

In Their Own Words: How Aspects of Engineering Education Undermine Students' Mental Health

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Introduction

Several recent studies have documented high rates of mental health struggles among engineering students [1]–[4]. To date, however, studies of mental health in engineering have been limited to primarily quantitative surveys. This paper advances the research landscape by presenting findings from an interview study with current and former engineering students. The interview data can help explain quantitative findings from previous studies and provide deeper insights into relationships between engineering culture and mental health. Semi-structured interviews were conducted with fourteen undergraduate students from five universities in four different states in the United States. Through the interviews, we identified seven specific features of engineering and engineering education that undermined students' mental health. Furthermore, our analysis identifies not only what aspects of engineering education undermine mental health but also explains how they do so. While the interviews were conducted during the COVID-19 pandemic in fall of 2020, the experiences reported by students were primarily pre-pandemic experiences, and are not specific to pandemic conditions. In addition to elucidating the seven aspects presented in the Findings, one aim in identifying and discussing these features is to challenge tacit or taken-for-granted notions that these aspects of engineering education are given, necessary, unchangeable, or desirable. Shedding light on the ways in which the features identified in this paper impact students can help engineering educators, administrators, and other students critically reflect on how their role in perpetuating these characteristics affects students and the engineering education system as a whole.

Background

Mental health in engineering is a research area that has grown rapidly in recent years and studies in this area have documented wide-spread and often severe problems [3]–[5]. In the past several years, nationwide surveys have found that undergraduate engineering students suffered from some mental health issues at significantly higher rates than the general U.S. population [2], [3]. Additionally, comparisons to other disciplines reveal that engineering undergraduate and graduate students are less likely than students in other disciplines to seek treatment for mental health problems [6], [7], and studies of the relationships between disciplinary stigma and help-seeking are underway [8]. Furthermore, there is a growing body of evidence showing that belonging to a marginalized group in engineering, for example, identifying as a woman or as LGBTQ+, increases the likelihood of experiencing mental health challenges [1]–[4], [9]–[11].

In this paper, mental health challenges and disabilities are both discussed, sometimes interchangeably, due to the ways in which interviewees themselves responded to questions. Because of these confluences, the data provides insights into where and how overlaps between the two phenomena occur, and adds to previous findings that mental health is often worse for engineering students who also identify as having a disability [3], [12]. For example, in our data, interviewees explain how anxiety (a mental health challenge) caused them to need different testing formats and spaces (which qualifies for a disability accommodation from disability service

centers). However, it is worth bearing in mind that not all mental health issues are disabilities, and not all persons with disabilities experience mental health challenges.

Methods

Participant selection

Interviewees were selected from a list of engineering students who had previously completed a survey about mental health [3]. When completing that survey, participants were asked to provide their email address if they wished to be contacted for follow-up surveys and interview opportunities. In fall 2020, all survey participants who provided an email address were emailed and asked to complete a screening survey to help us select interview participants. The screening survey asked potential interviewees if they had experienced challenges accessing their university's counseling services, if they had experienced challenges accessing their university's disability services, if they had experienced stigma around mental health issues as an engineering student, if they had experienced challenges requesting informal accommodations from instructors for mental health issues, and if they were a military veteran. If they answered yes to the questions about counseling services, disability services, and informal accommodations, they were asked if it was before the pandemic started, after, or both. They were also asked to provide their self-identified gender identity and racial or ethnic identity. The screening survey was active for ten days, and 80 students completed it. No veterans completed the screening survey. We had resources to interview only a limited number of students and wanted to select those who could share the greatest number of experiences with us. We therefore selected participants who answered yes to all 4 screening questions or to 3 out of 4 and who had experienced challenges before and after the pandemic started. That yielded a pool of 32 possible interviewees, which was then narrowed further by selecting interviewees who would increase the institutional diversity and gender diversity of the sample.

Participants

The fourteen interviewees attended five universities in four different states in different regions of the United States. The departments represented included aerospace engineering, chemical engineering, computer engineering and/or computer science, and mechanical engineering. Nine interviewees identified as women, three identified as men, and two identified as non-binary. Two identified as Asian, four identified as Hispanic, Latino/a, or Latinx, and eight identified as White. Their mental health diagnoses included ADHD, anxiety disorders, bipolar disorder, depression, OCD, and PTSD. They were in their second, third, fourth, and fifth years of college. Four interviewees were either taking a year or semester off of school while considering switching out of engineering, or had switched out of engineering entirely at the time of the interview.

