

“Barbed-Wire Boundaries”: Hidden Curriculum, First-Generation and Low-Income Engineering Students, and Internship Acquisition

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Abstract

Engineering industry internships provide significant benefits for undergraduate engineering students’ careers. First-generation and low-income students (FGLI) are one group of marginalized students who access internships at lower rates compared to their non-FGLI peers; however, the reasons for this gap have not yet been explored in the literature. In this paper, we investigate the internship acquisition experiences of FGLI engineering undergraduate students at a mid-sized private university in the western United States. We conducted ten semi-structured interviews to capture FGLI engineering students’ experiences encountering and navigating the process of obtaining an internship. Our findings highlight the ways in which much of the knowledges surrounding the internship search and recruitment process are implicit and how this implicit hidden curriculum and technocratic culture create structural barriers to internship access for FGLI engineering students. We present a structural critique of internship recruitment through the framework of hidden curriculum and propose that companies and engineering education institutions work together toward transparent modes of evaluation for internship recruitment.

Keywords: Internship recruitment, hidden curriculum, first-generation students, low-income students

Introduction

Engineering career pathways—how engineering students enter training programs, become socialized in the profession, and enter the workforce as engineers—have been a source of significant engineering education research and interest (Lowell et al., 2009; Sheppard et al., 2014). How students experience engineering, and the choices students make throughout and in response to their engineering education experiences, are fundamental influencers of their future engineering career pathways.

The engineering industry internship is one component of engineering career pathways that offers significant benefits for an undergraduate engineering student’s future engineering career prospects. In our study, we broadly define an *internship* as any work experience within an engineering industry setting for any duration, including summer internships, cooperative

education programs, and internships during the school year. We chose not to distinguish between the kind of internship to capture a broad range of internship experiences. While internships are often not explicitly required for a degree in engineering, they provide substantial advantages for engineering students to form their engineering professional identities and advance their engineering career pathways, such as opportunities to apply classroom principles into practice, demonstrate work experience to recruiters, and gain access to the engineering professional world (Capobianco, 2006; Castillo et al., 2022; Godwin et al., 2016; Powers et al., 2018; Trego et al., 2019). However, recent studies have shown that engineering industry internships are not accessed equally by all students; students from marginalized backgrounds access internships at a lower rate compared to their non-marginalized counterparts (Atwood et al., 2021; Lapan & Smith, 2022).

First-generation and low-income (FGLI) students are one group of engineering students that has received increasing attention in recent years due to their status as marginalized students in engineering (Atwood et al., 2020; Martin, 2015; Martin et al., 2015; Verdín et al., 2021). However, one area that has not yet been explored is how FGLI students navigate the internship acquisition process. While previous quantitative research has shown that internships boost both FGLI and non-FGLI engineering students' engineering professional identities, FGLI students remain less likely to take on internships compared to their non-FGLI peers (Atwood et al., 2021). This differential access to internship experiences motivates the research question: *How do undergraduate FGLI engineering students encounter and navigate the process of acquiring an internship?* In answering this question, we can begin to understand why this inequity exists and promote more equitable access to hidden curriculum of internship acquisition so that more FGLI students may reap the benefits of these co-curricular opportunities.

Background

Previous work on FGLI undergraduate engineering students has focused on using asset-based frameworks, particularly funds of knowledge and social capital theory, to explore student experiences. Funds of knowledge theory focuses on the knowledges drawn from an individual's family unit and social relationships with others in a community that manifest in daily life (Moll et al., 1990; Verdín et al., 2021; Wilson-Lopez et al., 2016). Social capital focuses on how social networks, such as peer and family networks, can provide resources to achieve a goal (Bourdieu, 1986). Social capital theory highlights the access, availability, and activation of social credentials, social influence, and information that shape an individual's ability to successfully complete an objective (Martin, 2015; Martin et al., 2014).

According to Martin (2015, 2020), first-generation engineering students have differential levels of access to and activation of resources embedded in their social networks compared to continuing-generation students, which impact their entry to and persistence in engineering. However, funds of knowledge and social capital theory have led to an incomplete structural critique focused on simply identifying navigational barriers for marginalized students' entry and persistence in engineering (Martin, 2015; Martin et al., 2020). In this paper, we expand structural

critiques posed by previous social capital scholars by using theories of hidden curriculum and technocracy to unpack the structural forces that create the navigational barriers to internship acquisition.

Engineering Internship Acquisition

We divide the internship acquisition process into two distinct processes: the internship *search* process and the internship *recruitment* process. Whereas internship search focuses on how engineering students actively seek out internship opportunities (such as going to career fairs), internship recruitment comprises the organizational processes, interactions, and people that play a role in interacting with prospective intern candidates, reviewing intern applications, and ultimately deciding which students are “successful” in acquiring internships. Both the search and recruitment processes contain structural inequities that impact students, and FGLI engineering students’ experiences open an avenue to structurally critique these processes.

While there is wide variation in how companies recruit, select and hire interns, for most companies, this process is largely bureaucratic in structure, as companies often need to meet particular legal and ethical hiring requirements (Barber et al., 1999). However, internship recruitment and hiring is a social and discursive process requiring the applicant to interact with a plethora of individuals, such as company representatives, recruiters, and hiring managers, that have significant power over their success in the internship recruitment process, and therefore, their future careers (Bowen et al., 1991; Holzer et al., 2006). Previous work has sought to elicit how the social nature of hiring, as well as social networks for referral and opportunities, contributes to a racialized, gendered system that disadvantages marginalized people (Bowen et al., 1991; Gemkow & Neugart, 2011; Holzer et al., 2006; Moss-Pech, 2021; Wofford & Smith, 2022). The discursive social norms around preparation, presentation, professionalism, and cultural standards in recruitment spaces all contribute to a complex, often implicit cultural landscape for students, particularly marginalized students, to navigate.

