



# “I Don’t Back Away from a Fight”: Examining First Year Undergraduate Latinas’ Perseverance in STEM

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## Abstract

Latina students have been enrolling in colleges at increasing rates but experience disproportionate levels of STEM major declaration and persistence, even at Hispanic-Serving Institutions (HSIs). This qualitative study explored the first-year experiences of Latina students at a newly designated HSI to gain insights into how to serve them better as they begin their STEM coursework. Findings from semi-structured interviews suggest that while the Latinas in this study entered college with a strong interest and passion for STEM, they faced challenges during their first year due to the STEM program culture and lack of representation of Latinas in STEM. Students attributed their perseverance and sense of belonging to the social networks they developed with peers and TAs. Implications for other newly designated HSIs include formalizing peer networks, providing supports for TAs, and creating environments that better represent and highlight Latinas in STEM.

**Keywords** STEM Education · HSIs · Latinas · Undergraduate Education

The growing population of Latinx/e<sup>1</sup> students is changing the higher education landscape (Johnson & Lichter, 2016). In particular, Latina (women) students have been enrolling in college at increasing rates (Excelencia in Education, 2019). While enrollment is growing, major declarations in science, technology, engineering, and math (STEM) and persistence in these majors are disproportionately lower for Latinas (National Science Board, 2017; National Center for Science and Engineering Statistics, 2017). One study found that Latino men were five times more likely to major in computer and mathematical sciences, three times more likely to major in

<sup>1</sup> In this paper, we use the term Latinx/e to describe the broader population of people who have historic, social, and geographic roots in Mexico, Central and South America, and the Caribbean. The participants in this study will be referred to as Latinas as that is how they self-identified.

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engineering, and two times more likely to major in physical sciences when compared to Latinas (Rincón & Lane, 2017). As a result, Latina students remain particularly underrepresented in STEM, making up just 3.5% of STEM degree recipients (Excelencia in Education, 2019; Gándara & The White House Initiative on Educational Excellence for Hispanics, 2015). Latinas are also less likely than Latino males to work in STEM fields, even with a related degree (Excelencia in Education, 2019). While Latinas make up 7% of the overall workforce, they comprise only 2% of the STEM workforce (Hispanic Heritage Foundation and Student Research Foundation, 2020). Furthermore, Latina college students experience underrepresentation even at Hispanic-Serving Institutions (HSIs), where federal funding is available to address retention rates and graduation of Latinx/e students (Excelencia in Education, 2019).

A growing body of research has begun to explore the experiences of Latinas in STEM. However, studies that have focused on Latinas have looked primarily at persistence once Latinas have gained entry to STEM occupations or at the end of their college career (Cantu, 2011; Gloria & Castellanos, 2012; Gonzalez et al., 2020; Rodriguez & Blaney, 2021). More needs to be known about the first-year experiences as grades received in STEM introductory courses are associated with a higher probability of majoring in STEM disciplines and are a good predictor of whether students receive a STEM degree (Seymour & Hewitt, 1997; Rask, 2010; Paschal & Taggart, 2021; Thompson, 2021). Understanding the unique experiences of Latina students during this critical time is needed so that services can be designed accordingly.

In addition, policymakers, educators, and administrators need to know more about how to best serve Latinas in STEM at newly designated HSIs. Garcia and colleagues (2019) have noted that simply being identified as an HSI is not sufficient and that institutions need to move from Hispanic-enrolling to Hispanic-serving institutions. There is a lack of guidance for institutions once they are designated as an HSI, which can make it challenging for colleges and universities to enact servingness (Garcia & Koren, 2020; Garcia & Cuellar, 2023). While servingness is hard to measure given the diversity of HSIs and the diversity of the students enrolled at HSIs, Garcia and colleagues have proposed a conceptual framework that includes indicators that can be used to measure servingness. These indicators include both academic and non-academic outcomes. One of these non-academic outcomes, sense of belonging, is particularly crucial to examine during the first year as students begin the transition to college.

This qualitative study was designed to dig deeper into the first-year experiences of Latina students who entered college intending to major in STEM at a newly designated HSI. The research questions that guided this study were: (1) After completing their first year of studies at a four-year newly designated HSI, what challenges related to sense of belonging are identified by Latina students who intend to major in STEM? (2) What contributes to their persistence and sense of belonging in STEM courses during the first year? This study contributes to the literature by analyzing the unique experiences of Latinas who intend to major in STEM during their first year and provides insight into how to better serve Latinas enrolled at a newly designated HSI during this critical period.

## Literature Review

This study builds on two main bodies of research: the successes and challenges Latinas face within STEM programs and the first-year STEM experience. Given the nature of our study, the literature review looks at STEM majors broadly and does not make distinctions between the differences across various majors. Our study is situated in these two bodies of work and seeks to address gaps related to the intersection of the two.

### Latinas in STEM

Prior studies show that Latinas do not all have positive higher education experiences (Villa et al., 2016; Castellanos, 2018). Despite their high academic achievement levels, family and employment pressures can present challenges to Latina students' transitions to higher education (Sy & Romero, 2008). Looking specifically at STEM programs, scholars have identified factors that create challenges for Latina students, such as doubts about their intellectual capacity (Stevenson et al., 2019) and microaggressions, which are subtle verbal and non-verbal exclusionary practices directed toward people of color (Huber & Cueva, 2012). In addition, the social climate Latinas encounter in STEM programs can be challenging due to feelings of marginalization, skepticism, self-doubt, and isolation (Rodriguez & Blaney, 2021).

Despite these challenges, factors have been identified that may increase Latinas' sense of belonging and persistence in STEM. These include role models, faculty, peer, and family support (Contreras Aguirre et al., 2020; Gloria & Castellanos, 2012; Rodriguez & Blaney, 2021; Villa et al., 2016). Latinas find support in peers who are like them regarding gender and family background, who can help them navigate negative stereotypes related to the intersectionality of ethnicity, gender, and science roles and can provide external validation (Rodriguez et al., 2019). Many Latina students find involvement with identity-based STEM organizations also encourages a sense of belonging and reinforces STEM identity (Banda & Flowers, 2017; Rodriguez et al., 2019; Rodriguez & Blaney, 2021). However, other Latina students shy away from identity-based STEM groups as a conscious decision not to group based on identities (Banda & Flowers, 2017). In addition to peers, Latinas perceive family support as essential to succeed in college (Gonzalez, 2013; Gonzalez et al., 2020). Latinas often seek to influence and motivate younger siblings (Gloria & Castellanos, 2012; Villa et al., 2016; Gonzalez et al., 2020). Being a role model for younger siblings, however, can also be stressful (Gloria & Castellanos, 2012).