Data collection and analysis

Semi-structured interviews were conducted virtually in fall of 2020. They were audio recorded and transcribed. Interviewees were given \$40 Amazon.com gift cards for participating. The interview protocol began with screening questions, with individual follow-up questions asked based on responses given. The structured prompts for all participants included: 1) Please tell me

about the challenges you have experienced accessing or utilizing mental health related services through your university counseling center?; 2) Please tell me about the challenges you have experienced when trying to access or use mental health related accommodations through your university disability services center?; 3) Please tell me about the challenges you have experienced when trying to request informal accommodations from an instructor for mental health related issues?; 4) Can you tell me about the stigma you have experienced as an engineering student related to a mental health issue?; and 5) Is there anything else you think I should know about the topics we have discussed or about navigating mental health challenges as an engineering student?

Dedoose coding software was used to thematically code interview transcripts with an open-coding approach [13]. The themes were emergent and not prescribed by a pre-selected theoretical framework because of the novelty of the topics explored. This paper reports findings related to characteristics of engineering education. Findings related to the practices and policies of university counseling centers and disability service centers will be reported in a separate publication, as will comparisons to other majors. Quotations were edited for readability and text in square brackets added by the authors for clarity. Gender-neutral pronouns are used for all students in order to protect anonymity.

Findings and Discussion

This section identifies seven aspects of engineering education that interviewees reported undermined their mental health. Because our aim is to help explain *how* these characteristics undermined their mental health, interviewees are quoted at length in some places in order to allow those explanations to most clearly and fully be presented. Understanding complex phenomena and lived experiences often requires longer quotations. In this case, they are an important part of helping readers understand the connections and mechanisms by which these features of engineering education undermine mental health.

1. Ubiquity of stress leads to trivializing and normalizing mental health challenges

It has been noted previously that engineering education programs are characterized by a culture of stress [4]. While our interviews echoed that prior research, they also revealed how the ubiquity of that stress culture leads to the normalization and trivialization of mental health challenges. The common thinking seems to be that because all engineering students are stressed out, there are no real mental health challenges to be concerned about; anyone suffering is just like everyone else, and therefore not to be taken seriously. In other words, mental health challenges are being conflated with a level of stress engineering students should be able to handle (see section 6) by students, faculty, and counselors. *Common* is being conflated with *unproblematic*. As one interviewee explained, engineering “is really tough, so we’re all depressed, like all messed up mentally, so everything gets swept under the rug. It’s like almost too talked about, where it’s like not even something to worry about anymore.” Another said that because “everybody’s suffering” it’s a “faux pas” to talk about your mental health. Similarly, two other interviewees explained:

Other engineering students, they don't take you seriously because they're struggling too and it's sort of like, 'Oh, I'm struggling more than you, because I have all these classes and extracurriculars and stuff' like because engineering students are people who are trying the

hardest, doing the most and stuff, and they don't take you seriously because they're going through all this crap too. And when I have like liberal arts majors who are my friends, they're like, 'Oh, you're going through something and it's not just because of your major, let's get you some help'.

And then also, people say, 'Well, anxiety isn't real. Like, you *should* be stressed over classes,' but I also have general anxiety, so I constantly am hearing like, 'Oh, this is just the classes you're taking. You'll be fine.' But in reality, it's also the anxiety, the stress, everything building upon each other. So a lot of it is just me being told, like 'You're fine. You chose to be in this major. You did this to yourself' basically, when in reality it's like No, I do have a mental health condition...Like it's almost like seen as it's not a thing.

Many interviewees also reported that the trivialization and normalization of mental health challenges occurs through students making jokes about mental health, including the commonality of suicide among engineering students. On one hand, while making jokes about these issues may serve to trivialize them, on the other, for some students it may be a coping mechanism or a cry for help. Trivialization and normalization also occurs through counselors actions, as recounted in this story:

I went to the [counseling center], and I talked to someone...and then he basically said that everything I was feeling was normal and because I'm an engineering student, this is what everyone feels like, so there's nothing wrong with you. You can come back, but he doesn't recommend I come [back]. And that was incredibly just not what I needed to hear, and it was not helpful at all.

Such stories indicate that counselors are an important stakeholder group to include in efforts to address unmet mental health needs among engineering students.