Particularly for FGLI engineering students, the process of obtaining an internship is an uphill battle due to the structured, often implicit nature of internship recruitment that is often misaligned with their funds of knowledge and social capital (Martin et al., 2020). This paper seeks to explore the ways in which FGLI engineering students encounter and navigate internship acquisition, attending to the structural inequities hindering their success in the recruitment process.

Theoretical Framework: Hidden Curriculum and Technocracy in Engineering Culture

Understanding engineering culture and its effects on marginalized students is central to structural critique. In this paper, we examine the impact of two aspects of engineering culture on FGLI engineering students’ internship acquisition experiences.

One way that marginalized students experience disadvantages in the current education system is through *hidden curriculum*. Formally, hidden curriculum is defined as “the unwritten, unofficial, and oftentimes unintended, assumptions, lessons, values, beliefs, attitudes, and

perspectives that are not openly acknowledged in a given environment” (Villanueva et al., 2020, p. 1549). In engineering education, hidden curriculum manifests in the implicit socialization and professionalization practices that neophyte engineering students absorb through their experiences in engineering (Polmear et al., 2019; Rea et al., 2021; Sellers & Villanueva, 2021; Villanueva, Carothers, et al., 2018; Villanueva et al., 2020; Villanueva, Gelles, et al., 2018). While recent scholars have distinguished between active and passive hidden curriculum to recenter marginalized students’ agency in leveraging hidden curriculum (Downey & Villanueva, 2022), for this paper, we focus on hidden curriculum as an institutional force that seeks to maintain the status quo in career development.

In addition, previous work has described various aspects of engineering professional culture and how engineering students are professionalized into it (Cech, 2014; Cech & Waidzun, 2022; Seron et al., 2018). *Meritocracy* is defined as the belief that the means of social advancement should be centered around one’s individual ability, and those who succeed earn it through hard work (Young, 1994). In engineering, the close ties between meritocracy and technical ability create a technocratic social structure in which social advancement is predicated on showcasing technical expertise (Cech, 2014; Faulkner, 2007). In a technocratic system, people with the highest technical ability and merit should be granted the most privilege, regardless of race, gender, or other identities (Cech, 2014). However, this identity-neutral perspective reproduces racialized and gendered structural inequities as they remain unchecked and unchallenged by the people making key recruitment decisions (Cobb, 2017). In particular, the technocratic engineering mindset views marginalized students through a deficit perspective, especially if their access to hidden curriculum of engineering is more limited. This deficit perspective is based on technocratic institutions demarcating technical work with “rigor” and “mastery,” setting boundaries along which performances of gender, race, cis-heterosexuality, masculinity, and Whiteness assert dominance over marginalized students (Slaton, 2010).

As a result, previous explorations of FGLI engineering students have found that they encounter a hostile technocratic engineering culture, in particular delegitimizing their practical experiences for “by-the-book” classroom curricula, imposing significant financial pressures, and causing curriculum overload without providing needed support structures (Atwood et al., 2021; Martin et al., 2020; Smith & Lucena, 2016; Verdín et al., 2021). These experiences can cause FGLI students to have less developed engineering professional identities and reduced senses of belonging in engineering compared to their non-FGLI counterparts (Atwood et al., 2021; Yang et al., 2022). Hidden curriculum and technocracy provide the language to critique the nuanced interactions between students and internship acquisition and suggest paths toward reimagining internship recruitment for FGLI and other marginalized engineering students.

Methods

Study Site and Participants

We conducted this study as part of a larger exploration of the role of internships in forming first-generation and/or low-income students’ professional engineering identity. The

study site (IRB #47781) and grant administration site (IRB #1259788-2) institutional review boards approved the study. Participant selection occurred through an online pre-screening survey distributed to all engineering departmental and student organization listservs at a private, highly selective mid-size university in the western United States that does not require internships for degree completion. The survey asked participants for the number of engineering industry internship experiences they had and the top three most memorable internships. The survey also collected demographic information. We asked participants to acknowledge informed consent prior to starting the survey. Upon completion, we prompted survey participants to provide their name and email if they were willing to participate in a follow-up interview, in which they received a \$25 gift card for compensation for their interview time.

The online survey recorded sixty responses. Twelve respondents met the interview eligibility criteria based on our definitions of FGLI status from previous work (Atwood et al., 2020). For first-generation, respondents must have identified that neither of up to two “parents” had graduated with a bachelor’s degree or higher. For low-income, respondents must have selected “low-income” or “lower-middle income” to an item asking them to report their family income while growing up. After filtering the responses based on the selection criteria, we contacted twelve participants for interviews. We interviewed the ten students who replied to our interview request. Table 1 shows the demographics of the ten interview participants based on their self-reported survey responses.

Table 1. Study Participants

Pseudonym	Gender Identity	Race/Ethnicity	Year	Major*	FGLI status**
Liam	Man (he/him)	Asian/Asian-American	4	ME	FG
Bryan	Man (he/him)	Southeast Asian	6^	ME	LI
Jacob	Man (he/him)	Hispanic/Latinx	4	ME	FGLI
Mason	Man (he/him)	Black/African-American	6^	EE	LI
Susanna	Woman (she/her)	Hispanic/Latinx	3	CS	FGLI
Arjun	Non-binary (they/them)	Asian/Asian-American	4	EE	FG
Adriana	Woman (she/her)	Hispanic/Latinx	6^	DE ⁺	LI
Gabriel	Man (he/him)	Hispanic/Latinx	3	ME	FGLI
Blake	Man (he/him)	Hispanic/Latinx	4	ME	FGLI
Marvin	Man (he/him)	Asian/Asian-American	3	DE ⁺	FGLI

*Major abbreviations: ME = mechanical engineering, EE = electrical engineering, CS = computer science, DE = design engineering

**See text for detailed definitions.

^Students in their 6th year were enrolled in a co-terminal bachelor’s/master’s degree program.

