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How Civil Engineering Undergraduate Students Navigate the Search for Full-Time Employment

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The purpose of an engineering education is to prepare students for the profession; yet minimal research focuses on the process students undertake to find career placement. Given the licensure requirements in civil engineering, the first post-college job may be particularly important for civil engineering majors. We use social cognitive career theory as a theoretical framework, focusing on the job search as a contextual influence that moderates choice goals and choice actions. We examined the following research questions:

1. What barriers and challenges do students encounter during the search for full-time employment?
2. How do students navigate through such barriers and challenges in the job search?

We interviewed 10 civil engineering undergraduate students and recent alumni during the Spring 2022 semester (five graduated in December 2021 and the other five planned to graduate in May 2022). Three women and seven men participated in the interviews, which took place at an institution highly ranked in civil engineering. The interviews focused on participants' experience with the job search, including submission of job applications, attendance at the career fair, and participation in interviews with recruiters. We conducted several rounds of qualitative coding, using thematic analysis. Initial findings indicate different types of barriers, including difficulties advancing through certain stages of the process. Discipline-specific barriers include difficulty obtaining employment in structural engineering with a bachelor's degree or missing key elective courses (i.e., steel design). Students shifted their job search strategy by practicing how to answer interview questions. In addition, they used resources at the university and relied on their social capital (e.g., older siblings) for guidance during the process. The findings from our study will provide helpful information for career services and civil engineering departments to better align their students' expectations with job-search process dynamics. Outcomes can inform the learning experiences offered (e.g., workshops, other professional development opportunities) that prepare students in developing adaptive strategies for job attainment.

Introduction

The purpose of an engineering education is to prepare students for the profession. The majority of engineering B.S. and M.S. graduates will pursue full-time employment, with fewer choosing to pursue further study (i.e., a doctoral degree) [1]. It becomes important to understand how engineering students search for jobs and navigate barriers that exist during the job search process, so that institutions can better support students in finding employment. Minimal research focuses on the process that students undertake to find career placement. Our study seeks to fill a gap in the literature and provide actionable recommendations for engineering student supports.

A few studies highlight the industry perspective of the job search, focusing on the skills valued by engineering employers [2, 3]. For example, Fleming et al. analyzed job advertisements for engineering positions, finding that employers searching for candidates with a bachelor's degree in civil engineering most frequently included problem-solving and coordination as desired professional skills [3]. Excel and AutoCAD were the most frequently included technical skills in

job postings for the same candidates in civil engineering. Wang and Jamison found that industry reviewers valued different experiences and skills on a candidate's resume, depending on the priorities of the company [2]. For example, a pharmaceutical company placed lower value on a biomedical engineering candidate's skill in Python and CAD. Other literature focuses on the perceived gap between what is taught at the engineering undergraduate level and skills needed in the workforce [4].

As Desing et al. highlight, on-campus resources exist to help engineering students with job attainment [5]. Some campuses provide an engineering-specific career center, while others have a general career center that serves all students. Common resources offered by career centers include information sessions, resume reviews, and access to career advisors. At highly resourced universities, career centers will often host job fairs and bring employers to campus for other events. In a prior study, career services professionals recognized that students benefit from different types of events (workshops vs. one-on-one consultations) depending on their needs and comfort level [6]. Similarly, another study found that engineering students use different supports during the process of career attainment, such as networking during internships, relying on family as social capital, attending the career fair and other networking events hosted by the university, and attending career-focused events hosted by student organizations [5].

We respond to the call that "further research is needed to better understand how students approach the process of obtaining a career in engineering" (p. 34), specifically focusing on the barriers within the job search [5]. Our research questions are as follows:

1. What barriers and challenges do students encounter during the search for full-time employment?
2. How do students navigate through such barriers and challenges in the job search?

We focus on the discipline of civil engineering. Given the licensure requirements in civil engineering, the first post-college job may be particularly important for civil engineering majors. Our findings will have implications for students navigating the search, employers, and universities seeking to better support their engineering students.

Theoretical Framework

We draw upon social cognitive career theory (SCCT) as the theoretical framework [7]. SCCT has been previously used to study career development in engineering, serving as a useful framework to understand the process of career choice. For example, Smith and Gayles examined how career-related experiences, such as internships, informed the career choices of women engineering undergraduate students who had already accepted full-time positions [8]. Several other studies in engineering have similarly used SCCT as a theoretical framework [9-11]. In this paper, we specifically focus on the "contextual influences proximal choice behavior", which refers to the supports and barriers that may influence students' career choices [7]. Desing et al. identify several contextual influences specific to engineering students, such as the career fairs offered by the university [5]. They highlight how the career fair could be viewed as a support (a helpful resource) or as a barrier (overwhelming) by the students. Participant sampling included the following engineering disciplines: biomedical, civil, materials science, and mechanical. We

narrow our focus to the job search and seek to understand the specific barriers that students may encounter during the job search and how they develop adaptive strategies to navigate through such barriers. While students mentioned many helpful resources (or supports) during the job search, we only focus on the supports that specifically helped students navigate through the identified barriers.

