's holistic advising approach that aims to validate students' lived experiences. Throughout this study, it became evident that the participants consistently recognized their struggles and actively sought assistance, only to encounter quick dismissals, ridicule, or blame for the difficulties they experienced in their busy research-focused STEM departments, which ultimately led to their pushout.

4.3. Psychological Toll of a Stripped STEM Identity

The final theme examines the psychological toll of being pushed out of STEM. The participants entered the institution with a strong academic self-concept and STEM identity. However, the transition to pre-major STEM courses at an R1, combined with theory-heavy, unmeaningful courses and unsupportive STEM environments that culminated in being pushed out of STEM, resulted in a psychological toll on all participants. For example, Sandra, a psychological and brain sciences pre-major, shared her experience coming to terms with the fact that she would have to switch to a non-STEM major:

> I'm failing everything. I'm feeling horrible about myself because I'm an academic [oriented] student. I've always done great in high school, 'what is wrong with me?'. . .it wasn't until I realized that it was the major that was pulling me back that I decided, 'Okay, it's fine...it's just not the right fit for me', and that's what

> made me really decide to switch. I was so sad. I felt like a failure. . .in terms of quitting, it was just a shock to me that I couldn't do it. It was like, 'What's wrong with me?'

Instead of closely examining the external factors that pushed her out of STEM, such as the disconnect she experienced in her STEM courses to the dismissive exchanges she encountered when interacting with institutional agents in STEM, Sandra blamed herself for not being able to persist in her STEM pre-major. Worst yet, Sandra, along with the other participants in this study, reported feeling "dumb" or like a "failure"—constantly questioning their academic and STEM abilities as conveyed in her question, "What's wrong with me?" Sandra experienced cognitive dissonance coming to terms with having been an excellent student in high school and being able to accomplish all her goals successfully to transitioning to an R1 and thinking STEM wasn't "the right fit" for her. Furthermore, participants often found themselves dwelling on what they had or had not done correctly to find themselves in their predicament rather than reflecting on how their research-focused STEM environments pushed them out. Sandra continued:

> It was chemistry courses...at first it was really boring because for me I thought I liked chemistry and math because I was so good in high school. It was different; I was so good at it. I had the best grades compared to my English grades. I had As in everything, but it was like overachieving grades and so it was such a shock to me when I just didn't get what was happening, and I would pay attention in class. I would stare at the board, stare at the professor, and try to take everything that they're saying in, and it would just not click for me. . .

Once again, Sandra internalized the disconnect she experienced in her courses that resulted in her pushout from STEM as her own failure. Sandra continuously emphasized that she had always been an academically strong student in high school and pointed out that she was an overachiever. As Sandra relived the struggles she endured in her STEM courses, she exhibited a strong sense of disbelief, reconciling with the fact that she was unable to understand the content and persist in her chemistry course.

Participants also shared that they often refrained from engaging in class because they preferred not to call attention to themselves, given that they were already struggling in their STEM courses. For instance, Lydia shared the following when asked if she thought it was intimidating to answer questions in class:

> Yeah, for sure because of, like, just the fact that you got the answer wrong, like people would know now...like you're already singled out, you already know how many Latinos are in there, so the fact that you got a question wrong, it's like, 'Oh, there goes that person that got the answer wrong.'

Lydia's response sheds light on the complex dynamics at play in classroom settings for Latinx STEM students at an R1 institution. As one of the few minoritized students in class, Lydia was hyperaware of her presence in the classroom and avoided asking questions for fear of being wrong and being perceived negatively by her peers. The hypercompetitive nature of STEM further intensified her self-doubt, which led to feelings of inadequacy. This toxic combination of academic pressure, perceived lack of support, and the fear of being judged by peers kept the participants of this study from asking questions or seeking help in class.

