Board 73: Student Perceptions of Engineering Stress Culture

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Student Perceptions of Engineering Stress Culture

Introduction

Stress is a particularly salient feature for engineering students who report high levels of stress [1, 2]. However, the association of stress as part of engineering culture and the implications for engineering programs has not been fully explored in the literature. Studies on engineering culture describe a particularly bleak outlook, with the rigor and selectivity of engineering programs perpetuating a "meritocracy of difficulty" [3] where student success can be interpreted as "being able to take it" [4]. Within engineering, disciplinary subcultures have also been described [5]. This work is part of a larger study to understand how students experience stress as part of engineering culture. The overarching goal of the project is to understand how a culture of stress develops in engineering and how it impacts student perceptions of inclusion in engineering disciplines and their level of identification with engineering. Our previous work has indicated that correlative relationships exist between engineering student identity, perceptions of inclusion, and self-reported stress, anxiety, and depression [2]. The current work is a project status update to present results of a thematic analysis of the student comments about engineering in response to an open-ended question collected as part of a larger survey [2]. Through this analysis, we identify themes in how students openly describe engineering culture and mental health in engineering, as well as themes of specific stressors and positive experiences in engineering. Common themes that emerged in the thematic analysis of statements about engineering culture were the association of mental health problems with studying engineering, lack of caring and community in engineering, and the need for more attention to mental health in engineering. The most common negative theme that emerged in the analysis of statements about specific stressors for engineering students included rigor of engineering programs and concerns about performance. The most common positive themes that emerged in the analysis describing experiences of engineering students were quality teaching, counseling, and participation in extracurricular activities. Analysis of student comments and discussion of the implications for engineering programs are discussed.

Methods

We previously surveyed undergraduate engineering students at a large, public university in the fall of 2017. The survey included questions about mental health, inclusion, and engineering identity [2]. At the end of the survey students had the opportunity to respond to the prompt "Is there anything else you would like to share that was not included on the survey?" The original survey collected responses from 1,173 students and 216 of these respondents provided additional comments which are the focus of the analysis (~18% response rate) presented in this paper. The first author conducted open coding of responses with particular attention paid to topics of the survey: engineering identity, perceptions of inclusion, and mental health. Next, the first author used constant comparative analysis [6, 7] to define coding categories that represented student responses. After a research team review of the code definitions with data excerpts, the first author reviewed all open responses and assigned primary codes. Secondary and tertiary codes were assigned where necessary. We then tabulated the number of responses that were coded in each category. Responses were categorized into four main categories: perceptions of engineering culture, stressors, positive experiences, and other.

Results
Results were analyzed based on the four overarching categories: student perceptions of engineering culture, stressors, positive experiences, and other. Responses categorized as "other" included clarifications the student wished to add to their survey response (e.g. "Currently in Australia on exchange"), suggestions for the survey (e.g. "You guys should probably ask for GPA or something, I think that would be correlated with whatever you are studying."), or general comments about the survey (e.g. "This is a good survey."). Of the 216 responses, 66 were categorized as other (30.56%). Each category is described in detail in the following sections.

Student Perceptions of Engineering Culture
Of the 216 responses, 46 students made statements about their perceptions of engineering culture (21.3%). Emergent themes, definitions, and their prevalence in student responses are presented in Table 1. Some statements represented multiple themes.

Table 1. Emergent themes in student perceptions of engineering culture.

Theme	Definition	Example	Prevalence
Engineering and Mental Health	Statement that links being an engineering student with stress, anxiety, or depression	"The engineering student life is stressful and sometimes detrimental to mental health."	30.43%
Lack of Caring and Community	Statement about lack of caring of the department, administration, or lack of community in the program	"I find many professors' attitudes towards student work is "get it done" or "deal with it.""	23.91%
Needs Attention	Mental health needs increased attention in engineering, including training for faculty and staff.	"I feel that members of the department should receive training on depression/anxiety in order to better understand students [sic] needs and reasons for things like missing deadlines."	17.39%
General positive culture	General positive comment about culture in engineering	"The <department> rocks!!!"	13.04%
Lack of Diversity and Inclusion	Statements that state that the college or program lacks diversity or that the college or program needs to increase diversity	"I think the gist of the <department> is that nearly any student can be valued, but most end up being fodder. The only racial minority that i think suffers systemic underrepresentation and lack of inclusion is the black minority."	10.87%
Pride	Statement about pride being an engineer	"I like the respect that we as engineers get here"	6.52%
Supportive Community	Statement about a supportive community	"Although this department is very competitive and rigorous, the students of <department> are a very welcoming community and their academic and emotional support has led to my success in this department"	2.17%
General negative culture	General negative comment about culture in engineering	"This school will get me a job but if my job is 50% like my time here then I may switch fields."	2.17%

