Latinx Students' Sense of Belonging in Engineering/Computer Science at an HSI

Dr. Alberto Esquinca, San Diego State University

Alberto Esquinca is an Associate Professor in the Department of Dual Language and English Learner Education at San Diego State University.

Dr. Erika Mein, University of Texas at El Paso

Dr. Erika Mein is Associate Dean of Undergraduate Studies and Educator Preparation in the College of Education at the University of Texas at El Paso, and Associate Professor in the Department of Teacher Education. Her scholarship focuses on disciplinary literacies in postsecondary contexts, with a particular emphasis on engineering identities and literacies among English Learners and bilingual students. Her research has been published in journals such as Theory into Practice, Action in Teacher Education, and Journal of Hispanic Higher Education. She earned her Ph.D. in Reading/Writing/Literacy from the University of Pennsylvania and has been a faculty member at UTEP since 2008.

Helena Mucino, University of Texas at El Paso

Helena Muciño is a Ph.D. student in the Teaching, Learning, and Culture program at the University of Texas at El Paso (UTEP). She holds a master's degree in Musical Education Research from the National Autonomous University of Mexico (UNAM). She is currently working as a Research Assistant for an NSF-funded project at UTEP dedicated to broadening the participation of Latinx students in higher education.

Latinx Students' Sense of Belonging in Engineering and Computer Science at an HSI

The persistent under-representation of Latinx people, particularly Latinas, in Engineering and Computer Science (E&CS) is well-documented. This under-representation occurs both in the pipeline into and through undergraduate E&CS studies, as well as into the profession: only one-tenth of E&CS degrees were awarded to "Hispanics" in the ten-year period from 2004 to 2014 [1], while 2018 data showed that only 8% of the engineering workforce was comprised of "Hispanics" [2].

To account for the persistent under-representation, researchers have studied the challenges experienced by Latinx E&CS students [3] [4]. A key factor in persistence may be "sense of belonging." In the research literature, sense of belonging, or belongingness, refers to the positive interactions and attachments experienced by an individual [5] and fostered within institutional contexts [6] [7]. When a student has a sense of belonging, they feel connected and that they matter to others on campus. Sense of belonging is thought to be a significant factor in persistence with colleges and universities investing in mentorship programs that promote belonging [8].

A large body of research literature has consistently found that Latinx students report a lower sense of belonging than white students [9] [10]. In particular, first-generation Latinx college students in predominantly white institutions [11] [12] report lower sense of belonging. In addition, recent studies have investigated the role of various stakeholders in creating a sense of belonging among Latinx students including: Hispanic Serving Institutions (HSIs) [13], mentors [14], professional organizations [15] and families and communities [16].

Studies have shown a correlation between high levels of belongingness and academic success in STEM [17]. In engineering education, specifically, studies have uncovered students' own views and experiences of belongingness [18] [19] and have shown the positive connection between underrepresented students' strong sense of "classroom belonging," their engineering identity, and their academic performance [20]. Strayhorn [10] compared white and Latinx students' sense of belonging drawing on data from a large survey of students in four-year institutions. He found that "academic and social experiences influence Latino college students' sense of belonging. For instance, it was found that grades and time spent studying positively influence Latino students' sense of belonging; time spent studying had a more powerful impact than grades. Taken together, findings may suggest that Latino students who excel academically (e.g., high achievers) feel more connected to campus than those who perform less well" (p. 313). Moreover, while time spent studying was a significant predictor of belonging for Latinx students, for white students this was not the case. Strayhorn suggests that "*time spent studying*

reduces White students' ability to engage in other activities that would increase one's sense of belonging (e.g., socializing with peers)" (p. 314).

