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Without My Family, I Don't Know If I Would Be Here: The Role of Families in Supporting Latinx Computer Science Students at HSIs

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Abstract: The underrepresentation of diverse communities in STEM disciplines, particularly in computer science, remains a significant challenge. This study investigates the experiences of Latinx students at Hispanic-Serving Institutions (HSIs) within computer science departments that are actively working to increase Latinx graduation rates. Utilizing data from ethnographic case studies, we conduct a thematic analysis through the lenses of Yosso's community cultural wealth model and Rendón's validation model to examine the pivotal role families play in fostering the success of Latinx students in computer science at HSIs. Our findings reveal that families provide essential encouragement, serve as a source of motivation to combat isolation, and celebrate students' achievements in their pursuit of computer science careers. Recognizing the critical contributions of familial support is essential for enhancing the success of Latinx students in one of the most underrepresented fields within STEM. These insights are crucial for developing strategies that can effectively promote diversity and inclusion in computer science.

Keywords: Latinx; Hispanic-serving institutions; computer science; diversity; family

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1. Introduction

Despite being the second-largest racial/ethnic group in the United States and within the country's postsecondary education system, Latinx remain underrepresented in many Science, Technology, Engineering, and Mathematics (STEM) fields. The racial/ethnic diversity within the field of computer science, which is a highly lucrative and in-demand STEM discipline, has been declining [1]. Computer science is also one of the least diverse disciplines by gender [2]. An analysis by the Pew Research Center indicates that, while Latinx constitute nearly 20% of the population, Latinx only represent 8% of workers in computer science fields [3].

The barriers to Latinx pursuing computer science have been well documented. Many of these barriers are linked to issues at the K-12 level, where students often have less access to a quality STEM education. For example, Latinx students are often concentrated at the lowest-resourced schools [4] and often do not have access to experienced science teachers [5]. Once Latinx students reach higher education, they often encounter additional barriers, often tied to the poor schooling experiences at the K-12 level. For instance, research has shown that Latinx experience feelings of impostor syndrome or feeling academically behind [6,7]. These feelings are often attributed to that lack of exposure that students from minoritized backgrounds have to computer science curricula prior to entering college [7,8]. Additionally, STEM disciplines like computer science often reinforce more of a "weed-out" and exclusionary culture, which can negatively impact the experiences of Latinx students

and students from other racially or ethnically minoritized backgrounds (e.g., Refs. [9–12]). Scholars have also noted that computer science is a hostile environment for Latinx students who often encounter racism and other forms of oppression [9,13]. Consequently, these encounters in hostile environments can lead to feelings of isolation for Latinx students in STEM [14], in addition to students feeling like they do not belong [9].

Furthermore, much of the existing research on computer science education primarily focuses on the barriers Latinx experience while pursuing computer science. This emphasis on barriers is primarily because the majority of this research has been conducted in Predominantly White Institutions (e.g., Ref. [15]), rather than at Hispanic-Serving Institutions (HSIs), which graduate disproportionately high shares and numbers of Latinx in computing fields [2,16,17]. Observers have recommended that further research be conducted at MSIs and HSIs to understand how and why Latinx students are more likely to succeed in these institutional settings [15,17].

To respond to this call, more recent research has taken an ecological approach to examine organizational conditions that promote the success of Latinx in computing fields at HSIs [18]. This research has found that when computer science departments enact Hispanic-servingness or establish culturally affirming environments for these students [19], Latinx computer science students are more likely to thrive [20,21]. This scholarship has also identified that computer science departments in HSIs constitute a central component of the college ecological setting [22] that Latinx college students navigate [18].

Our paper extends this work by examining Latinx families' role in computer science pathways at HSIs. Other research on Latinx computer science students drawing on the framework of community cultural wealth [23] has identified that familismo plays a positive role in Latinx computer science students' development [15,24,25]. We extend that work by asking, how do Latinx computer science students at HSIs describe the role their families play in their persistence in computer science? Our study is based on empirical research conducted at HSIs that have shown even higher rates of Latinx attainment in computing than other HSIs or PWIs [17]. That is, our study is situated in exemplars of positive Latinx outcomes in computing attainment and reveals the importance of taking an on- and off-campus ecological perspective in fostering these outcomes.

2. Review of the Literature

Latinx are the largest growing racial minority group in the United States. While they make up a sizable amount of the population, they remain underrepresented in many STEM fields like computer science. The lack of representation of Latinx in STEM in higher education is due to multiple factors. Many of the challenges that Latinx students face while navigating STEM programs are inherited from their K-12 experiences, often leaving them at a disadvantage in academic preparation when they enter higher education institutions [26]. The STEM literature recognizes that once racially minoritized students transition to college, they often encounter barriers such as hostile, racist, sexist, and competitive environments [9].