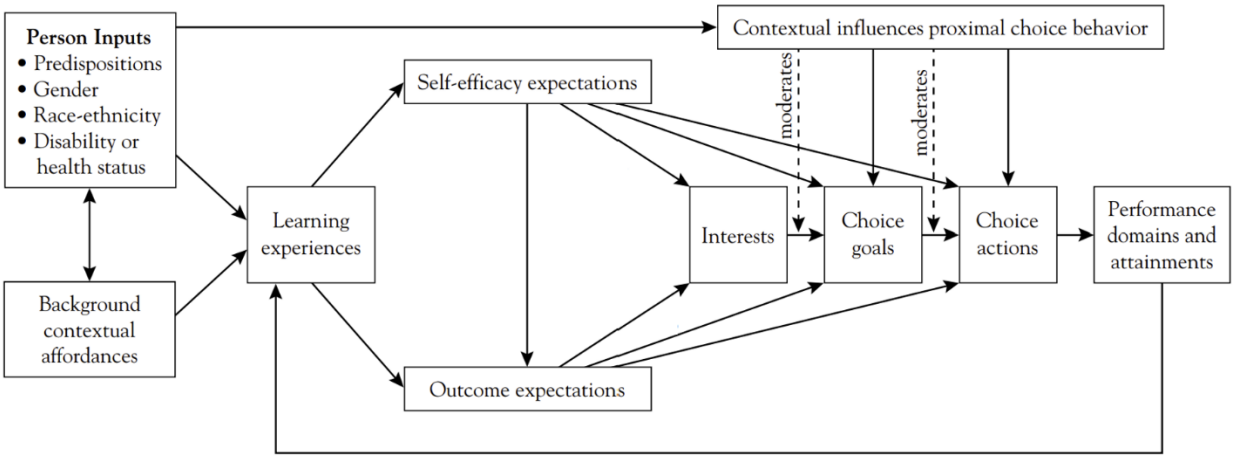

Figure 1. Social cognitive career theory model [7]

Methods

This work is part of a larger study focusing on the career decisions of engineering undergraduate students. For the larger study, we recruited participants to complete three interviews over the course of an academic year (specifically, October to May). This conference paper includes findings from the second set of interviews about the job search process for a subset of the participants. Participants remained in the sample if they had actively searched and applied for jobs at the time of the second interview. We removed participants if they only applied to graduate school (four participants), did not actively apply for full-time positions (four participants), or did not complete the second interview (two participants). Further details about the methods are provided in the following sections.

Participants

We recruited participants from a civil engineering department at a single institution. The department offers bachelor's degrees in civil, environmental, and architectural engineering. Both the College of Engineering and the civil engineering department are highly ranked [12]. Many resources are offered within the college and department, including a college-level Engineering Career Center. The Engineering Career Center hosts the engineering job fairs in the fall and the spring, in which over 200 employers attend. In addition, they host services such as resume reviews, career advising, and company information sessions. The Engineering Career Center also has an online system for employer job postings where students can apply for positions. They support students seeking internships, co-ops, and full-time employment. Companies that recruit for civil engineering through the university are primarily located in-state, often in a larger city.

We recruited participants through departmental emails, upper-level elective courses, and snowball sampling. To be included in the larger study, participants were required to meet the following criteria: 1) intend to graduate within the next year, 2) do not yet have post-graduation plans, and 3) have plans to search for full-time jobs. We reached study saturation for the larger study with 20 participants, with recruitment occurring during the Fall of 2021. This paper focuses on a subset of those participants (n=10), with the sampling described earlier (all actively applied for jobs at the time of the second interview). All participants were fourth or fifth-year students at the time of study recruitment. At the second interview (early Spring 2022), five of the participants had recently graduated in December 2021 and the other five planned to graduate in May 2022. One participant majored in architectural engineering, while the others majored in civil engineering. Three women and seven men participated in the interviews, with three identifying as white, three as Asian, three as Latino, and one as multi-racial. We use pseudonyms for all participants in the findings.

Data Collection

For the larger study, we conducted three interviews with each participant. The first interview focused on career interests, the second on the job search process, and the third on career decisions for their post-graduation plans. In this paper, we analyze the second set of interviews about the job search, which took place in February and March of 2022. The interview protocol focused on their career interests (specifically, if any changes had occurred since the first interview) and the job search (which was the majority of the protocol). The sections on the job search included the status of their job search, their process to find and apply for positions, the job fair, interviews, their approach to the search over time, experiences that helped them prepare for the job search, and challenges related to the job search. It is important to note that the interview was about the job search broadly, rather than specifically about barriers. We used a semi-structured interview protocol, with main questions and sub-questions. The semi-structured format allowed us to follow-up with additional questions as needed. Example questions from the interview protocol are listed below in Table 1.

Table 1. Example questions from second interview protocol

	Example Questions
Status of Job Search	What types of jobs (i.e., positions and industry) have you applied for?
Job Search	In general, how do you search and apply for jobs? Tell me about your process to find available positions that match your interests.
Interviews	Have you interviewed for any full-time positions? Tell me a bit about how your interview(s) have gone so far. Have you felt prepared during your interviews? Why or why not?
Challenges	Have you experienced any challenges during the job search process? If so, what are they? Have there been any challenges in pursuing your specific career interests?