Other studies of Latinx students' sense of belonging specifically investigate its relation to engineering identities. Latinx science and engineering undergraduates are often exposed to a hyper-competitive culture that does not promote a sense of belonging [21]. In addition to this, Latinx engineering undergraduates also reported the weight of outside responsibilities, travel to campus and quality of interactions with peers and instructors as factors that may negatively impact their sense of belonging [22]. While first-generation, low income engineering Latinx undergraduates report lower sense of belonging, they show a remarkable sense of resilience by actively constructing a sense of belonging in their area of studies by actively cultivating relationships between their family funds of knowledge and their engineering practices, as reported in one study [23]. Similarly, a study of professional organization suggests that for Latinx students, commitment to community, engineering role modeling, and nurturing an engineering familia are also crucial factors [15].

The present paper is part of a larger study on the relationship between identity and persistence among Latinx E&CS students' in their last year of E&CS studies at an HSI. In this paper, we investigate Latinx students' sense of belonging *in E&CS* by analyzing qualitative data to understand how this sense was constructed in both collective and individual levels. We show that the competitive culture of E&CS at the HSI potentially threatened belongingness, with Latinas, working-class and immigrant/ transnational students experiencing additional, intersectional threats to belongingness.

Methodology

This study is set at a research-intensive Hispanic Serving Institution on the US-Mexico border which enrolls close to 24,000 students, 80% of whom are "Hispanic". Four per cent of students are Mexican; 83% of students are from the county in which the university is set. Our study is situated within senior-level capstone courses in Mechanical Engineering and Computer Science (E&CS).

In order to explore the connection between engineering identity and belonging, this study draws on one-year of intensive ethnographic data collection [24] to examine: (1) how Latinx engineering/CS constructed their engineering/CS identities; and (2) how Latinx students experienced belonging in E&CS, both as a field of study and as a career option.

The study focused on 19 student participants who were selected using purposive sampling based on the following criteria criteria. Student senior design teams would be formed based on faculty member's existing pedagogical practices. All members of the team would have to agree to participate in the study. The teams would mirror the gender and ethnicity composition of the E&CS student body (6 women, 12 men, all Latinx).

Three key sources of data were utilized: participant-observation in capstone courses (more than 200 hours); in-depth interviews (52 total); and artifacts. Each participant was interviewed three times using Seidman's [25] method of deep interviewing, which permitted us "to understand the details of people's experience from their point of view" (p. 130). We also observed team design meetings and took detailed notes, video and audio recordings. The purpose of participant-observation is to capture everyday interactions in real time. Participant observation also allowed us to triangulate our other data collection methods.

A qualitative data analysis software tool was used to code participants' interviews and observations. After the coding process, tables with most relevant quotes were generated to conduct an in-depth analysis of the participants' experiences. Additionally, the research team gathered to discuss the resulting analysis to make collaborative meaning of the data.

Sense of Belonging in Engineering & Computer Science

Participants identified ways that their sense of belonging to and mattering to people on campus was constructed both collectively and individually. Our analysis uncovered both institutional and interpersonal factors that contributed to belongingness or exclusion. At the institutional level, four types of factors were identified: 1) professional relationships (with teachers/mentors); 2) pedagogical (which referred to the learning configurations of key courses); 3) informational (particularly with respect to the types/modes of information conveyed to students by the institution); and 4) sociopolitical (border-crossing and visa experiences of Latinx E&CS students). At the individual level, participants related personal and interpersonal factors, including their own and others' grades and grade point averages.

These institutional and interpersonal factors are interrelated, for instance, when particular learning configurations impact (or are seen to impact) grades. Similarly, participation in activities on campus with mentors could be hindered by factors that interrupted their participation on campus (including visa issues) or shortened it (including prolonged times on public transportation). In addition, participants' interactions with peers was another collectively oriented way that could promote a sense of belonging. Group interactional dynamics within

students' senior capstone teams could contribute to building, but also reducing the sense of belonging experienced by students.