When Latinx students and other racially minoritized students enter higher education institutions, they often feel underprepared for the rigor of STEM courses. This is often due to the effects of systemic racism [9], which have led to many Latinx students being concentrated at K-12 schools that are low-resourced [4] and have low science teacher quality [5]. Latinx students also on average have less access and exposure to computer science curricula at the K-12 level [27]. The limited exposure to computer science education among students is likely a significant factor contributing to the lack of knowledge and encouragement for students to consider a major in computer science [28]. Collectively, these factors place Latinx students at a disadvantage when considering STEM majors.

Within the higher education context, recent evidence suggests that Students of Color often experience hostile environments in STEM. Racially minoritized students often encounter racial microaggressions and racism both inside and outside of the classroom and in STEM settings, where there is little racial diversity [13]. This can also include STEM

departments at historically Black, historically White, and Hispanic-Serving Institutions [9]. Exposure to multiple forms of racial microaggressions and racism on campus can place an emotional, physical, and mental toll on Students of Color on college campuses [29]. Racism can lead to a range of negative outcomes including discrimination and the perpetuation of harmful stereotypes, especially for Students of Color in STEM. It can also lead to increased levels of stress and marginalization, which can have a detrimental impact on the emotional and mental well-being of students wanting to pursue STEM majors and careers, such as computer science. The prevalence of racial stereotypes that are promoted through racial microaggressions has been shown to negatively affect the experiences of Students of Color in STEM, specifically leading to minority status stress, racial anxiety, and, ultimately, the decision to leave STEM programs [9,30,31].

STEM programs have also been found to be hostile environments for women. Women of color often face discrimination along the lines of both race and gender. A research study on women in STEM [14] found that Latina students within STEM environments "faced skepticism" and "self-doubt" inflicted by their male peers, which resulted in feelings of isolation as they navigated the college environment. The study argued that the ongoing marginalization of Latina students in STEM remains an urgent issue requiring a shift in perspectives of who belongs in the field and who does not [14].

Latinx students in STEM also struggle with the lack of representation and lack of role models. Even at Hispanic-Serving Institutions that tend to be more diverse, the faculty at these institutions in STEM are often largely White, Asian, and international men. A study examining the experiences of racially minoritized students in STEM at an HSI highlighted the story of a Latino student [15]. The student explained that he chose to attend the HSI for its diversity but, as a STEM major, realized he would not have a professor who looked like him from that point until graduation. While students at MSIs might feel like their campus is culturally affirming, that might not be the case within their STEM departments.

In addition to the hostile environments and lack of representation in STEM, racially minoritized students also encounter cultures in STEM that contrast with their own cultural values. For example, STEM disciplines like computer science often embrace competition [32] over collaboration and individualism over collectivism [13]. To overcome these hostile environments in STEM, Latinx students often draw on their cultural assets to persist in these environments [15].

Evidence from research has found that minoritized students utilize various strategies to overcome hostile STEM environments [15]. Drawing on cultural assets is one way in which Latinx students can navigate hostile STEM environments. In a research study that examined the science identity development of Latinx STEM students, the findings showed that students' social justice orientations to help their communities motivated them to persist in STEM [24]. This study also found that families and communities helped ground students in their STEM goals. For instance, students in the study shared examples of how their family members' interests in STEM sparked their own interest in pursuing similar pathways. Students also described how family members were present in their academic journeys and how building community was essential for their success. Given the lack of representation of Latinx in STEM fields, students in this study also expressed a desire to give back and help remove barriers for others in the pipeline. Overall, these perspectives differed from the individualistic cultures present in most STEM environments.

In another study that explored the experiences of Latina undergraduate students in computer science, researchers [15] identified familial capital and familismo as central to students' success. Latina students in this study drew community cultural wealth from their families and applied it to their computing spaces. This included leveraging family capital that derived from immediate and extended family members that provided students with connections to the computer science discipline and a sense of support. Students described that family members were integral to their interest and persistence in computer science. Additionally, students used navigational capital from peers and mentors to access support and resources to overcome the challenges they encountered in the major. Finally, this study

highlighted how Latinas could enact resistant capital that helped them challenge sexism or other forms of oppression they encountered within computer science [15].

