# Hispanic Students' Integration into the STEM Research Community through a Mentoring Program

**Hilda Cecilia Contreras Aguirre, New Mexico State University**

Hilda Cecilia Contreras Aguirre received an Ed.D. degree in Higher Education Leadership from Texas A&M University-Corpus Christi (TAMU-CC), and an M.Sc. from the University of Technology of Compiègne, France. She is now a researcher at New Mexico State University (NMSU). She focuses her research on qualitative studies addressing minority and underrepresented student college persistence, such as Latinas' performance in STEM, mentoring, and Latinx' research involvement in Engineering. She is also interested in participating in collaborative efforts promoting interdisciplinary research. Lastly, she is currently the PI and Director of the Research-Oriented Learning Experience (ROLE) in Engineering, a National Science Foundation-funded project, and the coordinator of a Latinx Femtoring/Mentoring program at NMSU.

**Maryanne Long PhD, University of Texas - El Paso**

Maryanne Long, PhD is the inaugural Director of Postdoctoral Affairs and Graduate Fellowships at the University of Texas - El Paso. In this capacity she assists graduate students with funding opportunities and provides professional development support for postdocs. Her research explores High Impact Practices and what they mean for underrepresented college students pursuing STEM degrees. Long also adjuncts for the online master's in student personnel in higher education program at the University of Florida, where she obtained her doctorate in Higher Education Administration in 2021. Email address: mlong3@utep.edu

**Luis Rodolfo Garcia Carrillo, New Mexico State University**

Luis Rodolfo GARCIA CARRILLO received the PhD. degree in Control Systems from the University of Technology of Compiègne, France. He was a Postdoctoral Researcher at the Center of Control, Dynamical systems and Computation at UC Santa Barbara, USA. He currently holds an Assistant Professor position with the Klipsch School of Electrical and Computer Engineering at New Mexico State University, USA.

# Hispanic Students' Integration into the STEM Research Community through a Mentoring Program


## Abstract

The impact that mentoring research programs have on students should be measured by how well students change their perspective of feeling part of the research community and see themselves as scientists. The Latinidad STEM Mentoring program at New Mexico State University sought to create a program in which Hispanic undergraduate STEM students pursuing STEM degrees develop professional relationships with Hispanic STEM faculty, researchers, and graduate students through research and mentoring. The current study included data from two consecutive years of the program, cohort 1 in 2023-2024 and cohort 2 in 2024-2025, during which two different groups of students and mentors participated. In these two annual cohorts, 23 students and 16 mentors participated in the two years of the program. This study employs a mixed-methods exploratory approach, collecting both quantitative and qualitative data using the tripartite integration model of social influence (TIMSI) by Kelman to guide the study. Quantitative results indicated marginal changes in students' self-efficacy and science identity from pre- to post-surveys within cohorts; however, when standard deviation and standard error were included, greater consistency was observed in cohort 2 post-survey results. This could suggest a deeper understanding of the scientific role and self-confidence of cohort 2 students, potentially influencing their sense of belonging to the research community. The qualitative findings revealed students' compliance, identification, and internalization through feeling academically, professionally, and scientifically supported, being able to address questions, doubts, and concerns about career possibilities and opportunities, and identifying with others thanks to language affinity, the topics discussed, and shared STEM experiences. Lastly, social integration is a crucial aspect of the academic journey for college students, especially those from minority backgrounds, first-generation status, and with little to no involvement in research.


## Introduction

Effective mentoring relationships enhance the well-being of minority students [1], especially for those who are underrepresented in STEM disciplines [2]. Mentoring can be characterized by a mutual social exchange that requires consistent interaction and results in developmental benefits that impact a mentee's career [3]. With the increasing growth of the Hispanic population in the U.S. and, consequently, the enrollment of Hispanic students in postsecondary education, the term Hispanic-Serving Institution (HSI) has gained popularity. An HSI is a higher education institution with at least 25% of its full-time undergraduate students being Hispanic [4]. In effect, the steady increase in Latinx students in higher education has sparked national interest among scholars, institutions, states, and federal agencies in providing intentional support that results in better faculty and student retention and success [5], [6]. One of the most effective strategies for improving students' persistence and triggering their interest in graduate school is through research programs. However, how effective are undergraduate research experiences for minority students in terms of social integration into the research community? Several studies have examined underrepresented minorities in STEM and the impact of social influence on their sense of integration into the STEM community. For instance, Estrada and colleagues [7] noted the importance of self-efficacy among minority students when they receive positive feedback from

the academic community to pursue scientific careers. Even more important is the internalization of the social system and alignment with its values, which can make a deeper impact on students' decisions to persist in STEM. Another study also confirmed that quality mentorship and two semesters of undergraduate research experience positively influence scientific efficacy, identity, and values [8]. Like other HSIs, Hispanic faculty in STEM are underrepresented, and students have limited opportunities to engage with them [9]. Therefore, the Latinidad STEM Mentoring program aimed to pair Hispanic undergraduate students with faculty mentors in their respective departments to conduct research. This study includes data from two consecutive years of the Latinidad STEM Mentoring program, during which two different groups of students and mentors participated, all of them from minority backgrounds.