"They're Going to Throw You Under the Bus"

Belongingness is a collective sense potentially conflicting with the values of E&CS that seem to put a premium on individual markers of achievement and merit [21]. Students described the culture of E&CS as hypercompetitive. Alicia was a transnational mechanical engineering student who emphasized the competitiveness she experienced at the team level; she described her teammates by saying "they are very competitive and I'm not, I'm over that. I don't know. I don't feel that I have to be the best at this, it's not my priority. I don't feel like I have to be the number one engineer in the world." David was a transnational computer science major student who described the field of CS as in his major, saying "people in CS are super competitive and they're going to take the first opportunity to throw you under the bus just to get ahead. I mean, that's life in general, but it's very exacerbated here precisely because companies want to hire people like that, those types of people."

Alicia and David's descriptions match with what other students described as a culture in which students assessed their relative status to one another using GPA as an indicator. Senior design teams met periodically to work on their design challenges. Teams had been formed by the professor and students did not have a choice who was in their team. Although they did not choose the teams, they all knew each other from their classes. During the meetings for senior design projects, students would spend substantial time discussing the classes they were taking, their professors and, surprisingly, other students. In particular, they would discuss students who were known to be "top students" in their classes. They would wonder, for instance, how these students were meeting the design challenges. In some cases, they would refer to conversations they had with these students or about these students with other classmates. In interviews, students described their peers in terms of GPA. Elisa, a mechanical engineering student, explained that senior students think about GPA as shorthand for who among their peers "knows their stuff" and who will and will not get a job. However, she also contradicted the rationale by adding that there are students who have a low GPA who still get a job in large companies.

One CS student, Arturo, who had changed his major from electrical engineering, said that he had struggled to feel a sense of belonging both in the broader field and at a team level. Arturo compared himself to a "David, the top student," saying "I've struggled a lot in engineering, a lot, a lot, things that for others are really easy for me are not, for example David our [team leader], he has a 4.0 GPA, it comes natural to him, maybe he suffers, I don't say he doesn't

suffer, but for him it is really easy to learn these things, and for me is not easy, I struggle to understand things." This description suggests that Arturo seems to aspire to be in the other student's position, one for whom things seem to come easier, has a better GPA and may not suffer as much. This also coincides with the literature reviewed previously that points out that students with low grades struggle to feel a sense of belonging to their fields [26].

Students became aware of each other's GPAs through practices such as announcing their grades publicly to their peers or discussing grades with each other. They also typically asked each other what they got on the test, a practice that may be related to grade curving. In the context of the competitive culture, this could also be an opportunity for students to position themselves in relation to others. For instance, Genesis told a story of how she asked her (mostly male) peers about their grades on a test. "Or like, "Oh, well how did you guys end up doing on the exam?" I'm like, "Oh, well, I ended up getting an A on the exam." Like, "What? None of us got an A." And I'm like, "Oh, sorry. I don't know what to say." As the quote from Genesis suggests, announcing a high grade to a group may have permitted her to position herself as a competitor. However, it might have also positioned her as the student who "spoils the curve."

Students also described being acutely aware of one another's performance. This included what they said in class, the questions they asked or even if they took notes. In one instance, Adam said that he knew Alicia would not be a good teammate based on what he had seen of her in class. He said that they were in class together and he watched her not taking notes in class and not paying attention. Similarly, Elisa described a student as follows: "I have seen the ones that I don't even know how they have gotten so far. You are left thinking 'like how!?' There are others who are just there and they are very social but they aren't good at school." Being aware of each other's performance and grades suggests that students may have been sizing each other as competitors.

In the competitive culture of E&CS, grades were more than an indicator of academic achievement. Indeed, they were markers of status on a hierarchy, as suggested by the phrase "top students" to refer to those who had a high GPA. According to Strayhorn's analysis of Latinx sense of belonging [10] Latinx students who performed well academically "feel more connected to campus" (p. 313). It should be noted that the students in the study were those who had reached senior status, so we do not know the perspectives or experience of students who started but did not continue in engineering studies.

