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BOARD # 338: CAREER: Responsive Support Structures for Marginalized Students in Engineering - Insights from Year 5

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CAREER: Responsive Support Structures for Marginalized Students in Engineering - Insights from Year 5

Introduction

Undergraduate engineering in the United States is characterized by many opportunities, demands, and obstacles within and beyond the classroom [1]. Opportunities refers to things students can access to improve their overall success in engineering, demands refers to typical hardship expected of engineering (e.g., curricular difficulty, financial hardship, etc.), and obstacles refer to excessive hardship not necessary to complete engineering (e.g., isolation, discrimination, etc.).

The exact nature of these opportunities and obstacles differs across demographic identities [2], [3], [4] and institution types [5], [6], [7]. In our project, identities that are relevant to opportunities and obstacles include students who are women, Black, Latiné, Asian, international, first generation, and/or who work. We refer to these students, or students who face obstacles in engineering, as marginalized. Opportunities and obstacles for these groups also vary by institution type. In our project, we interacted with students from the following institution types: Primarily White Institutions, HBCUS, HSIs, public, private, small, medium, and large, R1s, and R2s.

We engaged students through an NSF CAREER project titled Responsive Support Structures for Marginalized Students: A Critical Interrogation of Navigational Strategies. We summarized the work of this project from its first through fourth year in prior work [8], [9], [10]. During the fifth year of this NSF CAREER project, we engaged marginalized undergraduate engineering students nationwide to better understand how they navigate undergraduate engineering in different contexts. In this poster, we will showcase our findings from interviewing upper-division engineering students and deploying a Situational Judgment Inventory (SJI) at multiple universities across the United States.

Project Overview

This NSF career project has a research agenda of three phases and an education plan. The three phases on the research agenda are: 1) develop a conceptual model of student navigation [1]; 2) conduct interviews at one institution to determine role of identity in navigation [11]; 3) conduct interviews across several institutions to determine role of context in student navigation. We have completed all data collection for the research agenda. The education plan aims to disseminate research findings from the research phases through workshops and implement an SJI that surfaces the navigational tendencies of students.

Current Status

<u>Research Agenda - Phase 3</u>
In this project, we collected data using semi-structured virtual interviews. We interviewed 47 upper-division undergraduate engineering students across 12 institutions. Data analysis of all 47 interviews is ongoing using the Conceptual Model of Student Navigation, an approach outlined in prior work [11]. The goal of this analysis is to determine the similarities of student experience

for those facing excessive obstacles in engineering and the role institutional context plays in marginalized student navigation.

Across students, we found that marginalized students experienced both demands and obstacles in undergraduate engineering, as hypothesized by [1]. Demands included conceptual difficulty, curricular difficulty, and teaching difficulty. Students (pseudonymized) voiced that engineering was hard because of professors. For example, one participant (Nadia) said “one of my professors has the most disorganized class, so half the time he's repeating the same content and it's impossible to pay attention to him because he is just so boring.” Students also discussed the challenging curriculum. For example, one participant (Isabel) summarized how she knows that engineering is academically challenging stating

> The requirements for getting the class added to your transcript and passing it is higher. For engineering, it's like you have to get like a C-minus to get it added. So it's like the bar is set lower for engineering, I guess, because they know it's more challenging.

Students also discussed demands related to managing their heavy engineering course load. One participant (Danielle) highlighted that she has to remind herself that academics are not everything in engineering stating "it's tough to kind of take that step back and understand that I'm more than academics." Finally, another common demand across students was having a weaker professional support system compared to their academic and social support system. Students navigated these demands by getting involved in engineering academic support systems, engineering social support systems, as well as non-engineering spaces to escape the academic pressure altogether. For example, one participant (Emily) used a K-pop dance group as a way to escape the academic demands of engineering.

