Board 338: Mental Health in Engineering Education Before, During, and After COVID-19 Related Disruptions

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Abstract: This paper summarizes the results of our NSF funded longitudinal study on mental health in engineering education (EEC #1929484 and #1929478). Survey instruments were used to measure the prevalence of several mental health conditions in engineering students at 8 partner institutions as they progressed through their engineering programs. Since this data collection began in Fall 2019, shortly before the outbreak of the COVID-19 pandemic and continued into 2021, our results provide a unique insight into the state of mental health in engineering education during "normal times," how it changed and how mental health issues skyrocketed during the early stages of the pandemic, and to what extent mental health has recovered to pre-pandemic levels as engineering students returned to campus.

Data Collection

This study used survey instruments to get a broad understanding of mental health trends among engineering students and targeted interviews to get a more in-depth understanding of experiences related to mental health in engineering programs among selected groups of students.

Survey Design

The survey initial survey instrument was largely comprised of widely used population-scale measures of mental health. Modules from the Patient Health Questionnaire (PHQ) were used to measure rates of depressive, anxiety, and eating disorders [1]. The PC-PTSD was used to screen for incidence of PTSD-like disorders among engineering students [2], [3]. The actual conditions measured are summarized in Table 1. Mental health conditions screened.. The Kessler 6 instrument was used to measure moderate-to-major psychological distress among respondents [4], [5]. Demographic questions were added to allow us to study whether and to what extent mental health disparities exist among different student groups.

Table 1. Mental health conditions screened.

Instrument	Condition
PHQ	Major depressive disorder
	Other depressive disorder
	Panic disorder
	Other anxiety disorder
	Bulimia
	Binge eating disorder
PC-PTSD	PTSD-like disorders
Kessler 6	Moderate psychological distress
	Major psychological distress

In response to the COVID-19 pandemic, in 2020 the survey instrument was updated with a revised version of the Social Readjustment Rating Scale to measure the impact of the pandemic on respondent life stress [6], [7]. Additional questions were included to ask respondents whether COVID-19 and the academy's response to it affected their food and housing security, and ability to access course supplies and instruction. Finally, we added some free-response prompts to the survey to allow students to discuss what they thought about their institution's response to COVID-19, how the response could have been improved, and what personal strategies respondents were using to cope with the effects of the pandemic.

Survey Data Collection

The survey was issued to first- and second-year engineering and pre-engineering students at our eight partner institutions across the U.S. a total of four times. The initial survey-based data collection occurred in Fall 2019 through early Winter 2020, with follow-up surveys in Fall 2020 and Fall 2021. In response to the onset of the COVID-19 pandemic in the United States, an additional survey was sent to respondents in late May–June 2020. In the first data collection, respondents were asked to provide an email address if they wished to be contacted for follow-up research; respondents who provided an email address formed our longitudinal population pool.

The initial survey garnered over 800 responses from students at our various partner institutions. Participation in follow-up studies was significantly lower, and only a small number of participants completed three or more of the samplings, as summarized in Table 2.

Table 2. Participants in different samplings

Sampling period	Total Participants	Participants who completed 3
T1	797	170
T1.5	157	89
T2	263	151
T3	256	150

Interviews

Semi-structured interviews were conducted among select survey participants to examine which aspects of engineering education undermine student mental health. Fourteen participants were selected from the survey population using a screening survey. Interviewees were selected from those who reported that they had experienced challenges accessing their university's counseling services, had experienced challenges accessing their university's disability services, had experienced stigma around mental health issues as an engineering student, and had experienced challenges requesting informal accommodations from instructors for mental

health issues. Ultimately, these individuals represented five different universities in four different states in different geographic regions of the United States.

Results and key findings

This project has resulted in several important contributions to the field to date. Our initial survey data collection provides a detailed snapshot of mental health in engineering students across the United States immediately before the COVID-19 pandemic [8]. This data not only highlights overall incidence of mental health disorders in engineering students, but also shows how mental health issues vary across demographics within engineering. Our data collection taken in summer 2020 for this project, along with similar data we collected under the related RAPID 2029206 illustrate how the early stages of the COVID-19 pandemic led to a spike of depressive disorders among engineering students and reshaped mental health and demographic variations in the engineering student population. Finally, the entire longitudinal data collection illustrates the extent to which incidence of mental health conditions have changed from pre-pandemic to the "new normal" "post-COVID" world of Fall 2021 [9].

Analysis of our interview data illustrated several areas where the culture of engineering education on campus was creating barriers to good mental health for students, and how campus policies were creating barriers to treatment and obtaining necessary academic accommodations. As a result of this work, we were able to develop recommendations for various stakeholders, including faculty, college administration, and campus wellness centers to better support engineering students.

The publications resulting from this project and the related RAPID project 2029206 are summarized in Table 3 and are all available online at https://sociologyofengineering.org/#post-21.

Table 3. Publications resulting from this grant and related RAPID 2029206 grant to date.

Publication
Danowitz, A. & K. Beddoes. A Longitudinal Study of Student Mental Health During the course of the COVID-19 Pandemic. ASEE Annual Conference, June 2023.
Beddoes, K. & A. Danowitz. Thinking Systemically to Better Serve Engineering Students' Mental Health Needs: Policy and Process Recommendations. ASEE Annual Conference, June 2023.
Research Briefs for deans, faculty and student advisers, student service providers, all students, and women students
Danowitz, A. & K. Beddoes. How the COVID-19 Pandemic Reshaped Demographic Variation in Mental Health Among Diverse Engineering Student Populations. *Australasian Journal of Engineering Education*, 27(2): 67-76.
Danowitz, A. & K. Beddoes. Effects of COVID-19 on Stress and Mental Health of Community College Pre-engineering Students. FIE Annual Conference, Uppsala, Sweden, October 2022.
Danowitz, A. & K. Beddoes. Mental Health in Engineering Education: Identifying Population and Intersectional Variation. *IEEE Transactions on Education*, 65(3): 257-266.

Beddoes, K. & A. Danowitz. In Their Own Words: How Aspects of Engineering Education Undermine Students' Mental Health. ASEE Annual Conference, June 2022.
Beddoes, K. & A. Danowitz. Learning from Universities' Responses to the COVID-19 Pandemic: Lessons for the New Normal. SEFI Annual Conference, September 2021.
Beddoes, K. & A. Danowitz. Engineering Students Coping with COVID-19: Yoga, Meditation, and Mental Health. ASEE Annual Conference, Virtual conference, July 2021.
Danowitz, A. & K. Beddoes. Work in Progress: A Snapshot of Mental Health and Wellness of Engineering Students Across the Western United States. FIE Annual Conference, Virtual conference, October 2020.
Danowitz, A. & K. Beddoes. Work in Progress: A Snapshot of Mental Health and Wellness of Engineering Students Across the Western United States. FIE Annual Conference, October 2020.

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[8] A. Danowitz and K. Beddoes, “Mental Health in Engineering Education: Identifying Population and Intersectional Variation,” *IEEE Transactions on Education*, vol. 65, no. 3, pp. 257–266, Aug. 2022.
[9] A. Danowitz and K. Beddoes, “How the COVID-19 pandemic reshaped demographic variation in mental health among diverse engineering student populations,” *Australasian Journal of Engineering Education*, vol. 27, no. 2, pp. 67–76, Jul. 2022.