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Exploring How Culture Matters in Building Responsive and Humanizing Contexts for Community College Students Pursuing STEM

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Abstract: While the vertical transfer process and culturally responsive approaches to education have been studied extensively, few scholars have addressed these two areas of concern simultaneously, particularly within higher education contexts. This study explores what cultural responsiveness means and how it matters for low-income community college (CC) students aspiring toward STEM careers and transferring to STEM majors at a local university. As part of a bridge program, students received two STEM faculty mentors, one faculty mentor from the community college and the other from the local university, beginning in their last year of enrollment at the community college. Each STEM mentor was trained in culturally responsive mentoring, and their mentorship extended post-transfer. Students participated in focus groups to share their experiences. The findings reveal that specific aspects of the community college students' identities, primarily their race and language, were relevant as aspects of culture that mattered for their STEM aspirations. The findings also show that cultural responsiveness in mentoring and support outside the classroom are important steps toward humanizing STEM spaces, but they are wholly insufficient when not paired with extensive culturally responsive efforts in STEM teaching and within the curriculum to improve the internal classroom climate for those with racialized identities.

Keywords: culture; STEM; transfer-receptive culture; culturally responsive

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1. Introduction

Transfer pathways between community colleges and baccalaureate degree-granting institutions serve as an important mechanism for the social mobility of a majority of underrepresented and historically minoritized students in the United States. A vertical transfer pathway involves the process of a student transferring from a 2-year community college to a 4-year college or university. Transferring vertically and receiving a baccalaureate degree from a 4-year institution often provides economic stability for those who need it most, such as those who have been historically excluded from higher education institutions [1]. Despite community colleges enrolling more than half of all Latinx and Native American students in higher education and nearly half of all Asian American and Black students, the retention and transfer rate of these students into baccalaureate degree-granting institutions remain low [2,3]. The transfer process between 4-year institutions and community colleges is varied and complex. It inevitably occurs as a set of interactions that enhance a student's opportunities, while simultaneously reflecting existing systems of privilege and reinforcing inequities [4].

The inequities in terms of access for students at community colleges as they aspire to achieve a baccalaureate degree is well-documented by scholars (Deil-Amen, 2011; Bragg and Durham, 2012), and Baber (2017; 2019a; 2019b) [5–9] the studies of which add an explicitly racial element to the phenomenon. The body of work of several scholars has acknowledged the role that race and racism play for students of color involved in community

college transfers, both within community colleges [9,10] and within four-year institutions post-transfer [11–13], in complex and nuanced ways. Similarly, a range of scholars have documented structural racism and historical exclusion within STEM educational environments more generally [14–16], for the past decade and a half. MacCambly et. al. (2023) [10] advances such work even further to include an organizational-level racial analysis of students' transfer pathways. Scholars studying STEM post-secondary settings note educational practices that aid in disrupting these exclusionary practices, such as facilitating a transfer receptive culture [4] and implementing mentoring programs [15,17]. What undergirds such educational practices is a commitment to the success of underrepresented students and being responsive and receptive to students' culture and social identities.

This study seeks to understand what it means to be culturally responsive when serving low-income community college students pursuing STEM majors and careers during the transfer process. Our study explores how culture matters and the relevance that social identities hold for underrepresented and historically marginalized community college transfer students, who matriculate into four-year institutions. This study's analysis draws data from a National Science Foundation grant-funded project, the STEMBridge Project, designed to foster more inclusive STEM academic spaces by facilitating a culturally responsive bridged community of practice between two Hispanic-serving institutions, a community college and a doctoral-granting university. Advancing culturally responsive mentoring and support helps build humanizing STEM education contexts for low-income community college students during the transfer process, by providing faculty mentors intent on building trust and validating relationships with students, nurturing them holistically, and taking their relevant identities into account. Our study highlights how these institutions attempt to advance student success by leveraging such culturally responsive STEM faculties and peer mentoring and combining it with academic and procedural/administrative support. By looking at the experiences of transfer students as a lens for interrogating institutional contexts, we find that particular aspects of culture and social identity operate to facilitate and engender feelings of both inclusion *and* exclusion for students. The STEMBridge Project's efforts to provide culturally responsive mentoring and support for students transferring into university STEM majors brings into sharp relief the contrast between the project's support *outside* the classroom and what is being experienced by these students *inside* their STEM classes.

2. Selected Literature

Community colleges serve as an entry point into higher education for many underrepresented and minoritized students in the United States. A disproportionately large number of low-income students, first-generation students, and students of historically disadvantaged racial/ethnic groups are enrolled in community colleges [4,18,19]. Students from underrepresented and minoritized backgrounds increasingly rely on community colleges in their pursuit of STEM degrees and careers [20,21]. By serving as an access point into higher education, community colleges have the potential to reduce gaps in economic and educational outcomes by broadening access to baccalaureate and advanced degrees in STEM [9,19].

Despite community colleges serving as a viable pathway for many underrepresented and minoritized students, students who demonstrate the potential to succeed in STEM courses experience many barriers throughout the transfer process [22–24]. A substantial body of literature highlights the challenging transfer process students navigate as they matriculate from two-year to four-year institutions [4,5,25,26]. The literature explores the "transfer shock" many students experience [4,27,28], as they struggle with academic and social challenges that often result in low persistence and degree completion for minoritized students [4,27,29,30]. To combat negative academic experiences associated with the transfer process, scholars call for institutional commitments to support students in transferring successfully from two-year to four-year institutions [4,8,10]. A transfer receptive culture is defined as an institutional commitment by four-year institutions to provide the necessary

support for community college students to matriculate successfully and minimize negative experiences, while facilitating positive ones [12]. In this approach, a transfer receptive culture facilitates an environment where, through institutional commitments, transfer students receive support throughout their entire academic experience, including through academic and retention support services [31].