### *Study's Purpose and Research Questions*

This study aims to highlight how student participants increased their sense of belonging and identification within the STEM research community after participating in the Latinidad STEM Mentoring program. The research questions address:

1. How different were the students' self-efficacy and science identity from cohort 1 to cohort 2?

2. What rules, roles, and values contributed to increasing students' sense of belonging in the research community?

The next section provides a detailed explanation of the undergraduate research program's features.

## The Latinidad STEM Mentoring Program

To enhance the research and interpersonal skills of minority undergraduate students, a STEM-mentored research program was initiated with federal support. The Latinidad STEM Mentoring program was housed at New Mexico State University, a Hispanic-serving Institution (HSI) located in the Southwest U.S. The structure of the Latinidad STEM Mentoring program follows that of other undergraduate research programs, where undergraduate students are paired with faculty mentors [8], [10]. One distinction was that most students and mentors identified as Hispanics or from minority backgrounds. In addition to faculty mentors, a few graduate students, postdoctoral researchers, and visiting professors participated in the program. In the Latinidad STEM Mentoring program, undergraduate students were involved in research activities under the guidance and support of their mentors. In both cohorts, students joined faculty research projects in STEM fields, such as engineering, chemistry, biology, astronomy, mathematics, and animal science. In addition to spending time in the mentors' laboratories, students also attended professional development workshops with topics such as introduction to research, well-being in college, literature reviews, stress and time management, and graduate school. Lastly, students experienced and participated in culturally relevant activities, such as building an ofrenda (offering) for the Dia de los Muertos (Day of the Dead) and participating in posadas (Mexican traditional Christmas celebration). In turn, mentors participated in monthly mentoring training sessions to learn more about best practices in mentoring. The Latinidad STEM Mentoring

program expanded from year 1 to year 2, with eight students and seven mentors during 2023-2024 and 15 students and nine mentors during 2024-2025. There were some changes from cohort 1 to cohort 2 that the program coordinator proposed to improve students' experiences. Such changes included increasing the number of student meetings, so students had more opportunities not only to learn about new topics, but also to create moments where they could talk to each other; closer tracking of students' research with monthly reports about their research activities and progress; and higher commitment from mentors as they consistently attended the program meetings and interacted with other mentors. Sometimes, even experienced mentors provided advice on teaching and mentoring to younger faculty and graduate students.

## Literature Review

The literature review addresses aspects that make mentoring a sound support for students and the applications of the tripartite integration model of social influence (TIMSI) [11], in other studies and academic contexts. First, Hernandez [12] noted that mentoring relationships provided four types of support: 1) instrumental support (e.g., sponsorship, guidance, visibility, and protection); 2) psychosocial support (e.g., counseling and friendship); 3) role modeling, an aspirational example for a person who emulates norms, attitudes, and behaviors of an experienced person; and 4) negative experiences (e.g., relationships mismatch, manipulative behavior, and lack of expertise). All experiences, except negative ones, contribute to achieving positive, effective mentoring relationships. Additionally, prior studies have utilized the TIMSI model; for instance, Estrada and colleagues [7] found that minority students who perceive the work of a scientist as feasible, develop a scientific identity, and value scientific work and activities are more likely to pursue a career in STEM fields. These behaviors resonate with socially integrated people who have internalized and agree with the values of a social system. In a longitudinal study, Estrada and colleagues [8] corroborated the findings of another study by the same authors [7], highlighting the impactful role of high-quality mentorship and research experiences in helping students feel socially integrated into the research community. Furthermore, minority students greatly benefit from high-quality mentorship and positive research experiences. Likewise, Mendez [13] and Li and colleagues [14] have further contributed to understanding the importance of research experiences among students, including those from underrepresented and first-generation backgrounds. Both studies emphasized the essential role of mentoring, particularly the time spent with a research mentor, which can positively influence scientific efficacy and community values. Lastly, socialization for students pursuing STEM degrees matters because it fosters a sense of belonging, encouraging them to engage in science tasks and adopt the values of the scientific community.

## Conceptual Framework

The tripartite integration model of social influence (TIMSI) guides this study. Kelman's model in [11] and [15] described the main elements that influence individuals' social integration, which may affect decision-making processes. It is through adherence to the rules, involvement in the roles, and sharing values that people feel integrated in an organization, group, or society. Social influence occurs within a social context in which everyone has a specific role, and interactions are shaped by those roles. Societies or organizations control their members and provide direction in line with their interests [16]. According to Kelman [11], there are three processes of influence,

including *Compliance,* where the individual hopes to gain a favorable reaction or approval from a person or a group; *Identification* is linked to conforming or looking for a desired relationship; and *Internalization* refers to allowing the influence because it aligns with the individual's value system.

The TIMSI model focuses on the community integration of individuals by understanding a community's rules, roles, and values, which, according to Kelman [15], correspond to the processes of compliance, identification, and internalization. Table 1 explains the sources of individual attachment to a group.