The most prevalent theme was the association of studying engineering with poor mental health. Students commented on the high levels of stress in engineering. Some students explicitly compared engineering as worse off compared to other disciplines (e.g. "Anxiety is so prevalent on campus and sometimes engineering culture adds to that significantly") while others made general statements specifically about the stress of being in an engineering program (e.g. "I think the stress levels that engineering creates are detrimental to students and unnecessary."). Many students described levels of stress that are unhealthy, with some attributing mental illness to studying engineering. Students also described the high numbers of engineering students struggling with stress, anxiety, and depression, and the need for great attention to mental health:

> "I feel that this department has a lot of issues with mental health. I know a lot of students who are constantly overwhelmed with schoolwork, including myself. A little bit of stress at times is normal and healthy but it's different when that stress becomes anxiety that prevents you from living your life normally. The engineering courses at this school can be so brutally rigorous and I feel that there is no sympathy for students at all. I believe that the College of Engineering is failing to address these mental health issues to the degree that they should be. They should be constantly reaching out to students letting them know the resources available to help them through hard mental times. The College of Engineering, and all the department's [sic] within it, should show that they care for the well-being of the students a little more."

Stressors
Of the 216 responses, 88 students made statements about specific stressors they encounter as engineering students (40.74%). Emergent themes, definitions, and their prevalence in student responses are presented in Table 2. Some statements represented multiple themes.

Table 2. Emergent themes in student descriptions of stressors.

Theme	Definition	Example	Prevalence
Rigor	Statement about how the study of engineering is challenging or hard or has heavy workloads or is competitive	"All professors seem to pile on work at the end of the semester, making it very hard to relax and have any downtime."	28.41%
Exams	Statement about how exams (finals, midterms, or other) case stress	"Midterms can be very stressful."	9.09%
Concern about Performance	Participant expresses concern about being successful in engineering or performing well in coursework	"I often feel like I am not creative enough to be an engineer, as I tend to struggle most with open-ended projects and applying knowledge. This often makes me doubt becoming an engineer."	5.68%
Poor Advising	Statement expressing poor experience with advising staff in engineering	"I feel like academic advisor and other advisors are annoyed if we go visit them, that is really disheartening, to be seen as a problem instead of a person."	5.68%
Lack of Connections with Faculty	Statement expressing concern or stress about not having connections with faculty members in engineering	"It's difficult to know where to start to get to know teachers. I do well in all of my classes, but still don't have connections with professors."	5.68%
Projects	Statement about stress due to course projects in engineering	"There's definitely been a few times, just not this week, that I've had a sort of anxiety attack (heavy breathing, increased heart rate, panic). It was usually caused by being overwhelmed with big projects."	4.54%
Poor Teaching	Statement about poor teaching in engineering by faculty or teaching assistants	"This department repeatedly gives classes to faculty who have been deemed awful at teaching by myself and my peers, resulting in a lower quality of engineer upon graduation."	4.54%
Lack of Emphasis on Learning	Statement expressing concern that there is a lack of emphasis on learning in engineering	"This is a good school to get a job from. This is a bad school to learn from."	3.41%
Concern about Jobs	Statement expressing concern about obtaining a job after graduation	"I still have doubts whether I am going to be able to get a decent job after graduation. I don't know what is enough for employers. They seem to never be satisfied."	3.41%
Discrimination	Statement describing an instance of discrimination experienced by the student	"I had a very sexist encounter with an assigned faculty mentor my freshman year and it made me reconsider my choice of major."	3.41%
Large Class Sizes	Statement about the large course sizes in engineering	"Some of the classes are so big that it can be easy to get lost and feel unneeded."	3.41%

Other stressors listed by students included debt, family, random calling in class, unstable curriculum (i.e. frequent changes in the curriculum for a major), public speaking requirements, poor advising, poor administration (i.e. department chairs and advisors), department disorganization, departments not listening to student feedback, short days, lack of support for disability, and lack of fit in the department (i.e. personality).