Transfer students' sense of connectedness within the university context is a central component of an institutional culture that is receptive to transfer students. A transfer receptive culture consists of five elements [4,12]. The first two elements of a transfer receptive culture are considered pre-transfer efforts and involve a commitment to facilitating a transfer sending culture by: (a) establishing the transfer of underrepresented students as a high institutional priority, and (b) providing outreach and resources. The last three elements are considered post-transfer elements and include: (c) offering financial and academic support, (d) acknowledging students' lived experiences, and (e) creating appropriate frameworks to assess, evaluate, and enhance transfer receptive cultures through intentional programmatic efforts [4]. Together, the elements of a transfer receptive culture are rooted in critical race theory, which is inherent in how a transfer receptive culture acknowledges higher education's history and its continual perpetuation of sexism, racism, and classism [4,32,33]. Race and racism are centered in discussions on what constitutes a transfer receptive culture, similar to how critical race theory centers racism structurally. Centering race and racism in facilitating a transfer receptive culture is essential to degree persistence and completion in STEM, because there continues to be disparities in transfer outcomes for Latinx and African American students [34]. A transfer receptive culture aims to bolster equity for minoritized students in the vertical transfer process [4]. Culture, particularly students' lived experiences and the knowledge that they bring with them, is considered valuable within a transfer receptive culture [4,12,35]. Furthermore, a transfer receptive culture allows for a critical exploration of how students' experiences of race, racism, and racialization are highly prevalent and, ultimately, impact retention and persistence [4,36].

Common features of a transfer receptive culture are bridge and college access programs, designed as partnerships between two- and four-year institutions [4,13]. Many bridge and college access programs include an intentional focus on mentoring. These mentoring initiatives are associated with positive personal and academic outcomes and often focus on building students' capacity to develop academic identities, increase their learning capacity, and encourage persistence within a particular academic discipline [17,37]. Within STEM educational contexts, mentorship is a promising fixture in recruiting and retaining underrepresented groups [15,38]. As such, mentoring programs contribute to students' sense of belonging within STEM educational environments and are consistently associated with long-term success within STEM, such as degree completion, graduate school enrollment, and career-related outcomes [39,40].

3. STEM Educational Environments and Culture

Racism remains entangled within traditional STEM educational environments and cultures [41]. STEM higher education is a byproduct of scientific racism, with historical ties tracing its roots to eugenics [42]. STEM ideology and culture reflects socially constructed ideas of Black and Brown genetics as inferior, while scientifically advancing White hegemony in the late 19th and early 20th centuries [14,42]. By furthering White hegemony in STEM, racial stratification remains embedded within STEM higher education, whereby Blacks, Latinx, and Native Americans are at the bottom of the racialized hierarchy [43,44]. Despite calls for diversifying STEM, racial and gender disparities continue to persist [14,45,46]. As such, students pursuing STEM degrees remain predominantly White or of Asian descent (e.g., Chinese and Indian), male, and middle class [47].

Institutions maintain regimes of inequality within STEM higher education contexts through an overreliance on a host of historical and contemporary STEM practices that negatively affect marginalized students [4,48,49]. Gasman and colleagues (2009) [50] uncovered how STEM education is characterized by a survival-of-the-fittest mindset, whereby failure

within STEM is attributed to students' characteristics. Within a survival-of-the-fittest mindset, educators and administrators do not contend with how structural barriers contribute to poor academic performance within STEM educational contexts [51]. In turn, marginalized students are assumed to be intellectually inferior to their privileged peers. Common STEM characteristics that contribute to negative material consequences for historically minoritized students include the lack of a critical mass of STEM faculty of color, imposter syndrome, unwelcoming institutional climates [42,46,52], and racial stereotyping [16,53]. STEM practices that commonly contribute negatively to historically minoritized students include institutional and social barriers in these departments [54], a lack of role models or mentors, and high numbers of students of color dropping out of college STEM fields [55]. These commonly relied upon STEM characteristics and practices further perpetuate a STEM culture where minoritized students are viewed through deficit frameworks, normalizing harmful educational environments as acceptable [46,56]. To navigate these environments, underrepresented students often rely on coping mechanisms to navigate the hostile climate associated with STEM [57]. These coping mechanisms, such as creating counter spaces with students who hold similar social identities, are used to safeguard their academic careers because of a fear of failure and being seen as unsuitable for STEM [56]. Students, despite their achievements, doubt their abilities within STEM educational environments. A combination of hostile STEM environments and cultures results in marginalized students doubting their abilities, despite their achievements [37,48]. To address hostile environments, scholars propose culturally responsive education, such as mentoring, to address structural barriers in STEM education [37,58,59].

Previous research, conducted within K-12 settings, regarding culturally responsive pedagogy (CRP), highlights the critical role culture plays in academic achievement and personal development [60–63]. Students bring unique experiences and cultures with them to educational environments, including aspects of socialization involving their families and communities. While culturally diverse students' experiences have been explored, most literature has focused on either language learning or racial/ethnic and cultural diversity within educational settings [63,64]. Often, cultural and language diversity is viewed from a deficit lens and seen as an obstacle to academic achievement [65]. However, scholars studying culture and language highlight how attending to both language and culture are integral to students' academic achievements [63], as language and culture are interconnected [66]. Attending to the interconnectedness of language and culture enhances socioemotional and sociocultural factors within culturally responsive environments, because individuals' lived experiences and culture are viewed as enriching to education. By enhancing socioemotional and sociocultural factors within educational environments, educators can support connectedness between students, peers, faculty members, and the institution. The connectedness between students, faculties, and academic environments correlates with students feeling a greater sense of connectedness to their field of study and research [31,67,68]. As featured in the culturally engaging campus environments model [68], students' direct and indirect engagement with culturally engaging campus environments is related to a greater likelihood of persistence. Educators should attend to students' culture by incorporating cultural responsiveness into mentoring and instructions and by viewing students' culture as central to the learning process [69–71]. By incorporating cultural responsiveness into mentoring and instructions, students see themselves reflected in the curriculum and wider education ecosystems, while increasing students' persistence and degree completion. While there is a significant amount of research on the role of culture within post-secondary contexts, there is scant research on culture's role, including language and race, within STEM post-secondary environments, especially community colleges.

Taken together, this body of research supports a move towards research that focuses on the significance culture has within post-secondary STEM transfer contexts. A focus on the role culture plays will elucidate how barriers to diversity and persistence operate within STEM ecosystems [72], particularly regarding the unwelcoming academic culture and racialized environment other scholars have identified [36,73,74]. Therefore, educators should

direct efforts toward improving the STEM academic culture/climate in research-informed ways, such as utilizing asset-based and student-centered approaches and acknowledging the role of power and oppression within learning environments. While emphasizing a transfer receptive culture is a step in the right direction, because it puts the responsibility on the institution for facilitating the matriculation process for transfer students, prior research has not yet explicitly analyzed how culture matters for underrepresented/minoritized students during this process. As such, this paper contributes to our understanding of why and how educators and mentors need to implement a culturally responsive praxis to support community college students pursuing STEM. While mentoring helps build humanizing STEM contexts, our study elucidates how implementing a culturally responsive praxis in mentoring is not enough to address the structural barriers in STEM education and sheds light on how these efforts should expand into curriculum and pedagogical design.

