

What Universities Should Know About Minoritized Undergraduate Engineering Students' Mental Health

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Abstract

Amidst a concerning surge in negative mental health symptoms amongst college students, engineering students with minoritized identities (e.g., students of color, first-generation college students, and sexual/gender minorities) face unique challenges. This study investigates the experiences of 21 such engineering students at large comprehensive research-intensive land-grant university in the Midwest, aiming to identify the crucial aspects of their educational experiences that influence their mental well-being. Employing semi-structured interviews and thematic analysis through inductive open coding, we discern three impactful themes: the role of professors, peer community, and a sense of belonging. By investigating the significance of these factors, we gain insight into potential strengths and weaknesses within the university system for supporting minoritized engineering students' mental health. This knowledge will enable us to better support our students, fostering a nurturing and inclusive environment for their academic and personal growth.

Keywords

Underrepresented, undergraduate, minority, mental health

Introduction

The soaring rates of negative mental health symptoms among college students constitute a significant challenge for higher education. A recent national study found a significant increase in rates of depression, anxiety, and suicidal ideation among college students between 2013 and 2021 [1]. While mental health is a concern for all college students, there is increased attention towards students' mental health within engineering education [2], [3] and sustained concerns about retention and persistence, as engineering education can cultivate a harsh environment (e.g., chilly climate, stress culture, meritocracy of difficulty) [4]–[7]. Moreover, studies have found that students with minoritized or marginalized identities (e.g., students of color, first-generation college students, sexual and gender minorities) are more likely to experience greater mental health concerns [1], [8], [9]. A contributor to these disparities is the higher likelihood for minoritized students to encounter systemic barriers, such as discrimination, within academic institutions. Consequently, concerns exist that engineering students with minoritized identities are more likely to experience mental health challenges [3]. This study aims to investigate minoritized engineering students' collegiate experiences as related to their mental health that remain unexplored in present literature through the following research question:

According to minoritized engineering students, what aspects of their engineering education experience most impact their mental health?

Methods

We conducted a qualitative research study using semi-structured interviews. We interviewed 21 full-time engineering students who hold at least one identity that has historically been marginalized in engineering: students of color, first-generation college students, low-socioeconomic status, or sexual/gender minorities. Considering the scope and intention of this study, 21 interviews is an appropriate sample size in the context of qualitative research. A summary of participant demographics is provided in Table 1. Demographics are shared at a high-level to avoid identifying individual participants. Each interview lasted approximately 60 minutes, and participants were asked a series of questions about their experiences as an engineering student and with their mental health. Importantly, in this study, we allowed participants to share their own definitions of mental health and describe their experiences as related to those definitions. We do not aim to identify specific mental health conditions in our participants, but rather aim to holistically understand their experiences as engineering students as related to their mental well-being.

Table 1: Identities of 21 Undergraduate Engineering Student Participants

First-Gen	Gender Identity	Sexual Identity	Racial Identity	Low-Income	Year in School			
	(not cisgender man)	(not straight)	(not white)	(<\$70,000)	1 st	2 nd	3 rd	4 th
7	16	10	6	7	4	7	4	6

We analyzed the data using an iterative process of inductive open coding and thematic analysis [10]. The inductive open coding process took place in three rounds. Round 1 was emergent open coding where each interview was coded by one author. In Round 2, the authors coalesced the Round 1 codes into themes that answered the research question. In Round 3, the authors returned to the transcripts with the coalesced themes to confirm the presence of those themes in each interview. Each transcript was coded by at least two authors in this round and any coding disagreements were discussed to consensus by Authors 1, 2, and 3.

Findings

In alignment with the aims of this study, results are grouped into the three most prominent themes that were present in over 80% of the interviews: role of professors, peer community, and inclusivity. The exact saliency of each sub-theme is shown in Table 2.

Table 2: Presence of Salient Themes (out of 21 participants)

Theme	Role of Professors		Peer Community		Inclusivity	
Code	Empathetic Professors	Apathetic Professors	Peer Community	Overwhelming Workload	Inclusion	Isolation
No. of Participants	16	17	20	17	12	20

Role of Professors

This theme captures the different roles played by the engineering faculty, which we categorize as “apathetic” and “empathetic.” Out of the 21 participants, 19 mentioned the presence of an

“apathetic” professor in their education, and 17 described their experiences with “empathetic” professors. Among the students who mentioned having an apathetic professor, several expressed frustrations towards the *inflexibility* of the professor. Students reflected on times when they could not receive the accommodations they needed, being told that the professor was “set in their ways.” Another student, after explaining extenuating circumstances, was told that “if I do this for you, I have to do it for everyone else.” This student expressed the frustration they experienced, saying that it “just invalidated me in a way and invalidated what I was going through (Participant 12). Other frustrations stemmed from the *inflexibility of pedagogy* within the program, with one student noting, “There's also not a lot of consideration for changing education styles” (Participant 15). After the COVID-19 lockdown and the emergence of new teaching styles, students have been exposed to completely different ways of learning. Students discovered new methods that aided their learning, including recorded lectures, supplemental videos, and posting notes online. However, students found that not all professors embraced these new strategies to cater to their student’s wide range of needs.