⁺ The Design Engineering major is a separate Bachelor's of Science degree but has significant overlap with the mechanical engineering major.

Interview Process

We conducted one 45-minute semi-structured interview with each participant over the video conferencing platform Zoom during Spring 2021. We chose semi-structured interviews to encourage elaboration, flexibly probe interviewees' experiences, and build rapport with the interviewees (Holstein & Gubrium, 1995). We divided the interview into two parts. First, the interviewer asked how the student acquired their internships and their experiences during their internships, including, "How did you find this internship?" and "What challenges, personally or professionally, did you experience in finding an internship?" Second, the interviewer asked questions prompting participants to reflect on whether and/or how their FGLI identity may have impacted their experiences. The interviews were both video- and audio-recorded, but only the audio recording was kept for analysis. We emailed informed consent forms to participants prior to the interview and requested participants to consent verbally at the beginning of the interview. We used Rev, an online transcription service, to transcribe the audio and further corrected the transcripts for inconsistencies and mistakes.

Transcript Analysis

We coded the interviews using a two-step iterative process via qualitative coding software Dedoose. In the first stage, three authors conducted a reading of the transcripts, then generated an initial codebook based on inductive codes from the transcripts, deductive codes from prior work on FGLI students, and the research questions (Saldaña, 2015). Inductive codes included recurrent phrases in the transcripts such as "knowledge barrier" and "time barrier," whereas deductive codes included terms from literature based on the broader research project questions and frameworks such as "funds of knowledge" (Verdín et al., 2021). We coded one transcript as a "norming transcript" for its likely coverage of the most codes in the initial codebook. After discussing discrepancies in coding, we collectively refined the codebook and identified negative cases to promote coding reliability (McAlister et al., 2017). The transcripts were then divided such that each coder coded six transcripts, and each transcript had two coders. After coding, we individually wrote analytical memos on the subset of transcripts we coded and collectively consolidated the codes into categories (Birks et al., 2008).

In the second stage, the first author developed a second codebook inductively using axial coding to more precisely capture the experiences of finding internships described in the transcripts. Examples of new codes included "identity-based connections," "curricular barriers," and "adapting to interests." The first author individually coded all ten interview transcripts with the new codebook, consolidated codes into themes, and wrote another analytical memo based on the new coding scheme.

Positionality

We engaged in a reflexive process in which all researchers contributing to the work participated in several dialogues and identified the most salient aspects of our positionality that impacted the research process along the dimensions outlined in Secules et al. (2021). The lead author then synthesized these team contributions into a succinct positionality statement highlighting the key identities and backgrounds that informed the research team's directions and choices. This discursive communication choice led us to take a balanced approach to our positionality and illuminate the key aspects of transparency necessary for research communication while removing details that may contribute less significantly to the research process. Because the lead author undertook the bulk of the transcript analysis during the second coding iteration and the development of the paper, we separated his positionality statement from the positionality statement of the team.

The first author identifies as a cisgender Asian-American man and doctoral student in an engineering field. He does not come from either a first-generation or low-income background. Having had previous experience in engineering education research on marginalized students as well as familiarity with interview-based methods, critical theories, and theories of structural inequity, he came to this research study with a distinctly qualitative, interpretive lens compared to the rest of the research team. This set of identities, including the researcher identity, placed him in a position of power in relation to the participants he interviewed in this study. To mitigate these power dynamics and establish rapport with participants during the interviews, he shared experiences from his own undergraduate education throughout the interview, which often proved to be a source of additional conversation with the interviewees. While this technique may introduce additional hidden curriculum or socialization into participant responses, he chose this approach to highlight his solidarity with participants' struggles. To ensure that the researcher's own experiences did not obscure those of the participants, we only coded participant responses. Furthermore, during the transcript analysis, his interpretivist background motivated him to pursue inductive analyses in the second iteration of coding compared to the mixed inductive-deductive coding team-based approach of the first iteration, and his epistemic grounding in critical frameworks enabled him to apply the hidden curriculum and technocracy as modes of structural critique and analysis.

The remainder of the research team held a variety of non-dominant identities, including women, Black, and former first-generation student. All members had prior experience in engineering education research as well as in engineering industry internships during their engineering education, and all members except the first-author doctoral student held teaching positions at the time of the study and advised students on finding internships and full-time employment. The principal investigator, who resides at a different institution from the study site, recruited participants to minimize possible perceived coercion during participant recruitment. These positionalities primarily impacted the team-based analysis during the first round of coding.

Research Quality

In our study, we took several steps to ensure research quality during the interview process following the quality management framework proposed by Walther, Sochacka, and Kellam (2013). First, we used purposive sampling to ensure we were able to capture the experiences of first-generation and low-income students. Second, highlighting the co-construction of experiences as a mechanism of validation during interviews, the interviewer shared their own experiences of finding and accessing internships to promote dialogue and elicit rich descriptions of the phenomenon under study. Third, prior to transcript analysis, we added to the transcripts specific contextual language and information associated with the study site that the researchers were familiar with. Incorporating these contextual adjustments in the transcripts prior to coding increased the researchers' ability to interpret experiences within the context of the participants, therefore serving as another validation mechanism.

With respect to transcript handling, we used negative case analysis throughout our codebook generation and coding processes to systematize the coding application and increase inter-rater reliability (Emigh, 1997). We present one example of negative case analysis later. In addition, the second round of coding systematically excluded experiences that were less relevant to finding and accessing internships, enhancing process reliability. We used analytical memoing to promote reflexivity on the research process and, in particular, give the researchers opportunities to consider their own interpretive frameworks in analyzing the transcripts and understanding how their positionalities and power dynamics bore on their interpretations of the participant transcripts (Birks et al., 2008). Lastly, all documents related to interview protocols, codebook discussions, and analytical memos were cross-referenced when necessary in drafting and communicating our methods and findings.