4. Theoretical Framework

The theoretical framework guiding this study is culturally responsive pedagogy (CRP), because it provides a way to understand the role of culture within STEM educational contexts and how students from underrepresented backgrounds make sense of their transfer experience [75]. Introduced as "culturally relevant pedagogy" by Gloria Ladson-Billings (1995) [70], this theoretical framework posits culture as central to fostering positive academic and educational outcomes by empowering linguistically, racially, and ethnically diverse students, by cultivating the permanence of cultural identity and heritage within educational environments. Different iterations of a culturally relevant approach have led to nuanced branches of thought and terminology, including culturally responsive [69,75] and culturally sustaining [76] pedagogy. Each iteration has a common intent: for educators to incorporate culture into the curriculum, instructions, and classroom environments by viewing students' culture as central to learning. Viewing culture as central to learning moves educators towards enacting a process and facilitating a learning environment that empowers students intellectually, socially, emotionally, and politically, by using cultural referents to impart knowledge, skills, and attitudes [75–77]. Ultimately, the use of CRP within educational environments cultivates faculty–student interactions, while valuing and recognizing the importance of students' cultural practices within learning. Moreover, we describe these approaches as culturally responsive, namely a framework that optimizes learning environments by recognizing the importance of relationship-building and socioemotional connections. Cultural responsiveness respects and uses students' identities, perspectives, and diverse cultural backgrounds to enhance their meaning-making process, connection to, and learning of new concepts across any educational subject area [78–81].

Culturally responsive pedagogy has mainly been applied in K-12 settings and, therefore, the literature is limited regarding culturally responsive pedagogy's role in higher education contexts [82,83]. Scholars studying the role of culturally responsive pedagogy have applied the framework to rethink diverse pedagogical approaches in college classrooms [58,59,84] and have encouraged educators to engage in reflective processes regarding what inclusive educational environments encompass [85]. Our study addresses the dearth of research on the role of CRP within post-secondary contexts, particularly in student–faculty mentoring relationships, by applying CRP to enhance our understanding of how culture operates within STEM post-secondary environments and the types of support that cultivate cultural responsiveness. By situating CRP within the context of STEM transfer bridge programs, we add to the literature by exploring culture's relevance to better understand what cultural responsiveness means for students pursuing STEM degrees and careers. Finally, CRP as a framework allows us to situate student learning and academic success within broader cultural and societal contexts and within the context of two institutions engaging in a partnership aimed at inclusivity. We consider how the institutions and their related programming facilitate a culturally responsive experience, pedagogically and procedurally, particularly through the mentoring relationship.

5. Methods and Methodology

5.1. Research Context

This study is part of a more extensive investigation of a project entitled *Bridging Faculty and Student Cultures: Culturally Responsive Support for STEM Students Transferring Between Two- and Four-Year Hispanic Serving Institutions*, involving National Science Foundation (NSF)-funded scholarships in science, technology, engineering, and mathematics (S-STEM). The project aims to create an inclusive and culturally responsive STEM community to increase STEM identity and the sense of belonging and improve success outcomes (transfer rates, GPA, retention/degree attainment in STEM majors) for Pell-eligible community college transfer students. For this present analysis, we examine the role of culture in sustaining an inclusive and culturally responsive transfer and STEM experience within post-secondary contexts. Consequently, our research questions flow directly from our theoretical framework, which considers the relevance of culture within educational contexts. The following research questions guide our study: (1) What does it mean to be culturally responsive in the context of STEM transfer bridge programs, and (2) what aspects of culture are salient for transfer students within STEM?

5.2. Participants

The participants in this study were recruited as a part of a larger grant-funded project, which applied culturally responsive mentoring as a central component of the project's efforts to support Pell-eligible community college students pursuing STEM bachelor's degrees and careers. Pell-eligible students receive a need-based subsidy from the federal government to pay for college due to their eligibility as a financially independent low-income student or a financially dependent student from a low-income family. A total of 27 racially diverse students were recruited while attending Pima Community College (Pima CC) to join the STEMBridge program, which was designed to support students during the transfer process. Participants in the STEMBridge program identified as Pell-eligible, academically "high-achieving" STEM students at Pima CC, who planned to transfer to University of Arizona (UArizona) and pursue STEM majors. The demographic data of the STEM faculty mentors in this study indicate the following social identities: a majority of participants identify as female (59%) and racially/ethnically underrepresented (70%), with 52% Latinx, with ages ranging from 18 to 38. Additionally, 75% identified as first-generation college students. Both higher education institutions in this study are situated within the United States–Mexico borderlands, which brings into sharp focus the use of culture in creating culturally responsive educational contexts for transfer students pursuing STEM degrees and careers. Table 1 below details the relevant identities of the student participants in cohort 1 and their major and eligibility for the STEMBridge program. It is important to note that nearly half of the selected students were low-income White students, and very few identified as Black or Native American.

Table 1. Demographic Data of STEM Bridge Participants Cohort 1.

Pseudonym	STEM Discipline	Eligibility	Race/Ethnicity	Gender
Alanah	Chemical & Environmental Engineering	Low Income	Latinx	Woman
Ray	Electrical & Computer Engineering	Low Income/First Generation	White	Woman
Ken	Systems & Industrial Engr	Low Income/First Generation	Asian	Man
Mimi	Chemistry & Biochemistry	Low Income/First Generation	Latinx	Woman
Sarah	Systems Engineering	Low Income/First Generation	White	Woman
Kelly	Geosciences	Low Income/First Generation	Latinx	Woman
Tia	Plant Sciences	Low Income/First Generation	White	Non-Binary
Henry	Molecular & Cellular Biology	Low Income/First Generation	Latinx	Man
Melissa	Environmental Health Engineering	Low Income	White	Woman
Tonya	Mechanical Engineering	Low Income/First Generation	American Indian	Woman
Arthur	Computer Science	Low Income	Asian	Man
Sam	Aerospace & Mechanical Engineering	Low Income	Latinx	Man
Luther	Electrical & Computer Engineering	Low Income	White	Man
Cieola	Natural Resource & Environmental Engineering	Low Income/First Generation	Black/African American	Man
Gabriella	Systems & Industrial Engineering	Low Income/First Generation	Latinx	Woman
Larry	Animal & Biomedical Sciences	Low Income/First Generation	Multiracial	Man
Kris	Ecology & Evolutionary Biology	Low Income	Latinx	Woman
Petra	Electrical & Computer Engineering	Low Income/First Generation	Latinx	Woman
Aldena	Plant Sciences	Low Income/First Generation	Latinx	Woman
Ally	Civil & Aerospace Engineering	Low Income/First Generation	Latinx	Woman
Matt	Aerospace & Mechanical Engineering	Low Income/First Generation	Latinx	Man
Bianca	Systems & Industrial Engineering	Low Income/First Generation	White	Man
Amy	Aerospace & Mechanical Engineering	Low Income	White	Woman
Santos	Physics	Low Income/First Generation	Latinx	Woman
Hector	Aerospace & Mechanical Engineering	Low Income/First Generation	Latinx	Man
Ben	Molecular & Cellular Biology	Low Income	Latinx	Man
Mike	Aerospace & Mechanical Engineering	Low Income/First Generation	White	Man
Patricia	Chemical & Environmental Engineering	Low Income/First Generation	Black/African American	Woman
Lucas	Electrical & Computer Engineering	Low Income/First Generation	Latinx	Man