2. Professors not being sympathetic, understanding, or accommodating contributes to mental health challenges and related stigma

With a few exceptions, interviewees reported a sense that their engineering professors (or professors of courses required for the engineering degree, e.g., physics and math) and teaching assistants (TAs) did not understand mental health challenges, did not take them seriously, and/or were not sympathetic or accommodating about such challenges. Some of the responses about professors linked this theme to theme 1 above, as well as to the widely-recognized weed-out culture of engineering. Interviewees' experiences included feeling like they could not ask for informal accommodations (e.g., extensions, extra time on tests, quiet rooms for tests, make up exams), suffering negative repercussions when they did ask, mostly having their requests denied if they did ask, and a generalized sense that engineering professors do not take mental health seriously and/or do not want to hear about it or discuss it. For instance, several described a general sense that it is difficult to talk to professors about anything; they do not seem approachable or interested, and that mental health in particular is not something students can discuss with professors. Here is how one student explained why they would never ask for informal accommodations:

That's something that wouldn't be accepted. Like, I don't think I've ever openly said to a professor, 'I need this extension because of mental health'. That's just not something you would do. I think the reason I have that view of that is maybe some small comments professors have made...like the university has us do like a lot of mental health and sexual assault and trainings at the start of the year...And the professors sometimes meet it with like eye-rolling attitudes like 'it's time for this again'...It just kind of is looked at with a flippant attitude.

Another student felt a similar taboo when trying to discuss a bipolar diagnosis with professors. They are "too afraid to ask questions or talk about it" and that "feels like a stigma, like 'oh no don't talk about it. We don't talk about those things here'." She wished they would "talk about it, normalize it, normalize getting help." One student drew a distinction between internal and external situations and explained that internal struggles are not seen as legitimate in the same way as external struggles, and it relates back to the previous theme of trivializing mental health challenges:

[Engineering] classes are more rigorous and have stricter deadlines, and, generally, are more competitive, and because of that, it doesn't always equate well to like if I let my professor know that I'm just having a really bad mental health day...that's not a compelling enough reason for them to allow an extension. They need like 'my house is on fire' or something. They need more of a physical or situational type of occurrence, rather than something that is purely internal. It's very clear that it's not seen as the same level.

Aside from professors just not wanting to talk about mental health, or not taking it seriously, however, several students described incidents of professors being unkind or even retaliatory when students did express any kind of mental health struggles. For example, one reported a time when they "had really awful experiences trying to approach a professor and ask for help":

I tried to explain that I had mental health issues that were interfering with my education and the professor's response wasn't welcoming and then he got kind of hostile...I was actually called on at one point in class and I gave the best response that I could, but it wasn't the response he was looking for and in front of the whole class he said that if you couldn't answer that question, you would make nothing more than a mediocre engineer. And so it just felt pretty awful.

Also evident in the interviews was a belief that engineering professors and teaching assistants do not understand that not all students' brains work the same way and that they misunderstand the nature of accommodations. One student recalled a time when even with a formal accommodation request from the disability service center, their teaching assistant would not honor it because he thought it was "too hard or annoying" and would give the student an "unfair advantage" even though the TA "was really misunderstanding what he was being asked to do." In the end, after a lot of pushback from the TA, the student gave up because they were "so exhausted with the conversation." When asked about stigmas, another student said that the stigma stems from engineering professors not understanding that people learn differently: "the biggest one that sticks out to me is a lack of understanding, a lack of recognizing that there are some people who learn extremely differently than others and may have significant barriers in the way that they learn." This lack of understanding manifests in the next theme as well, in the design of exams.

While this theme highlights improvements that can be made in individual professors' actions (e.g., not publicly shaming students who ask for help), it also highlights opportunities for policy change. Some of the unwillingness to offer informal accommodations likely comes from institutional policies that prevent professors from offering informal accommodations. For example, at some institutions, if an informal accommodation is offered to one student, it must be offered to every student. Such policies could be rethought with the interest of equity – rather than equality – in mind, and with a better understanding of the intersections between neurodiversity and mental health.

3. Certain exam formats exacerbate anxiety and are not inclusive of diverse ways of thinking

Several students explained how some exam formats caused challenges and could be changed to avoid those problems. Specifically, two students explained how exams that are set up to only allow students to go forward, rather than being able to move forward and backward between questions, negatively affected them. One explained how allowing students to see the entire exam made her exam grade go from 25 to 77:

...they made the exam to where you couldn't flip through the exam. So you had one question at a time to help prevent from cheating and it was one hour...and because I couldn't flip through and I have really bad test anxiety, it did not help me at all. And I tried to talk to the professor afterwards about how I had tried during the exam. So they changed it to where you could flip through it...And it helped a lot. So like for the first one, I got a 25%, and then being able to flip through it... I got a 77, so the difference is really big.