These studies focus on the overall experience of Latinas in STEM majors and give some insight into the challenges students face. They also offer some suggestions for how to increase a sense of belonging in STEM fields. However, these studies do not explicitly focus on the first-year experience. This study seeks to explore this critical time when Latinas begin the transition to college and take introductory STEM courses.

## First-Year STEM Experience

Students' first year of college, including grades and experiences in first-year courses, are important predictors of major choice and later academic success (Chang et al., 2014; Dika & D'Amico, 2016; Seymour & Hewitt, 1997). Students with higher GPAs are more likely to major in STEM, while students with low GPAs in the first year are often discouraged and do not pursue STEM majors (Seymour & Hewitt, 1997; Whalen & Shelley, 2010; Paschal & Taggart, 2021; Thompson, 2021). Although it is common for students to change their majors early in their college experience, students pursuing STEM degrees are more likely to do so (National Center for Education Statistics, 2017). By some estimates, 30% of non-STEM majors will change degree programs compared to 35% of STEM majors. The rate of change to non-STEM majors by Latinx/e STEM students compared to their White peers is 37% (Reiegle-Crumb et al., 2019). When students struggle in the first year, they are more likely to choose non-STEM majors over STEM majors (Paschal & Taggart, 2021; Stinebrickner & Stinerbrickner, 2011).

Race and gender can play a role in persistence during the first year. For example, women who failed an introductory course were less likely to earn a bachelor's degree in STEM (Ost, 2010; Sanabria & Penner, 2017). In addition, Chang et al. (2014) found that Black and Latinx/e undergraduates were less likely to persist in STEM than their White and Asian counterparts. However, experiences such as study groups and joining academic clubs and organizations can mitigate this effect. Cruz et al. (2021) found that peer-to-peer coaching at an HSI promoted increased persistence among Latinx/e students in STEM.

While these studies focus on the first year and on Latinx/e students in general, they do not explicitly investigate the first-year experience of Latinas. This study sought to highlight the voices of Latinas and unpack their perceptions of their first year as they participate in introductory STEM courses. Understanding their challenges, as well as how they attribute their perseverance, will allow for a better understanding of how to address their needs during the first year.

## Conceptual Frameworks

This study draws on two conceptual frameworks: the multidimensional conceptual framework of servingness and sense of belonging. In our larger study, we use the frameworks to design and measure the impact of our interventions. In the study that is the focus of this paper, the frameworks were used to guide the data collection and analysis. More details are provided in the two sections that follow.

### Multidimensional Conceptual Framework of Servingness

The federal government defines HSIs as nonprofit, degree-granting postsecondary institutions that enroll at least 25 percent of undergraduate Latinx/e students. HSIs represent some of the most diverse public institutions in the country and enroll many

low-income, first-generation, students of color (Benitez & DeAro 2004; Conrad & Gasman, 2015). However, there is no federal requirement for how institutions serve these students. Servingness is a concept that Garcia et al. (2019) developed to better explicate what it means to move from enrolling Latinx/e students to serving them. However, measuring how to best serve students at HSIs is complex, given the institutions' diversity and the populations they serve (Garcia & Koren, 2020; Garcia & Cuellar, 2023). To help with this, Garcia and colleagues (2019) introduced a multi-dimensional framework of HSI servingness.

The framework suggests that servingness can be examined in two ways: (1) indicators of serving; and (2) structures for serving. Indicators of serving can be used to measure servingness and were the focus of this study. They include academic outcomes, such as retention, persistence, graduation, transferring, course completion, STEM degree completion, post-baccalaureate enrollment, and job outcomes, as well as non-academic outcomes, such as the development of academic self-concept, sense of belonging, social agency, leadership identity, racial identity, critical consciousness, civic engagement, and social justice orientations (Garcia et al., 2019). While all these indicators are important components of servingness, this study focused on one aspect of the framework, students' sense of belonging, which we would argue is an important indicator to examine in the first year as students transition to a new environment.

Another important concept to consider in how institutions are serving Latinas is the idea of microclimates. Microclimates refer to smaller distinct spaces where individuals operate within institutions of higher education (Serrano, 2022). Microclimates can include programs, departments, or student organizations. An individual's perception of the campus racial climate at their university is influenced by their perception of the smaller microclimates in which they operate. For this study, the microclimate would be the STEM introductory courses and related activities these students participated in during their first year. Viewing their experiences in this microclimate allows us to zoom in on the experiences Latinas in this study have in their interactions with peers, faculty, and others within the STEM first-year courses, which may or may not be different from their experiences within the institution at large.

Using the multidimensional framework allows us to situate the ways that Latinas' individual experiences in their microclimate of introductory STEM courses are connected to indicators for serving. The framework emphasizes the significance of considering broader contexts and factors in defining servingness within HSIs and that academic outcomes alone are not sufficient measures for determining whether HSIs successfully serve their minoritized students. The nonacademic outcomes are an important consideration when exploring servingness within HSIs. This study examines one of these nonacademic indicators, sense of belonging, to better understand Latinas' perceptions during their first year. Sense of belongings will be further explained in the next section.

## Sense of Belonging

Sense of belonging refers to a feeling of mattering or being connected and can be seen as a reflection of the supports that exist within a given context (Strayhorn, 2012). A student's sense of belonging results from both individual and institutional factors related to interpersonal relationships, student engagement, and institutional climate (Hurtado & Carter, 1997; Freeman et al., 2007; Locks et al., 2008; Strayhorn, 2008). Sense of belonging is a predictor of academic success and retention in college (e.g., Freeman et al., 2007; Pittman & Richmond, 2008). It is associated with retention in STEM majors (Freeman et al., 2007; Pittman & Richmond, 2008; Johnson, 2012; Rainey et al., 2018; Master & Meltzoff, 2020). Relationships, perceived competence, personal interest, and science identity all contribute to a sense of belonging for STEM students (Rainey et al., 2018).

Gender and race gaps exist in terms of sense of belonging. Women and historically marginalized students tend to feel less like they belong in STEM relative to their male and white counterparts, respectively (Espinosa, 2011; Johnson, 2012). Sax and Newhouse's (2018) study of gender, race, and sense of belonging in STEM revealed that there was a gender gap, as men of color reported a significantly greater sense of belonging than women of color. Rodriguez and Blaney (2021) found that Latina students often felt marginalized within their STEM environments and faced skepticism and self-doubt inflicted by their male peers. To build a sense of belonging, students reframed their experiences as trailblazing and engaged with identity-based STEM organizations.

Latina students in STEM may experience multiple forms of marginalization because of their various identities, which may lead them to a decreased sense of belonging. As a result, we need to better understand how the intersecting identities may influence sense of belonging for students within this context, particularly during the initial experiences of the first year. The sense of belonging framework was used to both develop our interview questions and analyze our data and was used alongside the multidimensional framework.

