

WIP: Assessing Community Cultural Wealth and Funds of Knowledge for Students Attending a Co-Op-Based Engineering Program

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Abstract

This paper is a work in progress (WIP) exploring the experiences of students enrolled in an innovative engineering co-op program, Bridge Academy (a pseudonym). The inaugural cohort of the Bridge engineering program consisted of 25 students who began in August 2019. The conceptual framework for this study comprises community cultural wealth (CCW) and funds of knowledge [1]–[3]. CCW highlights the forms of capital, or cultural resources, available to marginalized students. Using qualitative methods, we found that Bridge Academy helps students to mobilize various forms of community cultural wealth for the participants. Many students demonstrated funds of knowledge such as navigational capital in their choice of the Bridge program to limit debt compared to traditional engineering programs; the program is in essence flipped so that participants spend more time in paid co-op settings. Participants also displayed resistant capital in their choice of Bridge over traditional education because Bridge fit their learning preferences. Students gained social capital from their program peers through their living and learning community. Although the students brought in their individual funds of knowledge, they built a synergistic form of social capital through Bridge, further developing their funds of knowledge compared to what they might have experienced through traditional education. The students appeared to represent a traditional engineering cohort according to typical demographic measures (e.g. race, gender), however their prior life experiences, funds of knowledge, and use of CCW made their choices and experiences informative. As described by a participant, the students’ “untraditional backgrounds” and “mutual understanding of struggling through life” is what made them a “pretty unique” community.

Introduction

Extensive research has been conducted on underrepresented engineering students, yet the demographic diversity of engineering degree programs remains stagnant [4]. The percentage of bachelor’s degrees completed by women has risen from 18.1% to 21.3% over the last 10 years, however over the same time period the percentage awarded for Black engineers has dropped from 4.7% to 4.1%. Degrees awarded to Hispanic engineers has increased, from 6.5% to 11.1%, although their representation still remains below that of the US population as a whole.

To address engineering’s homogeneity, there have been efforts and calls to broaden participation. The National Academy of Engineering released four reports from 2011-2014 examining different aspects of the issue [5]–[8]. Approaches to increasing diversity have generally involved programmatic efforts to support underrepresented students. In a literature review, Tsui [9] outlined 10 common intervention strategies used to increase diversity. It was found that most of the strategies focus on improving skills through summer bridge programs, tutoring, workshops, and creation of learning centers.

In 2017, the National Society of Black Engineers created a research-based toolkit of intervention strategies [10]. Comprehensive programs have found to be effective such as the Meyerhoff Scholars Program at the University of Maryland – Baltimore County and the Minority

Engineering Program, which was founded in 1973 in California and now exists in many universities [11], [12]. The Meyerhoff program's students achieved higher grade point averages, graduation rates in science and engineering, and admittance to graduate programs than underrepresented minorities within comparable samples [11]. Intervention programs are beneficial and, to some extent, successful. Nonetheless, despite the proliferation of these programs the data cited above shows that there has been very little progress made in increasing the diversity of engineering education. In recent years there has been an increasing awareness of broader structural and cultural issues that impact underrepresented students. Frameworks that have been used include critical race theory [13]–[15], ruling relations [16], and community cultural wealth [1]–[3]. These frameworks recognize racism as structural and omnipresent within the United States. They also acknowledge that normative or traditional expectations and knowledge play a significant role in reducing opportunities for students outside of the dominant group. Minoritized students bring assets to engineering through unique experiences and knowledge that majority students may not possess [17].

We are seeking to understand how a unique co-op based engineering program, designed specifically for increased access, impacts the experiences of participating students. Additionally, we are using CCW and funds of knowledge to understand what assets students bring into the program and their co-op jobs, and how they gain from participation in the program itself. Our primary research question is: What assets do students in a co-op based engineering program bring to that program, and what assets do they gain from participation in the program?

Background of the Bridge Academy

The Bridge Academy presented within this WIP is a two-and-a-half-year (five semester) upper division engineering program, designed for off-campus students. It is housed in the upper Midwest region of the United States. For the first semester, the Bridge program consists of an intensive on-campus experience with instructor-led and student-led competency-based (as opposed to the typical topic-based) engineering classes and learning experiences. Students spend subsequent semesters participating in a co-op anywhere in the world while at the same time continuing to participate in the learning experiences remotely. Students return to campus annually for the Bridge Conference, at which students present about their co-ops and undergo competency assessments (The Bridge Conference was held virtually in 2020 due to Covid-19).