Interviews took place with a single interviewer (first author). Prior to the second interview, the first author re-read all interview transcripts from the first interview and made notes for specific follow-up questions on their career interests (first section of the second protocol). All interviews were audio-recorded and took place either in a conference room on campus or over Zoom, as chosen by the participant. Participants signed a consent form prior to beginning the interview. Interviews were about an hour long. Participants were paid a $20 Amazon gift card for each interview that they completed. It is important to note that participants were at different stages of the job search process during the second interview. Seven participants had accepted job offers (with three of them already working), two were actively interviewing for positions, and one was waiting for an offer to go through (not actively interviewing).

Data Analysis

Interviews were transcribed by a third-party transcription company (GMR Transcription). Following transcription, we read the interview transcripts and narrowed the participant sampling to the 10 participants who had actively applied for jobs at the time of the second interview. The two authors then met and discussed the interview transcripts. The barriers and challenges that participants experienced during the job search and how they navigated such challenges became apparent on the initial read-through of the transcripts. We then input the transcripts into Excel and completed three rounds of qualitative coding, using thematic analysis as the analytic method [13]. We used three codes in the first round of coding: barrier/challenge, shift in job search strategy due to barrier/challenge, and resources used to address barrier/challenge. We took notes on each participant related to the three codes during the first round of coding.

The second round of coding focused on identifying specific barriers and challenges that participants experienced. Using the notes from our analytic memos, we first identified 13 categories of barriers and challenges, which we condensed to 10 for the second round of coding. We then coded each participant's interview for the 10 categories of identified barriers and challenges. Following the second round of coding, we removed one of the codes (personal) since it fit within other categories and did not have substantial findings as a stand-alone code. The nine categories of barriers and challenges are displayed in the Findings section. The third round of coding focused on the navigation of barriers and challenges. We coded according to the category of barriers and challenges, making notes in our analytic memos about the different strategies associated with each category.

Findings

Barriers and challenges

We identified nine categories of barriers and challenges that participants experienced during the job search process (Table 2). As a note, we consider the job search prior to receiving offers and do not include challenges with negotiating offers or making decisions about offers in this analysis. As another note, the participants also spoke of positives associated with the job search and described the resources and support received generally throughout the process. Our analysis specifically focuses on the barriers and challenges associated with the job search and how participants navigated through such barriers and challenges. It was out-of-scope of this paper to

discuss resources and support generally (outside of the context of barriers), although it should be noted that the students commented on the general helpfulness of the Engineering Career Center (and their resources), as well as the fall and spring job fairs. A detailed table containing the barriers and challenges shared for each participant is contained in the Appendix (Table A1).

Table 2. Summary of barriers and challenges

Academic	Related to student academic performance, GPA, or graduation date
Structural	M.S. requirement for positions in structural engineering
Internship	Challenge of not having an internship or not liking their internship
Applications	Lack of response after submitting job applications, difficulties with submission
Job fair	Challenges associated with structure of the job fair
Interviews	Issues with completing interviews
Alignment	Lack of alignment with interests or desired location
Timing	Timing with offers and timeline of response, graduation date
General stress	Related to the negative emotions or amount of effort involved in the job search

Academic

Academic challenges during the job search included delayed graduation dates, missing certain coursework or skills, and perceived lower GPAs. Participants also mentioned the stress of balancing academics with the job search (also included under General Stress category).

Both Fernando and Kaden dealt with delayed graduation dates. Fernando searched for full-time jobs before an issue with his classes moved his graduation date, explaining: “So, I kind of had two rounds of job searching.” Kaden moved his graduation date back due to challenges with his major GPA being too low, since he “had a bad semester”. He explained that issues with his mental health contributed to failing a semester, which significantly lowered his GPA. While he was able to access resources on campus (specific student support office) that helped him navigate this situation, he submitted the withdrawal for the semester past the required deadline and was unable to successfully withdraw. His lower GPA may have contributed to other challenges with the job search, including not receiving employer response for submitted applications (“I applied for a few, but honestly, I didn’t hear back from any of them.”). He navigated this challenge by relying on family, ultimately having an unofficial offer to join a civil engineering job from one of his relatives, once he had proof of graduation. Dhruv similarly perceived issues with GPA, which may have contributed to lack of employer response, saying, “I think I was kind of getting GPA-checked in a lot of instances, where my resume was getting auto-filtered because of that.”

Fernando experienced an academic barrier in that he was searching for structural engineering positions and had not taken a steel design course. He found that recruiters “lost interest” once they knew he had not taken steel design, explaining that they wanted candidates who had taken concrete design and steel design for structural positions. Once he realized this was a serious issue in obtaining employment, he considered how he could address it, saying:

> "Because I guess after running into that for so long, I kind of researched things I could do to make up for that. And so, after a while I was like, 'Okay, yes. I haven't taken steel design, and here's how I plan to make up for the educational, academic, whatever, make up for not taking that class.' Because there were classes I could take through the actual organization that make the code book and stuff. They offer classes that I could get a certificate in and stuff."