Similarly, Alissa shared her apprehension about asking questions in math and statistics classes, "I would be like, 'I don't even want to ask this question, what if it's dumb?'. . .It was intimidating because some [students] understood everything right off the bat. . ." Alissa's hesitancy reflects an internalized fear and lack of confidence in her academic abilities. Her fear of being perceived as incompetent or unintelligent, particularly in comparison to other students, prevented her from fully engaging in class. Another participant, Cecilia, a pre-biopsychology major, shared how being one of three minority students in her chemistry lab made her question whether she belonged in STEM at an R1:

> I mean, just looking at chem lab and seeing those two other People of Color. I mean, just seeing that like it was like, 'Fuck like I don't belong here' I think little portion of me went through a little bit of imposter syndrome because I was like, you know, like, 'I don't see anyone of my type, I don't see anyone that looks like me that is in STEM that is *making* it out here.'

Cecilia's experience vividly illustrates how the feeling of not belonging was intensified in high-stakes STEM environments at R1 institutions, particularly for minoritized students. Her reaction to being one of only three racially minoritized students in her chemistry lab underscores the psychological burden of underrepresentation. The lack of peers who share her racial background triggered a sense of isolation and imposter syndrome, leading her to question whether she truly belonged in STEM. In Cecilia's case, the absence of visible role models who look like her in STEM fields at an R1 institution amplified her self-doubt, reinforcing the notion that success in such a setting might be unattainable for someone like her. Her remarks highlight how the underrepresentation of racially minoritized students in STEM at R1 institutions not only affects academic performance but also deeply impacts students on a psychological level, further intensifying feelings of exclusion from these fields. Another participant, Lisset, shared some of the thoughts and experiences she had that made her question whether STEM was right for her:

> I really did enjoy math in high school. . .[here] I had a mixed feeling because I lost my scholarship, so am I really fit for this? I just kept trying; I was like, 'Okay, I guess I'm not doing that bad', but then I didn't really enjoy it.

Despite "not doing that bad" in math courses, Lisset ultimately came to the conclusion that she was not enjoying her major and that it was not the right fit for her. This highlights a critical aspect of STEM push-out—even when students can overcome academic challenges, the absence of feeling that they belong in STEM can ultimately drive them away.

In the following excerpt, Jasmin recounts a distressing incident where her professor's derogatory remark made her question her academic abilities:

> Yeah, so I received my midterm back, and I did really horrible. What got me so mad or so discouraged was that [the professor] made a comment like, I can't remember exactly what kind of comment it was, but it was kind of saying like 'y'all are stupid'. So then, like, that got to me, and I was like, 'Fuck, why am I here? Damn, I feel stupid', so then I was like, you know what this isn't for me. This really isn't for me.

For Jasmin, the professor calling students "stupid" was the final straw. This derogatory remark pushed her to a breaking point where she began to question her place in STEM and at the university. The professor's comment shattered her confidence and led her to conclude that STEM was not for her. These harsh words fueled her insecurities and fears and ultimately caused her to question her STEM identity and give up on her STEM aspirations. This excerpt vividly illustrates the emotional turmoil experienced by students before being pushed out. Perhaps Cecilia's comment below best encapsulates the overarching experience shared by these participants within STEM disciplines:

> [In other majors] if you fail a course, you don't pass it whatever, you're still in the major, but if you fail a course [in STEM], you're out, you know? You could work on it for four years and be out just like that. There is no, no little setback, no nothing! You're completely pushed out! So when people ask, 'Oh, did you get kicked out of the major?' It's like, no! You got *pushed* out of the major!' You didn't go by choice!

Cecilia's comments poignantly capture the common experience of these participants, revealing the unforgiving nature of STEM programs at R1 institutions. Her statement, "You didn't go by choice!" showed that despite her determination to persist in STEM, she was ultimately "pushed out" by a series of institutional barriers that created an unforgiving academic environment. Cecilia's comparison between STEM and non-STEM majors highlights

her awareness of the rigid policies and practices in STEM that offer no room for recovery from setbacks and that fail to take into account the complexity of students' needs.