Importantly, in their methods [15,24], these studies only focused on individual interviews or focus groups, that is, they only focused on the individual students, rather than the students' environments, as units of analysis. However, more recent research has identified that taking an ecological lens by examining organizational settings in addition to individual experiences can illuminate factors associated with successful outcomes in STEM for Latinx students at HSIs [18]. In prior research, our team identified components of the college ecosystem [22] that contribute to positive student outcomes for Latinx computer science in HSIs, including departmental faculty, staff, and peers [18]. Within this same research, we also identified off-campus factors like internships as critical in promoting student success [18,21,33]. However, in this study, we examine the potential of the family to contribute to an ecosystem of Latinx student success in computing through the lenses of community cultural wealth and validation. In the next section, we discuss two conceptual lenses that extended our understanding of the ecological model.

3. Conceptual Lenses

Within the context of an ecological model [22], we identified the importance of the role of staff [33], peers [18], faculty, and administrators [21,34,35] within the department as important factors contributing to how Latinx students in computing improve academic performance and access to co-curricular opportunities like internships, attendance at conferences, peer tutoring, and leadership roles within the department [18]. In other research conducted at PWIs, students described their families as offering support, confirming the importance of familismo for computer science students [32]. In this piece, we identify the family as an additional component that students describe as meaningful in their experiences within the settings of HSIs, which perhaps reflects the increased likelihood that HSIs enroll students who report living close to home as a reason for choosing their particular institution [36]. In this study, we employed Yosso's [23] community cultural wealth model because it helped us identify the various forms of capital that Latinx students bring to their educational environments, like familial, social, and aspirational. We utilized Rendón's [37] concept of validation to address the need for affirmation from institutional agents to promote Latinx student success, especially in computing fields.

3.1. Community Cultural Wealth Model

Prior research has identified that Latinx students in computing and STEM fields draw on their community cultural wealth [23] as a source of strength [15,25,38]. Yosso's original model [23] identifies six types of capital students bring, including familial, linguistic, social, navigational, aspirational, and resistant. For this study, we focus on familial, social, and aspirational capital. Familial capital refers to cultural knowledge nurtured among familia (kin). This form of cultural wealth may include knowledge from "immediate family members (living or long passed), as well as aunts, uncles, grandparents, and friends who we might consider part of our familia" [23] (p. 79). Social capital refers to networks of individuals and communal resources that provide both practical and emotional assistance in navigating societal institutions, especially for Students of Color. Aspirational capital refers to "the ability to maintain hopes for the future, even in the face of real and perceived barriers" [23] (pp. 77–78). In this study, we also employed the concept of validation to complement the community cultural wealth model. This approach allowed us to further understand and acknowledge the diverse strengths, resources, and capital (e.g., familial, social, and aspirational) that Latinx students bring to their experiences in computing and STEM fields.

3.2. Validation

Rendón's concept of validation refers to the "enabling, confirming and supportive process initiated by in- and out-of-class agents that foster academic and interpersonal

development" [38] (p. 44). Such agents can include faculty, academic affairs staff, peers, and family members. Latinx students in STEM who receive increased validation have been found to develop confidence to learn, enhance feelings of self-worth, and cultivate a sense of belonging in college [39]. Research on the experiences of young Latinas has found that receiving validation from their families for their work in computer science helps strengthen their computer science identity [40]. In the next section, we describe the specific methods utilized in this research study to investigate Latinx families' roles in supporting students' aspirations to pursue computer science pathways at HSIs.

4. Methods

This study utilizes data from a larger ethnographic case study [41] that examined the organizational behavior of faculty, staff, administrators, and students in selected computer science departments at three HSIs. Ethnographic case studies combine features of both ethnography and case study methodologies, allowing the researcher to engage in prolonged observations over time within a bounded natural context. The ethnographic element emphasizes observations rooted in cultural understanding and the case study component focuses on gaining insights into "individual, group, organizational, social, political, and related phenomena" [42] (p. 777), Ref. [43]. This study drew from a subsection of that larger study and focused primarily on the one-on-one semi-structured interviews that were conducted with the Latinx students who participated in the study. The following sections describe the student sample and the data collection process. The research question guiding this particular research study was as follows:

1. How do Latinx computer science students at HSIs describe the role their families play in their persistence in computer science?

4.1. Sample

This study was part of a larger study conducted at four postsecondary institutions across the country during the 2019–2020 academic year that were part of the Computing Alliance for Hispanic-Serving Institutions (CAHSI) network, a network of over 40 HSIs seeking to raise Latinx attainment in computing [17,44]. The sites for this study included three institutions from that larger study that investigated the organizational behavior of faculty, staff, administrators, and students to understand how these institutional personnel were advancing Latinx student success in computer science. Data for this research focused on the student interviews that were conducted for that larger study.