While his strategy somewhat helped, in that he found recruiters were more "open to continuing the conversation" and give advice or be connected on LinkedIn, he found that not taking the class was a still major barrier, stating that the recruiters had the mindset of: "it's just this class, we can't really work past that". Similarly, Luis found a challenge in that recruiters expected him to know a certain software (Revit) when he was interviewing for structural positions.

Participants also discussed the stress of balancing their current courseload while managing job applications and interviews. Tiffany limited the number of applications that she submitted because she placed a higher priority on managing the projects in classes during her last semester. Luis experienced profound stress, describing: "But trying to manage school and job applications, I was super stressed out. It was not easy. I was concerned about a lot of things." He began to receive lower grades due to the focus on finding a job. His dad provided emotional support and guidance during this time, reminding him to focus on his classes. Kaden's family members submitted some job applications for him, so that he could focus more on his classes.

Structural

Four participants (Fernando, Tiffany, Amina, and Luis) hoped to secure full-time employment in structural engineering. They faced a barrier in that most companies required an M.S. for structural engineering positions. Tiffany described the barrier, saying, "I did apply for a few structural jobs, but for their, a lot of the structural job requirements are to have a master's so that kind of limited me". Despite structural being her primary focus, Amina similarly found that her options were limited, sharing, "It was a little hard because I was really looking for structural at first and I couldn't get anything in that. So that part was a bit frustrating." Both Tiffany and Amina had additional interests in transportation engineering and applied for jobs within the specialization of transportation as well, with Amina changing her focus to be more even between structural and transportation. They also both applied to M.S. programs in structural engineering. However, Luis was only interested in structural engineering positions and his application to graduate school was rejected. Luis then focused on improving his job applications and interviews (see Applications and Interviews categories).

While Fernando was interested in structural positions, he had broader interests related to buildings and construction. His academic barrier with not taking steel design and trying to find a structural position is described above (see Academic category).

Internship

A few participants experienced challenges with job searching related to their limited prior internship experience. Kaden had not participated in an internship, since his two intended

internships were cancelled both summers due to COVID. He explained, “It was hard to find replacement internships, especially with how my GPA was due to that semester. Yeah, and ended up working in food service in both summers.” His lack of internship experience may have contributed to not hearing back from applications (see Applications category).

While Fernando had not completed an internship in civil engineering, he found that recruiters still valued the work experience he gained in his supply chain internship. Although Malik did not have a summer internship through a firm or government entity, he figured out how to communicate the value of completing a 4-week long, “unofficial” internship with a family friend. He explained what he learned and emphasized his skill development before clarifying the duration and context of the internship. Malik described his approach:

> “Well, I just kind of – I tell them what I did, which in that internship, I developed a website for my family friend; it’s a one-man company so he doesn’t really have time to develop his website. So, I did that for him even though I – and I put a twist on it. I’m like I did that even though I have no experience in web development but I took it on, I took the project on and it turned out all right. So, I will tell them what I learned from that experience before I say however, it was a rather short internship with a family friend.”

However, when asked what advice he would give to someone starting their junior year, Malik strongly emphasized the positives of having an “official” internship, saying, “…that’s like the best way to get a job offer straight off that bat.” This contrasts with his prior stance of wanting to enjoy his summers off and not work, as shared in the first interview.

Other participants had experience in engineering internships, but not exactly in their desired specialization or with a company they hoped to return to in a full-time position. Amina had two engineering internships. However, the first internship was in a specialization that she did not like (land development) and the second was not a good fit with the company. She felt like she was starting over in looking for jobs, compared to other students who could accept a return offer for a full-time position from their internship employer. While Luis had an internship in bridge inspection, he was concerned that potential employers would only want to hire candidates who already had previous experience in a structural engineering internship.

Applications

Participants often mentioned the frustration of not hearing from employers about submitted job applications and the time-consuming nature of applications (also included under General Stress). Kaden shared his frustration in not hearing any sort of response from companies, not even a rejection: “For one thing, the not really hearing back, and not being sure if it’s some mistake on my end, or if they just didn’t want to follow up.” Dhruv similarly faced frustrations in not hearing back from any of his applications for out-of-state positions, describing: “And that was kind of just a black hole. I would be submitting applications and calling people, cold emailing, things like that, and I very rarely got any responses; and I wasn’t even getting rejections.” He began tracking application details in an Excel spreadsheet due to the large number submitted.

Luis also experienced difficulties in not hearing back after submitting job applications. He felt frustrated that his resume might be automatically screened out by an algorithm. After receiving feedback from the Engineering Career Center, he decided he needed a second opinion and posted his resume on Reddit. Luis then changed the formatting of his employment dates, reduced the overcrowding of information, and wrote "EIT at the top so that it's easier to see". He credited the advice from Reddit for helping him "get a lot of interviews for the last semester."

A few participants discussed the challenging level of effort involved with submitting job applications. Fernando stressed the high number of steps for some applications, particularly if they involved a cover letter or short answer questions. Dhruv and Luis felt frustrated when they needed to manually input large amounts of information after they uploaded their resume to the application. Luis described the process as needing to "rewrite everything that was on your resume", sharing that it took "20, 30 minutes for each application." To compound Luis' frustration with the manual input, he did not receive any interviews from applications submitted through company websites (which required this step). All of his interviews originated from the Engineering Career Center portal, in which he simply needed to upload his resume. He expressed hesitations about the idea of job searching in the future without the use of the portal.