5. Discussion

The findings from this study reveal critical insights into the institutional factors contributing to the pushout of Latinx students from STEM disciplines at an HSRI. The experiences of the participants, as highlighted through the three main themes: disconnect in theory-based STEM classes, unsupported and busy research-focused environments, and the psychological toll of a stripped STEM identity, underscore the multifaceted challenges faced by these students. Overall, we found that students are seeking meaning in both their STEM courses and in their relationships with institutional agents on campus. Without these connections, we see the toll it takes on students' academic and personal selves.

One of our most significant findings was students reporting wanting to make meaning in their STEM coursework. The transition from high school to university-level STEM courses proved to be a significant barrier for many participants. The abrupt shift from computationally focused high school curricula to abstract and theory-based courses at the research university left students feeling unprepared and overwhelmed. This study highlights the ways that these courses are gatekeeping students to STEM majors [49,52,53], yet our findings highlight that the pushout in STEM can be traced to the theoretical focus, in this case, a math class at a research-intensive university. This disconnect not only hindered their academic progress but also led to a sense of alienation from the material, causing them to question their fit within their chosen STEM fields. Jasmin, Lisset, and Lydia's accounts highlight how a lack of adequate scaffolding in these courses contributed to their disengagement and eventual departure from their STEM majors.

The struggle to connect with course content, as seen in the experiences of Adriana and Sandra, further emphasizes the importance of culturally relevant curriculum in STEM, especially at HSRIs whose goal is to serve the Latinx student population by creating inclusive learning environments [6,9] and can bridge the gap between students lived experiences and their academic content so that learning can be meaningful. These students found themselves in environments where the course material did not resonate with their personal interests or perceived future impact, leading to a lack of motivation and a decision to pursue alternative majors where they could find meaning and success. While previous research has shown the lack of engaging pedagogy in STEM curriculum [54–56], it has been argued that the lack of cultural connection in the STEM curriculum experienced by Latinx students is a contributing factor to their departure from STEM [52,53]. The disconnection between students' expectations and the reality of STEM education points to a need for curricular reforms that bridge the gap between theoretical knowledge and practical applications, making the material accessible and engaging for all students is especially critical at an HSRI.

We also saw students wanting to build a connection with faculty, graduate students, and staff. The research-intensive focus of faculty and TAs and the overall institutional environment at an HSRI emerged as a significant factor in the pushout of Latinx students from competitive STEM fields [46]. Students in this study consistently reported feeling neglected by faculty who were more focused on research than student undergraduate education, similar to [72] who found a lack of faculty-student interaction. Jasmin, Lydia, and Mario all described dismissive and unapproachable faculty. The lack of faculty engagement not only discourages students from seeking help but also reinforces students' feelings of inadequacy and isolation in STEM fields and deters students from asking and learning about graduate school. This is particularly troubling given that the mission of an HSRI is to cultivate the next generations of researchers and scholars. The need for personalized attention also extends to the way students interact with teaching assistants, tutors, and staff. Many participants described feeling like they were invisible and had little opportunity to learn and/or engage these institutional agents. It was clear that in this R1 STEM

environment, students were treated as numbers rather than contributing and valued members of the academic community.

The lack of personal engagement can be detrimental to students' sense of belonging and their overall academic success. For example, Mario and Adriana felt like their interactions with STEM faculty and advisors were rushed and impersonal which made them feel undervalued and unsupported. However, when students had the opportunity to interact with non-STEM institutional agents who took the time to get to know their goals, they were more likely to feel motivated and to succeed. These findings shed light on the pockets of support for Latinx students at the university. Students are being deferred to these spaces to receive all of their support; however, it is imperative that departments develop their own infrastructure of support as a way to prevent STEM departure at HSRIs [66].

