

Board 374: Responsive Support Structures for Marginalized Students in Engineering: Insights from Year 4

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Introduction

The typical undergraduate engineering learning environment in the U.S. is made up of predominantly white male students [1]. Students who do not fit into those categories are usually outnumbered in engineering. This numerical underrepresentation, coupled with an oppressive culture means that some students face additional obstacles in engineering, beyond what is expected [2]. Typically, support for these students is not designed to dynamically interact with students' needs. Rather, it is more common that programs take the approach that students will find support if it exists. We aim to illuminate the experiences of students who navigate additional obstacles in engineering, who we refer to as marginalized students. We are also interested in developing ways to more responsively support their navigation of engineering. We conducted this work through an NSF CAREER project titled Responsive Support Structures for Marginalized Students: A Critical Interrogation of Navigational Strategies.

The purpose of this NSF CAREER project is to foster understanding of the relationship between the engineering learning environment and marginalized undergraduate engineering students, specifically as it relates to student support. Our project will benefit those who work closely with undergraduate students by providing insight into the requirements for providing responsive support to marginalized students. This five-year project is in its fourth year. We presented insights from the first three years last year [3]. Our poster will highlight updates from our project over the past year, which includes 1) preliminary results from completing semi-structured interviews with upper division undergraduate engineering students at one institution; and 2) updates to our Situational Judgment Inventory (SJI).

Project Overview

This project contains a three-phase research agenda and an education plan. The first phase of the research agenda involved developing a conceptual model of student navigation [2] to guide the forthcoming stages of the project. The second research phase consisted of conducting semi structured interviews at one institution to develop an understanding of the role of identity in student navigation. The final phase of the research agenda, which is upcoming, involves collecting semi structured interview data from other institutions to develop an understanding of the role of context in student navigation. The education plan involves disseminating research findings via workshops, as well as developing an SJI to increase alignment between students and practitioners around the utility of undergraduate student support.

Current Status

Research Agenda - Data Collection and Analysis

During year four, we completed the second phase of the research agenda. We conducted virtual semi-structured interviews with 26 undergraduate engineering students at Virginia Tech, a public research intensive Primarily White institution in the South Atlantic region of the U.S. The interviews focused on the experiences students had navigating undergraduate engineering, including discussing the demands, obstacles, and opportunities they encountered and their support systems. We were interested in making sense of this data from two different perspectives: an emotion-centered perspective and a person-centered perspective.

Undergraduate engineering education is an emotional endeavor, but the student support environment has limited understanding of how to be emotionally responsive to students' needs. For this reason, we were interested in uncovering the implicitly emotional aspects of navigating engineering. We used a subset of the interviews (n=17) and analyzed the content and context related to emotion words that naturally emerged from participants during their interview. From this data, we found that the universal aspects of engineering, or features that are relevant to most undergraduate engineering students, such as a course load and future career plans, evoked a limited range of emotions from students. When discussing future career plans, students used words associated with confidence and happiness, and when discussing course load, students mainly used words associated with feeling scared. Meanwhile, the interpersonal contexts of engineering, which vary across students, such as academic peers, professors, and women in STEM, evoke a wide variety of emotions within and across students, with words emerging across the emotion categories of angry, confident, happy, loved, and scared. The most salient emotion groups that emerged during our interviews across contexts were confident, happy, and scared. Our results indicate that navigating engineering is inherently emotional across a variety of students and in a variety of contexts. With that in mind, one recommendation we have for making student support more responsive is anticipating and responding to the emotional needs of undergraduate engineering students. Specifically, student support practitioners can leverage the fact that universal aspects of engineering generate a limited range of emotions and anticipate supporting those emotions as an inherent part of those experiences. For example, student support can design preventative measures to mitigate stress and fear during the most demanding parts of an academic semester. Then, for interpersonal contexts, student support practitioners can be responsive by recognizing that students' emotions will vary based on how their identities interact with others' identities and the dominant cultures of engineering education. For example, racially marginalized students may experience more negative emotions associated with interactions with academic peers, given that prior research indicates they experience social isolation and difficulty forming study groups with peers [4]. Emotionally responsive support for these students would include supporting those emotions. It is likely that interpersonal contexts will generate more negative emotions for marginalized students based on the extent to which their identities are in

contrast with the dominant groups. We will share these insights as well as additional insights from our emotions centered analysis in our poster.

As part of the second phase of the research agenda, we also conducted a person-centered analysis of our semi structured interview data. First, we used the conceptual model of navigation [2] to create a person-centered codebook for data analysis, with a priori codes from the major relationships of the model. We explained our process for developing this codebook and how we used it to analyze one participant interview [5]. Then, we dove deeper into our first five interviews, from participants who were all Women of Color (WOC) and juniors in engineering. We sought to understand how WOC navigated engineering in a way that led to their thriving. We uncovered that WOC accessed both support infrastructure on campus, as well as other opportunities that led to their development of thriving competencies. The support infrastructure included the engineering support center on campus with its various interventions and personnel and peers. Opportunities included campus organizations and engineering internships. We will share these insights in our poster.

Education Plan

The goal of our education plan is to provide practitioners with data driven tools for them to provide more responsive support for their students. Our tools are in the form of workshops, where we use our research findings to educate students and practitioners on the possibilities of responsive support, and an SJI. We have made considerable progress on our education plan. During year four, we developed and finalized the structure of our SJI [6], which is an assessment tool containing one sentence scenarios typical to undergraduate engineering and several response options, reflective of typical student behavior.

To finalize the structure of our SJI, we had to pilot our initial instrument and then use the pilot results to inform the restructuring of our instrument. We piloted our instrument with 45 incoming engineering students during the last day of a summer bridge program as part of a workshop on navigating the demands of engineering education. From our pilot results, we determined that we had inconsistently worded scenarios and too many response options for each scenario. To streamline the instrument, we revisited each scenario and aligned it with a structure that consisted of an obstacle, demand, or opportunity and a constraint. The constraints fell into the following categories: discrimination, ineffective strategies, lack of capital, limited time, negative feeling. Once we finalized the wording of each scenario, we streamlined the structure of the response options as well, by consulting relevant literature [7]. This iterative process resulted in five response option categories: no action and denial, independent troubleshooting, personal support, academic support, and helping professional support. We detailed this process in a conference presentation earlier this year, which is yet to be published.

The initial SJI had 24 scenarios, with four scenarios across six domains: academic performance, faculty and staff interactions, extracurricular involvement, peer-group interactions, professional development, and special circumstances [8]. Through a process of revisiting scenarios and removing those that were redundant, our final SJI now has 19 scenarios, with three scenarios in the first five domains, and the original four scenarios in the special circumstances domain. Each scenario has five response options, with the response options tailored to the specific context of each scenario. We used this updated instrument to partially design a workshop with practitioners on responsive support at the CoNECD 2024 conference. We will include the updated structure of our SJI and a sample of scenarios and response options in our poster.

Future Work

The next steps of our project will include further analyzing the data from the first institution, completing phase three of our research agenda and finalizing our SJI. First, we intend to wrap up the person-centered data analysis approach by conducting a comparative analysis of navigation by participants who encountered mostly typical demands in engineering and those who encountered excessive obstacles. Then, phase three of the research agenda will involve finding and interviewing undergraduate engineering students at several institutions outside of our home institution and analyzing that interview data to understand the role institutional context plays in undergraduate student navigation. To finalize our SJI, we will pilot our current version of the SJI with undergraduate engineering students and amend our instrument based on these pilot results. Then, our SJI will be ready to disseminate to interested practitioners to use in their student support contexts.

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