A second student similarly explained how because their brain did not work “linearly”, this exam format was a problem for them:

I've had some professors who have exams set up in a way that is really frustrating for me and not very accessible, but there's been no way to accommodate around it. Like this quarter I have a professor who essentially, the way her quizzes are set up, you can't go back on questions. So you have to answer them and then move on. They're online. And each question, the answer is locked in. You can't refer back. This is frustrating for me because I don't do things linearly, and when I am forced to I end up spending way too long on each question that I don't know the answer to rather than like trying to skip and move on and come back to it.

This student went on to explain that the rationale for not giving accommodations was to avoid perceived unfair advantages that would accrue if the student was allowed to move forward and backward through the exam:

The reason why that hasn't been able to be accommodated even though I did reach out to [disability services] on this one was because apparently there's some kind of exception where if the exam is set up in a way that like altering it would dramatically alter the state of the exam and therefore, give me a potential advantage or something then they don't have to accommodate that. And so essentially by allowing me to go out of order potentially, I

could get answers from earlier questions by reading later questions. And so I wasn't able to get that changed.

As with the previous theme, this finding offers an opportunity to rethink both individual practices as well as institutional policies, and it highlights a professional development opportunity to help professors better understand neurodiversity, mental health, and equity. There are likely ways that exams can be designed to avoid the perceived problem described above. Helping professors understand that there are better ways that are even more “fair” would go a long way toward improving engineering education for students like our interviewees.

4. 5-year degree programs sold as 4-year programs cause stress and anxiety

Another structural issue reported was that even when a vast majority of students in a program take five years to graduate, the university still sells it to students and parents as a four-year program. This creates an added sense of being behind from the beginning, which contributes to stress and anxiety:

There's a small population of people who actually can graduate in that major in four years, and I can't fathom [how they do it]. And I think that's mostly the university's propaganda of needing to push that the major is a four-year program, despite the fact that everyone knows it's not. There's no way you can finish in four years. I think it's like roughly 60 or, no it's gotta be more like 80%, of Mechanical Engineering students don't graduate in four years. So there's already a sense of like being behind because you're told when you enter the major that it's a four-year program. But by the time you start getting into late freshman year sophomore year, you start talking to upperclassmen and they're like, 'Are you kidding, you're not going to graduate in four years.'... Also there's the pressure of parents expecting you to graduate in four years and you now have to explain to them, 'Oh hey remember how we thought that I was going to graduate in four years? Guess what? No, no longer.'

Given that the average national four-year graduation rate for engineering majors is just 33% [14], this phenomenon of curriculum decisions undermining mental health is likely not limited to the one mechanical engineering program this student spoke about.

5. Ties to the military and government contracting prevent help-seeking

Students worried that having a record of being diagnosed with a mental health condition or having sought treatment for mental health would negatively impact their ability to get a job in industries that require security clearance or are tied to the military or defense sectors. This prevented them from seeking help for mental health challenges they were experiencing. In our study, it was primarily, but not exclusively, aerospace engineering students who discussed this aspect of engineering. However, this phenomenon likely affects many students as the military (and associated contracting) is one the largest employers of engineers in the United States [15]. In the following quotation, we can see how one aerospace engineering student explains this phenomenon:

In the engineering field, specifically, the one that I'm in, aerospace engineering, a lot of our jobs, at least some of the really cool ones, you generally need a security clearance for them.