By contrast, the students who have had positive experiences with faculty report it having a positive influence on their mental health and education. Empathetic professors showed empathy and flexibility, acknowledging each student’s unique set of needs and accommodating them accordingly. Students also appreciated it when professors took time to foster open conversations, offering time to ask questions and voice concerns. Students reported feeling more at ease in such environments. By incorporating a wider range of teaching methods and being flexible with their students’ situations, faculty can cultivate a supportive educational environment.

Peer Community

Peer community was described as a coping mechanism for students in facing the challenges of their engineering education. Participants reflected on seeking support from their friends. For example, one participant said they had “been kind of looking more to some of my friends and asking them for help” (Participant 1). Out of the 21 participants, 19 acknowledged the presence of a positive peer community. Notably, this theme was evident across all 6 interviews with racial-minority students, 8 out of 10 sexuality-minority students, and 14 out of 16 gender-minority students. Students noted that their peer community often helped them cope with the high workload and academic demands of engineering, which they described as having negative impacts on their mental health. For example, participant 8 shared that “the workload was such ... a constant burdensome slog, it was constantly stressful. It was constantly confusing. It was really difficult.” By contrast, participant 1 mentioned how “homework is just a really good bonding thing ... some of the greatest times I've had is working on homework.” Despite the widespread struggle with excessive workload, the positive impact of peer community emphasizes the importance of cultivating friendly and supportive environments.

Inclusivity

In the interviews, a duality of themes emerged: inclusion and isolation. Inclusion represents a sense of belonging and identity fulfillment, while isolation signifies an absence of such inclusion. Out of the 21 interviews, 20 participants indicated signs of isolation, while only 12 indicated a sense of inclusion. Among these 12, many attributed their sense of belonging to

various campus communities, clubs, or organizations (e.g., learning communities, the Honors program, the multicultural engineering program, the aerospace club, Spectrum, OSTEM, etc.). Notably, 9 participants discovered that student mentorship, whether as mentors or mentees, played a pivotal role in fostering their identity fulfillment and sense of belonging.

Conversely, among the 20 participants who reported a sense of isolation, a majority identified two primary sources: facing identity-related challenges and being overwhelmed by shouldering academic and personal burdens in solitude. Participants, all of whom hold at least one minoritized identity, often described feeling conspicuous and disconnected, contributing to feelings of isolation. Furthermore, 11 participants experienced both inclusion and isolation during their time in college, 8 being upperclassmen (third or fourth year) and 3 being underclassmen (first or second year). Additionally, of the 9 participants who felt solely isolation, 2 were upperclassmen, and 7 were underclassmen. This difference in participants' sense of belonging and feelings of isolation based on their academic year suggests that early college years may pose challenges to feeling included for minoritized engineering students. Moreover, the significant discrepancy between participants' feelings of inclusion and isolation raises concern, as previous research has linked a student's sense of belonging with their retention in engineering [11]. Addressing this issue is critical to enhance students' educational experience and long-term success in engineering.

Summary

In this study, we analyzed the experiences of 21 undergraduate students studying engineering at one university. The primary objective was to capture and understand the experiences of these students to gain insights into the struggles they face during their journey to achieve higher education. Based on the data collected, we have highlighted how peer community can play an invaluable role in supporting students as they cope with the heavy workload that they face within the program. Furthermore, our research explored factors that contribute to a student's sense of inclusion versus isolation within the academic setting. We discovered engagement in extracurricular activities assists in providing a feeling of inclusion amongst their peers. However, a student's sense of belonging to the engineering community and the level of college-related stress can contribute to their sense of isolation. Understanding what contributes to a student's sense of belonging is crucial for implementing effective support structures that can cater to the variety of needs of engineering students, specifically minorities, who may face additional challenges. A final significant aspect of our research was exploring the impact of professors on a student's educational experience. We discovered that empathetic and adaptable professors play an invaluable role in creating a positive learning environment, while apathetic and rigid professors can create stress and frustration within their students. We recommend that faculty continue to empathize with their students' needs, while remaining open to the constantly evolving teaching styles. Future work will include deeper analysis of the qualitative data and additional data collection, including focus groups and a quantitative survey.

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Contribution of Authors

The broader research project was conceptualized by Authors 4 and 5, whose respective research aims to examine the impact of classism and economic marginalization on student experiences (Author 4) and broaden participation in engineering (Author 5). Authors 4 and 5 designed and conducted the interviews for this project. This specific research project was conceptualized by Authors 1, 2, and 3.