Table 1. Characteristics of personal involvement with a research community, adapted from Kelman [15]

| **Types of orientation to the STEM research community** | | | |
|---|---|---|---|
| **Sources of attachment to the research and ethnic group** | **Rule orientation (compliance with societal rules)** | **Role orientation (identification with societal rules)** | **Value orientation (internalization of societal rules)** |
| Sentimental | Acceptance of rules that secure person's inclusion to the academics/research | Involvement in role as a mentee which enhances a person's sense of involvement | Commitment to values that resonates with the person's value system |
| Instrumental | Acceptance of rules that protect person's interest with the academics/research | Involvement in the group that contribute to a person's visibility | Commitment to basic cultural values for which the ethnic group stands |

Kelman [15] explained that individuals may identify with the six elements in different ways, as shown in Table 1. For example, a student mentee can be more involved with their mentor and the assigned activities than participating in the workshops with the whole group. Additionally, on the one hand, students may be sentimentally attached to the group because they feel represented and understood; on the other hand, they are instrumentally attached to the group, which helps them meet both academic and professional needs and interests. The rationale for using this model lies in identifying students' social integration and identification with the STEM research community and ethnic group. As Estrada and colleagues' [7] study showed, the more students feel integrated into a research group, the more likely they are to pursue a scientific career.

## Methods

This study employs a mixed-methods exploratory approach, collecting both quantitative and qualitative data [17]. Quantitative data were collected via pre- and post-surveys at two timepoints using the self-efficacy and science identity survey. This survey assesses how students perceive themselves as scientists [18]. The current study included data from two consecutive years of the program, cohort 1 in 2023-2024 and cohort 2 in 2024-2025, during which two different groups of

students and mentors participated. In cohorts 1 and 2, six students and eleven students, respectively, completed both surveys. The pre-survey was completed at the beginning of the program in September 2023 and 2024, and the post-survey by the end of the program in May 2024 and 2025. Students received in-person invitations to complete the surveys during student meetings, and they typically filled them out during one of those meetings. Qualitative data were collected through interviews, providing in-depth insights into students' experiences in the program. In particular, we focused on areas that showed an increased sense of belonging and confidence. From cohort 1, eight students, and from cohort 2, nine students, were interviewed, respectively. Both sets of interviews were conducted by an evaluation team and took place during the spring 2024 and the spring 2025 semesters. Using a semi-structured interview protocol, students reflected on their involvement in the research program and their relationships with their mentors.

For the quantitative portion, the analysis used small-sample effect sizes, enabling examination of differences by cohort. Students chose their responses from the following options: "strongly agree," "somewhat agree," "neutral," "somewhat disagree," and "strongly disagree," corresponding to a numerical value of 5 through 1, respectively. To determine the magnitude of the difference between cohorts, Hedge's g indicated the size of the difference in growth in students' perceptions of self-efficacy and science identity. The growth and effect size were reported [19]. Additionally, mean, standard deviation, and standard error were included in the analyses and are presented in the results. Given the small sample sizes, this study's results cannot be generalized and should be considered preliminary.

For the qualitative section, audio from interviews was transcribed and uploaded to Dedoose, a software tool for qualitative data analysis. Researchers became familiar with the data by reading the interviews several times. Then, identifying patterns and unitizing the data to create labels for themes and categories. Lastly, researchers used content analysis and constant comparative techniques to report findings [20]. These themes and categories helped address the qualitative research question.

The students were a very diverse STEM group in terms of student classification, discipline, gender, cultural identity, and professional aspirations. For most of them, participating in the program was their first research experience and their first mentoring relationship with a faculty member or professional. What follows are the quantitative and qualitative descriptive results describing students' growth and changes after their participation in the program. This study received Institutional Review Board (IRB) approval and pseudonyms were used to identify participants in the qualitative section.

**Quantitative Results**

Student participants from cohorts 1 (2023-2024) and 2 (2024-2025) assessed their self-efficacy and science identity via pre- and post-surveys [18]. Students differed from one cohort to another, as well as mentors, and consequently, their experiences. The effect size analysis for small samples indicated that cohort 1 students showed a growth in self-efficacy and science identity of 0.28 points, with a medium effect size (Hedges' $g = 0.46$), and cohort 2 students showed a

growth of 0.20 points, with a small effect size (Hedges' g = 0.27). Table 2 presents the means and standard deviations for six survey statements.

Table 2. Pre- and post- survey means and standard deviations by cohort

| | Cohort 1 | | | | Cohort 2 | | | |
|---|---|---|---|---|---|---|---|---|
| Statement | [1]Pre-S Mean | Pre-S [2]SD | [3]Post-S Mean | Post-S SD | Pre-S Mean | Pre-S SD | Post-S Mean | Post-S SD |
| 1. In general, being a scientist is an important part of my self-image. | 4.33 | 0.82 | 4.33 | 0.82 | 3.45 | 0.69 | 3.64 | **0.81** |
| 2. I have a strong sense of belonging to the community of scientists. | 3.67 | 1.03 | 4.17 | 0.98 | 3.45 | 0.77 | 3.55 | **0.69** |
| 3. Being a scientist is an important reflection of who I am. | 4.17 | 0.75 | 4.17 | 0.98 | 3.45 | 1.12 | 3.82 | **0.98** |
| 4. I have come to think of myself as a "scientist." | 3.50 | 0.84 | 4.17 | 0.75 | 3.45 | 0.93 | 3.64 | 0.81 |
| 5. I feel like I belong in the field of science. | 4.33 | 0.52 | 4.33 | 0.52 | 4.55 | 0.69 | 4.40 | 0.70 |
| 6. I am a scientist | 3.50 | 0.55 | 3.83 | 0.98 | 3.55 | 0.82 | 3.91 | **0.83** |