Taken together, one of the most detrimental findings on the wellbeing of students was the psychological impact of being pushed out of STEM. Many participants entered the university with a strong sense of academic self-concept and STEM identity only to find themselves questioning their abilities and worth in challenging and unsupportive academic environments. Sandra and Jasmine showed an internalization of these struggles, which led to feelings of failure and self-doubt, which eventually led to their departure from STEM. For example, Sandra experienced cognitive dissonance, coming to terms with having been an excellent student in high school and being able to accomplish all her goals successfully to transitioning to an R1 and thinking STEM wasn't "the right fit" for her.

The psychological impact of STEM experiences of Latinx students at HSRIs is less often discussed in the literature. The experiences of Lydia, Alissa, and Cecilia highlight the additional psychological burden of being one of the few Latinx students in their STEM classes. The fear of confirming negative stereotypes and the lack of visible role models who shared their backgrounds only increased their feelings of isolation and imposter syndrome. This form of racial microaggressions, of being the only ones in their courses and having few role models [32,37], created a psychological toll that was detrimental not only to their academic performance but also to their overall sense of belonging at the university. In Cecilia's case, the absence of visible role models who look like her in STEM fields at an R1 institution amplified her self-doubt, reinforcing the notion that success in such a setting might be unattainable for someone like her. Her remarks highlight how the underrepresentation of racially minoritized students in STEM at R1 institutions not only affects academic performance but also deeply impacts students on a psychological level, further intensifying feelings of exclusion from these fields. The unforgiving nature of STEM programs, as illustrated by Cecilia, further emphasizes the high stakes in students' educational journeys, where a single setback can result in being pushed out rather than choosing to leave.

5.1. Recommendations for Policy and Practice

The findings from this study have implications for both policy and practice at HSRIs and other research-intensive universities. To address the disconnect in theory-based STEM courses, institutions must consider implementing more supportive and scaffolded approaches to curriculum that support the transition from high school to college. This could include curricular reform to include more applied and practical examples in theoretical courses. For example, course projects and assignments could include concrete issues and examples that are relevant to Latinx communities. Along the lines of curricular reform, research-intensive universities can provide additional scaffolding opportunities to support students who are struggling with abstract concepts. This could be in the form of additional tutoring opportunities, peer mentoring, or programming to help transition students to STEM majors prior to attending the university. By serving and fostering a diverse learning environment that values multiple ways of thinking and problem-solving, HSRIs can better meet the needs of its students [9].

To combat the unsupportive research-focused busy environment, institutions must prioritize the professional development of faculty, graduate students, and staff to ensure

that they are equipped to provide meaningful and inclusive support to undergraduate students. This can include specific training on the racial microaggressions experienced by students in STEM classes at HSRIs [32,35]. Furthermore, institutional leaders at designated HSRIs have an ethical responsibility to implement targeted HSI evidence-based best practices designed to serve and ensure the success of Latinx students in institutional infrastructures. Providing students with service-learning opportunities is one example where faculty can implement opportunities for students to engage in projects in the local community. Giving students additional avenues to engage in undergraduate research would give them insight into possible career trajectories, including graduate school [75,76], especially at an HSRI. This would also allow students to build relationships with faculty and graduate students. Training in this area for faculty could improve the accessibility and approachability of office hours as well as foster a departmental culture that values teaching and mentorship alongside research. The reciprocal benefits of undergraduate students engaging in research not only serve undergraduate students at HSRIs but also help to support faculty. By acknowledging and rewarding the additional time it takes for faculty to mentor students in addition to their teaching, research, and service, perhaps institutions can better support this work at HSRIs.

However, it has been argued that the hierarchical structure of faculty and graduate students at research-intensive universities can create barriers to meaningful interactions as graduate students may be dealing with their own struggles within the academic hierarchy, and thus investing in mentoring programs would be beneficial [76]. While the previous article was not focused on graduate students in STEM fields, evidence from this study shows that training for graduate students in STEM fields needs to be specifically tailored to the needs of the discipline. We recommend that HSRIs invest in providing these opportunities.