Protection of Participants

We ensured the protection of our participants in various ways. Our study was approved by the university's institutional review board. Throughout the study, the participants only interacted with the first author, and the first author masked all transcripts prior to transcription. As a result, other authors who participated in transcript analysis and reporting did not encounter any personally identifiable information in the transcripts. In addition, the first author's positionality as a critical researcher led him to interact with participants with an ethic of care, particularly in sharing information about himself to co-construct situated knowledges of participants' experiences and highlight his solidarity with participants in their struggles (Reich, 2021). Furthermore, the first author chose a primarily inductive approach to the second round of coding to better honor participants' lived experiences within researcher-participant power structures (Martin et al., 2022). During reporting, we removed all identifiers in the transcript, such as participation in student organizations, attending specific events, and accessing specific resources, unless directly relevant to the participant's experience. In addition, because the site uses a different term for FGLI, we indicate where we replaced the term with brackets to ensure

site anonymity ([FGLI]). Because participants noted that major and year significantly impacted their internship experiences and opportunities (discussed later), we include these in the reporting.

Findings

FGLI engineering students identified several key areas of internship acquisition that they often needed additional knowledge for when encountering internships. They navigated internship search and recruitment using a variety of techniques, finding that identity-based connections with other marginalized peers and engineers often led to more success. In addition to knowledge barriers, students experienced temporal inequities perpetuated by structural forces such as curricula.

Knowledge Barriers to Internships

In encountering internships, every participant described not knowing some aspect of how the internship acquisition process worked or the skills or credentials necessary to be successful in obtaining an internship. In this section, we focus on three key areas of knowledge that participants consistently self-identified that they lacked when they first encountered internships and describe how participants attributed this sense of lack of knowledge due to the FGLI experience.

The first knowledge barrier was simply being aware of internships in general. Almost all participants mentioned some refrain of “I didn’t know internships existed.” Bryan described the experience of discovering internships, noting, “Freshman fall, you have a lot of people finding internships and I didn’t even know what was going on until it was April... I had never heard of [internships] before.” Bryan highlighted the first year of college as a crucial starting point that framed the remainder of his internships—particularly with the transition into college, the peers who knew about internships were able to start the process before him and secure internship positions before he was even aware of them. It was only through observing and interacting with peers who did have internships that participants learned that internships were an option. Similarly, without knowing the value of internships, Adriana simply did not prioritize them over coursework or other parts of her experience, stating, “[Internships] was never my top priority. My top priority was staying focused on classes, I’m going to do some groups and a job will come afterwards.” Adriana assumed that simply getting the degree would lead to job opportunities. Only through talking to their peers who obtained internships did Bryan and Adriana become aware of the implicit options, benefits and potential means to access them.

The second knowledge barrier was what companies valued in an applicant. Learning this information was generally experiential: it only happened in interview settings and after participants were accepted. Participants found that they needed to interact with a recruiter or the target of a networking opportunity in a way that left a lasting positive impression, whether through good communication or highlighting technical skillsets. For some participants (often not men), this type of interaction was unnatural and served as a hurdle. Adriana noted, “I know that the person went to [university] and I went to [university] too so I can just talk to them. It feels so

weird because I've never talked to that person before... I think I don't do it in the proper way because I rarely get any responses in those cases.” Adriana’s description of how “doing [networking] in the proper way” was something achievable and tangible underscored the implicit nature of interpersonal communication in internship recruitment. Through his interview process, Jacob learned about the importance of listing all of his achievements on his resume. He noted, “[My resume] was kind of basic and it didn't have ... Not only are you supposed to quantify your achievements and stuff. I think that's something that probably made me lack when it came to networking.” Jacob’s experience showcased how unwritten rules and norms of communication also extended to written documents, in the name of presenting oneself positively on paper. Additionally, participants learned during their internships the key factors that contributed to an offer. Gabriel noted, “Now that I've had a couple internships and interviewed with several different companies, one thing that has become really evident to me is that companies really prioritize hands-on experience and a good GPA.” Gabriel's internship experience subsequently changed how he presented himself for future internships. Implicit cultural and professional norms of how to prepare and present oneself professionally continued to bear on participants’ experiences. Not being aware of these professional norms could impact students’ success in internship recruitment. Thus, the implicit rules of engagement for interacting with companies and their representatives were emblematic of the structured and rigid system of internship recruitment—rules that FGLI students had not been taught.

The third knowledge barrier was university resources: few participants knew about or utilized them. In conversations with his peers in an identity-based student organization, Marvin realized how little he knew about the resources available to him through the university and engineering school. He expressed, “I don't know if I've ever used any resources from the school of engineering, and I don't know any of them... I'm sure there are a lot of resources out there to help us, but we just don't know about them.” Despite the university and school of engineering offering various resources including a university-wide career center with extensive programming and career-oriented mailing lists, Marvin found that these resources were not accessible because he never encountered them at the university or in the school of engineering. As will be described later, this led to him experiencing significant difficulties in navigating and orienting his internship search toward his interests.

By and large, students attributed the various gaps in their knowledge of internships to their FGLI status. In particular, all participants felt that the lack of pre-existing connections to people who had had internship recruitment experiences—for example, family members, family friends, or other connections—made internship acquisition significantly more difficult. As Gabriel stated, while access in and of itself to internships and applications was equitable, “as a [FGLI] student, I don’t have anyone that I can ask, or I’m not familiar with how companies function and how they hire engineers and at what times. This is all information that I have to somehow somewhere figure out by myself...” Gabriel emphasized how the lack of interpersonal support systems with people who had had the experiences of internship recruitment became a knowledge barrier to being successful in his internship searches. Unlike non-FGLI students, who

may have access to those implicit knowledges through their connections, he felt that he was largely on his own to learn how the system worked.