[1]Pre-S: Pre-Survey, [2]SD: Standard Deviation, and [3]Post-S: Post-Survey

Table 2 illustrates positive changes in students' perceptions of self-efficacy and science identity in both cohorts, as indicated by their means. Students from cohort 1 showed positive changes in almost all statements from pre- to post-surveys, while students from cohort 2, according to the SD (bold), reported higher consistency in their perceptions of having a stronger sense of belonging to the scientific community and feeling like a scientist, as an important reflection of who they are. The post-survey SDs for statements one, two, three, and six were equal to or lower than those in cohort 1, showing more consistency, which might positively influence students' science efficacy and identity.

Table 3. Pre- and post-survey standard error by cohort

| | Cohort 1 | | Cohort 2 | |
|---|---|---|---|---|
| Statement | Pre-S Standard Error | Post-S Standard Error | Pre-S Standard Error | Post-S Standard Error |
| 1. In general, being a scientist is an important part of my self-image. | 0.33 | 0.33 | 0.21 | **0.24** |
| 2. I have a strong sense of belonging to the community of scientists. | 0.42 | 0.40 | 0.21 | **0.21** |
| 3. Being a scientist is an important reflection of who I am. | 0.31 | 0.40 | 0.34 | **0.30** |
| 4. I have come to think of myself as a "scientist." | 0.34 | 0.31 | 0.28 | **0.24** |
| 5. I feel like I belong in the field of science. | 0.21 | 0.21 | 0.21 | 0.22 |
| 6. I am a scientist | 0.22 | 0.40 | 0.25 | **0.25** |

To assess the precision of the sample mean, Table 3 presents the pre- and post-survey standard errors for cohorts 1 and 2. Figures 1 and 2 present the results of Table 3 graphically.