There was a clear call for more hands-on and personalized attention in STEM education at an HSRI. This was evidenced by all students who felt so disconnected from Math 8 and were told they should switch majors, given that their grades did not compare to their peers. Students expressed the potential benefits of educational pathways that are tailored to their individual strengths, career goals, and interests. The current STEM curricula do not allow students much variation to develop interests or a sense of ownership over their career trajectories. One solution would be to work with STEM advising to really help create and implement course and career plans that meet the needs of students. For example, an effective approach to better supporting Latinx students at HSRIs would be to develop STEM-specific programs that incorporate successful advising models, such as the Educational Opportunity Program (EOP), which was frequently referenced by the participants in this study.

Finally, addressing the psychological impact of a stripped STEM identity requires a concerted effort to create more inclusive and supportive environments where Latinx students feel seen, valued, and supported. This includes increasing the visibility of Latinx role models in STEM who specifically address the challenges of underrepresented students in these fields. For example, providing mental health resources that meet students' needs. Hiring Latinx therapists who are sensitive to the experiences of Latinx students in STEM is imperative. Additionally, developing programs that build community and resilience among Latinx STEM students is another way to support students. Expanding campus organizations such as the Society for Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS) and increasing these supportive student groups is another way to help students foster their STEM identity. By recognizing and mitigating the psychological toll of being pushed out of STEM, institutional agents at HSRIs can cultivate a more inclusive STEM community that empowers students to pursue their passions and see themselves in STEM. Addressing these issues means that we not only look at the systemic barriers and biases but we foster a supportive and inclusive learning environment that supports and validates students' identities and experiences [7,43,44].

5.2. Limitations

A potential limitation of this study arises from its exclusive focus on a single public four-year Hispanic-Serving Research Institution, or HSRI, in California. Therefore, the findings may be specific to this sample population and geographical area. Furthermore, most of the participants in this study self-identified as being of Mexican descent. To improve generalizability, future research should include a multi-institutional study conducted across the United States and Puerto Rico. This approach would ensure a more comprehensive representation of the diverse Latinx student population at HSI and HSRI institutions. Another limitation was that participants self-selected themselves to be interviewed. This resulted in an overrepresentation of mathematics and psychological and brain sciences majors. Future studies need to include a more representative sample of STEM majors. A more diverse sample of STEM disciplines would ensure that findings are more broadly applicable across different fields. This would provide a more comprehensive understanding of the unique challenges and experiences faced by Latinx students across various STEM majors. Additionally, the self-selection of participants may have introduced bias, as those who chose to participate could have different experiences or motivations compared to those who did not, potentially skewing the results. To mitigate this, future research should consider employing strategies to reach a wider range of students, thereby capturing a more representative snapshot of the Latinx STEM student experience. Lastly, given the majority of participants self-identified as women, it is crucial for future research to include a more balanced representation of genders. This would allow for a deeper exploration of how gender intersects with race and/or ethnicity to influence experiences in STEM at an HSRI, thereby offering a more nuanced understanding of the barriers and supports that impact Latinx students.

6. Conclusions

The experiences of the Latinx students in this study underscore the urgent need for systemic reform within STEM education at R1 institutions designated as HSRIs. It cannot be overlooked that the Latinx population has the highest participation in the workforce, yet less than 9% of Latinx students receive STEM degrees [17,18]. Addressing the disconnect between course content and students' lived experiences, fostering supportive and inclusive environments, and mitigating the psychological impact of exclusion and pushout are crucial steps toward creating a more equitable pathway for Latinx STEM students at an HSRI, which can lead students to graduate school and eventually increase the number of Latinx STEM faculty. These changes are not only necessary for the success of individual students but also for the diversification and enrichment of the STEM fields as a whole. R1 institutions must move beyond their traditional identity as predominantly white institutions to fully embrace their HSRI designation. To truly serve Latinx students, institutional leaders must commit to creating environments that validate, empower, and support these students at every level of their educational journey.

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