## Project Overview

This study is part of a larger five-year project that aims to develop, deploy, and study a set of effective success practices to transform first-year STEM education to attain equitable educational outcomes in STEM. The university is a large public four-year urban institution in the Northeast and was recently designated as an HSI in 2019, meaning that it reached a 25% enrollment of Latinx/e students. The institution offers a variety of STEM degrees but does not offer engineering. For this study, we specifically focused on students whose intended major is in the math, biology, or chemistry department. The first-year courses students take that are of interest to this study are the introductory chemistry and mathematics courses. Six different instructors teach chemistry, and 17 instructors teach mathematics.

**Table 1** Composition of Full-time, First-time Freshmen by Sex

| Sex    | Frequency | Percent | Cumulative |
|--------|-----------|---------|------------|
| Male   | 87        | 28.43   | 28.43      |
| Female | 219       | 71.57   | 100        |
| Total  | 306       | 100     |            |

*Note.* Total indicates the total number of full-time, first-year freshman students who intended to major in STEM

**Table 2** Composition of Full-time, First-time Freshmen by Race/ethnicity

| Race/ethnicity | Frequency | Percent | Cumulative |
|----------------|-----------|---------|------------|
| White          | 80        | 26.14   | 26.14      |
| Black          | 17        | 5.56    | 31.7       |
| Hispanic       | 48        | 15.69   | 47.39      |
| Asian          | 137       | 44.77   | 92.16      |
| Others         | 12        | 3.92    | 96.08      |
| Non-resident   | 12        | 3.92    | 100        |
| Total          | 306       | 100     |            |

*Note.* Total indicates the total number of full-time, first-year freshman students who intended to major in STEM. Others include students who identified themselves as American Indian/Alaska Native or multi-races

The demographics of the first-year STEM students are as follows. Out of the 306 full-time, first-time freshmen students who have identified STEM as their intended major, approximately 28.43% are women, while around 71.57% are men (see Table 1). Analyzing the breakdown by race, the largest proportion of these students self-identify as Asian (44.77%), followed by White students (26.14%). Latinx/e students comprise only about 15.69% of the cohort, with Black students comprising approximately 5.56% (see Table 2).

With support from NSF's Improving Undergraduate STEM Education: HSI Program, the project team plans to generate knowledge on the institutional transformation process itself by deepening understanding of how intra-institutional teams can function to support student success, enhance undergraduate STEM education, broaden participation in STEM, and build capacity at HSIs. We are currently in the initial stages of the project, and the study presented here is the first study that comes out of our work in understanding the first-year experiences of Latina STEM students before the support received by this grant so that we can inform our design decisions using the voices and experiences of students.

## Context

As a newly designated HSI, our first step in unpacking the first-year experience was to examine student outcomes in first-year chemistry and math courses during the 2021-2022 school year. Using institutional data, we examined grade

**Table 3** Introductory Chemistry Course Grade Distribution by Race/ethnicity and Sex

| Grade | White |        | Black |        | Hispanic |        | Asian |        | Others |        |
|-------|-------|--------|-------|--------|----------|--------|-------|--------|--------|--------|
|       | Male  | Female | Male  | Female | Male     | Female | Male  | Female | Male   | Female |
| A+/A  | 50.00 | 33.33  | 16.67 | 10.00  | 45.45    | 17.14  | 52.38 | 35.96  | —      | 18.18  |
| A-    | 3.85  | 7.84   | —     | —      | —        | 5.71   | —     | 6.74   | 100    | 9.09   |
| B+    | 7.69  | 13.73  | 16.67 | 10.00  | —        | 11.43  | 9.52  | 12.36  | —      | 9.09   |
| B     | 11.54 | 15.69  | 33.33 | 20.00  | 18.18    | 11.43  | 26.19 | 14.61  | —      | 18.18  |
| B-    | 11.54 | 3.92   | 16.67 | 10.00  | 9.09     | 2.86   | 4.76  | 5.62   | —      | 9.09   |
| C+    | 3.85  | 5.88   | —     | 10.00  | —        | 8.57   | 2.38  | 11.24  | —      | —      |
| C     | 3.85  | 13.73  | —     | 20.00  | 27.27    | 22.86  | 4.76  | 12.36  | —      | 27.27  |
| DFWs  | 7.69  | 5.88   | 16.67 | 20.00  | —        | 20.00  | —     | 1.12   | —      | 9.09   |
| Total | 26    | 51     | 6     | 10     | 11       | 35     | 42    | 89     | 1      | 11     |

*Note.* Total indicates the total number of full-time, first-year freshman students who intended to major in STEM. ( $N=306$ ). Others include students who identified themselves as American Indian/Alaska Native or multi-races. The table excludes students whose racial/ethnic, sex, and/or introductory chemistry course grade information is missing

**Table 4** Introductory Math Course Grade Distribution by Race/ethnicity and Sex

| Grade | White |        | Black |        | Hispanic |        | Asian |        | Others |        |
|-------|-------|--------|-------|--------|----------|--------|-------|--------|--------|--------|
|       | Male  | Female | Male  | Female | Male     | Female | Male  | Female | Male   | Female |
| A+/A  | 3.71  | 47.73  | 20.00 | 25.00  | 16.67    | 20.00  | 58.06 | 47.76  | —      | 16.67  |
| A-    | 14.29 | 13.64  | 20.00 | —      | 16.67    | 6.67   | 9.68  | 7.46   | —      | —      |
| B+    | 7.14  | 9.09   | —     | —      | 16.67    | 6.67   | 3.23  | 7.46   | —      | 16.67  |
| B     | 14.29 | 9.09   | —     | 50.00  | 16.67    | 16.67  | 12.90 | 22.39  | 100    | 33.33  |
| B-    | 14.29 | 4.55   | 20.00 | —      | —        | 3.33   | 6.45  | —      | —      | —      |
| C+    | —     | 2.27   | —     | —      | 16.67    | 3.33   | —     | 1.49   | —      | 16.67  |
| C     | 7.14  | 6.82   | 40.00 | 25.00  | 16.67    | 20.00  | 9.68  | 11.94  | —      | 16.67  |
| DFWs  | 7.14  | 6.82   | —     | —      | —        | 23.33  | —     | 1.49   | —      | —      |
| Total | 14    | 44     | 5     | 8      | 6        | 30     | 31    | 67     | 2      | 6      |

*Note.* Total indicates the total number of full-time, first-year freshman students who intended to major in STEM. ( $N=306$ ). Others include students who identified themselves as American Indian/Alaska Native or multi-races. The table excludes students whose racial/ethnic, sex, and/or introductory math course grade information is missing

distribution by race and sex. Tables 3 and 4 show the disparity of grade outcomes for the different subgroups. In the case of the introductory chemistry course, a higher proportion of female students received grades of D and F, and some even withdrew (W) from the course, compared to their male counterparts. Furthermore, when specifically considering Latinx/e students, approximately 20% of Latina students received a final letter grade of D, F, or W, while none of the Latino students fell into this category. While the disparity in grade outcomes for the introductory math course was not as pronounced as in chemistry, the result



still indicates a higher proportion of female students receiving lower letter grades than male students. Once again, when focusing on Latinx/e students, it was observed that almost one-fourth of Latina students received grades of D, F, or W, while no Latino male students fell into this category.