6. Data Collection

From 2020 to 2023, we facilitated fifteen semi-structured focus groups over a three-year period using a culturally responsive approach [86], with student participants from the first cohort engaging via Zoom, to gain a phenomenological understanding of the relevance of culture for these STEM-aspiring students. We approached this study using qualitative and grounded [87] exploratory methods, allowing us to "make sense of the situation without imposing pre-existing expectations on the phenomenon under study" [88]. Before transferring, we facilitated five focus groups over Zoom with the students, while they were still enrolled at Pima CC. Subsequently, three focus groups were conducted after the students transferred to UArizona at the end of their first semester, three focus groups were conducted in the spring of their first year after transferring, and again toward the end of

their fourth semester, and a final focus group, when the semester students had graduated from UArizona. The students were guided through PowerPoint slides that addressed key topics and asked probing questions about their experiences at two Hispanic-serving institutions, Pima Community College and UArizona, particularly within STEM courses, and their interactions with their faculty, peers, and mentors. All the focus groups were approximately 1.5 h long and were recorded and transcribed verbatim.

7. Data Analysis

A team of three researchers transcribed the dialogue from each focus group and made corrections to errors in the transcripts. We then applied a thematic analysis to the transcription data, which entailed reviewing and examining the data for patterns and themes related to the research topic through the process of coding [89]. Inductive and deductive open and focused coding [90] were used to understand the role of culture within STEM educational contexts for transfer students. First, open coding was conducted by reviewing and tracking words, phrases, and lines to identify patterns. Second, focused coding was conducted by comparing the data sets and using the codes to confirm the proper selection of codes and themes. The themes for this study were chosen from the emerging focused codes with the highest frequency and those that spoke to our two research questions and the study's theoretical framework. This process allowed the research team to center culturally responsive pedagogy in our coding process and uncover how students made sense of the role of culture, as they described their STEM experiences and the transfer process.

In addition to the coding process, memo writing was utilized to continually check for credibility regarding the appropriateness of the codes and themes generated to represent participants' experiences. A constant comparative approach to generate additional core categories on support, STEM identity, and belonging was applied to account for personal biases, enhance validity, and maintain a high degree of reliability [91], (pp. 342–343). The researchers discussed discrepancies collaboratively to enhance reliability in the coding process and arrive at a consensus for each emerging code. This data analysis approach aimed to develop a composite on the relevance of culture within STEM post-secondary contexts. Themes in the data highlighted the relevance of culture in promoting feelings of connectedness or disconnectedness, thus suggesting culture and mentoring support as a central area of concern for those interested in supporting the persistence of underrepresented students in STEM post-secondary environments.

Researcher Positionality

Who we are as individuals and researchers informs our approach to this inquiry; as a result, we share our individual and collective positionalities. Collectively, our interests in being members of the larger research project center on our commitment to dismantling oppressive systems that disenfranchise the experiences of underrepresented minorities within STEM post-secondary contexts. We desire to engage in true inclusion work within STEM educational spaces grounded in transformative praxis.

First author is a Black, queer woman and professional and doctoral candidate in higher education. Given her commitment to a Black feminist epistemology through enacting liberatory educational praxis, she paid close attention to the role of culture, race, and gender within the framing of the focus group questions and the coding and analysis process. Second author is a Latinx woman professor of mixed racial/ethnic heritage, whose research centers around college access and community college populations. As the lead PI of the grant, she made an effort to be approachable and friendly during the focus group process, affirming students' responses and encouraging their verbal participation, following a format in which she explained that each student would be invited to answer every question, which they did for most of the focus groups.

8. Findings

While the STEMBridge program exemplifies aspects of a culturally responsive environment and a transfer receptive culture, forces of both inclusion and exclusion were at work as students navigated the STEM cultural milieu. Before transferring, student participants highlighted how culture was significant to their STEM identity and contributed positively and negatively to their sense of belonging and connectedness at Pima CC. After matriculating to UArizona, student participants highlighted how they felt served by the culturally responsive mentoring, academic, and procedural support milieu provided by the STEMBridge program. They experienced the STEMBridge program's environment of support beyond the classroom as receptive to their identities and material needs. However, our findings also revealed how their cultural and racialized experiences *inside the classroom* were not accounted for, particularly in interactions with STEM professors, peers, and within the STEM curriculum.

8.1. The Language of Cultural Inclusion and Exclusion

In the focus groups conducted while the students were still enrolled in their last year at Pima CC, various aspects of culture emerged as most prominent in relevance to their STEM experience. These elements were noted as either negatively detracting from or positively contributing to their STEM identity. In particular, language and race were described as mechanisms of inclusion or exclusion dependent on the individual student and their experience.

Regarding language, some Latine participants highlighted how language, as an aspect of culture, contributed to feelings of exclusion. For example, Petra highlighted her experience with her native language, Spanish, in STEM community college classes:

"...the accent was very problematic for me at the beginning... like the way teachers explain things--concepts are totally different from Mexico. It was a culture shock for me at the beginning... there were some classes where I felt a little bit... not discriminated against, but like they would make a joke of me because of my accent... When I get nervous, I tend to forget my English... Because of that, I don't usually participate in classes which is very important for me because I really like to participate, and... there were a lot of semesters where I was scared to participate".

For Petra, her native language and her accent were named as a factor in her negative experience of STEM environments and which also influenced her level of engagement and participation in the classroom. However, other Latine students described how their Spanish language was an asset that aided in connecting them with other STEM peers. For example, Aldena highlighted how her Mexican cultural background helped them in making connections with other peers and boosted their confidence within STEM courses:

"I have a Mexican cultural background, and it actually has benefitted me...I have classmates that... speak spoken Spanish, and I'm like, "oh, you speak Spanish?" And then we start like talking about our backgrounds... and I feel more confidence... we have more to talk about than if we didn't know about our backgrounds".