Emily had hoped to return to her previous employer in a full-time position but did not hear back after applying online. She spoke to the employer's recruiters at the fall job fair, hoping for an update as it had been a month since her application submission. However, her co-op office was located out-of-state and did not have communication with the in-state recruiters. She described it as, "kind of different hiring process almost." She kept following up on the application and never heard back from the out-of-state recruiter, describing the experience as "very frustrating." Tiffany experienced frustrations in waiting for jobs to be posted online, sharing that recruiters often told her to apply online and to "just keep checking on the job posting website" when the jobs were not yet available. She found herself either continually checking or eventually would have to make a decision to move on if the job was not posted.

Job Fair

A few participants discussed challenges with the virtual format of the job fair. Typically held in-person, the fall and spring job fairs were moved online due to concerns with COVID-19. Participants recognized that the virtual format was new for everyone and acknowledged that challenges existed with the typical in-person version of the job fair as well. Participants often viewed the challenges with the virtual fair as minor annoyances, although Kaden shared how both formats of the job fair were very difficult for him to navigate as an introvert.

Challenges with the virtual job fair included the need to find a place to stay on campus and waiting in long virtual queues. As a commuter, Amina needed to find a quiet location where she could call into the job fair and be focused, since she was on campus all day. She shared,

> "I think for me, it was just like being on a laptop for so long was a bit difficult and then I commute to campus – or I did commute to campus, so I was kind of stuck because I had classes in the morning and I had an org meeting in the evening and so I ended up having to book an interview room, so I was stuck in this very small room."

Waiting in the lines (or queues) could also be difficult. Tiffany described waiting in line for 90 minutes to talk with a company, then needing to exit the line because she had class. She said, “I just went out of the queue, so I kind of wasted my time on that.” Similarly, Dhruv shared his frustrations with the limited time to talk with each company and the slow nature of the process (sharing that he only talked to five companies in three hours).

Interviews

Three participants (Fernando, Emily, Luis) experienced major challenges with interviews, in that their initial interviews did not go well. Each adjusted their interview strategy and used resources to be more successful with their interviews. In addition, participants described certain types of interviews (technical, situational) as more challenging of a format. Other participants highlighted challenges with not hearing back from an employer after completing an interview (Tiffany), difficulty in managing large numbers of interviews (Amina), and the logistics of scheduling and physically traveling to interviews (Dhruv). Emily and Dhruv also acknowledged that it could be more difficult to read people or build chemistry over interviews on Zoom.

Fernando described his first few interviews as “really rough”, saying, “I think at first, I was a lot more nervous, and you could tell.” After receiving a few rejections, he realized that his interview strategy was not working as intended. Fernando then asked for feedback from a recruiter and for interviewing advice from his siblings (who were involved with recruiting at their companies). He realized that he was approaching interviews too casually, more like a conversation, and that he needed to focus on specific talking points to emphasize to the recruiter during the interview. Fernando described the shift in his approach:

> “So, then I was like, ‘Okay, let me have a game plan of how I want to steer this conversation.’ If they bring this up, then I can bring this up. Or if I really want them to know that I did this, or took this, or did this, I’m going to try to sneak it in like that.”

This advice came from his siblings, in addition to the advice of being “direct and clear, make it known what you want.” Fernando also interviewed with a few companies of lesser interest, viewing those interviews as “practice” and gaining confidence in his interview skills.

Similarly, Emily’s initial interviews did not go well. She described her “first four or five” interviews as “absolutely horrendous” and felt confused at the outcome, since she had prepared for the interviews by researching the companies and interviewers prior to the interview. She explained, “And yet, I would get stuck on the darndest of questions, and I would find myself answering in a way that wasn’t really exuding confidence or knowledge.” She then recognized that she needed additional preparation for responses to interview questions, remarking:

> “But yeah, I think, like I said, after those other ones that I didn’t feel that great about, I found a way to prepare more, and to kind of I started making a document of common question I was getting. And I would try to paraphrase how I would answer it. So, it wouldn’t be scripted obviously, but I would type out an example answer to that question just so I knew what bases to hit, and what points I should be making in those things to underscore the end all, be all of it.”

She researched common situational questions asked in interviews and best practices for responses to difficult questions (such as 'What is your greatest weakness?'). She found question banks online and looked at recruiting websites for advice. She also practiced interview questions out loud and recorded herself responding to the questions. Emily realized that she was relying heavily on examples from classes and that she could use examples from her internships in certain responses. In addition, she began to have a mindset shift when she started interviews, making jokes, which she found both put her and the interviewers in a better mood.

Similarly, Luis struggled in his initial interviews and did not receive a response from the recruiters following the interview. He asked for feedback from a recruiter and was told that he did not seem interested in the job, which confused him. He then reached out for advice from a tutor on his senior design project and a counselor in a learning center on campus. He shared,

> "And I worked with this student and with this counselor and she helped me through a lot of stuff and basically how to tell a story because people don't remember what is on your resume, but they remember how they felt when they were talking to you. And people are drawn to stories and instead of just speaking back what's on my resume, if I can tell a story on how I came to be in this position then they would remember it much better."