Grades and Access

Our study uncovered practices that contributed to the perpetuation of a competitive culture of E&CS - which in turn helped shape students' sense of (academic) belonging. The competitive culture was reflected in pedagogical practices and department policies. Pedagogical practices included forming teams to work on projects. Students described becoming aware of each other's GPAs based on team formation. Javier, a CS student, said that he was aware that faculty used GPAs to form teams. "So, they start to form teams, one with a high GPA and then they start to balance it out. The lowest GPA gets placed randomly and then they start to balance it out with the other three." It should be noted that this process is different from what faculty described as rules for forming teams. The crucial point is that students believed that GPA played a role in establishing hierarchies of power and status in teams.

In addition, students also frequently mentioned that GPA was a way to access other resources, such as internships or scholarships and, by extension, eventually jobs. For example, Arturo, a CS student, argued that GPA prerequisite policies kept him and others from accessing opportunities for internships and scholarships.

> I would have liked the department to be more empathetic with people who do not have the required GPA. […] Maybe a program for people who have less than 2.5 or less than 3 GPA. A program, that if you show them you can and you have the interest, that helps you to get an internship, that makes it easier for you to earn a scholarship, that make it easier for you to have opportunities, because I struggled a lot, I tried to go to study abroad but they wouldn't allow me to go, to look for scholarships and I couldn't because I didn't have the GPA; I tried to be involved with Smart cities, which is a program where you go to Guadalajara or to other cities, do a project and that looks really good in your CV and they did not accept me because I had a low GPA. So, they tell you: "you can't because you have a low GPA" so many times that you do not feel the confidence to go after a research opportunity for example.

Arturo added that he understood that a low GPA would impact his job prospects, perhaps unfairly. He said that big companies would not look at him or consider him. Similarly, Genesis (mechanical engineering) told us that she was excited that she had an interview with NASA during a Career Fair. "I even had this interview with NASA, where it was going-- everything was going great until he saw my GPA and then he kind of just like, "No. I'm wasting my time talking to you […] NASA isn't legally allowed to hire anyone that isn't within that range of the GPA that they allow. So if you are not part of that like from three to four, they can't hire you." Though we cannot confirm that recruiters would outright reject speaking to a student with a low GPA, what

students' words reveal is that GPA was perceived as shorthand for ability and even intelligence. In fact, students also pointed out that they knew students with a high GPA who did not possess other necessary skills such as communicative abilities as well as students with a low GPA who were able to land desirable jobs in large companies.

Professors and TAs as Gatekeepers

In investigating Latinx students' sense of belonging to engineering, we found that coursework played a central role in constructing that sense. Students often described pedagogical practices-- particularly in courses that come early in the program of studies-- that they perceived as a barrier to building belonging. This perception suggested that they saw professors as people whose pedagogical practices were meant to keep people out.

For example, Elisa described a Statics professor who "would only give zeros if any little thing was wrong so he would fail a lot of people." Alex also described a professor who "was out there just to fail people, is what it seemed like, is because he would always-- it would seem like he'd always get a kick out of seeing people get bad grades." He also pointed out a prerequisite course saying, "What would happen is, you'd go in there, and he'd bring up a topic, and he'd speak about the topic and how knowledgeable he is about the topic, but then he wouldn't teach us the material that was going to be on the test. We'd just go in there, and he'll show how cool he is, and then the material that was on the exam wasn't that stuff that he was talking about. It was other stuff. So that's what sucked about that. […] So that's what made me hate chemistry."

Alfonso also described pedagogical practices that impacted his trajectory in the program. "This is his teaching style and this is how I'm going to learn from this class and then I, like, with [Professor S] I just kept on trying and trying and trying and nothing gave results. Like the first class I just kept on getting F's and F's and F's and I just didn't understand why. And then I started getting mad at him because I was like, you're not teaching this correctly. Like you need to do this. Like you need to do this, like, I need to understand it and, like, I never mentioned it to him but it was thoughts that were coming into my head. [...] Like, oh my goodness I wish that [the professor] could [do] this or I wish that he could show us correctly and then I took it the first time I had to drop it because I just kept on getting F's and I was just like no."