Similarly, Tony noted how speaking Spanish helped him support other students in STEM courses at the community college, who were not native English speakers:

"...it kinda helps that I know a little bit of Spanish sometimes cause some people don't speak any English...I had an Engineering class... someone did not speak any English at all so people that spoke Spanish would help".

As featured in Aldena and Tony's experiences, having a similar language background went beyond just connectedness amongst students and influenced the students' sense of belongingness within STEM educational contexts. It seems that a critical mass of Latinx students at this HSI community college allowed for such connections to emerge within the community college STEM classes in particular.

8.2. How Race Matters for Cultural Inclusion and Exclusion

While attending Pima CC, race appeared relevant in different ways, either in its absence of importance or as a mechanism of exclusion only. In students' narratives during the focus groups, race was not presented as an integrative or inclusionary element in how students navigated their STEM classroom environments. However, students did not highlight race as a particularly exclusionary element either, despite repeated questions around race, culture, and gender. For the non-Black students, the general narrative around race was one of irrelevance, while Black students pointed to discomfort around race.

For example, Sam, who identifies as Mexican–American shared the following:

"…I do not think my racial background has affected my experience at [Pima CC] because I've seen some people that are like me in my STEM program". Again, the critical mass of Latinx students at Pima CC seemed to prevent Latinx students from feeling a sense of isolation or exclusion based on racial background.

Expectedly, White students also noted the absence of race as relevant. Sarah, a White student, shared sentiments very common among nearly all of the White students:

"I just feel like as a white person, I don't really feel like there's gonna be, I hate to say it, but I don't think there's gonna be any bias against me, but neither do I feel like I am treated better because of it. I just feel like it's neutral".

Both Sam and Sarah highlight the lack of relevance of their racial identity within STEM classroom environments in two notably different ways. For Sam, race was irrelevant, because they were often in classroom environments where they saw people like them. For Sarah, race was irrelevant because whiteness and seeing students like her within STEM educational environments is the norm. These experiences reflect the experiences of a majority of STEMBridge student within an institutional context in which White and Latine students were the majority, given Pima CC's federal designation as a Hispanic-serving institution.

In contrast, Cieola, a refugee who identifies as Black, commented when asked how race has affected their experience within STEM at Pima CC:

"…being Black and all, I haven't seen lots of students who are Black doing STEM in my classes. So, it is a bit of a challenge, and it's kinda scary".

For Cieola, race was relevant because of the absence of seeing other Black students in their STEM classes. Cieola's mention of the scariness of being within non-Black spaces illuminates barriers that many of their non-Black peers may not experience. Such reported experiences by Black participants are likely the result of an institutional context, in addition to a STEM academic context, where Black identities and experiences are often not reflected.

After the students transferred to UArizona, their responses in the second set of focus groups shifted somewhat regarding race. Race as an element of culture appeared to have become a more salient force in how students made sense of their STEM identity and feelings of connectedness and belonging within the new university context. The relevance of race was a complex phenomenon that differed across racial groups. White students continued to reflect the themes highlighted in the initial focus group, in that they expressed that any challenges they faced within STEM environments were not necessarily connected to their racial identity. Instead, students, particularly students who were White and self-identified as women, noted gender as the status that raised concerns. They highlighted the absence of other women within STEM classrooms, compared to their community college experiences. Sarah, a White student, shared:

"I have a lot of privilege so as far as race I haven't really had experience with that, so I can't really speak on that. But I've noticed that compared to Pima, there are fewer women in my classes and that bothers me. I don't know it's just something that irks me…there are like 5 other women in my classes of 100 people".

Sarah recognizes that she experiences privileges based on race. Notably, Sarah, like many of the other women in our study, finds herself reflecting on the absence of other women in her classroom environments. Gender appears to be operating as a partially exclusionary force for students through the physical absence of women in particular STEM spaces. Meanwhile, the social climate within these spaces was noted, but not emphasized as problematic, among

students in this cohort, and our focus group questioning did not probe this topic in enough depth. Interestingly, while Sarah is conscious of race, her experience lacks reflection about the ways that her race contributes to her ability to navigate STEM environments.

In contrast, students of color appeared to have experiences where their racial identity was more salient and relevant within the STEM classrooms at UArizona compared to their experiences at the community college. For example, when asked about race and their experiences within STEM classes, Cieola shared, "I've noticed in some of my STEM classes there are not a lot of Black guys. . .I feel like a unicorn". Cieola recognizes the absence of other Black students in his classes, while also reflecting on his presence as an outlier, which influences the salience of his racial identity. At UArizona, STEM class sizes also tend to be larger, which might have enhanced the sense of being a racial exception among so many non-Black students.

Similarly, there were changes in how Mexican American students made sense of their racialized experiences after transferring to UArizona. They sometimes racially compared the STEM environments between Pima and UArizona. For instance, Bianca explained how she might expect more Latine students at Pima, which Bianca interestingly described as "a Hispanic Serving Institution like Pima Community College", despite the fact that UArizona is also an HSI. Bianca shared the following in response to a question about race at UArizona.

"I think it is more challenging being Hispanic because. . .relatability to other students is not there. I would say it gets bad where I feel like students of color are commodified where UArizona tries so hard to be like performative. . . it feels like less authentic. . . the overall institution is trying to make it look like they are super diverse. . . but when you are one of those students you don't see a lot of results. . . so it feels not authentic and commodifying". Immediately after Bianca shared this, Hector, who identifies as Mexican American, added the following, ". . .as a minority student, you don't realize it until you are already here and all the things you should have paid attention to a long time ago".

Later in the focus group, Bianca shared an additional observation about her STEM classrooms:

> . . .like sometimes it hits you really hard when you are talking to another student, and you realize 'I can't relate at all'. . . and when you experience that you feel a little alone. And that happens the most in my classes that are predominantly white. And when that happens, I just try to remind myself of my community back in my Mexican American Studies classes. . . Having those two majors really brings balance, because if I was just in the STEM classes, then I would feel like a bigger outcast.

Like sentiments expressed by Mexican American students, a Native American student, Tonya, talked about her racialized experiences in STEM classroom environments at UArizona. Tonya shared.