Twelve students were recruited from these institutions to participate in this study. The students in this study were recruited by faculty and staff from each computer science department. Faculty and staff selected students who were Latinx and involved in computer science organizations, leadership roles, or peer tutoring in their departments, often in connection with the CAHSI network.

Pseudonyms were assigned to each participant for anonymity. Out of the 12 student interviewees, eight of the students identified as men and four of the students identified as women. Nine of the interviews were of undergraduate students and three of the interviews were of graduate students, including one doctoral and two master's students. All three of the graduate students in this study received their undergraduate degree in computer science at the institution they were currently attending for graduate school.

4.2. Data Collection

Semi-structured interviews were conducted with each participant. Participants were interviewed individually one time and each interview lasted approximately one hour. The interview protocol encompassed questions regarding how students developed an interest in computer science, their experiences in the field to date, the supports and barriers they encountered while navigating the major, and their perceptions of the departmental and institutional climate.

4.3. Data Analysis

After the interviews were transcribed, the transcripts were analyzed using thematic analysis methods to identify the major themes described by students to address the research question. To analyze the data collected from the interviews, we utilized researcher notes, which encompassed reflections on observations made post-interview. We meticulously reviewed and revised the transcriptions by listening to the recorded interviews. This process was crucial, as several participants engaged in code-switching between languages, and the initial transcription services were unable to accurately capture the information shared in Spanish. After reviewing the transcripts, two members of the research team coded the data by generating themes using thematic analysis.

Thematic analysis is a method for identifying, analyzing, organizing, describing, and reporting themes found within a data set [45]. Thematic analysis is an iterative and reflective process that develops over time and consists of constantly moving back and forth across the data. According to Braun and Clarke [45], conducting a thematic analysis consists of six phases: (1) familiarizing oneself with the data; (2) generating initial codes; (3) searching for themes; (4) reviewing themes; (5) defining and naming themes; and, finally, (6) producing the report.

The two members of the research team read the interviews several times to familiarize themselves with the data. This was followed by initial coding to pinpoint specific examples provided by students about the influence of their families on their experiences as computer science students. The two researchers coded the interviews independently, developed separate codebooks, and then engaged in discussions to reach a consensus on the coding. As a result of the coding process, the researchers identified ten distinct codes from the interviews. These codes were subsequently organized into three different categories based on the coding: (1) familial support prior to enrollment in computer science; (2) familial support during the computer science major; and (3) familial support for future careers in computer science. Further analysis enabled us to identify overarching themes within these three categories.

4.4. Positionality

The three members comprising the research team shared a common identity as Latina, second-generation immigrants and possessed fluency in both English and Spanish. Our bilingualism and biculturalism played a crucial role in establishing effective communication, fostering understanding, and gaining the trust of study participants who shared our identities. Each team member brought unique perspectives through professional or student experiences at Hispanic-Serving Institutions (HSIs): one as faculty, another as staff, and the third as both an undergraduate and graduate student at HSIs. We also all attended Historically White Institutions (HWIs) during our higher education journeys, providing us with a contrasting viewpoint to comprehend the distinct experiences of students at HSIs. These firsthand encounters at both institutional types enriched our insights, enabling a profound understanding of Latinx students' experiences at HSIs, particularly recognizing the influential role of the environment in shaping students' identity development.

5. Findings

This study aimed to answer the following research question: How do Latinx computer science students at HSIs describe the role their families play in their persistence in computer science? The analysis identified three major themes underscoring the pivotal role of families in fostering the success of Latinx students entering and thriving in computer science majors. The first theme was "encouragement", describing the contributions of family members in sparking students' interest in computer science. The second theme, "motivation to challenge isolation", described the ways families helped students navigate and negotiate feelings of isolation in the major. Finally, the last theme, "celebrating successes in careers", described how families provided support and guidance as students navigated careers in computer science.