Navigational Techniques

Once students were made aware of the opportunities and benefits of engineering industry internships, they had to navigate the complex internship recruitment landscape. We focus on two recruitment methods: interacting with recruiters at career fairs and using identity-based connections. Participants also mentioned instances of leveraging peer support such as pooling money for practice problems (Susanna) and providing encouraging words in the face of uncertainty (Mason), but because we chose to focus on direct participant interactions with the recruitment institution, we considered these areas of support outside the scope of our study.

1. Recruitment Paths

Half the participants gained at least one internship through standardized application processes that included connecting with recruiters at career fairs, applying through online portals, and interviews. Online applications were the main mechanism for participants to formally apply to internships, and every participant except Gabriel initially utilized a “broadcast seeding” approach to online applications—applying to as many places as they could in the hopes that at least one would be successful. Bryan noted that he was not aware of the sheer number of applications that he perceived others applied to, explaining, “I applied to a bunch of mechanical engineering internships my sophomore year for sophomore summer, but I didn't get any.... You have to apply on the scale of hundreds of places.” Bryan, and others, tied their broadcast seeding approach to a simple strategy: the more positions they applied for online, the higher the likelihood of getting an internship. Over time, participants tailored their internship searches to match their interests, which we will discuss later, but as Bryan noted, the yield was often extremely low without additional face-to-face interaction with the company.

Career fairs were venues for students to interact with company representatives, learn about many companies at once, disperse resumes, and make first impressions on companies that they were interested in. As Susanna described, the impersonal online application processes could be a key barrier to using the broadcast seeding approach, and she instead preferred talking to recruiters in-person at career fairs to make a human connection. However, this was also fraught. She described,

[G]oing there too was also just a weird experience because most people are looking for seniors who are trying to get something like full-time jobs. There's also just trying to figure out how to navigate a career fair. They have FGLI-focused workshops, so I went to one that was how to navigate a career fair beforehand. But I still would say suboptimal experience. Very confused, and overwhelming too.

Going to career fairs was Susanna's way of increasing her chances at an internship, but it also proved to be a daunting and overwhelming task for her. While the conventional path of simply broadcast seeding applications online and talking to recruiters at career fairs was used by half of

the students, from both Bryan and Susanna's experiences, the rate of success was low, and participants often found higher success through other means of connecting with employers.

2. *Identity-based Connections*

The most widely used and most successful technique that participants used in navigating the internship search process was leveraging identity-based resources. Identity-based resources were defined as resources and events that were facilitated by an identity-based group. At the university, identity-based student organizations such as Black, women, and Hispanic in engineering professional societies often organized industry career events as well as provided resources for larger career fairs. Five students used these events to gain access to recruiters, hiring managers, and other technical company representatives.

Jacob and Gabriel benefitted particularly from their participation in the local chapter of the Society of Hispanic Professional Engineers (SHPE), who sent them to the national conference and provided financial support throughout their conference trip. Gabriel noted that they were subsidized by the local chapter for flight, registration, membership fees, and more. The national conference offered several benefits: it was easy to access the centralized information on all the companies present, they were surrounded by people with similar identities and experiences that made informal networking easier, and they could be interviewed and receive an offer at the career fair. Gabriel obtained all of his engineering industry internships exclusively through the conference. In highlighting how the national conference aided him in his internship search, he underscored the importance of the central hub of information that the conference provided:

With the national convention, they made it very easy to see all the lists of employers, see all the different types of engineers that they're looking for, and have the opportunity to actually speak with the recruiter and ask them corresponding questions as far as applying and submitting your resume and all of this information.

The national conference allowed Gabriel to access not only the online resources he needed to apply but also connect with company representatives in a setting with other people like him also accessing the same opportunities. Having the additional support of his local chapter to attend the conference made a significant difference in his internship search. As Jacob noted, "when the recruiters were visibly Hispanic, it was a bit easier to approach. They were also seeing my last name and stuff. They were a bit more kind...there was just some cultural connection there I guess." The cultural connections that participants sought extended beyond the recruitment process, as Gabriel often explicitly sought out mentors or peers for this cultural connection, which enabled him to connect with people easier and maintain the connection over a longer term.

Mason and Adriana echoed the value of these connections, as they described how they felt the constant need to prove themselves to others who did not share the same identities. Mason highlighted, "A lot of the first questions that goes through my mind is, 'me and this person, a 55, 60-year-old white man. There's a non-zero chance he may not be okay with Black people. Let's see if I maybe adjust my voice a certain way and display above-average knowledge, maybe I can

assuage that person's fears.'” Mason’s heuristic assessments of recruiters underscored the challenges that some participants perceived from navigating a space where many recruiters often did not look like them. These heuristics played into how participants caused negotiations of self, changing their behaviors to adapt to their perceived expectations from recruiters.

Time Accumulation of Knowledge

Throughout the interviews, time emerged as a key consideration in the narratives of the participants. Contrasting the experiences of participants who encountered internships early in their undergraduate careers (Mason, Arjun, Gabriel) with those of participants who started later, it was evident that beginning internships early gave participants an advantage due to the ability to accumulate more knowledge, technical experiences, and reflections over a longer time period. The *time accumulation of knowledge* from internships altered the trajectories of students who had the opportunity to participate in multiple internships.

1. Curricular Barriers

Curricular barriers emerged throughout participant’s experiences of feeling constrained by required courses. At the most basic level, curricular barriers could hinder participants from gaining access to specialized technical courses that, in theory, would be most relevant to internship acquisition. For example, at the university, students with Advanced Placement (AP) credit could waive some required introductory courses. As Bryan and Mason noted, not coming in with AP credits made it difficult for them to explore multiple courses and disciplines. In particular, Bryan noted,

If you don't have the AP credits coming in, it really messes with your ability to discover other classes because you're stuck taking all the basic classes that other students don't have to take because of AP credit. [...] I didn't have those class slots to do the things I wanted to do. At this point, I've only taken two classes where I build things. I get two electives and I'm using one of those electives to do the [shop classes]. I didn't get enough. I wanted more. Whenever you come in without the units from AP classes, you don't have as much opportunity.