Students also delineated the obstacles they faced in engineering. These included isolation, discrimination, and exposure to microaggressions. One participant (Danielle) detailed the feeling and consequences of isolation stating

> It ties back into that feeling of a lack of community on a daily basis. ...it's almost like I'm going to class, and this chunk of time is going to be you know kind of isolated.... Like my senior design team, they're nice, but it's always missing that kind of comfort. And it's not even necessarily you know that I want to be around maybe another Hispanic student. It's just another minority in general. I find it kind of comforting to know like, ‘Hey, we're both here’…It's tough to stay in love with the academics when it feels like you're by yourself.

Students responded to obstacles by leaning on their academic and social support systems, which included family, out-of-major friends, in-major friends, professors, support program staff, etc; however, this response is not straightforward because students expressed that there can be a tradeoff between getting work done and reaching out for support. For example, one participant discussed why they did not join an racial student organization to be in their community stating “I was so consumed in my work because I wanted to really do well my first year. So, you know, that distracted me from joining any organizations that could have offered that kind of support.” We will present these findings in our poster.

Further analysis of interviews is ongoing to understand the role institutional context plays in marginalized student navigation.

Education Plan

For the education plan of this CAREER project, we developed the Engineering Student Preferences in Navigating (E-SPIN) SJI. E-SPIN, for short, contains 19 scenarios related to the obstacles and opportunities commonly encountered in engineering and various ways to respond [12], [13]. The goal of E-SPIN is to surface students' navigational tendencies to help them learn about themselves and provide a basis for practitioners to offer personalized support.

E-SPIN scenarios span six domains: academic performance, faculty staff interactions, professional development, extracurricular involvement, peer group interactions, and special circumstances. Table 1 includes an example scenario and ways to respond. Users select two responses to the prompt "What would you least likely and most likely do in response to this scenario?"

Table 1. Example Scenario and Response Options

Least Likely	**You want to get involved on campus but are unsure which activities to select**	Most Likely
o	Wait and see what opportunities you stumble across naturally	o
o	Search Instagram or other social media to find organizations around campus that sound interesting to you	o
o	Ask your friends about what organizations they have joined	o
o	Ask you advisor for recommendations based on your major and/or interests	o
o	Attend campus organization fairs to learn about organizations around campus	o

For each E-SPIN scenario, there are five specific response options that correspond to five general navigational modes: no action, independent troubleshooting, personal support, academic support, and helping-professional support.

During the past year, we developed a public website to disseminate E-SPIN to students across the country [14]. When a user completes E-SPIN on our website, they receive an analysis report, which contains a summary of their navigational tendencies and a copy of their responses. The summary of their navigational tendencies presents their most and least chosen navigational modes, a frequency graph for each navigation mode, and their preferred navigation mode by each scenario domain.

We partnered with practitioners at two different universities to pilot the website with current students. 75 lower-division undergraduate engineering students completed E-SPIN and 50 of those students provided us feedback about their experience. 88% of students said their experience completing E-SPIN was good or very good. Qualitative student feedback about taking E-SPIN and reviewing the analysis report included:

- "It's formatted very well."

- “It really got me to start thinking about potential scenarios in college, which I really appreciate.”
- “This was honestly helpful to see what resources are feasible based on actual life circumstances.”
- “I really enjoyed reviewing the analysis to see what type of person I am and how I respond to problems.”

One practitioner provided feedback of their experience deploying E-SPIN in their class. They said

> It made for a lively discussion as students were able to take what they had seen and think further about what they could do in the future to succeed…Students seemed to enjoy learning about themselves and greatly reflected on their college trajectory by using it.

The student and practitioner feedback reflects that E-SPIN is useful for students to get exposure to common scenarios encountered in undergraduate engineering, practice responding, and learn more about their patterns of response.

Future Work

This project will be completed in one year during which time we will complete the dissemination of our project. Dissemination will involve writing up our interview analysis across institutions for a journal, writing up our E-SPIN development and dissemination process for a journal, and broadly disseminating E-SPIN.

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