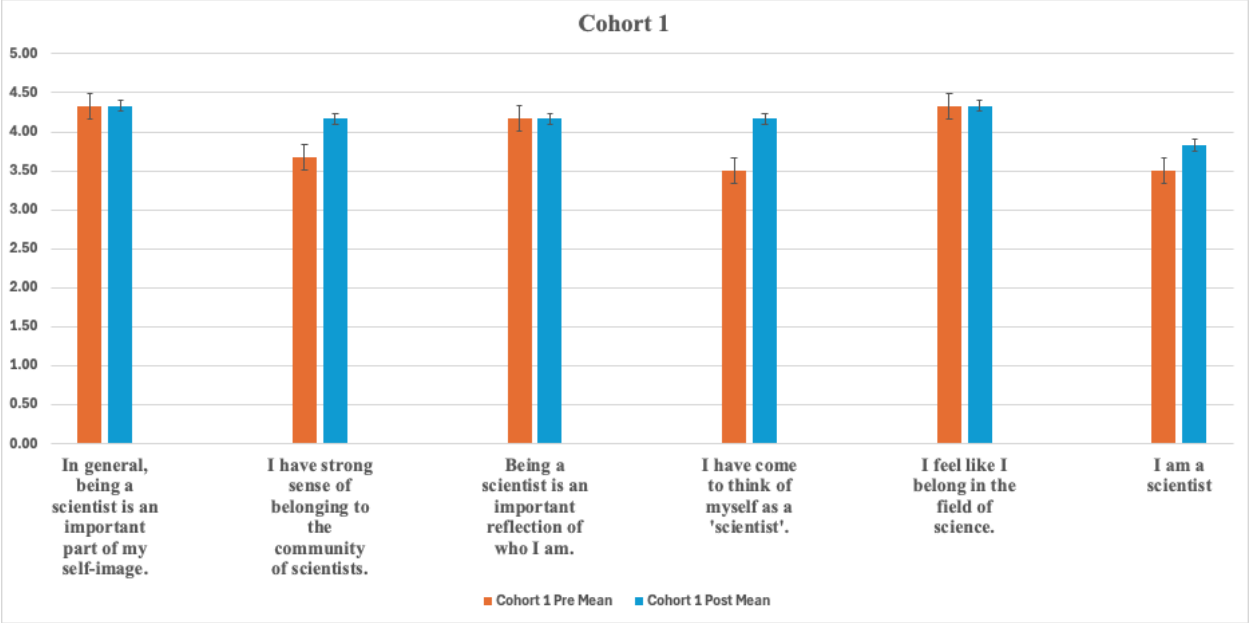


Figure 1. Pre- and post-survey means with standard error of cohort 1

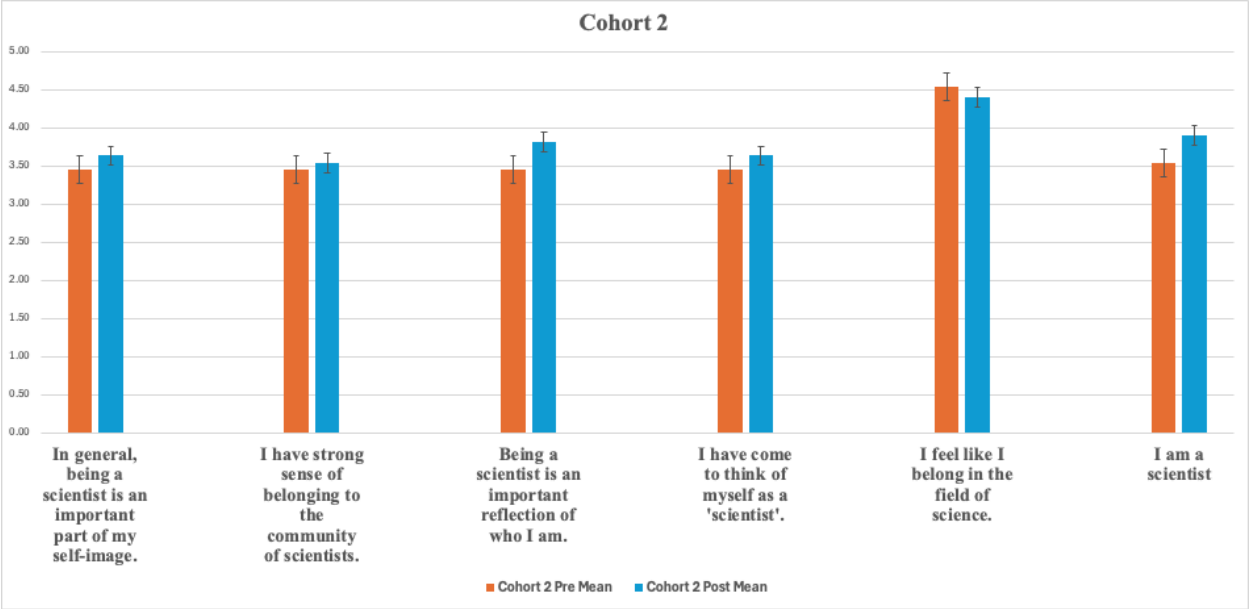


Figure 2. Pre- and post-survey means with standard error of cohort 2

The results show that cohort 2 had lower post-survey standard errors (bold) than cohort 1. These preliminary results suggest that students from cohort 2 further developed an understanding of what it takes to behave, act, and look like a scientist, thereby positively influencing their sense of belonging to the research community.

To complement the quantitative results, the following section presents qualitative findings that describe how students' involvement in the research program and interactions with peers and mentors advance their feelings of inclusion, involvement, and adjustment.

**Qualitative Findings**

Student participants from both cohorts reflected on aspects that were important to them and that made them feel part of both the research community and the ethnic group. Traits of rules, roles, and values were identified through the interviews as students expressed their interests, involvement, and commitment to the research program. Such concepts can be linked to the survey results, showing that students develop a stronger sense of science identity and a stronger sense of belonging to their STEM fields. The following information includes students' reflections that indicate signs of social integration.

**Feelings of Inclusion and Individual Interests - Rule Orientation**

During their time in the research program, students could interact, some of them for the first time, with a professional who became their mentor. Students hoped to have a positive experience and be accepted through their research work by mentors and the group. Self-efficacy became an important concept among students who need to learn and adapt to the new setting and research demands. Students developed a sense of inclusion, for example, when they felt fully supported by their mentors. Carla, a Microbiology junior student from cohort 1, mentioned,

> She [the mentor] is definitely pushing forward academically. I believe I learned a lot with her because we learned in our classes more like theory of how we would do something and in the lab when she's actually like making me apply it.

While this student described a favorable experience of theory and practice that improved her understanding and had a positive impact on her academics, other students indicated they felt included because of the space created with other students with similar interests. On the one hand, Perla, an Animal Science sophomore Student from cohort 2, commented, *"Just being able to relate with people and seeing that they are also in research. I guess the research and academia feel less lonely."* This student highlighted the importance of connecting with people with similar research interests. On the other hand, Pedro, a Biology Community College student from cohort 2, said,

> I am Hispanic, but I don't speak too much Spanish. It was really nice to be able to go to every meeting, and we just like to talk. And they were just super friendly. It does have a sense of belonging.

Both quotes emphasized the importance of creating a positive, friendly environment where students feel represented and welcome in the group, as they share multiple identities. Likewise, several students shared moments and situations in which they felt their mentors or the program responded to their individual interests, whether academic, professional, or research-related. According to the TIMSI framework, students experienced compliance, in which both inclusion and interests were felt and addressed respectively [11], [15]. The first two quotes are related to students' professional plans. Lola, a Chemistry junior student from cohort 1, vented, *"Connecting with the professor, and getting to know a little bit of about what my options are. If I wanted to pursue higher education or learning a little bit more about the industry from the Professor [mentor]."* Then, Rosa, a Kinesiology senior student from cohort 2, expressed, *"I kind of was able to work with my mentor. And she helped me a lot with that process, too. So, I feel like it has helped me with a lot of my future career prep."* Both students found responses to their questions on career opportunities through their mentors.

