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TRENDING TOPIC

Community values: Exploring what undergraduate engineering students value in their community college experience

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Abstract

Previous research exploring the lived experiences of marginalized groups of students in STEM at community college settings is limited, despite the fact that community colleges have the potential to create pathways to 4-year engineering degrees and diversify the STEM workforce. This study explored what underrepresented students in STEM valued most as they navigated community college. We conducted nineteen semi-structured narrative interviews. Our findings suggested that the students found some of the values implicit compared to other explicit values mentioned by the participants. For example, they valued intimate class size, invested faculty, available tutors, and financial support as explicit values. They appreciated the low-pressure environment, directional support, networking opportunities, and hands-on learning as implicit values associated with their college experience. Our research has a direct implication on how such experiences influence students' chosen pathways toward engineering careers, and institutions can learn directly to establish programs with an understanding of what they value.

INTRODUCTION

Engineering programs at universities enroll fewer underrepresented students. The silver lining is that traditionally underrepresented students in engineering programs are overrepresented at community colleges (Harper & Thiry, 2022), which provides a valuable pathway for many of these students to pursue STEM education. Underrepresented Groups (URGs) of students refer to the intersections of multiple marginalized identities; for example, first-generation college student, gender, race, ethnicity, socioeconomic status, veteran, a person with a disability, and gender identity are all components of marginalized identities (Mishra, 2020). Despite exhaustive partnerships between community colleges and four-year

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universities, transfer data from 2017 highlight that the transfer rate was less than 35% (Johnson & Mejia, 2020). Understanding better what supports transfer in engineering programs is critical.

Community colleges are not a new partner for STEM higher education. For example, the National Science Foundation has been actively trying to promote the role of these colleges for over 20 years. Research has examined community colleges as a means to incorporate inclusion in the engineering workforce (Starobin et al., 2016; Wang et al., 2016) and the pathways of URGs to 4-year college (Wang et al., 2020). Investigating what community college values URGs identify in their programs can help promote their participation in STEM education and transfer to four-year engineering programs. The research question at the heart of our study was: What do community college students, and especially those from URGs, value most in their engineering programs?

A greater understanding of students' experiences could identify early interventions and strategic opportunities to foster an awareness and desire among community college engineering students to transfer to 4-year colleges to complete their engineering studies. Understanding what URGs of community college students value can inform how these transfer students can be supported both pre- and post-transfer.

LITERATURE REVIEW

Much of what is known about URGs of students in their STEM experience is largely based on studies from four-year institutions. However, there are substantial differences between 2 and 4 year institutions (Whitehead, 2019). More students from marginalized backgrounds attend community colleges over 4-year institutions (American Association of Community Colleges, 2022). Thus, understanding how community colleges can attract, retain, and improve transfer rates of students is important (Rosas Alquicira et al., 2022). Rosas-Alquicira and colleagues (2022) concluded that providing intense research experiences opportunities for independent study/research, partnerships with other institutions, and finally professional development workshops for students and faculty members are crucial to promoting transfer. Parnes (2020) suggested that relationships with faculty members have the potential to impact student success at community college. Understanding the payoff of pursuing STEM transfer helps community college students confront financial challenges or debt and motivates them to invest in their education (Wickersham, 2020). Further, students appreciate the flexibility offered by community colleges as an important element in their pathway experience (Wickersham, 2020).

Increasingly, community colleges have been recognized for their role in STEM education and transfer STEM students' outcomes may be more heavily shaped by non-academic contextual factors relative to four-year native STEM students (Blaney et al., 2022). A study by Ortagus and Hu (2019) revealed that a positive relationship between the transfer experience and the level of selectivity of students' destination 4-year institution. This study also highlighted the benefit of starting at a community college before transferring to a 4-year institution.

The responsibility of addressing the myriad of realities and all other extra roles and responsibilities that impact STEM students does not lie with community colleges alone. Thus, community colleges should leverage or expand their existing networks to support their students by providing childcare, creating a culture where students feel that they belong, and helping students identify meaningful and well-paid work opportunities and financial support (Blaney et al., 2022). Carlsen and Gangeness (2020) demonstrated

that the use of shared advisers that cross the community college and university divide can provide a foundation of student success as students receive information about both campuses. When community college students have a sense of belonging, which is often achieved by participating in high impact practices like community-based projects, mentoring programs, internships, and culminating senior experiences, there is an increased probability of completing STEM degrees (Dihn & Zhang, 2021). Yet, Dihn and Zhang (2021) also found that minoritized identities (like being Black) are negatively associated with STEM baccalaureate attainment for transfer students. Thus, it is important to find out what helps support URGs who transfer to 4-year STEM degree programs.