Based on these grade outcomes, we designed a qualitative study to better understand these results. The approach we chose was to examine the first-year experiences of Latina students who were either successful in these courses and/or persevered in their intended STEM major. We defined this as students who either received a passing grade in their first semester courses or decided to re-take the course despite not receiving a passing grade. They were interviewed after their first year of studies was completed so that we could gain insight into their entire first-year experience. While other studies (Ong et al., 2011; Hazari et al., 2013) have focused on students who were not successful in these courses or who did not remain STEM majors, we wanted to better understand the experiences of those students who were successful in the courses or persisted in the major despite initially being unsuccessful in building upon their experiences to think about how to better serve all Latinas who were intended STEM majors.

## Methods

### Data Collection

An exploratory/descriptive qualitative study was used to generate a portrayal of the perceptions of first-year Latina STEM students enrolled in introductory STEM courses. As part of the larger study, we first sent out a survey at the end of students' first year. The survey included Likert scale questions related to sense of belonging and servingness and open-ended questions that allowed them to expand on their experiences. Sample items included: "I can really be myself in my STEM courses," "I intend to remain in STEM," and "It is hard for people like me to be accepted in my STEM courses."

306 students who were enrolled in an introductory Chemistry and Math course during the 2021-2022 school year were sent the survey. The analysis of this survey is not the focus of this paper, rather it was used as a tool to select students to be interviewed. Using the results from this survey, we selected eight students (out of 35 total Latina students who took the introductory Chemistry course) who identified as Latinas to participate in a one-hour semi-structured interview. We initially selected them based on their grades in their first-year courses and their intention to remain in STEM. This choice allowed for an asset-based view of the students and allowed us to explore what factors led to their persistence in STEM majors. However, after this initial selection, we discovered during the interview that one of the students elected not to remain in STEM and transferred to a non-HSI institution. We made the decision to include her in the analysis because she received high grades in the courses, and we found her responses to be insightful as a contrast to our other participants. Table 5 provides more information about each of the participants.

At least two members of the research team conducted hour-long interviews that included approximately 15 questions with students after their first year of studies was

**Table 5** Participant Information

| Name    | Ethnicity | CHEM | MATH | Major              |
|---------|-----------|------|------|--------------------|
| Rose    | Latina    | C    | B-   | Human Biology      |
| Jasmine | Latina    | B +  | B +  | Bio Science        |
| Lily    | Latina    | B +  | A-   | No longer enrolled |
| Heather | Latina    | B-   | B    | Computer Science   |
| Laurel  | Latina    | B    | C    | Chemistry          |
| Ivy     | Latina    | D    | D    | Human Biology      |
| Iris    | Latina    | A    | D    | Psychology         |
| Violet  | Latina    | B    | B    | Bio Science        |

completed. Researchers had no prior relationships with participants. The research team consisted of the three authors of the paper: a STEM education faculty member and co-PI of the grant, a post-doctoral researcher, and a graduate student. The three female researchers have a variety of experiences in STEM as educators and students. None of the researchers identify as Latinas. We acknowledge that the lived experiences of the students interviewed are complex and nuanced. Throughout the research process, we engaged in regular discussions to ensure the study reflected these lived experiences.

The questions in the interview were developed using the conceptual frameworks to better understand students' sense of belonging and how the institution was serving them. The first part of the interview focused on their experiences in each of their STEM courses, what they attributed their successes and perseverance to, and the challenges they faced. This section included open-ended questions such as, "Describe your experience in chemistry," and "Did you feel like you belonged in your first-year STEM classes? Why or why not?" The second part of the interview included questions about their interest in STEM and motivation as well as questions about the ways they felt the university and STEM programs served them as Latinas. This section included open-ended questions like, "Were you always interested in science? Tell us more about it," and "How do you feel that your culture and identity are represented on campus and within your STEM courses and program?" The eight interviews were recorded on Zoom, transcribed by a transcription service, and then reviewed by the team for accuracy.

## Data Analysis

To explore our research questions, we used Braun et al.'s (2016) thematic analysis method, which is an iterative process consisting of six steps: (1) becoming familiar with the data, (2) generating codes, (3) generating themes, (4) reviewing themes, (5) defining and naming themes, and (6) locating exemplars. The first stage of data analysis involved reading the transcripts and taking detailed notes to familiarize ourselves with the data. During this initial review of the data, open coding was used to generate both broad and specific codes related to the research questions and using the conceptual frameworks as a lens (Charmaz, 2014; Saldaña, 2021). Some of these initial codes included support from professors, support from TAs, support from peers, interest in STEM, representation, transition to college, and STEM culture.

**Table 6** Overview of Themes

| Main Themes                          | Sub Themes                                                                                                     |
|--------------------------------------|----------------------------------------------------------------------------------------------------------------|
| Motivations and STEM program culture | Interest in STEM field<br>Interest in STEM careers<br>Perceived competitive nature                             |
| Lack of representation of Latinas    | In STEM fields<br>At the College                                                                               |
| Social Capital Development           | Specific Professor's Design of Course<br>Peer Tutors<br>TAs<br>Informal Peer Support<br>Mentors/Family Members |

Next, two research team members independently coded the transcripts using Dedoose, an online platform that helps analyze qualitative data. This analysis of the transcripts was an iterative and collaborative process of generating and revising the code list and applying codes to transcripts (Saldaña & Omasta, 2016). The members met to discuss differences in coding and reconciled these differences.

After this, themes were identified to capture meaning across multiple codes to develop an understanding of the phenomenon being examined, in this case, the experiences of Latinas in students during their first year as intended STEM majors at a newly designated HSI. The team then reviewed, defined, and named the themes and located examples, which are shared in the findings section. This thematic analysis allowed us to examine the perspectives of different research participants, highlighting similarities and differences and generate unanticipated insights. In addition, researcher triangulation allowed us to ensure the trustworthiness of the findings.

## Findings

Our findings are organized by themes. Table 6 summarizes the overview of the themes and sub-themes. Each theme will be described in detail in the following sections with examples that illustrate the findings.