Due to the curricular requirements implemented by his program, Bryan perceived that taking introductory classes was a setback, as he could not take as many hands-on, exploratory classes as he wanted compared to his peers. Missing out on the opportunities to explore shop classes and other disciplines of mechanical engineering meant that he would never be able to access those chances to learn about fields that might have interested him. Curricular barriers could constrain participants to make career-changing tradeoffs in their coursework.

2. Foot-in-the-Door Effect

We define the “foot-in-the-door” effect as having an easier time acquiring an internship due to having a previous internship. Five participants indicated that this effect allowed them to relax more and focus on optimizing other aspects of their internship experiences. Having a foot

in the door in the form of a previous internship meant that participants could show that employers desired them, talk about their previous technical experiences, and leverage their expertise in recruitment. Blake described this effect,

Once I had [prestigious company] on my resume, most of the jobs I applied for the next summer, they would reach out back to me and I'd be interviewing with them. It was less of trying to get any job and more of choosing where I wanted to work. I think that [prestigious company] did set me up because it is such a rigorous environment with the fundamentals needed to succeed in most roles.

Blake showcased how by interning at a prestigious company with a rigorous program and project, he was able to secure more offers from more companies, giving him more security and freedom to choose between his options. In addition, his first internship was a significant learning experience that he then used to inform subsequent internship searches, which we will discuss later.

Previous experiences that gave participants a foot in the door could extend to other opportunities for engagement with technical topics. Participants benefited from having technical extracurriculars, such as interest in cars, consumer electronics, or control systems, that gave them additional items to showcase their technical competencies. For Mason, his “through-the-roof passion for things” was a massive part in persisting in engineering, and his technical interests “[gave] me enough intuition and talking points by way of brute force” to be successful in technical interviews. Similarly, in his spare time, Gabriel often “watch[ed] videos about new technology, how things are mass manufactured, produced, and tested. Throughout the interviewing process, these were topics and subjects that really helped me be able to answer their questions well.” Gabriel’s technical interests in consumer electronics enabled him to perform well in his interviews with a large consumer tech company. Thus, for participants who had them, technical extracurricular interests gave starting points to demonstrate depth of knowledge to potential employers.

Marvin’s experience was a key negative case to the foot-in-the-door phenomenon. Marvin participated in one technical extracurricular designing a solar-powered vehicle, which led him to secure an internship at a large auto company—his first and only internship. As a mechanical engineering student, he wanted to intern for design firms, but he was unable to secure an internship at one. As he stated, he was “desperate” for an internship and left with no other options, he took the only internship offer he had. Despite being uninterested in vehicles, he attributed his success in applying to the auto company to the fact that all his hands-on engineering experience was in the vehicle industry. While he was only a third-year at the time of our interviews, he felt that his lack of success in leaving the vehicle industry was made difficult due to his perceived lack of diversity of engineering experiences. Marvin’s experience showcases how particular hands-on experience could potentially pigeonhole students into an industry they did not desire.

3. *Reorienting Priorities*

After the foot-in-the-door effect, reorienting priorities was the second phenomenon that occurred after the first internship. Participants often undertook significant reorientations in their internship searches to better align the companies they pursued to their priorities and interests. For example, identifying both what she enjoyed and what she did not enjoy about each internship enabled Adriana to identify the key areas of interest that she wanted to explore in subsequent internship searches, such as medical devices. In another case, after spending two internships in an industry that often worked on-site outdoors in rural areas, Bryan decided to switch into a different discipline. On switching, he opined, “I would've liked to get another mechanical engineering internship.... I never got that chance, but that's fine because now I've switched to software engineering and I'm enjoying what I'm doing now as well. And I feel like the career path is a little bit better for me, especially in terms of the locations that I want to live in.” Similarly, Susanna enjoyed her exposure to software engineering at her first internship but felt that she missed other opportunities to explore project management or data science as well as her other non-engineering interests in marketing and music. She underscored, “I just hear ‘Microsoft, Google’ as the only things in software engineering. I feel like I got sucked into the Silicon Valley thing, so still trying to figure out what my place is in all this.” As a result, at the time of the interview, Susanna had recently applied to music industry internships. As shown through the comments of Bryan, Adriana, and Susanna, participants reoriented their internship searches to various technical and non-technical priorities that they began to value as they gained internship experience. Whether it was switching disciplines or investigating different roles, participants made significant changes in their internship searches after each experience based on their interests.

While the time accumulation of knowledge was often a positive element of gaining internship experience, for some participants, it also highlighted how initial knowledge barriers systemically impacted them far beyond their first encounters with internships. In equating knowledge with privilege, Mason poignantly stated,

The amount of time I spent trying to figure out all that stuff [for my first internship], which in hindsight, future me could just come back and tell old me in 20 minutes - I spent months, first of all just calling apartments and being like “How does [housing] work?”

A lot of [FGLI] kids, their timeline's been pushed way back. They're maybe getting into their first real internships in their junior year or maybe even not much at all and just trying to get a job straight out of college after their senior year because all of these *barbed-wire boundaries* [emphasis added] are deterrents, right? That's very real for [FGLI] kids.

As Mason described, in industry internship recruitment, where experience was a commodity, time was the mediator that controlled whether and how much knowledge FGLI students could ultimately gain from their internship experiences before they had to launch into the workforce. Thus, the time accumulation of knowledge was a process where students who were able to encounter internships early were able to gain access to more knowledge of the engineering

discipline, thereby opening additional doors to opportunities and potentially more personally satisfying career paths.