He also emphasized the importance of showing enthusiasm during the interview, particularly in the tone of voice and towards the type of work at the company. He found more success in his interviews after taking steps to illustrate his enthusiasm for the position and the company.

Certain types of interviews were viewed as more challenging by participants. Sebastian shared that he viewed situational interviews as more challenging than basic questions about his background. Fernando was caught off guard with technical questions in a few interviews, with surprise at the level of detail and understanding needed from prior classes. He shared,

> "…there was this one interview that I really remembered because basically they wanted me to give a run-down of the entire class I had taken by asking, 'Okay, this is your concrete beam. The reinforcing goes here. Can you draw the graph, then expand the graph, and then put in stirrups and stuff? How does that impact the shear?'"

After not doing well, he started checking Glassdoor to see which companies asked technical questions in their interviews. He would then review information from key classes prior to the interview. Malik was also caught off guard when asked questions about generating business for the company, since he viewed that as outside of the scope of a civil engineer's role at a firm.

Alignment

Several participants experienced challenges finding employment aligned with what they wanted. For example, four participants found it difficult to obtain structural engineering positions without an M.S. degree (interest alignment; see Structural category). Other participants found a lack of alignment related to location or company culture. Tiffany grew up in another city within the state, where her family still lived. She hoped to return to this city after graduation. However, she found that most offices recruiting for full-time positions through the university were located

locally, in the same city as the university. Since she was searching for non-local positions, recruiters often did not know if positions were available and referred her to the company website.

Dhruv grew up locally, in the same city as the university, and strongly hoped to secure employment in an out-of-state position. He submitted over 60 applications and did not receive an interview for any of them, despite his efforts to connect with recruiters and employees. However, Dhruv did find success with local and in-state positions, so he eventually stopped submitting applications for out-of-state positions. He shared, "I kind of gave up on getting a job out of state by mid-to-late October, because I just wasn't getting responses from anyone. So, then, eventually I was kind of like, 'This is a waste of time.'" He remained unhappy that he ultimately could not secure an out-of-state position and planned to search again after gaining work experience in his current role. Fernando also applied to places where he did not necessarily want to live, expanding his search from three major cities within the state to other smaller cities. He explained why he considered more options, saying: "Because there was a point where I was like, 'You know what? I will just take anything.'"

While Malik strongly valued work-life balance and prioritized time for friends and family, he interviewed with companies that did not share the same mindset. He recognized this lack of alignment from reviews online and questions asked during his interviews. For example, one company had reviews "that pointed towards burnout and zero work-life balance." Malik also found that some interviews focused on bringing in business and profits, which did not align with his interests. Despite describing such companies as "not a good fit", Malik shared that he would likely accept a job offer if one was provided and that he was willing to work longer hours.

Timing

A few participants had challenges with the timing of their offers or related to graduation. Emily hoped to return full-time with her co-op employer but had not heard back from her submitted application (see Applications category). She received several full-time offers from other companies and eventually had to release the hope for a return offer, due to the timing. Tiffany mentioned that her offer felt "kind of last minute" since it was so close to her graduation. Michael received a return offer from his internship employer early in the job search. He negotiated an extension, so that he could apply for jobs and explore his options while considering the return offer. However, he found the different timelines between companies frustrating, noting that some companies wanted a response immediately and others allowed time for consideration. Other participants noted that the job fairs tended to recruit for full-time positions that needed to be filled that semester. Sebastian and Malik (with planned graduation in the spring) did not attend the job fair in the fall because they were told companies would prioritize fall graduates and that there would be many positions available in the spring. Michael mentioned that many companies at the fall job fair told him to return in the spring. However, he needed to respond to his return offer prior to the spring job fair, complicating the timing of his search.

General Stress

Participants often referenced negative emotions associated with the job search. They also discussed the time-consuming nature of the process, highlighting the difficulty of managing large

numbers of applications and interviews. Fernando described the job search as “kind of rough” and “exhausting”, while Malik said that it was “a daunting task.” Emily viewed the search for full-time positions as “a little more terrifying” compared to the internship search. She shared,

> “It kind of felt like a game with internships almost. Like, ‘Okay. No strings attached, I’ll just go there for a couple months in the summer, see if I like it, get paid, put it on my resume’. But now it’s like, ‘They’re looking at my resumé for a lifetime for a career.’ And so, my game face has to be on all the time, I have to say the right things, and I have to look everywhere.”

She expressed discomfort with the uncertainty of the job search, a sentiment shared by other participants. Emily used tools such as an Excel sheet to track her progress and discussions with her roommate to help manage the negative aspects of uncertainty. Several participants mentioned the difficulty of balancing the job search with other responsibilities (see Academic category), with descriptions of “drowning in work” (Emily) and “a lot to juggle” (Amina). Malik shared how it was tough to manage everything: “I think it’s just so hard to balance job search your final semester, your friends, your last semester of college and everything really.”