### Motivation and STEM Introductory Courses

Participants entered their first year of college with a strong interest in science and motivation to pursue STEM careers and majors. They discussed science classes they had in earlier settings and how these experiences motivated them to pursue a STEM major. They attributed this passion for STEM to their perseverance even when they faced obstacles during their first year. For example, when asked why she persevered despite challenges that arose, Rose noted:

Honestly, I really enjoyed learning about science. And that's the only reason because if I didn't, I for sure would have changed majors because it was really, really rough. But I do enjoy the process of like learning about science, and it is a passion for me. And I think that's the only reason why.

Their motivation also came from learning about others' stories and their careers in STEM. Sometimes, this occurred from them doing research online. When asked about what helped her persevere during her first year, Heather mentioned:

I guess just like reading people's stories online. Like a lot of people, you know, who just post their experiences like, how they got this job, how they did this, and you know, people like me, you know posting and all that stuff. And I did binge-watch a bunch of, you know, YouTube vlogs about people. Yeah, just for motivation. Honestly, it did help. It did help a lot that it said that oh, she can do it, so I can do it too.

Their motivation to pursue STEM careers helped them persevere as well, even when they felt that they didn't belong. Ivy said:

I've decided to be pre-med since I was like, in high school, I've always wanted to go into the medical field. And it's very challenging. And I think if you ask anyone, like my siblings, every day, I would come home and say...I'm gonna change my major. You hear me every day complaining, but I still stick to my pre-med track, because it's something I'm very passionate about. And whenever I feel like I don't belong, like, in this career, I always like to tell myself that I, if I didn't belong here, then I would have like, changed my mind a long time ago, because I know it's my passion. Even though I'm struggling a lot, I still continue.

Similarly, Violet found that when she received a bad grade or struggled, her interest in becoming a PA helped her continue:

I learned my way through like, accepting hardship, like accepting failure at times, and then just keep pushing forward, obviously, with the motivation that I want to, in my case, I want to become a PA. So, I know that being a PA and getting to that goal, like accomplishing that goal, it's not going to be easy. So, I understand that. I had to like, accept that failure in a way, and then use that failure to see what did I to assess what did I do wrong in this case, and then just move forward with trying different strategies, maybe a different studying technique, or maybe like connecting with some other peers, to like, study together, that's something that actually did help me, I changed up my study technique.

The students we interviewed all entered their first year with a strong interest in STEM as well as a motivation to pursue STEM careers, which differs from studies that have found that Latinx/e students often have difficulty developing and sustaining STEM identities (Sorge et al., 2000; Master & Meltzoff, 2020; Rodriguez & Blaney, 2021). In most cases, their passion and strong motivation to pursue a STEM career motivated them to continue in their courses despite the setbacks or challenges they encountered.

However, despite their strong interest in science and successes in STEM courses in high school, participants described challenges in the transition from high school to introductory STEM courses in college. They discussed the more rigorous coursework, the independent, self-study nature of the large courses, and perceived increased academic competitiveness and pressure. Students often attributed the need to change their study patterns to the teaching methods used by their professors, which were often a departure from the methods used in their high school courses.

Participants' experiences in introductory STEM courses were markedly different from their experiences in non-STEM courses. Students often mentioned the fact that STEM classes involved more independent work than they were accustomed to in high school. Many of these large introductory classes involved flipped classrooms (Wieman, 2014), where students watched videos and then attended lectures and recitations. Students mentioned that the self-study nature of the courses was overwhelming at times for them. The difference between the collaborative nature of non-STEM courses and the independent work of the large intro STEM courses was mentioned as a challenge by participants. Rose said:

With my non-STEM classes, the lectures were taught in person and through the teacher, and we were able to do more projects and work together more as a group. It felt like an actual class. In my STEM classes, it was mostly learning through prerecorded videos, and not really interacting with other students or the teachers and my students.

The larger size of STEM classes also contributed to students' lack of a sense of belonging. They felt isolated at first in these courses. In addition, multiple participants mentioned the competitive nature of the courses and that they felt that the courses were designated to "weed students out". Heather noted:

I've never been in a big class like this. So, it was like, so crazy to me. And so, when I'm sitting there, I'm alone because I didn't really know anybody, and the professor's talking and she mentioned how, you know, this class is going to be very hard. And that, you know, it's purposely going to be hard because they have to weed out students.... And, you know, I've talked about this experience with a bunch of my classmates, and we're just like, this is crazy, because it's like, you know, these professors are supposed to be there to help you. And they're like, literally telling you to your face that they have to weed you out. So, I was definitely intimidated. But I did not, I don't back away from a fight. So, I'm not easily intimidated. I did do really well. For all my classes, I did get B's and above, I had a 3.6 average. And it was great. But because it was such a really crazy environment, and there was so much anxiety, I burned out.

Another student, Laurel, also described how these classes did not provide a sense of belonging. She described the difference between these STEM classes and her previous educational experiences:

I would hear stories before I even like started taking those classes that they make those classes on purpose to weed you out. And I felt very intimidated. And it made me feel really frustrated. Because when I look at school in the past couple of years, it's always been an institution where I've been able to feel supported and protected. And I come here, and I don't really feel that. I feel like I'm thrown, like away and I'm, you know, trying to figure out, figure out the stuff on my own, trying to advocate for myself. And yeah, I don't really feel like I'm welcome there. I feel like I try my best. I definitely am still trying my best.

The students interviewed tried to reconcile their passion for science with the nature of these introductory courses. Jasmine noted the tensions she felt because of the difficulty of the courses:

Supposedly college is supposed to be what makes you love science and what brings you closer to your path. But if you end up dreading science and hating it, because of courses made so hard, you just become drawn further from what you want to do.

Overall, the students interviewed described challenging coursework, the independent nature of the course, and a perceived competitive STEM culture as negatively impacting their sense of belonging and the ways in which the institution was not meeting their needs. This is consistent with other studies that have reported how Latinx/e students found STEM classroom culture to be unwelcoming (e.g., Flores et al., [2023](#)).

### **Lack of Representation of Latinas**

The second theme that emerged in the analysis was that the students interviewed noted the lack of representation of Latinas in STEM, and the lack of opportunities to gather with other Latinas. Several students noted that they felt a lack of a sense of belonging because they did not see STEM fields as being areas where Latinas were welcomed. For example, Violet spoke about the lack of representation of Latinx/e s in STEM:

I know that especially for Latinos in our community, it's really an underrepresented community that might not indulge in much of these types of, I would say careers. Because someone like, I would say from my background, and from my prior experiences, we think of a career in STEM as something very hard to achieve for us. But it's not. Everybody is, is equally capable of achieving anything that they really want to accomplish.

Violet acknowledged the obstacles she faced in overcoming the barriers she felt existed for Latinx/e s entering STEM fields. Despite these challenges, she acknowledged that she did not think that these barriers were insurmountable and that all students are capable of pursuing STEM careers.