Discussion

Returning to our research question, “How do undergraduate FGLI engineering students encounter and navigate the processes of internship acquisition?”, our findings show that internship recruitment is a highly structured institution with an implicit hidden curriculum. While internships can make lasting impacts on students, hidden curriculum disadvantages FGLI students from accessing these opportunities. This curriculum, situated within a technocratic institution, creates lasting, cumulative structural “barbed-wire boundaries” that potentially impact FGLI engineering students’ access to internships, which, in turn, shapes students’ career pathways.

Hidden Curriculum

FGLI engineering students perceived being at an immediate disadvantage compared to their non-FGLI peers due to hidden curriculum. Participants identified three areas of knowledge that were both implicit and imperative to learn to be successful in finding internships: that internships existed, what companies valued, and what resources they could leverage. These elements of hidden curriculum point to deeper structural barriers in the standards and social norms that shape internship acquisition. Grade point average (GPA), previous experience, and seniority demarcated standards of merit to recruiters while norms of communication such as interviews framed the discourses and performances deemed appropriate for recruiting settings. These knowledges were not directly accessible to our participants, and they gained this knowledge primarily through experience and broadcast seeding. Placing significant emphasis on GPA, previous experience, and seniority highlighted how recruitment embodied broader values of technocracy in engineering culture, privileging students who already have or can easily access and employ the implicit, goal-specific instrumental information necessary for success.

Recruiters and employers evaluated students’ mastery of hidden curriculum through performance: students had to demonstrate that they met the implicit standards of hidden curriculum on-paper (i.e. through resumes and cover letters) as well as through normative standards of communication and engagement, such as with elevator pitches and interviews. *Performativity* is the idea that social actors, in this case, prospective interns, perform actions to manage the impressions that others have of them (Butler, 1990). In the two-way interaction of FGLI students engaging with company representatives, participants attempt to control how companies viewed them and their professional backgrounds in the hopes of successfully obtaining an internship position, even attempting to mitigate anticipated racial or gender stigmas; representatives assess participants on their performances within the social interaction, determining whether they are a good match for the company based on the impressions formed of the participants. How and how well participants could perform within the recruitment process depended on their mastery of social, professional, interactional norms of presenting oneself

across various media (Sellers & Villanueva, 2021; Villanueva, Carothers, et al., 2018). Even in informal networking contexts, recruiters do not just evaluate candidates; they evaluate how candidates have (un)successfully learned, internalized, and performed the elements of hidden curriculum.

For some FGLI engineering students with multiple marginalized identities, the performative nature of recruitment engendered additional intersectional burdens. This was most evident in the experiences of Mason and Adriana. In particular, Mason's voice adjustments and demonstrations of "above-average knowledge" exemplify ways in which he sought to downplay his Blackness in the context of an engineering professional space. These identity management techniques have been explored elsewhere in the literature on marginalized students (Sellers & Villanueva, 2021), highlighting how the social norms of engineering center Whiteness and masculinity in the performance of professionalism (Bowen et al., 1991; Cech, 2014; Faulkner, 2007; Holzer et al., 2006; Riley, 2017; Slaton, 2010). As a response, multiply marginalized students leveraged heuristic assessments of recruiters, negotiating their selves and presentations to meet their own perceptions of hidden curriculum expectations instead of challenging these norms - particularly when they viewed their professional careers at stake (Sellers & Villanueva, 2021). Since internship recruitment is situated within and serves the broader engineering profession, hidden curriculum reproduces the ways in which social interactions within engineering internship recruitment spaces adopt the dominant technocratic norms in engineering. Thus, multiply marginalized students needed to consider the additional complication of their visible identities in crafting their professional performances for company recruiters.

Reframing such interactions between company representatives and students through the lens of hidden curriculum, performativity, evaluation, and assessment highlights the innate power dynamics at play in internship recruitment as well as how technocracy contributed toward further marginalization of FGLI students. Not only did students have to directly interact with recruiters who evaluated potential interns' performances of techno-social abilities along standards and norms, they had to craft their own performances to fit the prescribed molds of hidden curriculum to meet the gaze of power. As a result, many participants utilized deficit language to describe their lack of skills, background, or abilities during recruitment, often highlighting their lack of connections to people with knowledge to be successful and comparing themselves to their non-FGLI peers (Martin et al., 2015). This deficit-based discourse could only occur in relation to the implicit technocratic expectations that companies had of internship applicants—in other words, inhabiting a technocratic environment that continually reinforces barriers to access may directly engender deficit thinking among students themselves.

While all students likely encounter these phenomena in internship recruitment, we theorize that FGLI engineering students are uniquely marginalized within these systems because, as Gabriel, Mason, and Marvin describe, they are unaware of the knowledge barriers they face and where (or whom) to source that knowledge. Compared to continuing-generation students, first-generation students have weaker ties to resource-rich higher education professionals and potentially no ties to close family members who are able to transfer hidden curriculum

knowledge and provide specific information to navigate the power structures in internship acquisition, corroborating interviewees' perceptions (Martin et al., 2015, 2020). This disparity in social networks disproportionately impacted FGLI engineering students, leaving students like Gabriel to "figure it out" by themselves.

The Barbed-Wire Boundaries of Access

We find that in this paper, hidden curriculum is an issue of access: for the participants we interviewed, hidden curriculum was the primary barbed-wire boundary that hindered their ability to access internships. In addition, the time accumulation of knowledge highlighted the gatekeeping power that both higher education institutions and companies held over FGLI engineering students in terms of gaining the technical experiences needed for internship access. On the higher education institution side, students perceived that curricular barriers could limit the number of electives a student could take, thus reducing the number of technical or hands-on experiences that they could utilize to gain experience. In particular, differential access to AP courses in high school uniquely impacts FGLI students in college, as FGLI students are likely to come from schools with fewer AP course offerings, and low-income students are less likely to participate in AP courses due to high exam costs (Kolluri, 2018). On the company side, privileging students with previous experience and technical passions propagated the technocratic structural inequities of hidden curriculum by gatekeeping students without experience from first internships, creating a self-fulfilling prophecy that disadvantaged students without experience. In addition, as Marvin's negative case illustrated, by potentially looking for a narrow set of technical skills, companies may devalue or overlook transferable skills and funds of knowledge from students with backgrounds ostensibly outside the industry (Smith & Lucena, 2016; Verdín et al., 2021). The effect of gatekeeping resonated long after participants gained experience, as students who were unable to obtain internships early in their undergraduate careers were penalized with fewer opportunities and less time to reorient their career priorities.