THEORETICAL FRAMEWORK

We situate this work in Harrington and colleague's (2014) *Students as Partners* (SaP) framework. The SaP framework promotes students and faculty/academic staff working together as partners to develop teaching and learning experiences (Mercer-Mapstone et al., 2017). The SaP framework involves "a relationship in which all involved—students, academics, professional services staff, senior managers, students' unions and are actively engaged in and stand to gain from the process of learning and working together" (Harrington et al., 2014, p. 12). SaP advocates that students "contribute equally, although not necessarily in the same ways" to the formal and informal curriculum (Cook-Sather et al., 2014, p. 6), and the framework relates to this work impacting students' decision making. Several scholars have used the framework to study student engagement (Harrington et al., 2014; Mercer-Mapstone et al., 2017).

An integral concept in the SaP is that students describe their experiences through narrative construction, as individuals naturally have a narrative way of describing their life stories (Bruner, 1991). SaP highlights that cooperation among all stakeholders is crucial, and thus the voices of students are essential to co-construct their learning experiences. The nine steps of the SaP framework include: authenticity, inclusivity, honesty, reciprocity, courage, trust, empowerment, and responsibility that foster a relationship where students are equal partners (Harrington et al., 2014). In this study, we analyzed what values the participating students identified from their community college pre-transfer experience to help identify ways that community colleges can more effectively engage their students.

METHODS

The study took place at two different community colleges, Large Community college (LCC) and Public Community College (PCC), which were selected based on prior relationships established by the lead author during a National Science Foundation (NSF) grant project. One located in a Southeastern state and another in a Southwestern state in the United States. To understand the complex lived experiences of the URGs we studied a total of 19 (LCC = 4, PCC = 15) participants across the two institutions.

Participants and the colleges were assigned pseudonyms to protect their identifying information. Students were enrolled in the pathway programs at the participating colleges and consented to be recorded. The SaP framework informed development of the interview questions and focused on the experiences of the community college students and what they found of value in their time at the community college. Each interview lasted between 60 and 120 min. See Table 1 for a list of participants.

TABLE 1 Participant Details: Pseudonyms, major, academic year, and identity aspects.

Participants details	Self-reported identity
Eileen, computer science, 4th semester	White, female, heterosexual, upper middle class, dyslexia or ADHD
Charisma, general engineering, 4th semester	Black, choctaw native Åmerican and Irish, female, heterosexual, lower middle class.
Josephine, general engineering, 5th semester	Filipino, Irish, English, female, heterosexual, lower middle class
Kathryn Hill, AS engineering, less than 6 semesters	White, English, and German, female, lesbian, middle class.
Maya, AS engineering, 2nd semester	American Indian/Alaskan, native or black, female, heterosexual, upper middle class.
Otto, engineering, 4th semester	White, male, heterosexual, middle class.
Maleficent, civil engineering technology, less than 6 semesters	White, female, heterosexual, low income
Kiarra, computer science, 3rd semester	White, Russian, female, heterosexual, lower middle class
Ryan, computer science, 4th semester	Opted not to answer demographic info
Selena, civil engineering, 2nd semester	Black/African American, female, bi-sexual, low income
Shelly, computer science and business administration, 5th semester	American Indian/ Alaskan, Irish/German/Polish, female, asexual, low income, dyslexia or ADHD.
Shane, engineering, 5th semester	White, female, heterosexual, upper middle income
Sienna, civil engineering, 3rd semester	Black/African American, female, bisexual, low income.
Nicole, computer science, 2nd semester	White, German, Norwegian, Scottish, Icelandic, and Irish, female, heterosexual, middle income.
Tessa, engineering, 4th semester	White, female, cisgender, lesbian, upper-middle income.
Fabian, engineering, 5th semester	Hispanic, male, heterosexual, low Income.
Liz, electrical engineering, 6th semester	Hispanic, female, cisgender, low-income
Kevin, computer science, 3rd semester	Hispanic, male, heterosexual, low-income
Shannon, electrical engineering, 4th semester	Black, female, low- income

Interview protocol

Using a semi-structured interview protocol with 20 questions, we asked the URG students about their perception and experiences of community college. Sample questions included: Coming out of high school, what was it like navigating the decision to pursue community college? How did you decide community college was the appropriate path for you? What made you decide to choose this community college, specifically? How would you describe your interaction with faculty members? Do you go to your professors at all with confusion or questions? Do you participate in any activities on campus? How has your time at the community college helped you with building a community of peers, either in computer science or STEM in general?