". . .being at UArizona, I feel like I am the minority, and I'm afraid to say anything especially when people bring up Native American communities. . . I am Native, but it feels like people don't know that Native Americans are still here. At Pima CC everyone knew about Native Americans, but here, it's just really weird". Tonya further talked about being Native in relation to her degree, highlighting how her community is framed within classroom discussions, despite her being from the communities discussed in the classroom. Tonya shared.

"Like in my environmental science class, they bring up Native American communities in the area and how they don't have electricity or running water. I have to be that person who is like, 'yeah I grew up like that and this is why I chose my major'. . . and everyone is kind of like, 'oh like I didn't know that was real.'" Tonya's experience reflects the common phenomenon of Native erasure, in which Native perspectives, experiences, and identities are understood as historical rather than contemporary. When asked how these experiences made her feel, Tonya responded.

"I feel more afraid to speak up or like I don't feel like that's my place. . . I don't want to speak up for all of the Native communities. . . I don't want to generalize the Native community based on mine, you know, so it's kind of hard for me".

Students' experiences within STEM classroom environments reveal that there were gaps in the university's ability to provide humanizing experiences, especially in STEM classes where the presence of Latine, Native American, and Black students was sharply more underrepresented than at Pima CC. And, unlike the mentoring relationships provided by the STEMBridge programs, classrooms were not as culturally responsive. Overall, specific aspects of the students' identities emerged as relevant components of culture that mattered and operated in nuanced ways. In particular, language and race operate in complex ways, each serving at times as a mechanism of inclusion and, in other ways, as a force of exclusion. Together, these experiences highlight the importance of culturally responsive educational environments, while necessitating the importance of addressing gaps in STEM ecosystems through cultural responsiveness and a transfer-receptive STEM culture. Notably, students across the board, regardless of racial background, did not share experiences of direct racism or discuss any analysis of more structured or systemic racism during the focus groups.

9. A Transfer-Receptive STEM Subculture?

While there seemed to be negative impacts on students' sense of belonging and connectedness once the students enrolled at UArizona, especially in the classroom, our findings suggest that the STEMBridge program was instrumental to how students found community and connectedness outside of the typical STEM classroom environment. The STEMBridge program essentially created a transfer-receptive STEM subculture, which aided in building humanizing STEM contexts for students outside of the classroom. There were multiple areas of the STEMBridge programming that the students identified as reflecting a culturally responsive and transfer-receptive culture. These included the faculty and peer mentorship, the direct assistance of staff available to help with procedural hurdles, the compositional diversity of the program, and the benefits of the courses that students attended as part of their STEMBridge participation.

When the students described the struggles they experienced within the classroom, many of the students normalized these difficulties by equating the STEM environment as being hard and a part of the process. The students further complicated this narrative by highlighting how they often felt excluded within STEM classroom environments and how the STEMBridge program offset these feelings by facilitating an environment where they felt like they were a part of the larger STEM community. For example, Cieola shared the following.

"I think the STEM community in the STEMBridge program has been more helpful compared to the general UArizona STEM community. . . in the general STEM community it's hard to get to know people. But in the STEMBridge program there are people who are calling and asking you if you need help and that they will be there for you. . . the general community is a bit intense and scary. . . it's hard to get to know people or ask questions, so the STEMBridge program has been all the help".

In terms of Cieola's experience, they highlight how the STEMBridge program provides connections and support in ways that the general STEM community does not. Similarly, other students talked about how the STEMBridge program helped combat some of the difficulties students experienced in the STEM classroom by providing students with the necessary resources, such as departmental and financial aid advocacy. Many students highlighted how they doubted whether they belonged within the STEM environment. When students started to doubt their abilities, they often contacted STEMBridge program staff for support and highlighted how the support offered was instrumental. For example, Cieola shared.

"I started struggling with my programming classes. I started having second thoughts, and maybe this was not for me. I talked with [staff member], and they reassured me that they were here to support me, and I was like 'yeah, I think I can do this'".

The STEMBridge students highlighted how UArizona tenured professors in STEM were generally unapproachable and often left students to fend for themselves. While students echoed that they found the culture of their new learning environment to reflect a 'survival-of-the-fittest' mentality, students highlighted how, in the subculture of the STEMBridge program, staff and faculty mentors served as instrumental forces in their sense of belonging and connectedness within UArizona. For example, students often spoke about how the STEMBridge program offered support during the transfer process, such as helping students with their application, fielding questions about the financial aid process, and connecting students with undergraduate research opportunities. As a result, students spoke about how these pre-transfer experiences aided in a smoother transfer experience and facilitated both a culturally responsive and transfer-receptive STEM culture. When talking about her experience within the STEMBridge program, Tonya shared the following:

"I thought everyone was just gonna let me fail and do whatever on my own and figure things out. But the STEMBridge program has been really helpful".

Tonya further talked about the ways that the STEMBridge program supported her sense of belonging related to her connectedness with other diverse students:

"I'm Native. . . and am used to being in the Native community, but the STEMBridge program is like full of diversity, and it's pretty interesting learning about everybody's background and where they come from and how we all pretty much relate to each other. . . I feel welcomed in the STEMBridge program".

Students' narratives about the STEMBridge program's role in facilitating a diverse environment and its contribution to connectedness and community building highlight the important role of mentoring and student-success initiatives. As emphasized in students' narratives, the bridge program facilitated a diverse environment and community of learners that was often absent within STEM classroom environments. Thus, the STEMBridge program can serve as a case study for developing a culturally responsive and transfer-receptive culture within STEM.

10. Discussion

This study identifies elements of cultural responsiveness and how its presence and absence can serve as a mechanism of inclusion and/or exclusion within post-secondary STEM educational spaces. This study elucidates what it means for underrepresented and historically marginalized students to participate in programs designed to facilitate a more humanizing transfer-receptive culture [4]. Considering the original pedagogical underpinnings of cultural responsiveness [75], our study extends the role that culture, particularly language and race, have in facilitating belongingness and developing a STEM identity [36,62,67]. It also highlights the pivotal role that faculty and staff can play in facilitating inclusive STEM spaces, where these aspects of culture are visible, considered, and valued, creating a more humanizing space for students. Taken together, our study highlights how elements of cultural responsiveness help build humanizing STEM environments for underrepresented and historically marginalized students.