In the multitude of barriers FGLI students encountered, identity-based student organizations provided one avenue of access for FGLI engineering students, as they were a site where participants could draw on social peer networks and organizational resources to gain access to hidden curriculum (Lee & Matusovich, 2016). For our participants, identity-based student organizations provided a fast-track to internships, as students gained additional social networks that they could leverage in making informal connections and/or connecting with company hiring personnel, potentially buffering the inequities of hidden curriculum (Martin, 2015; Martin et al., 2020). These skills, networks, and information likely translated into more refined internship seeking strategies and therefore higher success rates in obtaining internships through more standardized processes outside of identity-based career spaces (e.g. career fairs). We discuss the implications of this next.

Implications/Recommendations

Examining hidden curriculum of internship acquisition reveals the ways in which obtaining internships are fraught with many challenges for marginalized engineering students. Considering that engineering students come from a broad variety of backgrounds and take a multitude of pathways to and through engineering, such as community college, transferring from other disciplines and/or institutions, or being a non-traditional student or veteran (all of which may be linked to FGLI statuses), this work has important implications for understanding how these students, along with students with marginalized identities, structure their pathways to and through internships. Given the power of internships to provide on-ramps into engineering careers, this analysis shows that internship acquisition is a point of opportunity to address equity in engineering education and the workforce.

A primary implication of this work is opening dialogue between industry stakeholders and higher education institutions to reassess the technocratic criteria upon which internship recruitment is based. We suggest companies and higher education institutions work together to move toward novel and transparent forms of evaluation that embrace students' funds of knowledge while dismantling hidden curriculum. One recent option is the use of portfolios. For FGLI students, portfolios may be a way to showcase the multitude of knowledges they acquire outside of the classroom, how they intersect with engineering, and how those knowledges translate into the workforce (Carter, 2021). Companies and higher education institutions may design settings where students searching for internships present portfolios of their work to recruiters, such as poster sessions or student showcases. This may promote more holistic evaluation of candidates and validate how engineering thinking and design are embodied throughout students' lives - their funds of knowledge. In translating research into praxis, researchers may educate companies on how funds of knowledge are multifaceted, malleable, and transferable skills to workplace settings (Verdín et al., 2021).

To alleviate the effects of hidden curriculum in the classroom, we recommend for higher education stakeholders and engineering educators to incorporate several aspects of career development into their formal engineering curricula to make hidden curriculum explicit as early in an undergraduate student's career as possible. Having and advertising more hands-on experiential learning courses and extracurricular opportunities for first- and second-year students would help students explore their interests while generating important resume fodder. Most importantly, incorporating identity-based student organizations and peer connections into formal curricula can facilitate a transfer of experiential knowledge of resources from senior students to newer students. This may be accomplished through first-year projects with senior student or industry mentors from identity-based student organizations and/or co-developing experiential learning programs leveraging university resources such as makerspaces to foster peer learning.

Limitations and Future Work

We acknowledge several limitations of this work. First, we did not compare between students who were either first-generation or low-income but not both and students who were both

first-generation and low-income. Experiences and perspectives may also differ between students with one identity and not the other—we recognize that FGLI students are not a monolithic group. What narratives and assumptions FGLI students hold about internships, where those experiences come from, and how they have been communicated should be explored in future work (Sellers & Villanueva, 2021). Support structures and procedures may also differ with each internship, which may cause different experiences for longer internships like year-long co-ops compared to summer-long internships.

Second, while our focus has been on internship acquisition, we narrowed our focus to students who were farther along in their undergraduate engineering careers. First-year and second-year students may express a different perspective, particularly if they had tried and failed to obtain internships in their shorter tenure at the university. This limitation presents a rich area for future work, as the concerns for internships may present additional challenges for students transitioning into a university or engineering program environment.

Third, while we highlight internship acquisition as a particular space and process through which FGLI engineering students must navigate, the processes of internship acquisition are dynamic, often non-linear, and unique to individuals' lived experiences and disciplinary technical/professional knowledges. Future work should explore how internship acquisition impacts other facets of engineering student pathways, including coursework and curricular choices, student perspectives on future engineering careers, and engineering professional student identities. In particular, our interviewees' priority reorientations may suggest that internship experiences serves as a sorting mechanism for student persistence, with some students leaving engineering to pursue other interests.

Lastly, COVID-19 had a significant impact on the nature of our participants' internship experiences. While we do not explore these experiences here, future research could investigate how COVID-19 impacted interns' experiences during recruitment as well as how broader trends and shifts in the labor market due to COVID-19 shaped employers' perspectives on interns. Dimensions of virtual recruitment, remote work, and rapidly shifting global geopolitical and health climates could be explored further in future research.

Conclusion

This paper examined the ways in which FGLI engineering students encountered and navigated internship acquisition. We found internship acquisition to be an implicit process in which standards and social norms steeped in technocracy continued to discount the lived experiences and cultural knowledge of FGLI engineering students. As a result, these students encountered significant “barbed-wire boundaries” embedded within hidden curriculum to internship acquisition, whose negative gatekeeping effects were often cumulative over time and potentially led to deficit thinking within students themselves. We call upon engineering educators, industry professionals, and administrators to begin deconstructing the structural inequities imposed by hidden curriculum, removing the oppressive barbed-wire boundaries to

internship access, and reimagining what a more equitable, authentic, holistic internship recruitment process may be.

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