Data sources and analysis

The interviews were audio-recorded with the consent of the participants, and later transcribed by a third-party transcription service, and each participant was assigned a

pseudonym. Interviews were imported to Dedoose 12 for data management and analysis. Data analysis was conducted in three stages, consisting of inductive coding where we developed a codebook, and pattern coding (Saldana, 2015).

Positionality

Given the importance of trustworthiness in qualitative research, it is important that we share our biases, commitments as noted by Merriam (1998), and locate our socio-political priorities while exploring the lived narratives of those URGs students because our life experiences impact the research. The first author is a postdoctoral researcher and woman of color with an international multicultural background whose work involves diversity, equity, and inclusion-driven academic research efforts. The second author is a black woman faculty member in engineering and a scholar in the field of racial equity who has studied STEM at the undergraduate and graduate levels. The third author is a black female undergraduate engineering student, and she participated in this project as a part of her research experiences for undergraduates (REU) program. Hence, we all were driven to unpack the experiences that URGs students value in their STEM journeys.

RESULTS

Our findings identified the implicit and explicit values of the undergraduate students in our study. For example, when the participants described the class size as intimate, an implicit value emerged. Implicit values represent less tangible aspects of value (e.g., individualized support) and explicit values represent what students see as a direct value (e.g., student support services).

Implicit values

We found that class size and the proximity of the community college to home were of great value to the participants and often impacted students' decision to pursue STEM in a community college. For example, Ryan, a computer science major 4th semester male student said, "I guess a lot of the PCC classes are high school sized classrooms as opposed to big lecture halls. And I've got familiarity, I guess, with the campus." There was a level of intimidation associated with the large class sizes at 4-year colleges whereas community college provided a safe space to the students. Ryan's statement indicates that he was able to navigate the campus and classes easily due to the small class size. In another example, Shane, a white female engineering 5th semester student mentioned she appreciated the classes because; "probably the support, like there's just people always there for you. Even the teachers, the students, just because of the smaller class sizes." Intimate class size represents a culture of safety and lowers the stakes of risks in the learning process comparted to learning in social settings with a lot of people that might perpetuate identity-based stereotype threats.

The low cost of failure and a shared value of collaboration is prevalent in community college STEM education. Our data highlighted that students did not perceive public failure as punitive in the community college classroom; rather classrooms felt safe. For example, Fabian, a Hispanic, male student, 5th year general engineering student mentioned that although it was engineering, students did not feel the competitive

culture in the community college setting. People were seen as individuals pursuing their own path rather than being forced to meet expectations of the monolithic student.'' Historically, students of color value collaboration over competition (Banks & Dohy, 2019). Consider how Malficent, a white female, low-income semester civil engineering technology student, highlighted the low-pressure environment at community college.

> It's a smaller college, and you have that more one-on-one. You can go up and talk to your teacher. There's 30 people in the class as opposed to a hundred. I'm like, you really should go ahead and do community college at the beginning, unless she has a full ride to some other college that she can go ahead and get her bachelor's. I just think that if she's going to have to do it on her own that really she should start at LCC, or a community college.

Malficent's comment represents the level of comfort she had overall. She highlighted the value of education, small class size, and one to one interaction with faculty members within the same quote which sums to the low-pressure environment where students don't feel overwhelmed.

According to Schudde (2019), engagement with faculty has a positive impact on college outcomes for students. Our findings revealed that the smaller classes created more immediate and frequent interactions with the faculty members in learning environment. One of our participants Otto, a white male heterosexual middle class 4th semester student in engineering, conveyed an appreciation of the faculty's ability to provide them individual help compared to their 4-year college experiences in which interactions with faculty are not as immediate and present. Otto reflected:

> I've enjoyed it at PCC because definitely a difference with the math teachers here. You pick good ones that actually enjoy teaching math, which helps a lot with learning. That's really what I think I got my passion back into math, because I always thought I was horrible at math because my math grades in high school were a lot lower…but really once I came to PCC, it's like I almost flipped the switch, and I started studying more, started kind of learning what these concepts were. …And my professor…He loves math. It was just like I was learning so much from him, and I was putting in a lot of time studying. I was learning.