Two female participants pointed out pedagogical practices, including discouraging questions from students, that could be interpreted as counterproductive to learning. Genesis described a situation in which she felt her questions discouraged. "It was for my Dynamics class. Well, it happened twice. It happened in my Dynamics class. I can't remember what the professor was

explaining, some sort of angular acceleration or something like that. And he had explained it and I wasn't able to catch it because I was writing down the notes rather than listening to him. So I was like, "Hey, can you repeat that again?" Yeah. I asked him to repeat that again or something like that. He's just like, "Well, isn't it obvious?" I was just like, "It obviously isn't obvious if I had to ask you."" The student's account highlighted an absence of explanation and support that was needed for her to understand the content. In that way, the student pointed out a pedagogical approach that ran counterproductive to her learning and understanding.

TAs were also seen as gatekeepers by some students. CS student Alejandra gave an example of a rude TA that discouraged questions during her initial years in the program. "All the other people that took that computer science course with me can verify this, but he was really rude. He was the kind of person that you go in and ask him for help-- he was a PhD student. And I'm taking my baby steps in computer science, right? So you would think that he'd be a little more understanding. Like okay, I've been there. You're learning. And this may not be great, but this is what you can do. Right? That's what you hope for as a student. But he was the kind of TA that he would honestly mock what you were doing. He'd be like, "No, no, no. This is dumb." And he would, like, overtly laugh if he found something funny. He was very rude. He was rude, rude, rude. So I was scared of asking him questions." The TA practices described by this student represented an example of a counterproductive pedagogical approach that detracted from this student's academic sense of belonging in the program.

Intersectional Perspectives

As shown above, institutional and pedagogical practices seemingly backed up the culture of hypercompetitiveness that was diametrically opposite to creating a sense of belonging. Students reported being very aware of their own and others' grades. For many participants, GPA appeared to serve to index where students fell in the hierarchy of E&CS. Students who perceived their place in the hierarchy as low, based on their grades, reported falling into a situation of anxiety and depression. This space of uncertainty may be more serious for Latinas, as reported in Authors (in press). From an intersectional perspective, Latinas in E&CS faced a double challenge. In the narrative Alejandra, a transnational female CS student narrates her uncertainty.

> And then I was so lost with Dr. H's class that sometimes I didn't even know what to ask him because I didn't even know where to start. Like, "Okay. So [inaudible] this." And it was bad. I cried a lot that semester because I was putting a lot of effort-- a lot, a lot of effort-- and nothing seemed to be fruitful. Nothing was producing [results]. And that's when I started thinking, "Is computer science really for me or is it just a rough patch that

I'm going through right now?" And I was wondering, okay, let's say I change my major from computer science. What do I change it to? I've never thought about doing anything else, never thought about a plan B. What if I don't like this major? What am I going to do? That's what I'm thinking, "What am I going to do?" That was also adding to my anxiety because I didn't know-- I was anxious. I was depressed. I was sad all the time because I didn't know what was going on in my life. I didn't know if this is what I wanted to. I didn't know if I was in the right place or if I just wasn't doing enough. But it felt like I was doing a lot. So it was just a handful."

Latinas were in a double bind [27] [28] because they not only faced a hypercompetitive culture, they also faced the hostility of their Latino male peers. After telling the story of how she and another transnational female managed to get through their coursework, Alicia summarized the experience of being a Latina in engineering with the following story.

Yeah, me and Linda, we always talked about it, we always talked about how we were behind anybody else, because I had failed some classes, and I mean, for me, graduating is like a super achievement because I feel like all of them though "Oh, Alicia won't make it", "Alicia and her friend are dumb", in one exam we got an 80 and they got a 60, and then they were talking saying: "oh well, who did you copy from?"