Dhruv described the exhaustion involved in the process, emphasizing the need to perform in each interview. He shared, “It’s draining. So, I think I was really burnt out in November.” Luis highlighted the stress of the job search, due to the level of effort put in and the frustration of not receiving any offers. He described the experience as “super stressful” and “very unpleasant”. He mentioned, “I was always thinking of the worst-case scenario. What if I don’t get a job in engineering? I’ll just have to, I don’t know, start getting a tech certificate or something.” While his dad helped Luis manage his emotions during the search, other participants relied on their friends or roommates in engineering for emotional support. However, participants typically did not feel less stressed about the job search until they received an offer.

Discussion

We identified nine categories of barriers and challenges in the full-time job search for the participants in our study, from a single institution’s civil engineering department. Barriers and challenges related to their prior experiences (academic, internship) or a specific step in the job search process (applications, job fair, interviews). Participants also experienced frustrations in pursuing certain options (alignment, structural) and with logistics related to the search (timing). Other barriers encountered were specific to civil engineering (academic, structural; see below). Negative emotions often resulted from the other barriers and challenges of the search, causing exhaustion or emotional distress (stress). We add to the literature in engineering education on social cognitive career theory (SCCT) by identifying specific barriers in the job search [7] and respond to a call for additional research on career attainment in engineering [5].

The majority of the identified barriers and challenges likely apply to engineering students broadly; however, several are specific to civil engineering. Notably, four participants searched for positions in structural engineering and found that most positions required an M.S. They also encountered requirements for certain classes (steel design; Fernando) or software (Revit; Luis). Fernando also struggled with technical questions related to his structural classes in interviews. In

response, participants expanded their options, applied to graduate programs, and additionally prepared for interviews by reviewing coursework. It is not clear whether participants were aware of the M.S. requirement for structural engineering before the job search or before their interests in structural engineering developed. It may be important for civil engineering departments to communicate the requirements for structural positions earlier in students' degree program, so that students are aware of the limited roles in structural for bachelor's degree-holders. Similarly, departments may consider providing additional resources for students such as review sessions for technical interviews, specific career advising for students interested in structural engineering, or workshops focused on submitting graduate school applications.

Participants often developed adaptive strategies by actively searching for solutions and trying different approaches when faced with a barrier in the job search process. They relied on family members for interviewing advice (Fernando), help with finding positions (Kaden), and emotional support (Luis). Friends and roommates also provided emotional support with the general stress of the process. Participants reached out to Reddit for resume advice (Luis), contacted employers (Emily, Dhruv), and expanded the options they originally considered (Fernando, Amina, Dhruv, Malik). They received interview coaching from counselors on-campus (Luis), practiced responding to interview questions (Emily), and used Glassdoor to research interview questions (Fernando). It is important to note that participants were not able to resolve all barriers in the job search. Participants commonly did not receive response from employers about completed applications or interviews, which remained a frustration. In addition, some applications required large amounts of information to be manually entered. A few participants (Dhruv, Emily, Michael) had remaining issues with timing or alignment and were required to make a final decision regardless of the unresolved challenge.

It should be noted that this study took place at an institution with a highly ranked civil engineering department and College of Engineering. At the time of the interview, seven of the 10 participants had secured full-time employment. Despite this, participants shared many challenges and barriers during the job search, some of which were not resolved. In addition, the general stress and uncertainty of the overall process was discussed by participants, even after receiving one or more offers for a job. Our findings emphasize that civil engineering students at a highly ranked, well-resourced university still experienced a variety of challenges and frustration. It becomes important to consider how students in other institutional contexts and engineering disciplines navigate through barriers and challenges of the job search for future work. It should also be noted that the level of challenges and frustration varied by participant in our study.

Conclusion

We identified nine categories of barriers and challenges experienced by civil engineering students during the full-time job search. In addition, we discuss how participants navigate such barriers and challenges. Our work is applicable both for civil engineering departments and broadly for engineering programs and career services. Our findings highlight the perspectives of students' experiences in the job search and the adaptive strategies they developed, which can provide useful insight for workshops or other professional development opportunities designed for engineering students. Future work should examine other SCCT supporting elements related

to engineering students who are navigating the job market, including student self-efficacy expectations and outcome expectations in the early phases and late phases of career development, and evolution of choice goals and choice actions that support job attainment.

References

[1] J. Roy, "Engineering by the numbers," in "American Society for Engineering Education," American Society for Engineering Education, 2019.

[2] A. A. Wang and C. S. E. Jamison, "Exploring the use of resume reviews to understand skill sets valued in biomedical engineers by employers," *Biomedical Engineering Education,* vol. 4, no. 2, pp. 361-379, 2024, doi: 10.1007/s43683-024-00154-6.

[3] G. C. Fleming, M. Klopfer, A. Katz, and D. Knight, "What engineering employers want: An analysis of technical and professional skills in engineering job advertisements," *Journal of Engineering Education,* vol. 113, no. 2, pp. 251-279, 2024, doi: 10.1002/jee.20581.

[4] S. R. Brunhaver, R. F. Korte, S. R. Barley, and S. D. Sheppard, "Bridging the gaps between engineering education and practice," in *US Engineering in a Global Economy*: University of Chicago Press, 2017, pp. 129-163.