Lily explicitly addressed the intersection of race and gender and how STEM classes could potentially be more welcoming.

I feel like it's a reason why a lot of like Latinos and not just Latinos, like underrepresented minorities, and even just women in general. I feel like they're intimidated by STEM. They feel like maybe they think that they're just not smart enough, which is bogus. Like that's bogus. So, I feel like maybe if they were, I don't know, I guess more welcoming. Not that not that they're not welcoming. I feel like they don't really, it's just, you know, STEM courses, I feel like they never really encouraged people to join...I feel like a lot of people are intimidated to try something new because they're like oh, that it's too hard. I don't belong there. But I feel like anyone can belong, you know, anywhere if they were given the opportunity, given the welcome, you know, given the support.

In addition to discussing the overall lack of representation of Latinas in STEM fields and the lack of a sense of belonging, participants also noted that while there were many Latinx/e students at the college, the representation was not always highlighted or celebrated. For example, Lily noted:

There is a huge Latino community at X College. There is a huge one. I was there. I felt it. But I think there's a lack of representation of it. I think that you don't know that there are Latino students to meet people. You don't see this presence of the Hispanic culture.

Lily also offered advice on how to better highlight the community:

I think something that I would advise is to advertise that you guys have this community-show that you have such a huge amount of Hispanics and Latinos in general in your school, not just showing it in the demographics. Show it in real life, and when it's Hispanic Culture Month, like put placards, put signs, put things that show that you are proud of this Latino community. Not something that you say, 'Oh, yeah, College X has diversity', but, yeah, where is it? You're not really telling me anything to be honest. So, there's a huge community there but when you get to the school, unless you talk to people, you aren't going to see the diversity.

Of all the students interviewed, Lily was the only one who chose to transfer to another institution. She transferred to a non-HSI institution to pursue a non-STEM major that was not offered at the institution. While she did not explicitly name this lack of representation as the reason why she transferred and switched majors, her responses raise the question of whether a better representation of Latinas might have resulted in her remaining at the college.

Another student, Ivy, talked specifically about the lack of clubs dedicated specifically towards STEM and Latinas. She mentioned the importance of being around other Latinas:

Maybe there are clubs that are focused with Latinos and STEM. But maybe I don't know about them. And I think that's a problem with College X..., letting students know like, what kind of clubs are there, especially if they are for like Latinos or like women in general. I also feel like for like, Hispanic

Heritage Month, like embrace that a lot, because I feel like a lot of people, a lot of the Hispanics feel very, like close during, Hispanic Heritage Month, or Latin Heritage Month. Because it's like when we all come together, and we feel like we relate to each other. And I think I can say this from the Latin community that we really do feel like very comfortable surrounded with our people. Because they know like, especially, like women. We know, like, their culture. They know my culture, they probably know like, what it is growing up a woman in a Latin household or just in the Latin community.

The desire for these types of clubs was echoed by other participants. However, there was a tension some participants faced when thinking about these opportunities. For example, Iris noted some trepidation about joining clubs while also noting that having a club might have helped her form connections with other Latinas.

Overall, students noted that the lack of representation of Latinas and the lack of opportunities for gathering impacted their sense of belonging. They offered multiple suggestions for how the university could better meet their needs, including highlighting their culture and offering specific clubs for them.

### **Social Capital Development**

The third theme that emerged was related to the social capital or network of relationships, that students developed during the first year. Students attributed their perseverance to these relationships that were formed. Some were formed through formal supports provided by the university, such as peer tutors, while others were informal support networks students developed on their own, such as study groups.

In terms of formal supports, participants mentioned the support they received from TAs and peer tutors at the academic learning centers as contributing to their success. In terms of faculty support, one specific chemistry professor was mentioned in several of the interviews. The structure of her course differed in some ways from the other sections of the course. Professor X was mentioned as being encouraging to students even when they were struggling and had a system of pairing them with peer mentors if they needed extra support. Ivy, who retok the course and had Professor X the second semester, mentioned her encouragement and pairing her with a peer as factors that contributed to her success:

I did feel like the new professor was more attentive with her students, she never made us feel, like, pressure. Like, if you fail one exam, instead of like 'okay, like drop the class', she always pushed us to do better for the next exam. And she even, like, if you went up to her or emailed her, she would pair you up with a Peer TA to study and like, do better for your next exam.

The professor's strategy to pair them with individual peer mentors was mentioned by several other students who took the course with her. One noted that the peer mentor she was paired with continued to be a support after the course had ended. Although the large size of the courses did not necessarily allow students to have personal one-on-one connections with the professor, students felt supported by her.



Another recurrent sub-theme in the interviews was a sense amongst interviewees that they felt supported by the TAs across multiple introductory courses. They felt that they related to the TAs because they had recently taken the courses. In addition, the TAs provided them with strategies for understanding the course materials. Given the large nature of the courses, participants often had more interaction with the TAs than the professors and attributed their success in the courses to the support provided by the TAs. As an example, Rose described how she felt more supported by the TAs than the professors of the course due to the large size of these introduction courses:

*It (interactions with instructors) was mostly with the TAs. I guess because most of the classes had a lot of people in them. I really liked my lab instructor. I felt really supported by him and I enjoyed how he like he's pretty young and he knows how hard college can be and he's really supportive ... he's doing the best he can to not make the work be so overwhelming and be something you know, enjoyable and to learn, but not make it be like something that really stresses me out. So, I believe I feel more connected with the TAs.*

Laurel echoed this sentiment and gave examples of how the TAs helped unpack the material for the student using visuals.

*I felt like I was able to connect more with my lab instructor than my own professor. Thank God for that lab, the lab instructor, she was really nice. And she really did help me understand some of the concepts. Like mitosis and meiosis were very, very weird for me to picture it in my head. But she did such a great job in introducing it and like presenting it like she had these really great graphics. And yeah, I feel like if it wasn't for her, I don't think I would have done, I would have been able to get a passing grade.*

Overall, the relationships with TAs seemed to be a key factor mentioned by participants. They also mentioned that the TAs were approachable during both recitation and office hours, and they felt more comfortable sharing their concerns and struggles in the courses with the TAs than their professors.

Other students found the peer tutors at the learning centers at the college helpful. Students mentioned going to the science and math learning centers to receive support for exams or course assignments. They talked about how the peer tutors at these centers made the material easier for them to understand. Jasmine said the following about the students who provided support at the centers:

*They knew what they were doing. They were like better teachers or professors themselves. So, it was like really like they simplify a topic. ... They were like, always try to simplify it. Like not use, like all these big words, and they'll make it way more like, it made me want to learn the actual topic instead of just leaving aside.*

While students noted that many services were available, not all students took advantage of them. As Heather noted:

I think X College provides a lot of great resources. It's just me. I was like, I just you know, don't take advantage of them. I feel like I wish I could have you know, but I always feel like oh, there's not enough time but really there is you know. I just have to, I should start going to, like, the Math Center. I've never gone to that, but people have said that it's really helpful. So, I'd like to try that out sometime.