As the above story shows, Alicia's male peers questioned her legitimate belonging in engineering through the question of grades. The story, provided here in translation, but told in Spanish, suggests that, though her male counterparts could potentially be a Latinx community within engineering for Alicia and her friend Linda, it was instead the opposite. Sadly, we also heard stories of Latinas creating a hostile environment for other Latinas in ways that precluded them from participating in engineering-related activities.

Latina participants could also use good grades to resist perspectives that would position them as inferior. For instance, Genesis, the student referenced above who announced her grades, said that she felt good about announcing her good grades. "It's really nice to be taken seriously. And not just that, but it's really nice to, what's the word that I'm looking for, to exceed expectations that were set on me. A lot of people were just like, "Oh, she's just a girl. She doesn't know what she's doing." And then they would see what I'm doing and be like, "Oh. All right. She knows what she's doing." It's really nice to have that like, "See, I told you I'm smart. I swear, I know what I'm doing here. I do belong here.""

Another challenge to belongingness was that women reported feeling that their appearance was scrutinized, or their visiting E&CS spaces was regulated. Genesis reported that when she

dressed "really nice" with "dresses and skirts and shorts and cute tops," makeup and groomed hair, her peers treated her differently than when she dressed more casually. She said that "people would just assume that I didn't know what I was doing" when she dressed "really nice." Alicia said that the first time she visited a machine shop she was told she could not enter unless her (male) teammates went with her. "They told me I couldn't go alone, because something could happen to me, because they have wood machines, and it's like if I couldn't, I don't know, because I'm a woman, I felt that way. They've asked me are you coming alone? Where is the rest of your team? They told me to ask the rest of my team to come because I was not going to be able to hold on to the wood to manipulate the machine and cut it, and so one guy came and did it."

Moreover, from an intersectional perspective, working-class Latinas in our study reported that they face additional challenges. These included spending less time on campus because they had to spend a long time on often delayed public transportation. One participant, who crossed the border on a daily basis, reported the obstacles to building a sense of belonging as follows. [I'm] a minority of a minority of a minority. I'm a woman in computer science. I'm a Hispanic in the borderland. I live in [Mexico]. I don't even live in this country. I'm a minority of a minority of a minority." It's been hard. It seems normal to me, because this is where I come from. This is all I know, this is all I have. […] Some people complain like, "Oh, I live in the far east." I'm like, "Really? You have a car, and you live in the same country. Don't complain." Simple things as commuting. Commuting was a big problem for me.

Conclusion

In sum, this study is set in an HSI with a greater than 80% Latinx population, mostly of Mexican-origin. Though values of family orientation are evident in the broader community, including those that value collective well-being and community functioning [19], we found that a culture of hypercompetitiveness seems to preclude Latinx participants from constructing a sense of belonging to a collective in E&CS at the HSI we investigated. The culture was promoted by institutional policies and pedagogical practices. Latinx students also adopted the values and ideologies of hypercompetitiveness in which GPA was used as an indicator of status. Although GPA was sometimes also conflated with knowledge or intelligence, some students remained critical of the cultural values and ideologies they were being exposed to. A critical perspective was evident when they critiqued pedagogical practices in assessment and instruction. Finally, the hypercompetitive nature of coursework, and gendered views about engineering may have also been threats to promoting a sense of belonging. Latina participants, especially working-class women, reported feeling a low sense of belonging. Some participants reported having

been taunted by their peers and responding with emotional responses similar to anxiety and depression.

This study's use of an ethnographic and sociocultural lens to examine the lived experiences of Latinx students in engineering/CS contributes to a small but growing set of studies in this area [29]–[32], with the larger aim of understanding the connection among students' identities, belonging, and retention in (or attrition from) the field. Findings from this study have implications both in and beyond engineering/CS, especially in ways that institutions can work to create the conditions for belonging in order to enhance the recruitment and retention of underrepresented students, particularly Latina students.