Similarly, but more academically related, students also found meetings including interesting topics, for instance, two students noticed, Maria, a Mathematics Education junior student from cohort 1, said, *"All the workshops give me certain information…I liked the workshop when she [program coordinator] invited people from the scholarship programs, so that gave me options that I didn't know existed."* And Paula, a Mathematics sophomore student from cohort 1, added, *"You get all these skills and the basics. So, you can apply later on. I think you're developing your skills now that you think you'll be able to use them if you pursue graduate school."* These two students discussed options and skills development useful in college and beyond.

Overall, this finding describes students' feelings of inclusion and personal interest, which were evident in both mentor and group sessions. Students experienced adherence with the group when they felt accepted and validated by trusting their mentors and finding allies who could help them in their academic journey and future profession. As a result, students showed gains in their perceptions of themselves as scientists.

**Sense of Involvement and Visibility - Role Orientation**

Students took advantage of the opportunity to be paired with a professional or someone with more experience in college-related topics. Most students were from first-generation households and needed the information and support that anyone entering higher education for the first time requires. Students demonstrated their involvement from different lenses and perspectives, situations that made them develop their sense of involvement as mentees. Sentiments of belonging were also reflected in the surveys, particularly in cohort 2. The next three quotes illustrate students' participation in either mentor-led or group activities. Maria commented, *"My mentor inspired me to get more things in my life, like to finish my bachelor's and then continue with a master's. I would like to do that."* Then, Pepe, a Computer Science senior student from cohort 2, expressed, *"I have participated in research and creativity week and a couple of events through the program, so I think it has increased my sense of belonging."* And finally, Perla added, *"It's kind of nice to hear from people more of like my age group and like peers, so to say…what they're doing or what they're struggling with. And it just makes it more realistic."* These students' reflections indicated the strong relationships they developed with their mentors, which would influence their future decisions, as well as their active participation in group activities and peers' research. This also reflects the sentimental attachment students developed, which enhanced their sense of involvement, resulting from conforming to a desired relationship according to the TIMSI model [11], [15].

Additionally, through the group meetings, students found a space to share and discuss their academic and research experiences. It was also an opportunity to learn from each other and even find solutions. For example, Maria mentioned, *"In the workshops, we share ideas for different presentations. So even though we have a similar background. We learn from each other, like everyone has different ideas and different problem solutions."* Paula said, *"With this program I've been making a lot of connections…I didn't know that there were people that it's doing the same thing as me, so that's helpful to ask or like guidance."* Similarly, Rosa expressed, *"I feel like it was a really cool place to be able to feel connected with others, and kind of, you know, like to represent each other too, so it would feel good."*

In summary, this finding highlights that, through the relationships students develop with their mentors, they can deepen their involvement in their academic and research endeavors. Students also found a space where they could be visible, express their questions and concerns, and find answers and solutions that would be valuable in their future decisions. Therefore, students experienced instrumental attachment, gaining visibility and finding a desired relationship, as explained in the TIMSI model [11], [15]. This finding also aligns with the survey results, indicating that the research program contributed to improving students' belief in their capacity to behave as scientists and be perceived as such.

**Personal and Group Value System - Value Orientation**

In this theme, students' integration into the research community is addressed by analyzing culturally affirming peer group similarities. By discussing cultural aspects and shared identities, students reflected on their personal value system that made them feel influenced by their mentors and the group. Some students highlighted shared values related to their upbringing, language, family, and community. Such group characteristics made it easier for students to develop a

stronger sense of belonging, a quality difficult to find in other higher education settings. First, students commented on the individual values that aligned with those of the mentors. On the one hand, Lola mentioned,

> What mattered most to me is that we [mentor and mentee] were both from Mexico. Well, I wasn't born in Mexico, but I did grow up in Mexico for a few years and what matters most to me is that we were able to connect through culture.

On the other hand, Rio, a Nutrition Science junior student from cohort 1, added, *"I would say he [mentor] is continuing his education while having a family…I noticed that once we started talking about family, we both, I guess, kind of opened up a little bit more and felt more comfortable with each other."* Both students felt more comfortable sharing similar experiences, which helped them build stronger relationships with their mentors. In addition, students also found similarities with their peers and others attending the group meetings. As in the previous quotes, students noticed camaraderie, complicity, mutual understanding, and a sense of community through their participation in the meetings. A few quotes are included next:

> I think we all connect more. We're able to talk more. We're more comfortable together, and it's really allowing me to meet more people with similar goals, which has made me feel more like I belong…made me feel more welcome (Carla).

> It was really fun to hear people at the program meetings say stuff that more aligned with how people might say it in my home…especially in Spanish. I don't speak Spanish, but I can understand it for the most part…It just felt more relatable (Perla).

> It's given me a sense of community with other Latinx people who are in STEM programs and are doing STEM research or STEM majors, people who may be 1st generation like me…So it does give me a sense of community when it comes to those circumstances (Perla).