And if you have like a disability, specifically mental disability, it can sometimes prevent you from getting a clearance or working in defense in certain jobs. And so it was really nerve wracking [asking to] take an exam in a quiet environment...we know that our work is life and death, we build rockets that can have people on them or we build airplanes that have people on them. And if you're the guy who makes something blow up, that's lives lost or if nothing else it's a lot of money lost, so it's a serious job. A big thing that a lot of us experience is that when you want to work in defense or certain space jobs where you need a clearance and you're not perfectly mentally fit... so if you have any sort of mental illness, if it's anxiety, if it's depression, maybe those can get by, but anxiety is pretty questionable depending on how severe it is, if you have it stated that you have a disability for anxiety then that reduces or almost eliminates your chances of getting a clearance or getting into jobs. And there's the concept of like, 'Nope. People don't want to take a chance on hiring someone with a higher chance of mental breakdowns when deadlines are approaching,' let alone if it's a more visible mental illness that might affect things more like a personality disorder like bipolar, schizophrenia, where they don't think they can trust the quality of your work day to day. There's a big stigma of like if you're not good the week before deadlines and you know we're putting out serious stuff to military helicopters where if they can't read the proper amount of fuel left in the helicopter and you're going to be the reason that they run out of fuel mid-flight. It also prevents a lot of students [from] talk[ing] about having any sort of mental health issue, and it also prevents a lot of them from seeking help from disability services out of fear that having that title of someone with a disability would hurt your chances of what you can accomplish, what you want for your chances of how far you want to go and they just kind of see it as a hindrance....But if you're also medicating for something, that's going to prevent you from getting work, especially in like clearance or defense. I think one of my friends who takes anxiety medicine was rejected from some job she was going for in the defense industry because they said, 'Well, you're reliant on anxiety medication and we can't count on that to just work perfectly for you every day, or that you're going to remember to take it every day, or that it's not going to like wear off and you're going to need a new one, and you're gonna have this weird in between period where you're not going to be able to work, how we want.' And it's a big stigma of, like, basically, if you have any sort of mental illness, you better sure hope that you can control it or keep it at a minimum or have it to a point where you don't need medication, where you don't need too much help because it's basically just going to hurt your chances of getting your dream job. And it's sad, but we have a lot of people drop out of the program. So I guess I'm used to seeing it, but it certainly has been rough when I was going through my high anxiety times...and saying, 'Well, I guess I just have to deal with it because if this all blows over, if I feel better in a couple of months because I get better at managing it without medication... if I jumped the gun now [by getting help], it could ruin my future.'

The following day, this student sent the interviewer a follow-up email with a story that they wanted to share because it demonstrated an example of how this phenomenon had already impacted their credibility among other engineers and engineering students. They wrote:

Regarding the stigma against mental health experienced in engineering...a personal example I should add is the stigma I experienced personally in an engineering club on campus. I'm public about my anxiety with most of the project leads I work with (as club

chief engineer) mainly because a lot of them knew me when my anxiety was much worse than it is now. I've never let my anxiety affect my work here and was elected for the position because of my capabilities and expertise. Recently it was used against me when I tried to suggest a safety feature for a project; the lead got upset with me and the tension was mitigated by another lead saying I was only being so cautious because of my anxiety, downplaying the legitimacy of the concern. I couldn't even argue for myself much because it would support the insane/anxiety argument. This became a big deal because part of my job relies on having project leads trust my word when I tell them to change something to be safe as possible, add backup plans, etc. Launching rockets is risky and we've seen how bad things can get when safety is overlooked and people can get physically injured- the last thing we need is a project lead not willing to listen to a voice of reason. In conclusion: It's not just industries that will fear they can't trust your word if you're not mentally 'perfect', but students in college clubs can also have strong fears and stigmas against you (especially if it plays to their advantage).

The problem with this situation is that it does not ensure that all engineers are "mentally fit" (without getting into who gets to decide what counts as mentally fit and what that means for engineering). Rather, it ensures that the field ends up with engineers with *untreated* mental health challenges.

6. An ethos of superiority creates a culture of silence

A sixth aspect of engineering education that emerged from the interviews was an ethos of superiority that perpetuated stigmas around having and discussing mental health challenges. Interviewees described a normativity that engineering students are the smartest, the toughest, the most capable, and should be able to handle anything thrown at them. If you are struggling, you do not belong. There is no room for anyone who is not "mentally fit." Typically this was by comparison to students in other majors, who are viewed as inferior. This ethos prevented students from discussing their mental health struggles and from seeking help. As one interviewee put it: "People expect engineering students to be prepared for a lot of things and...we're expected to be able to handle more...and I just feel like the stigma for having some mental health concerns is very high in that aspect." Voicing a similar perception, a different interviewee explained:

There's just not a lot of room for people who have mental disabilities like myself. It's very specifically that major [mechanical engineering], but like just the vibe of engineering is that it's prestigious and therefore cutthroat and, if you can't make it, if you fall behind, like, sucks [for you]. And you know, that's pretty common.

Yet another interviewee evidenced that perception of the "typical" engineering student when they said: "I've always been kind of the non-typical engineering student in that I don't have the best grades or everything doesn't automatically make sense."