The supports outside of class were found to be helpful for students who attended them, but there were factors, like time and conflicting obligations, that did not allow all students to utilize them.

In addition to formal supports, participants mentioned informal social networks they formed that they attributed their perseverance and success to during their first year. These included peers that they met in their courses, family members who encouraged them, and mentors they connected with on their own. Of particular interest was that students noted that they found it encouraging to know that other students were struggling. Rose mentioned how her peers helped her feel less alone and helped her address the obstacles she faced: I think through the recitation classes, it showed me that I wasn't alone. We were all kind of in the same boat, struggling and we were all helping each other out. So, I didn't feel so isolated or alone.

Furthermore, this social support was a factor in helping her mitigate other challenges, such as feeling unsupported by the course instructor. Rose expanded upon this:

After the recitations, we were all lost and we didn't get it. It was basically after like, the second week, where we were just all scared and lost. And we didn't really feel supported by our teacher. So, at the end of it, we were like, we wanted to help each other out. So that's when we formed our study group.

Another theme that emerged was that students found commonalities with students that helped them develop a sense of belonging. One student, Ivy, mentioned specifically how she formed connections with another Latina who was interested in science and how that fostered her sense of belonging:

I've met a lot of people who have a similar background as me. I actually have my friend who I'm very close to who I met my first semester first year at Hunter and we're still friends. She's also Hispanic. And she's also interested in the sciences. And we have a lot of similarities. And I also met other students who have a lot of similarities— were either like Hispanic or we grew up with like immigrant parents, low income.

Similarly, Heather mentioned how being among students she felt were like her made her more comfortable to ask for help:

A lot of, most people, are from the same area. So that was one thing from you know, similar cultures. A lot of Latino students, you know, a lot of people from

the Caribbean that I've seen so yeah, in that way, we're similar. It's great, It made me more comfortable to like, you know, reach out to them.

Mentors and family members also helped students persevere when they were unsure of themselves or struggling in the courses. Several mentioned that it was this social support that caused them to persevere. For example, Laurel talked about mentors that she met through her family and friends and how they were critical in her success:

I don't think I would have kept going if it wasn't for my mentors. I think when you reach a point where you're like failing really badly in a class, you're starting to think about your whole, like, career path that you set in place, especially because medical school is supposed to be even harder than undergrad. And if you're struggling in undergrad, and it's like, how am I even gonna? How am I even gonna pass medical school? So, yeah, so my mentors definitely helped out in that, that part.

Ivy also mentioned how she was struggling in her course and had a negative interaction with a faculty member. Her older sister provided support and guidance:

I was really upset. But since I had like an older sister, who was in engineering, she told me that it's normal for like, professors to tell you like, oh, this career isn't for you. And she always like told me like, you shouldn't really listen to them. Because she also had an experience like that. And she didn't listen to them. She continued her career, and she graduated. So that's what I get told a lot. Don't listen to your professors because if that's really your passion, go for it and continue. And just continue working hard.

Overall, support from peers, mentors, and family members seemed to provide these students with encouragement and a sense of belonging which is consistent with the literature (Contreras Aguirre et al., 2020; Gonzalez et al., 2020; Rodriguez & Blaney, 2021). Peers and family members also helped students overcome challenges they encountered during their first year.

## Discussion

This study was designed to answer the following two research questions: (1) After completing their first year of studies at a four-year newly designated HSI, what challenges related to sense of belonging are identified by Latina students who intend to major in STEM? (2) What contributes to their persistence and sense of belonging in STEM courses during the first year? Three main themes emerged that addressed these questions. First, students in this study entered college with a strong interest and motivation to succeed in STEM, which they felt contributed to their persistence. However, the structure of their courses and perceived competitiveness within these courses did not necessarily foster a sense of belonging. Second, despite being enrolled at an HSI, they noted a lack of representation of Latinas in STEM as negatively impacting their sense of belonging. Finally, they attributed their perseverance

to the social capital that was developed either through formal institutional supports like peer mentoring or informal supports, such as study groups, friends, and family members.

As Garcia & Cuellar noted (2023), there is no federal guidance for newly designated HSIs on how to best serve their growing Latinx/e student population. The findings in this study contribute to a better understanding of the ways that the newly designated HSI can serve Latina students during their first year. One area that warrants attention is that the students interviewed had a strong passion for STEM fields and careers. Other studies have noted that Latinx/e students often have difficulty developing and sustaining STEM identities and recognizing themselves as potential scientists or mathematicians despite expressing interest in related careers (Sorge et al., 2000; Master & Meltzoff, 2020; Rodriguez & Blaney, 2021). We did not find that with the students we interviewed. In fact, we found the opposite with these students in that their interest in STEM careers was sustained and, in fact, motivated them to persist despite the challenges that arose.

However, despite this passion and interest, the STEM introductory courses did not appear to be serving these students in terms of their sense of belonging. The multidimensional framework of servingness (Garcia, et al., 2019) points to the need to serve students in multiple ways. While their academic outcomes in terms of persistence and retention may be being met, as all but one continued to major in STEM even after receiving non-passing grades in some courses, the non-academic outcomes, such as sense of belonging, need to be better addressed. Students mentioned the competitive nature of introductory courses, the large class sizes, and the teaching style as barriers to their sense of belonging in these courses. These factors seem to be the “fight” that Heather noted when she said, “I don’t back away from a fight.” Flores et al. (2023) found that within Minority Serving Institutions, Latinx/e students found STEM classroom culture to be competitive and unwelcoming. Our results were similar in some ways for Latinas during their first year in terms of the challenges they faced in transitioning to the nature of these courses. These findings suggest that it is necessary to examine how to remove these barriers so that students do not feel that they are engaged in a “fight” during their first year.

Another dimension of servingness that arose in this study is the need for culturally engaging environments. Museus et al. (2018) found that culturally engaging campuses can foster a sense of belonging for college students. Although their study did not specifically focus on first-year students in STEM contexts, we found that these findings align with ours. Latinas interviewed in this study discussed how their perceived lack of representation of Latinas in STEM negatively influenced their sense of belonging. They also mentioned the lack of organizations or clubs on campus that focused specifically on Latinas in STEM and the desire to see their culture highlighted on campus. Despite being enrolled in an HSI, which has a higher percentage of Latinx/e students than non-HSIs, Latinas did not feel a strong representation or celebration of Latinas within STEM. This points to Serrano’s (2022) argument that microclimates impact students’ experiences. The students interviewed commented on their experiences within the microclimate of their STEM introductory courses. Within this microclimate, students did not feel there was a strong representation of

other Latinas and desired more ways in which their culture was represented and celebrated not just within the institution but also within this microclimate.