Bridge has various unique features designed to support non-traditional students. For example, all travel and living costs associated with the program, including the Bridge Conferences, are included in the tuition. Additionally, the program includes costs for any of the students' family members. By incorporating these costs into the tuition, financial aid packages can cover the charges. This eliminates extra or unexpected out-of-pocket costs for students. Another unique feature with the Bridge Academy is the freedom of the co-op experience. Students have the ability to co-op wherever they choose with no restriction in location. Thus, the majority of the time students spend in their co-op locations, which could mitigate barriers of relocation and expand access to engineering education should they secure co-op opportunities in their home community. Underrepresented minorities and first-generation students often have family or financial obligations that prevent them from attending school far from their homes.

The inaugural cohort of the Bridge engineering program who participated in this study began in August 2019. The cohort consisted of 25 students, 19 of which interviewed with us. Of the 19 students interviewed, three self-identified as women, one was Asian, two were Hispanic, one was Indigenous American, and 15 were White. Two participants had first-generation college status. Overall, the cohort does not exceed national engineering averages for gender and race, yet there is some suggestion from demographic surveys that it is more diverse in age and income. One student explained that they were previously homeless, and others have described that they were from low-income backgrounds. Thus, the cohort consists of many students with non-traditional life experiences.

Methodology

This study was informed by the frameworks of Community Cultural Wealth [17] and funds of knowledge [18] to understand the assets that the cohort of students in the Bridge Academy brought to and gained from the program. Specifically, we focused on six types of capital outlined within CCW: aspirational, navigational, social, linguistic, familial, and resistant [17]. By focusing on these sources of capital that the students possess in relation to their marginalized statuses, we capture their unique assets compared to dominant forms of capital. Capital of the dominant group is used to “legitimize certain cultural norms and practices as superior” [1, p. 95], thus CCW provides means of resistance for marginalized students. Funds of knowledge are “bodies of knowledge and skills that working class families possess to survive and make a living even in the midst of economic dislocations” [3, p. 200]. These funds of knowledge provide unique insights when solving engineering problems, leading to innovative solutions [2], [3].

The data for this paper were collected through semi-structured interviews with the first cohort of Bridge students conducted at the beginning of the program and at the end of their first semester on campus. Interviews were conducted in person at the Bridge Academy. In the initial interview, we solicited narratives about their early experiences leading to the Bridge program. The second interview explored their experiences in the Bridge program and their aspirations for their co-op. Interviews were professionally transcribed and pseudonymized.

Data were analyzed using a narrative approach that includes multiple readings [19]. The multistep process included reading for: familiarization with the transcripts, identifying content such as individuals mentioned and major storylines, detecting identity of the participant and others, and uses of CCW and funds of knowledge. After the readings, a narrative case was written for each participant.

Quality was considered internally and externally. Internally, we used the Q³ framework [20], [21] as a reflexive tool to guide each phase of the project. An advisory board provided advice and monitored the project for external quality checks.

Findings and Discussion

In this section, we present preliminary findings from the first two series of interviews with the Bridge program participants. We used the frameworks of community cultural wealth and funds of knowledge to highlight assets the students brought to the program.

Community Cultural Wealth

Community cultural wealth highlights forms of capital that Students of Color bring from their communities and homes into the classroom [17]. The Critical aspect of this framework shifts the focus of values from White, middle class culture to the cultures of Communities of Color [17]. We recognize that CCW was intended for use with People of Color, however it informed our study through explorations of capital that minoritized engineering students bring into the Bridge program.

The Bridge program was typically introduced to participants while they were taking first year classes at their initial colleges. Bridge facilitators went to various colleges to recruit students. One participant described “sign[ing] up immediately” because he trusted them and knew this would propel him towards his future aspirations. He also felt that the program would fit his style of learning better, therefore he had aspirational capital to pursue it. Other participants also mentioned choosing the program for its “project oriented” and “very hands on” learning styles that align with their interests. Participants displayed resistant capital by choosing Bridge over traditional education systems because Bridge fit their learning preferences.

Students described their choice in the Bridge program not only for the educational structure, but the financial aspect as well. The program does not demand a traditional full school load with the potential addition of working, rather it gives students the time to learn within their co-ops and the classroom without competing. For example, a student stated, “I also see a lot more potential... with this whole program setup other than college where I’m off just studying 24/7. They really try to focus their classes in to get you the information you need in the most efficient time possible.” Many students also recognized the advantage of industry connections that come from the required co-op placement. These instances display sources of navigational capital because students purposely chose the program for financial backing and future connections. According to Yosso, navigational capital recognizes “the social networks that facilitate community navigation through places and spaces” including “schools” and “the job market” [15, p. 80].