The goal of having a group of people who shared multiple identities and values was to foster a deeper connection among participants, so that students and mentors felt understood and identified. These quotes, from the students' perspective, highlight the different aspects that made them feel accepted and integrated into the research community through this ethnic group. This finding also represents students' internalization of the group's influence due to shared values. According to the TIMSI framework, students are more likely to commit to the group when their personal and cultural values align with those of the group [11], [15].

**Discussion**

The purpose of this study was to gain insight into students' better sense of belonging and identification within the STEM research community after participating in the Latinidad STEM Mentoring program. The first research question focused on the differences between cohorts 1 and 2 in terms of students' self-efficacy and science identity. The effect size analysis revealed that students from cohort 1 experienced greater growth in their self-efficacy and science identity, with a growth of 0.28 points and a medium effect size of Hedges' $g = 0.46$, than students from cohort

2, with a growth of 0.20 points and a small effect size of Hedges' g = 0.27. A few changes were implemented in the program activities from the first to the second cohort, such as more student meetings with additional topics and time for social activities, closer tracking of students' research progress through monthly reports, and higher commitment from mentors who attended more meetings and were more aware of their students' work. Therefore, by closer examination of the pre- and post-survey results by statement, the standard deviation and standard error revealed higher consistency among students in their perceptions of seeing, feeling, and behaving as scientists due to their research experience in cohort 2 than in cohort 1. Furthermore, students also reported a stronger sense of belonging to the research community. This can indicate how students, through their involvement in research and high-quality mentoring, whether in a lab or on a project with a mentor, felt included and adjusted to the research community. This result also aligns with prior studies that have documented the critical role of effective mentoring and robust research experiences, in which students feel capable, identify with, and value their work, thereby fostering social integration [7], [8].

The second research question examined the rules, roles, and values that contributed to increased students' sense of belonging within the research community. According to Kelman [11], individuals can develop social integration and allow their feelings to be influenced when they hope to gain a favorable reaction or approval from a person or a group (compliance). In this study, student participants demonstrated compliance with or acceptance of rules when describing moments or situations in which they felt academically, professionally, and scientifically supported. This finding resonates with Hernandez's study [12], which identified different types of support through mentoring, in particular, instrumental support, characterized by feeling sponsored, guided, and protected by their mentors. Furthermore, students' personal interests were addressed, and they could find answers to questions, doubts, and concerns about their career prospects through their role as mentees. Additionally, individuals would conform or seek a desired relationship (identification) to develop social integration [11]. Students in this study reported developing strong relationships and role orientation with their mentors and peers, which helped them develop a serious commitment to their research. Students were able to learn from their mentors and peers, making their academic journey less lonely and isolated. Students could feel psychologically supported by strengthening the relationships with mentors and peers with whom they shared values [12]. Even more important was the students' ability to be able to relate to others, feel connected, and be influenced by the research group [7].

Lastly, individuals accept social influence because it aligns with their value system (internalization) [11], which may be those of the ethnic group conducting the research. Through students' quotes, this study revealed attitudes and behaviors that aligned with students' values, and with those promoted by the Latinidad STEM Mentoring program. Students could easily find a sense of community that was familiar to them through the language, topics discussed, or shared STEM experiences. In particular, by talking or hearing Spanish, sharing family-related experiences, and feeling understood without having to explain why certain aspects or values were important to them, students could develop stronger connections and identification with the group through value orientation. The behaviors and attitudes students demonstrated are linked to individuals who develop social integration and allow the group to influence their decisions, which, hopefully, would impact their persistence and continuation in STEM programs and future careers [7], [13], [14].

## Conclusion

This study contributes to the existing literature on the benefits that undergraduate research programs with an effective, intentional mentoring approach have for minority students. Additionally, social integration is a crucial aspect of the academic journey for college students, especially those from minority backgrounds, first-generation status, and with little to no involvement in research. Overall, this study reported minimal changes in students' self-efficacy and science identity in some statements from pre- to post-surveys within cohorts; however, by including standard deviation and standard error, higher consistency was found in cohort 2 post-survey results. This could indicate that students in cohort 2 developed a deeper understanding of their scientific role, which could potentially influence a sense of belonging. To complement the quantitative results, qualitative findings revealed students showing compliance by experiencing diverse types of support (e.g., academic, professional, and scientific) that secured their inclusion and interests. Additionally, students developed role orientation by understanding their mentee role and addressing questions, doubts, and concerns about career possibilities and opportunities. Lastly, students could easily internalize their value systems through the group, thanks to the language, topics discussed related to their communities, and shared STEM experiences.

According to this study's results, the implications for practice imply a better understanding of students' needs beyond academics, leading to the creation of mentoring programs that address socioemotional and cultural gaps. Despite minority students adapting to the higher educational context, they struggle to find meaningful relationships in which they express who they are, what they value, and what is important for them. Lastly, given the small simple size of this study that limits its generalizability, future work could include the assessing of larger and longitudinal mentoring programs that further explore the influence of mentors in improving students' science identity and sense of belonging through research.

## References

[1] S. M. Stuckey, B. T. Collins, S., Patrick, K. S. Grove, and E. Ward, " Thriving vs surviving: Benefits of formal mentoring program on faculty well-being. *International Journal of Mentoring and Coaching in Education*, vol. *8*, no. 4, pp. 378-396, 2019.