5.1. Encouragement

Many students in this study described familial capital, often coming from immediate family members in the form of family encouragement, as central to their persistence in the major. Despite not having had the opportunity to attend college themselves, parents played an active role in motivating their children to pursue higher education. For example, Sebastian, a first-generation college student, shared how his family was critical in encouraging him to pursue higher education. Sebastian described his first-generation college-going status, "So, technically, I'm a first-generation student. Like not even my grandparents, uh, no uncles, aunts, none of them went to college". However, he emphasized that his family placed a high value on higher education. Sebastian shared, "When I was raised, their ideology was, you know, you're going to go to college, you're going to do good . . . So it was already in my head". He also explained how these values were also instilled in his younger sister. Sebastian stated, "she plans to come here [Southwest University}, and she plans to major in chemistry where she will, you know, go into something STEM". Sebastian continued by explaining, "I feel like if my parents wouldn't have really pushed me so hard, you know, really ingrained it in my head that, you know [said], "Hey you're going to . . . [or] You might not . . . You don't need to go to . . . Like, you can do whatever you want",-. . . I don't know if I would be here". While Sebastian's family was unable to guide Sebastian through college, Sebastian relied heavily on familial capital such as encouragement and support to pursue higher education.

In addition to instilling a college-going mindset, Sebastian explained that his family sparked his interest in computing when he was just a baby. He shared, "What really got me into computers was when I was very young, my mom told me this story about . . . I don't even remember; I was so young. That she says that I would sit on her lap while she was checking her emails, because she would be using our big computer. You know, one of those big, oh- Windows 2000. They're huge and-if you press one key and it makes a big old sound and everything, screen static. Uh, she said that when I would see her move the mouse and stuff, that I would try to actually move the mouse". After that initial interest in computing, Sebastian described,

> "I grew more and more interested, you know, pinball on the computer and all that stuff. Notepad, you know, you can do a lot of things. Uh, create documents, I used to create documents. And then it just kept growing more. You know, I began to give myself self-computer literacy, so I knew how to operate the computer. And I just kept wanting to do more. So, I think it was more so just having that, being exposed to that, and having not really much else to do that really influenced me to really go into computer science."

This early exposure to computers through his family played a role in Sebastian's interest in technology. Despite lacking access to role models in computer science at a young age, Sebastian credited his family's early exposure to technology as the motivation to learn more about technology, ultimately leading him to teach himself more about computers.

Another student, Eduardo, shared that his interest in computer science was influenced by his family as well. He explained that this interest stemmed from his mother's encouragement to take courses at the local community college while he was in high school. Eduardo stated,

> "My mom was always really big on me taking courses outside of school, like at the community colleges and everything. Well, she works there, so I think, I can get in free because of that. And so, she always put me in all these courses, like art and all that sort of stuff. And one of them was Lego robotics, which was like computing, so it got me interested in that."

In addition to this, Eduardo explained that his mother would

> "Take me to the library on the weekends, because I wanted to go and read. I was like really nerdy as a kid. So, I'd read, and I'd use the computer to learn things and everything. So, I think just her encouragement really helped me gain the interest or keep the interest instead of just thinking [to myself] no, I can't do that."

In line with the theme of parental influence and support, Daniella also described how her father played a significant role in her interest in computer science. When prompted on how she became interested in technology, Daniella stated:

> "My dad. So, my dad's an electrical engineer, and he's also a graduate from Southwest University. And my dad kept a lot of his old college books. So, when I was a kid, I would go into his bookshelf, and I would pull out the math books. Which I like math now, but I blame him for me liking math (laughs), . . . because he used to work for IBM. And so, he would sit at his computer and like do work, but give me an unplugged . . . keyboard, and let me like type next to him. So, I've always had a love, from like very young (laughs)."

Similar to Sebastian's example, Daniella's early exposure to computer equipment at home from a young age influenced her interest in computer science.

Another student, Carlos, explained how family members outside of his immediate family played a role in his interest in computer science. Carlos shared:

> "I knew I always wanted to do something in an engineering field because of that or something in the STEM field. But when I got there in the actual program and I was like, "Yeah, I could see myself doing this, it makes so much sense. And the more I start to think about it in retrospect, it makes more sense to me [being a computer science major]. I was always surrounded by computers when I was little, my older cousin builds computers and stuff like that. And then I have another family member that is also electrical engineer, so like it makes sense for me. It made more sense the more I look back on it now that it's something that I was like meant to do."

Although Carlos had no immediate family members in computing, his extended family members provided him with the exposure and validation that he belonged in computer science.

Other students shared how their family members encouraged them in their majors in other ways. Alejandra, one of the only graduate students interviewed for this study, shared that she had been involved in research since she was an undergraduate student at her institution. She explained that in her department, faculty had been very encouraging of students engaging in undergraduate research but that her sister was also an influence on her engaging in research. Alejandra shared:

> "I think also my sister was an influence, just because she was involved in research. So I think, if I remember correctly, she might've also just mentioned, like, "Yeah, you should get involved in research as well," you know? "You need to. . ." Like, "What are you gonna do in the future," you know? So just like get involved in things, so you know. So like kinda like explore, so you can make an educated choice of what you wanna do."