Positive Experiences and Ways to Reduce Stress
Of the 216 responses, 18 students made statements about positive experiences and specific ways they cope with stress as an engineering student (8.33%). Emergent themes, definitions, and their prevalence in student responses are presented in Table 3. Some statements represented multiple themes.

Table 3. Emergent themes in student descriptions of positive experiences and ways to reduce stress.

Theme	Definition	Example	Prevalence
Good Teaching	Statement about quality teaching in engineering courses by faculty or teaching assistants	"The department best benefits from professors that care about teaching."	27.78%
General positive experience	General statement about a positive overall experience in school	"I love school."	22.22%
Counseling	Statement that counseling was a positive experience and/or improved mental health	"It was only with consulting Counseling...I felt better."	16.67%
Extracurriculars	Statement about positive experiences in extracurricular activities	"I enjoy giving back to the community."	11.11%

While many students attributed their experiences with poor mental health to engineering, some students described resources and practices they were pursuing to improve their mental health: "Developed an anxiety disorder after starting college, currently taking steps to help (seeing a professional, practicing mindfulness/wellbeing).". Other positive experiences listed by students included department resources (buildings, budget, etc.), good advising, faith, mindfulness, and meditation.

Discussion
The overall goal of the project is to understand how a culture of stress develops and is perpetuated in engineering programs. Towards this goal, we surveyed undergraduate engineering students to examine the relationships between engineering student identity, perceptions of inclusion, and mental health [2]. In this study, we focus on the open responses provided by survey respondents to gain additional insight into the relationships measured between the survey constructs. The results were analyzed in three overarching categories: perceptions of engineering culture, stressors, and positive experiences in addition to a catch-all category of "other". Results from this analysis suggest that engineering students often associate studying engineering with poor mental health. High rigor and exams were found to be the most prevalent stressors discussed by students in this analysis. Positive experiences and ways to support wellness most

commonly described by students in this analysis included quality instruction, counseling, and participation in extracurricular activities.

Limitations
There are several limitations to the present study. First, the open response opportunity at the end of the survey did not ask students for specific content, and the content of the survey likely prompted students to give responses related to the questions of the survey, particularly about mental health and department inclusion. Second, the survey was distributed during the last two weeks of class of the fall 2017 semester. The end of the semester is likely a higher stress time for students due to upcoming final exams, projects, and reports, which may bias their responses about their overall experience in engineering and may also skew their description of stressors to exams and projects that are more common at the end of the semester.

Implications for Engineering Education
In recent years, colleges are grappling with what has been described as a "mental health crisis" [8]. The present study explores this crisis in an undergraduate engineering program through the voices of students. Students commonly described engineering culture as associated with poor mental health and often described their own struggles with mental health due to being a student in engineering. Additional resources for students, such as increased accessibility to counselors, as well as increased awareness and training for students, faculty, advisors, and administrators will be important steps to improving student well-being. Further, recognizing and addressing program-specific stressors and promoting student wellness will be critical in dismantling the association of poor mental health with engineering, which will have positive benefits for recruitment and retention of students in engineering. Engineering faculty and staff should consider the ways in which they communicate to students that perpetuate or exacerbate students associating "being stressed out" as the socially accepted norm in the engineering culture. Our study also highlighted the need for the development of inclusive communities in engineering programs. Students voiced the importance of feeling cared for by the department and making connections with faculty that are more challenging with large class sizes, which was also considered a stressor by several students. Students expressed concern about being treated like a "number" and about discrimination faced in engineering programs. As engineering programs enroll larger student numbers, it will be important to foster connections between faculty and students and to build a sense of community for students.

Conclusion
The present study analyzes student comments provided as part of a larger survey to study the association of stress as part of engineering culture. Overall, the current study highlights the need for greater attention to mental health in engineering programs. Future research is needed to understand specific stressors and elements of engineering programs that promote the association of stress with engineering in order to improve culture in engineering programs and enhance student well-being. Furthermore, understanding disciplinary history and the evolution of social norms within each engineering discipline will allow us to consider strategies to dismantle or overcome social norms that no longer reflect current and future engineering practice.

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