[2] H.C. Contreras Aguirre, A. Happle, and L.R. Garcia Carrillo, "Mindfulness in mentoring: Latinx STEM faculty and students' perspectives at an HSI," *CEDER Journal, in press.*

[3] F. Sanfilippo, "The importance of mentorship in career development," *The American Journal of Pathology*, vol. 195, no. 10, pp. 1758–1765, 2025. [Online] doi: 10.1016/j.ajpath.2025.07.002 [Accessed Dec 15, 2025].

[4] Hispanic Association of Colleges and Universities, *About Hispanic serving institutions - Hispanic Association of Colleges and Universities*, n.d. https://www.hacu.net/hacu/About_HSIs.asp [Accessed Nov 25, 2025].

[5] F. E. Contreras, L. E. Malcom, and E. M. Bensimon, “Hispanic serving institutions,” in *Understanding Minority Serving Institutions*, M. Gasman, B. Baez, and C. S. Viernes Turner, Ed. Suny Press, 2008, pp. 71-90.

[6] H. C. Contreras Aguirre and C. Romero, “Advancing Latinx faculty and students in academia through femtoring/mentoring” In *Best Practices and Programmatic Approaches for Mentoring Educational Leaders*, A. Wilkerson and S. Samuels Ed. IGI Global, 2023, pp. 35-47. https://doi.org/10.4018/978-1-6684-6049-8.ch003

[7] M. Estrada, A. Woodcock, P. R. Hernandez, and P. W. Schultz, "Toward a model of social influence that explains minority student integration into the scientific community," *Journal of Educational Psychology,* vol.103, no. 1, p. 206, 2011.

[8] M. Estrada, P.R. Hernandez, and P.W. Schultz, “A longitudinal study of how quality mentorship and research experience integrate underrepresented minorities into STEM careers,” *CBE Life Sciences Education*, vol. 17, no. 1, 2018. [Online] https://doi.org/10.1187/cbe.17-04-0066 [Accessed Sept 15, 2025].

[9] National Center for Education Statistics, Characteristics of Postsecondary Faculty, *Condition of Education. U.S. Department of Education, Institute of Education Sciences*. May 2024. [Online] https://nces.ed.gov/programs/coe/indicator/csc [Accessed Sept 20, 2025].

[10] A. Frederick, S.E. Grineski, T.W. Collins, H.A. Daniels, and D.X. Morales, “The emerging STEM paths and science identities of Hispanic/Latinx college students: Examining the impact of multiple undergraduate research experiences,” *CBE Life Sciences Education*, vol. 20, no. 2, 2021. [Online] .https://doi.org/10.1187/cbe.20-08-0191 [Accessed Sept 16, 2025].

[11] H.C Kelman, “Compliance, identification, and internalization: Three processes of attitude change,” *Journal of Conflict Resolution*, vol 2, pp. 51–60, 1958.

[12] P. R. Hernandez, "Landscape of assessments of mentoring relationship processes in postsecondary STEMM contexts: A synthesis of validity evidence from mentee, mentor, institutional/programmatic perspectives," National Academies of Science of Effective Mentoring in Science, Technology, Engineering, Medicine, and Mathematics (STEMM), pp. 1-64, 2018. [Online] https://nap.nationalacademies.org/resource/25568/Hernandez%20-%20Landscape%20of%20Assessments%20of%20Mentoring.pdf [Accessed Nov 16, 2025].

[13] V. Mendez, "The impact of research experience and mentorship on STEM socialization: Evidence from a summer research program," Master's thesis, Dept. of Psychology, California State University, Long Beach, Los Angeles, CA, 2025.

[14] L. Tong, L. Oseguera, and C. Kirk, "Examining the influence of first-generation status on STEM socialization among undergraduates in a STEM scholars program," *Research in Higher Education*, vol 65, no. 3, pp. 417-438, 2024.

[15] H. C. Kelman, “Interests, relationships, identities: Three central issues for individuals and groups in negotiating their social environment,” *Annual Review of Psychology*, vol. 57, pp. 1–26, 2006.

[16] H.C. Kelman and V. L. Hamilton, *Crimes of Obedience: Toward a Social Psychology of Authority and Responsibility*, New Haven, CT: Yale Univ. Press, 1989.

[17] J. W. Creswell, *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, California: Sage, 2014.

[18] M. M. Chemers, E. Zurbriggen, M. Syed, B. K. Goza, and S. Bearman, “The role of efficacy and identity in science career commitment among underrepresented minority students,” *Journal of Social Issues*, vol 67, no. 3, pp. 469-491, 2011. [Online] https://doi.org/10.1111/j.1540-4560.2011.01710.x [Accessed Jun 13, 2025].

[19] D. Lakens, "Calculating and reporting effect sizes to facilitate cumulative science: a practical primer for t-tests and ANOVAs," *Frontiers in psychology,* vol. 4, pp. 863, 2013.

[20] Y.S. Lincoln and E. G. Guba, *Naturalistic Inquiry*, Beverly Hills, CA: Sage,1985.