Otto's statement highlights how trust motived him to learn in his math classes. He explained his love for math grew over the years at his college with the help of a math instructor. The passion faculty members exhibited highlighted an investment they had in their students. Tessa, a white, female, cisgender, lesbian 4th semester engineering student echoed that the professors want students to learn and grasp the concepts. She offered,

> If I liked the professor and I liked their teaching style, I go to their office hours or I email them and say, hey, can you help me out with this? And, and I stay after during class time and go before and it's… they work with you.

When students feel faculty members are willing to help and are available, students develop trust in the community at the college. Students value faculty member's authenticity and the feeling of inclusivity that develops when they feel like they belong in STEM.

Explicit values

A form of explicit support was evident in the level of on-campus resources and facilities available to students. Charisma, a black and choctaw native American female a 4th semester general engineering student commented on her experience with advising and how it relieved her anxiety about the courses she was taking. Sienna, a black/African American, Female, Bisexual, Low Income civil engineering, 3rd semester student also highlighted other campus support:

> I checked out a calculator from the women's center…a TI-84 I think… Miss H is really cool. She really good about giving information. So I have a computer at home that I got from PCC, the computers for success thing, and I told them that I'm in engineering, I need it for CAD, so they gave me one that's like something terabytes. Apparently, that's huge.

Receiving tangible support from college faculty and student support services provided the students with the tools they needed for success.

Participants valued opportunities to engage with the professional community and the opportunities for real-world application they experienced. These activities fostered students' formation of engineering identities. For example, Maya, an American Indian/Alaskan, native or black, female 4th semester aerospace engineering reflected:

> I get to use my skills, and I get to talk to these other students and encourage them or go to these discussions, like discussions and transportation and having them answer my questions…And also, like staff and getting more recommendations and meeting people that have connections in the field and they're more accessible, not a sea of 400 and the likelihood of me ever talking to them is like about 10%. So, I get those additional connections and networking.

Maya's comment highlighted the networking opportunities presented to the students at the community college in an intimate setting because that facilitates meeting professionals and industry recruiters. These connections help students develop strategies to navigate different resources while still enjoying an affordable education-value for money. Shannon, a black female low-income 4th semester electrical engineering student also mentioned how the networking opportunities that one gets at the community college helps in ultimately getting a job.

IMPLICATION FOR PRACTICE

Findings from this study offer several implications for community colleges in supporting URGs. Community colleges are perceived as a space in which students learn in an intimate class setting with fully invested faculty members (explicit) in a low-pressure environment with a focus on collaborative learning (implicit) by our participants. In hindsight they valued the sense of community.

Our study found that students appreciated authenticity (willingness to support students always), inclusivity (lack of structural or organizational barriers to reach out to professors and administrators), empowerment (students often felt empowered with all the help), trust (students trusted the nature of learning culture), and community learning (learning in a collaborative, low pressure climate)—all of which are values mentioned by SaP framework.

More robust student mentoring or structured advising support could further support the students' community college experience (Edenfield & McBrayer, 2021).

Our data show that students recognize the value of network capital; they understood the value of having peers from diverse industries across different age groups. We recommend that students learn how to tap networks directly in their college experience by program faculty building a formal professional network for the students. Also, our findings implied that students valued a culture of collaboration. Therefore, working with 4-year transfer receiving institutions on the value of community for URGs would provide these students with a continuum of support.

Finally, understanding what works for URGs of students can help reimagine what is needed to build more equitable systems of education. For example, this study demonstrated students' appreciation and a sense of belonging when instructors were reachable and available to the students after class and during office hours. That said, we expect this study may be used to augment cultural sustaining pedagogy at community colleges (Doran, 2021) and students' learning environments at 4-year institutions, so that transfer students feel supported. Providing campus resources and opportunities for networking will support students as they transition to 4-year colleges. Once on 4-year college campuses, helping students identify faculty mentors and opportunities for one-to-one time with faculty members can create an environment after transfer in which transfer students will flourish.

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