[5] R. M. Desing *et al.*, "Identifying supports and barriers in engineering students' processes toward career attainment," *Biomedical Engineering Education,* vol. 4, no. 1, pp. 33-56, 2024, doi: 10.1007/s43683-023-00119-1.

[6] C. Carrico, A. Harris, H. M. Matusovich, S. R. Brunhaver, R. A. Streveler, and S. Sheppard, "Helping engineering students get jobs: Views from career services professionals," in *2016 ASEE Annual Conference & Exposition,* New Orleans, LA, 2016.

[7] R. W. Lent, S. D. Brown, and G. Hackett, "Toward a unifying social cognitive theory of career and academic interest, choice, and performance," *Journal of Vocational Behavior,* vol. 45, no. 1, pp. 79-122, 1994, doi: 10.1006/jvbe.1994.1027.

[8] K. N. Smith and J. G. Gayles, ""Setting up for the next big thing": Undergraduate women engineering students' postbaccalaureate career decisions," *Journal of College Student Development,* vol. 58, no. 8, pp. 1201-1217, 2017, doi: 10.1353/csd.2017.0094.

[9] I. Miller, G. Lopez-Alvarez, M. T. Cardador, and K. J. Jensen, "Determinants of intra-major specialization and career decisions among undergraduate biomedical engineering students," *Biomedical Engineering Education,* pp. 1-14, 2024, doi: 10.1007/s43683-023-00133-3.

[10] K. J. Jensen, M. T. Cardador, G. Lopez-Alvarez, A. J. Kunze, and K. J. Cross, "Interest in, and characterization of, managerial and technical career paths among second-year women engineering students," *J. Women Minor. Sci. Eng.,* vol. 30, no. 4, 2024, doi: 10.1615/JWomenMinorScienEng.2022041570.

[11] M. T. Cardador, K. J. Jensen, G. Lopez-Alvarez, and K. J. Cross, "An analysis of factors influencing intra-major specialization choice among second-year women engineering students," *J. Women Minor. Sci. Eng.,* vol. 30, no. 2, 2024, doi: 10.1615/JWomenMinorScienEng.2022042788.

[12] U.S. News and World Report. "Best Undergraduate Engineering Programs." https://www.usnews.com/best-colleges/rankings/engineering (accessed.

[13] V. Braun and V. Clarke, "Using thematic analysis in psychology," *Qualitative Research in Psychology,* vol. 3, no. 2, pp. 77-101, 2006, doi: 10.1191/1478088706qp063oa

Appendix Table A1: Summary of barriers and challenges shared for each participant

	Academic	Structural	Internship	Applications	Job fair	Interviews	Alignment	Timing	General stress
Amina		M.S. required	Did not like specialization; company not a good fit		Virtual due to COVID-19; long queues	Managing many interviews	Unable to attain structural engineering position		Balancing demands
Dhruv	Low-GPA perceived concerns			High effort; no response from employers after application submission; time consuming manual entry	Long queues with minimal recruiter interactions	Managing many interviews and logistics; virtual interview - social limitations	Disconnect between [local] recruiters and [non-local] company opportunities		Balancing demands; interview performance
Emily				Disconnect between [local] recruiters and [non-local] company opportunities		Poor initial experiences; virtual interview - social limitations; preparation needed for certain question types		Multiple offers with different acceptance deadlines	Higher stakes for full time search vs internship; uncertainty-related discomfort; balancing demands
Fernando	Delayed graduation date; missing course	Lacked steel design course M.S. required	Supply chain internship (not civil engineering)	High effort level required		Poor initial experiences; too nervous, too casual in approach; preparation needed for various types of challenge questions (e.g., situational, technical)	Unable to attain structural engineering position; difficulty obtaining employment in desired cities		High levels of difficulty and effort
Kaden	Low-GPA perceived concerns; delayed graduation date; course load vs job search effort balance		No prior internship (COVID)	High effort; no response from employers after application submission	Introversion - related challenges				
Luis	Missing skill in a software; course load vs job search effort balance	M.S. required	Bridge inspection internship, but not structural engineering	Only success was through university career center portal; no response from employers after application submission; time consuming manual entry		Poor initial experiences [based upon interviewer's perceived lack of enthusiasm]; no post-interview response from employers	Difficulties with attaining structural engineering position		High levels of unpleasantness, difficulty and effort; uncertainty about finding an engineering job
Malik			Short "unofficial" internship			Preparation needed for various types of challenge questions (e.g., situational, technical, business)	Profit-driven; no work-life balance	Fall career fair prioritizes Fall graduates for full-time opportunities, so had to wait until the Spring career fair	Balancing demands
Michael								Multiple offers with different acceptance deadlines; disconnect between offers and career fairs' timing	
Sebastian						Preparation needed for various types of challenge questions (e.g., situational, technical, business)		Fall career fair prioritizes Fall graduates for full-time opportunities, so had to wait until the Spring career fair	
Tiffany	Course load vs job search effort balance	M.S. required	Disconnect between recruiters' information and company's job postings	Long queues		No post-interview response from employers	Unable to attain structural engineering position; Disconnect between [local] recruiters and [non-local] company opportunities	"Last minute" offer so close to graduation	