Our findings highlight the importance of language as a component of culture within historically exclusionary educational contexts, through the experiences of Petra, Alden, and Teresa. As highlighted in our study, the student's use of language within STEM educational spaces allowed them to understand and navigate STEM ecosystems as both inclusionary and exclusionary spaces. In some cases, students' use of their native language inhibited their ability to engage in classroom spaces fully. In other cases, students' use of their native language aided how they found community with their peers, supported their peers, made sense of STEM materials, and saw a place for themselves in the STEM classroom. This function of language as a component of culture in STEM classrooms underscores the importance of educators honoring linguistic capital [65] in terms of sustaining culturally responsive educational spaces. Language as an important, yet distinct, component of the cultural diversity of students has been highlighted in K-12 contexts [63]. While the work of Scanlan and López recognizes that being dominant in a language other than English

can be a challenge, our findings support the idea that such multiple language capacity can be considered an asset. Our students reported how their use of language served either purpose depending on the context and relationship, and one aspect of context that emerged as significant is the presence of a critical mass of language minority students in STEM classroom spaces.

Social identities also inherently shape educational experiences and were a vital aspect of our findings on how students' social identities influenced their experiences of STEM culture. The specific context of the educational setting directly impacts the saliency of how students understand their identities. As stressed through the experiences of Cieola, Tonya, Bianca, and Sarah, our study contributes to the existing body of literature on this topic by identifying and emphasizing exactly how language and race operate as aspects of culture within STEM post-secondary educational contexts. This has implications for better understanding how such aspects of culture can vary in unique ways, which can help to envision improvements to cultural responsiveness in such contexts [28]. In hindsight, one important limitation of the study was the lack of racially homogenous focus groups that might have otherwise contributed to more open and honest discussions of race and racism. Since so few of the students were students of color, especially Black and Native American, this might have created a power dynamic that inhibited discussions of race and racism among students of color, particularly since each focus group included several or a majority of White students, who were also discussing the challenges of being low-income and other challenges to their success. Focus groups organized by racial background might have allowed for less discomfort in discussing race, particularly among STEM majors, who do not normally talk about race and racism in classrooms with their STEM peers.

Regarding gender, our findings are consistent with prior research that has revealed how the climate in STEM fields is often less than welcoming to women and other students with marginalized gender identities, mirroring aspects of a culture dominated by cisgender heterosexual men, where hegemonic masculinity and heteronormativity are pervasive aspects, especially in engineering, computer science, and physics [46,91]. This suggests that gender is salient in nuanced and complex ways, and such analyses should be featured within studies of STEM educational environments. Our study did not analyze gender in further depth due to the nature of our data, but future research should address such nuance, particularly the ways in which the climate of STEM functions to exclude based on gender and gender identity [46].

An institutional culture that often focuses on one dimension of identity at a time ultimately fails students, especially those already marginalized within education [40,55]. As featured in our study, the saliency of students' identities shifted based on the institutional context and the demographic makeup of their STEM classrooms. Our findings underscore the importance of considering the intersectional nature of how identities operate within larger systems [92], particularly in regard to any efforts to develop and sustain a transfer-receptive culture and sense of belonging [4]. Our findings also reveal how structural inequities continue to be imbricated in institutional cultures if they remain unaddressed [48,49,56]. Collectively, our findings about language, race, and gender add new understandings about how identity as a part of culture should be considered and further explored within culturally responsive STEM environments.

While studies have focused on what it means to facilitate a transfer-receptive culture by engaging in and facilitating a supportive transfer-sending and transfer-receiving process [4], our study uncovers the pitfalls in the transfer process. Our findings expand what it means to facilitate an authentic transfer-receptive culture by revealing what it means for different subcultures of STEM students to transfer from two-year to four-year institutions. As detailed by our participants' experiences, transfer students encountered affirming and transfer-receptive environments outside the classroom through mentoring and membership in identity-based student organizations [15,37]. Providing this type of STEM subculture helped create a more humanizing experience for students as they navigated the STEM transfer process, with the advocacy of mentors and the assistance of program staff, all of whom

knew the students' well and as whole people. Such an approach helped when motivating struggling students and when seeking support to meet their unique needs. However, in contrast, the university classroom environments, particularly in STEM, seemed much less equipped to provide adequate receptiveness, often resulting in a dehumanizing classroom experience for students. The disconnect between a transfer-sending and transfer-receptive culture contributed to conditions wherein students' sense of belonging within STEM classrooms appeared to be negatively impacted. Despite the STEMBridge program contributing positively to students' sense of belonging through student support services and humanizing mentoring relationships, more must be done to affirm students' unique experiences and social identities within classroom environments post-transfer. Without intentions to cultivate a transfer-receptive culture within STEM classrooms, the opportunities for students who transfer to consider themselves members of the larger campus STEM community are weakened. The responsibility of facilitating a transfer-receptive culture is the role of the entire institution, not just that of program-specific staff. The work of facilitating a transfer-receptive culture has to be coordinated across all levels of the university, including university administrators, staff, and faculty.

Our findings uncovered misalignments that students experienced within different ecosystems and how this impacted their overall sense of belonging within STEM environments. Students' experiences revealed that *inside* the classroom environment, they often encountered feelings resembling the more dehumanizing experiences of exclusion and commodification based on their marginalized identities, and the reinforcement of the survival-of-the-fittest mentality often engrained in STEM. However, *outside of the classroom* within STEMBridge, students experienced affirmation from staff members and connectedness through mentorship, including through STEM faculty and peer mentorship. These findings confirm previous studies about the importance of culturally responsive mentoring [15,16,37] and facilitating a culturally engaging campus environment [4,68]. However, these findings also illuminate the impact of misalignments between STEM mentoring programs and larger campus ecosystems. While mentoring programs are essential in addressing inequities within STEM, without significant campus and STEM cultural changes, educators will continue to perpetuate inequities (un)knowingly [15,16]. Further, those committed to addressing inequities within STEM can learn a lot from staff members who facilitate mentoring and transfer bridge programs.

Higher education literature often critiques community colleges in terms of persistence and completion rates [19]. However, by hyper-focusing on the role of community colleges in addressing the retention of underrepresented students, the literature also fails to recognize how four-year institutions fall short in providing appropriate student support [4,93]. In the case of our study, Pima CC implemented the necessary resources to address persistence and retention and partnered with UArizona to develop an effective and holistic bridge program. While the students were enrolled in Pima CC, they were a part of STEM educational environments where aspects of their culture were affirmed. Despite the presence of the STEMBridge program and staff members trained in CRP, students still encountered procedural hurdles throughout the transfer process when entering UArizona. Once the students transferred, transfer-receptive and culturally affirming spaces were absent outside the STEMBridge program. Our findings confirm previous research about the importance of transfer-receptive cultures [4], while simultaneously adding to educational research's understanding of the role and nature of partnerships between community colleges and four-year institutions. Moreover, in implementing mentoring bridge programs it is one thing to facilitate a transfer-sending culture and another to truly support students matriculating to a four-year institution in a way that recognizes their cultural assets.