Alejandra also explained how her sister had carved out a path for her to follow for college; she explained that she enrolled at her institution because that is where her older sister was enrolled. Alejandra shared, "it wasn't like an option to go somewhere else, just because she was already here at South University. Um, I guess kind of like that. Like, 'Oh, whatever she's doing, I guess I should be doing as well.'" Alejandra's sister was critical in providing her with guidance and a pathway to succeed in her STEM major.

These examples highlight the contributions that families made for students in this study by influencing students' interest in computer science majors, providing them with encouragement and validation as well as a pathway to success.

5.2. Motivation to Challenge Isolation

Feelings of isolation have been well documented in research on Latinx students in STEM [12]. In this study, students described that their families' motivation and support helped counter their isolation within the major. Families provided students with advice

on how to reframe barriers they encountered, as well as the confidence to resist in hostile environments. Examples of the feelings of tension experienced by students within computer science included isolation due to a lack of representation along the lines of race and gender.

Alfonso, a first-generation college student who was raised in a nearby rural community near Southwest University, described the ways his family helped him navigate the isolation he felt as one of the few Latinx students in his department. When Alfonso was asked who was the most influential in his computing journey, he responded, "my parents". Alfonso shared that at one point in his college journey, he was "giving up on college". He further shared that he felt "intimidated" because he "didn't see many other students, like [me] studying, at least other Hispanic students studying computer science". He shared that he felt like he could not find community in his department, but then his mom shared some advice with him. As he described, she "put it in another perspective, and that because I'm Hispanic, [that's why] I should push for it". Alfonso's mother encouraged him to broaden his perspective from seeing himself as "the only one" to perceiving himself as a leader in his community, among the few Hispanics in computing who were forging new pathways in the major.

Daniella, a student leader in the program, experienced isolation as a result of the low numbers of women represented in her computer science department. She was actively helping make changes in her department so that students could have a more positive experience. Daniella was particularly aware of the challenges students in her department confronted and shared that prior to beginning the computer science major, she had encountered a woman who left the major due to the hostile environment for women in the major. Daniella explained, "I met a woman who dropped out of computer science because a teacher told her that she wouldn't make it, because she's a woman. And she warned me not to go into computer science. And I remember telling her, 'You watch me. If they tell me I can't do it, I'm going to get an A in that class'". Daniella had shared earlier in her interview that her resilience in computer science came from her parents. She stated:

> "Just in life, things have made it hard. And if we're talking like academically, some of the experiences haven't been pleasant, but I think I'm fortunate that my parents made me have thick skin so I can tough it out, but there are, there are some comments that you just don't want to hear."

Both Alfonso and Daniella experienced isolation in their major due to the lack of representation of other students who shared similar identities. However, with the help of their families, they gained the confidence to not only overcome these feelings of isolation but also contribute to shifting the culture in their department.

5.3. Celebrating Successes in Careers

Graduating from a computer science major is just the first hurdle for many Latinx students to overcome in their journey to becoming computer scientists. In order to be competitive for careers in STEM like computer science, students often need to engage in research or internship experiences. For many of the participants in this study, families played an important role as students navigated internship opportunities. Navigating internship opportunities often presented challenges for students due to an unfamiliarity with pursuing professional careers in technology or feeling that they were not competitive for internships with top technology companies.

Daniella shared that she was initially nervous about applying to Google for an internship. She explained:

> "I think it's because we all think that we have to be perfect when presenting, because Google is notoriously known to be like super, super hard, [they] only hire the best. Microsoft, Amazon, like the big companies, are known to hire people with high GPAs, that are very smart. And I think it's intimidating for us, especially because we don't go to some big fancy Ivy League school. Like no one really knows about Southwest University. And so, I think, for us, it's-it's

> really intimidating, because I have the same problem. You know, I didn't want to do it, because I was too scared to mess up."

However, she said that through the advice of her dad and her boyfriend, she felt more confident in applying. She shared, "And it was actually my dad and my boyfriend that were like, 'Just go, and mess up, and it's okay'". And I did exactly that, and I learned what not to say, which was good for me, 'cause when it came time for my Google interview, I knew what to do". Having that familial encouragement and advice helped Daniella overcome her insecurities and eventually led to her not only gaining an internship with Google but also a job offer after her internship.