The social capital that was built within the Bridge program was illustrated through many of the participants’ narratives by the support and care that was built between peers and facilitators. After his first semester, one participant described that the best aspect of the program was “the amount of support that we get through everything going on,” which included both “academic” and “personal” lives. The cohort was so close, another participant acquired the group’s support for their marriage proposal and party. Students recognized that “every single one of the Bridge students came from an untraditional background” where they “all have something that [they’re] struggling with.” Therefore, “that mutual understanding of struggling through life is what makes us approachable to everyone,” which was “pretty unique.” Another participant described this care, stating the “best part of the program so far for me has been the people... Fellow students [became] really good friends.” They expressed social capital with the “supportive” facilitators and professors, stating that they are “so open to speak with us and receive feedback from us.”

Funds of Knowledge

Although “funds of knowledge” was termed by Vélez-Ibáñez and Greenberg [18] to describe the abilities, assets, bodies of knowledge, and cultural influences of Latinx students, we applied it to the Bridge program because of participants’ unique life experiences that placed them in minoritized positions. Our approach for engineering aligns with Smith and Lucena’s [2] use of funds of knowledge for low income and first-generation engineering students. Prior to interviewing we expected more diversity within the nontraditional education program in order to appropriately apply Critical frameworks. Since the demographics were similar to national engineering demographics, we were instead informed by funds of knowledge in order to investigate how students navigated into the Bridge program and the assets they brought. This shift towards an assets-based approach is important for nontraditional learners because education has historically relied on a deficit model to structure instruction for minority students, consequently underestimating funds of knowledge [18].

Many of the participants described growing up in working class families and one was formerly homeless. They had worked various jobs prior to Bridge in order to afford education. Similar to Smith and Lucena [2], many of our participants were attentive to minimizing costs of their education because of their low-income upbringing. This distinguishes them from their privileged peers that excel with minimal barriers in traditional education [2]. One participant described their funds of knowledge gained through work experience by stating, “I ended up taking a year off of high school, I picked up a job... I worked for a year there and I basically picked up the money to put me through [college].” Participants were cognizant of what it took to afford an education and applied this to their choice of the Bridge program.

Another participant described their choice in Bridge because it helped with current familial finances. They stated,

“I was trying to figure out the best way to support my family and go to school at the same time... and they told me about this program where I could work and go to school at the same time but work in my field. So I wanted to be able to find a job once I got out of school because I had found most of the jobs that I found online they wanted years of experience so I figured why not graduate and have work experience so I can get those jobs.”

The Bridge program itself provided students with unique assets through the experiential learning aspect. One student described that “engineers have very little design experience” and employers look for experience. Therefore, the co-op experience that Bridge requires gives the cohort funds of knowledge and advantages to navigate career options when they complete the program.

Conclusion

Through this work in progress, we have found that although the Bridge program aligns with national demographic averages of traditional engineers, their life experiences are unique compared to traditional engineers. Thus, we shifted CCW and funds of knowledge to focus on nontraditional engineers rather than the diverse demographic population we were anticipating for the program. Compared to the dominant group’s story of traditional engineering education, the Bridge program provides various forms of capital and funds of knowledge to its students.

Together they have built a community with strong social capital that will help them throughout their careers. They are building new funds of knowledge through experiential learning that they may not have experienced with traditional education.

Many elements of the Bridge program are similar to those proposed by NSBE [10] such as mentoring relationships, relevant professional development, and semester check-ins. Thus, the program might be attractive to underrepresented minority students. As previously mentioned, we were surprised by the seemingly typical profile of the cohort as a whole. We were left wondering if underrepresented minority students have sufficient awareness that such a program exists, how location might still matter even though they will spend minimal time at the home campus (e.g., more comfortable with greater urbanicity), and if representation among faculty and other students would make Students of Color hesitate to apply.

Future Work

This WIP is currently in the data collection phase for the cohort's last year of the Bridge program. Once a semester we interview the participants to explore their development within the program. The broader impacts of the project include a planned workshop with findings from the project for future research and collaborations. Selected narratives from the 19 students will be presented to engineering programs to highlight ways in which academia can support underrepresented students centered around an asset-based approach.

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