References

[1]   National Science Foundation, "Bachelor's degrees awarded, by field, citizenship, ethnicity, and race: 2004–14," 2017.

[2]   N. Graf, R. Fry, and C. Funk, "7 facts about the STEM workforce." [Online]. Available: http://www.pewresearch.org/fact-tank/2018/01/09/7-facts-about-the-stem-workforce/. [Accessed: 14-Oct-2018].

[3]   S. M. Camacho, M. M., & Lord, *The borderlands of education: Latinas in engineering*. Lanham, MA: Lexington Books, 2013.

[4]   M. M. Camacho and S. M. Lord, "Latinos and the exclusionary space of engineering education," *Lat. Stud.*, vol. 11, no. 1, pp. 103–112, 2013.

[5]   R. F. Baumeister and M. R. Leary, "The need to belong: Desire for interpersonal attachments as a fundamental human motivation," *Psychol. Bull.*, vol. 117, no. 3, pp. 497–529, 1995.

[6]   D. Reay, M. David, and S. Ball, "Making a difference?: Institutional habituses and higher education choice," *Sociol. Res. Online*, vol. 5, no. 4, pp. 1–12, 2001.

[7]   A. Nora, "The role of habitus and cultural capital in choosing a college, transitioning from high school to higher education, and persisting in college among minority and nonminority students," *J. Hispanic High. Educ.*, vol. 3, no. 2, pp. 180–208, 2004.

[8]   P. Y. Talbert, "Strategies to increase enrollment, retention, and graduation rates," *J. Dev. Educ.*, vol. 36, no. 1, pp. 22–36, 2012.

[9]   S. Hurtado, D. F. Carter, "Effects of college transition and perceptions of the campus racial climate on Latino college students' sense of belonging," *Sociol. of Educ.,* vol 70, no. 4, pp. 324-345, 1997.

[10] T. L. Strayhorn, "Sentido de pertenencia: A hierarchical analysis predicting sense of belonging among Latino college students," *J. Hispanic High. Educ*. vol. 7, no. 4, pp. 301-320, 2008.

[11] C. Gonzalez, J. Graber, D. Galvez, and L. A. Locke "'They say they value diversity, but I don't see it': Academic and social experiences of first generation Latinx students at a predominately white Midwest institution," in *Perspectives on Diverse Student Identities in Higher Education: International Perspectives on Equity and Inclusion*, J. Hoffman, P. Blessinger, and M. Makhanya, Bingley: Emerald, 2018, pp. 61-73.

[12] M. Dueñas and A. M. Gloria, "¡Pertenecemos y tenemos importancia aquí! Exploring Sense of Belonging and Mattering for First-Generation and Continuing-Generation Latinx Undergraduates," *Hisp. J. of Behav. Sci.*, vol. 42, no. 1, pp. 95-116, 2020.

[13] G. A. García, and B. Dwyer, "Exploring college students' identification with an organizational identity for serving Latinx students at a Hispanic serving institution (HSI) and an emerging HSI," *Amer. J. of Educ.,* vol 124, no. 2., pp. 191-215, 2018.

[14] H. Holloway-Friesen, "The role of mentoring on Hispanic graduate students' sense of belonging and academic self-efficacy," *J. Hispanic High. Educ. vol 1, no. 13, pp.*, 1-13, 2019.

[15] R. A. Revelo Alonso, "Engineering identity development of Latina and Latino members of the society of Hispanic professional engineers," in *ASEE Annual Conference and Exposition, Conference Proceedings, Seattle, WA, USA, June 14-17, 2015*, pp. 1–13, doi: 10.18260/p.23967

[16] P. Witkowsky, V. Obregon, B. Bruner and J. Alanis, "Connecting familismo and higher education: Influence of Spanish language PFMO programs on Latinx family involvement and sense of belonging," *J. Hispanic High. Educ, vol. 1. no. 1*, 2018.