Another example of students navigating internship opportunities came from Miguel. Miguel, a first-generation college student at West University, shared that since his freshman year, he had his mind set on his dream company. He further explained how he was able to go to a national STEM conference and be interviewed by his dream company. Upon receiving the offer, he shared that he immediately called his family. Miguel shared:

> "When I got the offer, I called them [his family] immediately. And then we all just started crying on the phone. Cause immediately I started crying and bawling my eyes. They were really happy because, the company that I got the internship for is actually the dream company that I wanted to work for. So ever since I started college, since my first semester, and since I learned about that company, I've told them, "I want to work for this company. I want to work for this company. I want to do this. I want to get an internship". And when I told them that I got it from my dream company, they just, they started crying and they, you know, they were so happy for me."

Although Miguel's parents did not have the opportunity to go to college and access institutional knowledge to navigate higher education, they were a source of motivation for him to persist and pursue his dreams. Sebastian also shared a similar example when he described receiving an offer for a summer internship. He explained how his family reacted to the offer: "They were super-duper excited, when I called them after I got it".

Alfonso also explained that his family encouraged him to pursue a research opportunity in another city. He described how his family felt: "Um, they were really nervous. Um, 'cause they've never had a son, a child, travel so much. So, they were pretty nervous. But they were really happy for me. For me pushing out for these opportunities". Although this was a new experience for his family, they were supportive and happy about the opportunities that Alfonso was seeking out.

Across each participant's experiences, it is evident that students encountered challenges to persisting in computer science. However, they leveraged encouragement and support from their families to help them advance to the next steps in pursuing a career in computer science.

6. Discussion

The student interviews revealed that while the overall culture at most Hispanic-Serving Institutions was welcoming, largely due to the predominantly Hispanic student demographics, students faced challenges at the departmental or disciplinary level. Our analysis indicates that families play an important supportive role in helping Latinx students overcome barriers in computing at HSIs. Encouragement from family members, the motivation to overcome feelings of isolation in the field, and celebrating successes in careers emerged as key themes that students expressed were meaningful to them in persisting in the major, securing internships, and laying a foundation for pursuing computer science careers. The findings illustrate the important role of familial capital, as part of community cultural wealth [23], in promoting positive experiences and outcomes for Latinx computer science students. Consistent with Yosso's [23] conception of familial capital, students named a broad array of family members—parents, siblings, grandparents, aunts, uncles, and cousins—as important agents in their college and computer science journeys.

In this study, familial capital yielded other components of community cultural wealth [23], including social and aspirational capital. Based on student accounts, certain components of community cultural wealth were more prevalent among Latinx students than others. Although this study did not specifically examine all aspects of community cultural wealth, familial, social, and aspirational capital do shed light specifically on the significant role family members play in motivating and supporting students in their pursuit of and persistence in computer science.

Confirming previous research demonstrating the impact of family members in supporting Latinx students in their pursuit of college [15], we discovered that families provided social capital through relational support in two main ways. First, before attending college, family members instilled expectations and beliefs into students and encouraged them to pursue higher education. Second, once students were in college, parents—including those who had not attended college or knew about computer science—expressed confidence and interest in their students' pursuits of computer science studies. As such, our findings highlight how the social support received from family members, whether on-campus, out-of-class, or off-campus, served as a vital form of validation [38] for students. Moreover, in this study, students perceived parental social capital and support as a critical component of a supportive campus ecology for their persistence in computing studies [22].

Families offered aspirational capital [23] by expressing beliefs that students could succeed, even in the face of challenges. For example, Alfonso described how his mother helped him shift from a fixed mindset, which involved feeling incapable of performing well, to a growth mindset, which consisted of the belief in the ability to develop and enhance one's capabilities [46]. The more recent concept of cultures of growth [47] expands the concept of a growth mindset from an individual to a collective orientation. Our findings suggest that through validation and the cultivation of community cultural wealth, families can create cultures of growth with their students that can positively influence students' outcomes, especially in disciplines such as computing.

In Alfonso's case, his mother offered him a consejo or advice to view the underrepresentation of Hispanics in computer science as an opportunity for him to go beyond perceived barriers and transcend the situation. This view illustrates aspirational capital and is consistent with Herrera and Kovats Sanchez's [24] community-centered STEM identity model, which integrates racial/ethnic Latinx identity development with their development as scientists. Building on this consejo to locate one's achievement within the broader Hispanic community as a culture of growth [48], families provided resistance capital [23] by modeling the way to combat deficit stereotypes of Latinx abilities in computer science. For instance, Daniella observed her parents developing "thick skin" in the face of hardship and discrimination, which helped her develop the strength necessary to resist negative stereotypes regarding her abilities in computer science. Although the array of different capitals described by students in this study reflects diverse efforts aimed at supporting the continued resistance of Latinx students in computer science, there is still a need for institutional action to combat the negative stereotypes, exhaustion, and fatigue experienced by Latinx students pursuing computer science, particularly at HSIs.