Of particular interest were the comments made by Lily related to representation. Lily was very vocal about the lack of representation she saw of Latinx/e students at the institution. Interestingly, she transferred to a non-HSI institution after the completion of her first year and chose not to remain in STEM. This raises the question of whether a better representation of Latinas in STEM might possibly have impacted her decision to stay at the university and within the field. More research needs to be done to investigate this question, and we are beginning to explore this by interviewing others who have left their major or the institution.

In terms of mitigating the challenges students faced, this study highlighted how the development of social capital positively influenced the sense of belonging and perseverance. For the most part, these relationships were not with professors, which is common in first-year large STEM introductory courses. While one specific professor's approach to her class included the use of strategic peer mentors, this was not true across all sections of the course, and as a result, students needed to find other support networks to help them. Students formed relationships and received support from TAs and peer mentors. The role of informal peer networks, family and mentors also played a role in their perseverance and contributed to their sense of belonging. These findings align with the research related to the importance of peer relationships for Latinas (Gloria & Castellanos, 2012; Rodriguez et al., 2019; Contreras Aguirre et al., 2020; Rodriguez & Blaney, 2021) and add to it by demonstrating the importance of these social networks for Latinas during the first year. Students in the study mentioned these supports as helping them overcome challenges as they transitioned to STEM introductory classes, which were markedly different than their experiences in high school. However, relying on peer support may pose challenges as these peers may not have the tools to support them, particularly if they are also struggling themselves.

This study and our findings highlight the voices of Latinas in STEM during their first year when many students decide to pursue or abandon the major. Many of the previous studies (Cantu, 2011; Gloria & Castellanos, 2012; Rodriguez et al., 2019; Contreras Aguirre et al., 2020; Gonzalez et al., 2020; Rodriguez & Blaney, 2021) have investigated Latinas' persistence at later points in their college experience or careers, but fewer have addressed the first-year experience of Latinas. This is a critical time as these students are attempting to find a sense of belonging and identify their place in these fields. In addition, while supports and interactions with faculty may change as students move past introductory courses, this may be too late for some students as many abandon the major after their experiences in these introductory courses (Cruz, et al, 2021). While the study focuses on a small number of students, hearing directly from Latinas about their challenges and successes provides insight for other newly designated institutions as they begin the work of better serving this growing population at their institutions and addressing the indicators of servingness as described by Garcia et al. (2019).

## Limitations

There are several limitations to the current study. Given that we only interviewed students at one newly designated HSI, we do not know whether the experiences of our sample are the same at other institutions. We encourage similar analysis at other newly designated HSIs to see if the findings are comparable. Furthermore, we did not interview students who withdrew or received an F in the course. Future work will investigate the experiences of these students. Finally, while participants identified as Latinas, we did not ask them to further specify their ethnic origins. We recognize the diversity of the Latina population and plan to incorporate additional questions about their cultural background in future interviews. Despite the limitations mentioned, we feel that this exploratory study adds to the literature by sharing the unique experiences of these students. Future work will continue to build on these initial findings.

## Implications

Our findings suggest several ways that institutional agents at newly designated HSIs may want to explore how to address a sense of belonging during the first year. For example, they may want to consider how to foster clubs and organizations that focus on Latinas in STEM. They also may want to find ways to allow Latina students opportunities to connect with one another within the STEM program. In addition, they may want to create cultural spaces that celebrate Latina culture. Another area to explore is the interactions Latinas have with faculty and TAs during their first year, as participants in this study attributed interactions with a specific professor and their TAs as positively influencing their sense of belonging. Specific supports for TAs and faculty that allow all students to have these positive interactions might be considered and researchers may want to study the different ways in which these supports can be developed.

Finally, those at newly designated HSIs may want to consider how to formalize the informal peer support that students spoke about. How can study groups or other mentoring opportunities be created in ways that serve Latina populations? The students in this study described peer and family supports that arose organically but what about those students who did not have these supports? In addition, how can these informal supports be combined with formal supports that allow students to form connections with higher-status individuals and ensure that the individuals they connect with have the tools to help them? Administrators, faculty and staff working with STEM programs may want to think about how to create structures and opportunities for all Latinas to have access to these supports during their first year.

## Conclusion

This study is significant for several reasons. First, it provides a more nuanced understanding of Latinas' first-year experience in STEM introductory courses at a newly designated HSI. Latinas are a growing group in higher education, and their experiences,

particularly during the first year, need to be better understood. This is particularly important as more and more institutions will be designated as HSIs as college enrollment demographics continue to change. Institutions need guidance on how to better serve incoming STEM students during their transition to college. In addition, this study highlights the voices of Latina students and allows for an exploration of what their perceptions of their experiences are. This is different from studies that look solely at the challenges and hypothesize on what might mitigate these challenges. All but one of the students in this study persevered in STEM despite the challenges they faced, and better understanding of the factors that led to this are instrumental in understanding how to formalize these factors and provide a sense of belonging to serve all students.

The results from this study will inform the next steps in our project as we try to revise our own structures for servingness. We are examining how to design systematic supports based on these findings to help other Latina students persevere. For example, TAs may be a lever for increasing servingness and a sense of belonging. We are considering how to ensure that all TAs are given supports in making connections with students and encouraging a sense of belonging while also acknowledging that TAs are often a marginalized group on campus, and careful consideration must be given to increasing their responsibilities. Strategic peer mentoring is another area to further examine. Participants mentioned one professor's strategy for doing this, and we are now looking at what structures the university can put in place to ensure all students are given this opportunity. We are also examining ways to mitigate the challenges described in terms of representation. For example, we are exploring how to encourage the formation of Latina STEM clubs or other events where students could get to know each other, as well as ways to highlight Latinas in STEM and on campus.

The results also raise further questions to explore. We are curious how these first-year experiences impact retention and graduation rates. Is this perseverance sustained, and if so, how? We also need to investigate the experiences of students who transferred or changed majors and compare their experiences to the ones studied here. As Garcia and colleagues have argued (2019), simply being designated as an HSI and enrolling Latina students is not enough. We need to examine how to best serve them. This study points to the need to examine how to build upon and sustain the passion for science that Latinas enter college with, how to better represent and celebrate Latinas in STEM, and how to build upon peer supports to better serve Latina students at HSIs who intended to major in STEM during their first year.

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**Data availability** The datasets collected and analyzed for this study are currently not publicly available because they contain identifying information about the research participants. They can be made available from the corresponding author on reasonable request.

## Declarations

**Conflict of interest** The authors have no relevant financial or non-financial interests to disclose.

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