[17] D. Wilson *et al.*, "Belonging and academic engagement among undergraduate STEM students: A multi-institutional study," *Res. High. Educ.*, vol. 56, no. 7, pp. 750–776, 2015.

[18] J. A. Rohde, L. Benson, G. Potvin, A. Kirn, and A. Godwin, "You either have it or you don't: First year engineering students' experiences of belongingness," in *ASEE Annual Conference and Exposition, Conference Proceedings, Salt Lake, UT, USA, June 23-27, 2018*, pp. 1-14, doi: 10.18260/1-2--31320

[19] B. S. Benedict, D. Verdín, R. A. Baker, A. Godwin, and T. Milton, "Uncovering latent diversity: Steps towards understanding 'What counts' and 'Who belongs' in engineering culture," in *ASEE Annual Conference and Exposition, Conference Proceedings, Salt Lake, UT, USA, June 23-27, 2018,* pp. 1-16, doi: 10.18260/1-2--31164

[20] M. Schar *et al.*, "Classroom belonging and student performance in the introductory engineering classroom," in *ASEE Annual Conference and Exposition, Conference Proceedings*, Columbus, OH, USA, June 25-28, 2017, pp. 1-22, doi: 10.18260/1-2--28034

[21] E. J. López, V. Basile, M. Landa-Posas, K. Ortega and A. Ramirez, "Latinx students' sense of familismo in undergraduate science and engineering," *The Review of Higher Education,* vol. 43, no. 1, pp. 85-111, 2019.

[22] T. O. Allen, M. L. Thompson and S. Collins, "How do Latinx dual credit earners describe their sense of belonging in engineering programs?," *J. of College Stud. Retention: Res., Theo. & Pract.*, January 2020.

[23] J. M. Smith and J. C. Lucena, "Invisible innovators: how low-income, first-generation students use their funds of knowledge to belong in engineering," *Engineering Studies,* vol. *8*, no. 1, pp. 1-26, 2016.

[24] R. M. Emerson, R. I. Fretz, and L. L. Shaw, *Writing ethnographic fieldnotes*, 2nd ed. Chicago, IL: University Of Chicago Press, 2011.

[25] I. Seidman, *Interviewing as a qualitative researcher: A guide for researchers in education and the social sciences*, 5th ed.New York, NY: Teachers College Press, 2019.

[26] K. L. Tonso, "Engineering identity," in *Cambridge Handbook of Engineering Education Research*, A. Johri and B. M. Olds, Eds. Cambridge: Cambridge University Press, 2014, pp. 267–282.

[27] M. Ong, N. Jaumot-Pascual, and L. T. Ko, "Research literature on women of color in undergraduate engineering education: A systematic thematic synthesis," *J. Eng. Educ.*, vol. 109, no. 3, pp. 581–615, 2020, doi: 10.1002/jee.20345.

[28] M. Ong, C. Wright, L. L. Espinosa, and G. Orfield, "Inside the double bind: A synthesis of empirical research on undergraduate and graduate women of color in science, technology, engineering, and mathematics," *Harv. Educ. Rev.*, vol. 81, no. 2, pp. 172–208, 2011, doi: 10.17763/haer.81.2.t022245n7x4752v2.C. D.

[29] K. L. Tonso, "*On the outskirts of engineering: learning identity, gender, and power via Engineering practice*," 1st ed. Rotterdam, South Holland, Netherlands: Sense Publishers, 2007,.

[30] Allen and M. Eisenhart, "Fighting for desired versions of a future self: how young women negotiated STEM-related identities in the discursive landscape of educational opportunity," *J. Learn. Sci.*, vol. 26, no. 3, pp. 407–436, 2017.

[31] Author, 2018.

[32] Authors, 2019.