These findings suggest that families play a pivotal role in enabling Latinx students to develop various forms of capital, such as community-centered STEM identities [24], which provide them with strength and purpose, even in the face of the potential isolation that pursuing computer science can bring. Other research suggests that when HSI computer science departments are intentionally committed to raising Latinx attainment through enacting an array of academic, financial, social, cultural, and career supports, Latinx students' persistence and degree completion in computer science increases [17,18,21,33,34]. This study highlights the importance of integrating families in the broader scope of computing attainment that includes departmental supports that can exist for Latinx and minoritized students (including women and Latinas) at HSIs in ways that might not be as available at PWIs [16,18].

Limitations

This study provides valuable insights into the role families play in supporting Latinx students in computer science at Hispanic-Serving Institutions (HSIs). For example, the larger study primarily investigated the organizational behaviors of faculty, staff, administrators, and students to understand how these institutional personnel were promoting Latinx student success in computer science [18]. As a result, the role of families was not the central focus of the research. Despite this, the importance of family support emerged as a significant theme during the student interviews. It is important to note that students often described faculty, staff, and administrators as being like family. However, this research focused specifically on the support provided by students' families.

Furthermore, because this study did not specifically concentrate on family dynamics, it did not fully capture all aspects of Yosso's community cultural wealth model [23] or Rendón's validation model [38]. This omission limits the comprehensiveness of the findings related to familial contributions. Future research should aim to explicitly explore the role of families to better understand their holistic impact, which could include further enrichment of the understanding of the application of these conceptual lenses to strengthen Latinx students' STEM outcomes.

7. Conclusions and Implications

This study indicates the value of conducting research on college outcomes with multiple agents in students' on- and off-campus ecologies [22]. Embracing the assets Latinx families bring can enhance the experiences of Latinx students in STEM and majors like computer science. Institutions should incorporate family support if they are invested in increasing representations of Latinx in computer science. In fact, we found this in our other research, which shows that students who have access to supportive environments are more likely to persist and thrive in computer science [33]. Additionally, for Latinx students in STEM, families serve as validating agents; incorporating them into campus or departmental programming can help further connect students' STEM identities to their salient social identities and home lives [39].

Implications for further research emphasize the importance of a more comprehensive understanding of Latinx students in HSIs. Moreover, it is crucial to broaden the scope of studies by adopting an ecological lens that considers the influence of family and other institutional agents in supporting students' access to various forms of cultural capital and validation. More importantly, an ecological approach can benefit students in many ways beyond validating cultural practice. First, it can help students comprehend the intricate interplay between individual behavior and collective cultural practices. Second, by examining how individualism and collectivism intertwine within a cultural context, an ecological model can offer insights into why certain racial/ethnic groups may be underrepresented in particular settings, such as computer science. If disciplines are able to recognize how multiple stakeholders within an ecological model can help promote student success, this has implications for the recruitment and retention of minoritized students. Third, this deeper understanding of a student's ecosystem can guide efforts to promote inclusivity and diversity by addressing the underlying factors that contribute to the lack of representation in the field.

Our initial study findings on institutional and departmental environments demonstrate that the support structures for Hispanic students' persistence and success in STEM fields go beyond their families. They also include their exposure to culturally relevant curricula and co-curricular experiences, and the departmental leveraging of institutional and human resources toward Hispanic-servingness serve as additional support structures for their persistence and success in STEM fields [18,21,33,34]. Our research on these students' departmental and HSI contexts illustrates that many faculty, staff, and administrators design ways of interacting with and encouraging students to participate in ways that are responsive to familial contexts by, for example, (a) encouraging students to inform their families about their own accomplishments, (b) guiding students on how to attend

off-campus opportunities like conferences and internships (including assuring families that there will be adult guidance from the HSI staff and faculty at these events), and (c) celebrating students' achievements on campus through activities like research days, to which families are invited [7,18,21,33–35]. These are all practices in which any departmental personnel can engage to work with Latinx families to advance student success and bridge what are too often cultural divides between the institutions and the families. This research indicates that HSIs are ripe contexts to examine further lessons for research and practice to cultivate inclusive science identities where students can integrate their racial/ethnic, gender, linguistic, class, and other backgrounds [49]. Our study indicates that intentional family engagement to bridge students' and families' worlds can serve as a key way for institutions to foster Latinx student success in STEM.

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