While our study reinforces the work by Museus et al. (2017) [68] on how facilitating culturally engaging campus environments positively impacts students' sense of belonging, our study complicates the CECE model by emphasizing the importance of critically examining systemic oppression. As highlighted in our findings, there were elements of culturally engaging campus environments in the STEMBridge program, such as cultural

familiarity and cultural responsiveness through the cohort-based model, faculty and peer mentoring, and dedicated staff support. However, our findings uncovered elements of oppression embedded within STEM classrooms that still need to be addressed in the larger CECE framework. For example, the consistent experience of cultural exclusion experienced by students across multiple subcultures and classroom spaces speaks to a larger systemic issue that must be rectified through the CECE framework in order to realize greater equity. Moreover, our collective efforts are only complete if institutional agents and programs actively address structural oppression and the realities that marginalized students in STEM encounter [4,17,51].

Our study contributes to a renewed understanding of transfer-receptive cultures, students' sense of belonging, and connectedness within STEM educational environments. Our findings allude to the ways that mentoring programs contribute positively to students' sense of belonging outside of the classroom, while simultaneously revealing structural realities that STEM students continue to face within the [51,55]. Thus, our findings confirm what we already know about the positive attributes of transfer-receptive cultures, the sense of belonging, and connectedness. However, our findings also suggest the need for a renewed understanding of the interplay between a sense of belonging, cultural responsiveness, identity, and transfer-receptive culture by situating the literature within the context of different educational spaces, such as mentoring initiatives.

11. Conclusions and Implications for Research and Practice

As STEM researchers dedicated to dismantling structural inequities, educators should understand that representational diversity, although it can certainly contribute to belongingness and inclusion, is not the end goal of developing culturally responsive campus environments. We offer implications that require deep and critical reflection. Our implications serve as a call for educators to engage in true coalition building between faculties, staff, and campus administrators. As McGee (2020) [55] highlighted, if historically marginalized students are not able to integrate within STEM educational environments fully, there will continue to be severe material consequences for them. Thus, our study's implications call for educators to dismantle systems that result in adverse educational and life outcomes for those already marginalized. The entire campus community must have active and intentional commitments, including faculty members, to facilitate authentic transfer-receptive classroom environments. To address the structural inequities embedded in STEM, educators must consider what it means to extend cultural responsiveness into organizational spaces that combine teaching and mentoring.

Identity is a large part of a student's understanding of environmental contexts and educational experiences. Consequently, educators must remain attuned to how an absence of attention to identity in classroom environments becomes a stand-in for monolithic understandings of students' experiences, including how they come to learn, know, and eventually contribute to and position themselves within society as STEM professionals. In equity and justice-centered work, it is essential that educators maintain an awareness of the role of power in addressing issues of inequity. With this in mind, we recommend that institutional leaders engage in an identity-conscious framework. Drawing on the work of critical Black feminists, bell hooks (1984) and Kimberle Crenshaw (1981), identity consciousness centers on identity, power, and systems, including how policies are enacted within organizations to maintain oppression. Applying an identity-conscious framework to policy and program implementation centers identity and power, while challenging educators to reconsider educational structures, including policy and practices. Centering identity extends the work of cultural responsiveness, while putting into sharp focus power within organizations. Given the historical implications of STEM environments, applying an identity-conscious lens to policies and practices can facilitate possibilities for movement away from mere representational diversity work toward true inclusion work. Moreover, true inclusion work facilitates humanizing educational contexts for all by putting into sharp

focus the role that identity and power play in dismantling inequities that impact a student's success, persistence, and degree attainment.

Suppose that we are to enact real and long-standing change within STEM post-secondary contexts. In that case, we must remain cognizant of how faculty members, particularly those who are tenured or in a tenure-track position, are implicated in how hostile educational environments are perpetuated and maintained [73]. Faculty members must play an active role in addressing and dismantling hostile classroom environments for students. Equity work that exists outside of the classroom does nothing to address mechanisms of exclusion that marginalized students may face in the STEM workforce. Faculty members can address these efforts by incorporating a culturally responsive praxis in the development of their course curriculum that honors students' unique experiences and contributions to STEM. By focusing on these efforts, faculty can aid in building and sustaining a more humanizing STEM context for students that permeate academic spaces both within and outside the classroom.

Contributing to a positive sense of STEM identity for students while in STEM classroom environments can contribute to workforce retention. Thus, we recommend true coalition building that focuses on providing STEM faculty, particularly those not already connected to equity and inclusion initiatives, with the necessary training on culturally responsive pedagogy. This process can allow for greater alignment between student support programs, such as mentoring programs and classroom experiences. Furthermore, while training is important, it is also crucial to move beyond training to hold institutions and faculty accountable, because equity work cannot be transformative without institutional accountability.

Additionally, we recommend implementing equity classroom cards, a publicly available system that allows students to score STEM faculties based on their classroom experiences pertaining to structural issues, such as the climate. This practice would allow students to share data with administrators about their experiences within the classroom. This process differs from teaching and instruction assessments as it centers solely on equity and inclusion. Extending this recommendation, we suggest a flipped mentorship program. A flipped mentorship process allows students to serve as mentors to faculty mentors on issues prevalent within STEM educational spaces. Students would meet with faculty regularly and guide the faculty's development toward supporting students in STEM and beyond. Implementing a flipped mentorship model facilitates the possibility of an innovative approach toward collaborative learning and development within organizations. At the same time, we recognize that this places a responsibility to address structural inequities on students themselves. However, implementing a flipped mentorship process would facilitate better intergenerational relationships that can speak to STEM culture in ways that individuals not situated in STEM classroom contexts cannot.

In summary, our study highlights the relevance of race and language as components of identity and culture and how they operate to include and/or exclude within STEM post-secondary educational environments. We believe our findings conservatively reveal the relevance of the dynamics of race/ethnicity and language, due to the racially diverse composition of the focus groups conducted, which might have created a less-than-ideal context for discussions about a topic as sensitive as race, especially given the intensity of such feelings in the aftermath of the racially charged climate of 2020. Future research should explore these cultural and identity-based topics, utilizing more race-sensitive methodologies. Overall, our findings also emphasize the crucial need for administrators and educators to differentiate between two-year and four-year STEM institutional contexts, and within those four-year contexts, the differences in how culture matters within and outside the classroom. Such examinations can help us grapple with how best to facilitate a transfer-receptive culture that centers students' lived experiences.

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