This ethos creates a perception among students that they are the only ones struggling; everyone else is doing great and thriving in the competitive culture of engineering education. This means that the students struggling feel that they should not talk about it, which continues the cycle of silence that bolsters the ethos of superiority. In other words, it is a cycle where the ethos that

engineering students are superior and can handle anything creates a culture where students pretend that that is true so they are not judged negatively, and, consequently, students perceive that no one else is struggling. It calls to mind a form of disciplinary “keeping up with the joneses” in which rather than financial problems, what is being perpetuated are mental health problems. It also feeds into imposter syndrome. The following excerpts from three different interviewees highlight this phenomenon:

When I talk to people in other majors they think that ‘oh engineering students are so smart’ like because you got into engineering in the first place...But that's not the real case. When you actually enter engineering buildings, you realize that there are some people that are doing extremely well and there are others who are not doing that well but don't talk about it. They try to only show that they're doing well in internships or projects or they're like club leaders, etc., and they never talk about anything like failures. When I go to the computer science subreddit, on Reddit.com and I read through those, people anonymously would write [about] how much they're struggling...[But outside of that,] people usually just try to show off how good they are, but they always hide what's really going on...I have a friend in engineering that's really close to me, and during midterms or finals we usually call each other and cry in front of each other because we're having panic and anxiety attacks and we tell each other because everyone looks like they're succeeding. There's nothing to show like that failure is okay...People out there are struggling too, they just don't show it. So I feel like if there was something that showed that it's okay to fail in these courses, if the professor had said that ‘it's okay, even if you fail, you can take it again. There is no rush to get it all at once’, I feel like students would be more calm, there wouldn't be so much stress around the engineering buildings all the time.

The first thing I noticed when I went into engineering...[was that] a lot of the engineering majors that I met are super passionate, super hard workers. It's like straight A kind of students, you know, like didn't fail classes, were super hard workers. And when I was struggling with mental health, I couldn't focus. Loss of concentration is a really big problem for me. So when I can't focus on my work, I feel like a failure. Within engineering, it's really hard to stand up to them because everyone in engineering is super competitive, they're going to all the job fairs, they're doing all these outside projects and like, ‘look at me, look what I'm doing, I'm doing all these amazing things’. It makes me feel like crap because I'm just here to get my degree and I'm already struggling mentally, so that makes me feel worse because it's like, ‘well, now I'm not good enough, now I need to be doing all these things I don't have the energy for’.

I always try to avoid being with the other student engineers because they are really smart ...and I remember a professor told me that lots of engineering students, especially CS students, tend to have this fly or drown situation where, like, if they're drowning they don't tend to ask for help at all because they see everyone [else] flying.

These findings highlight a similar phenomenon to what has recently been identified as *professional shame* by other engineering education researchers [16]–[18]. The findings also reveal a disconnect and striking contrast between what our interviewees experienced in their courses and what other engineering students are experiencing in labs; recent research has demonstrated how stories of

failures and personal struggles in engineering and engineering education are commonly used to socialize students into engineering in labs [19]-[20]. What could be gained by bringing some of that mentality to engineering coursework?

7. Being in an environment dominated by men adds to stress and pressure on some women

Several women connected their discussion of mental health challenges to being in a field dominated by men. They felt that they were already being viewed negatively for being a woman in engineering in the first place and showing weakness or emotion related to mental health challenges would compound the perception that they did not belong. For example, one explained that “being in engineering and a woman and not being able to hold a straight face all the time, it's a little hard. I think of it as like ‘you’re not supposed to show feelings at all’.” Another likewise said that “engineering, is very strict and straightforward and ‘don't cry about it’, type of thing...[it's] a lot of pressure...to be the model of what they want you to be...because usually I'm one of the only women in my class. So it's a lot of judgment.” These findings offer some explanation to prior survey findings that women engineering students’ mental health tends to be worse than men engineering students’, particularly around added stresses they experience to fit in [3]-[4]. A much longer analysis of all the ways in which the themes reported in this paper are gendered could be written as well, and may be explored in our future work.

Conclusion

This paper identified seven aspects of engineering education that are undermining engineering students’ mental health. These characteristics either create and perpetuate mental health challenges, or create stigmas and barriers that prevent help seeking. The aspects of engineering education identified above are likely not an exhaustive list of features of engineering education that undermine mental health; indeed, others have been identified elsewhere [21]. For instance, raced and racist aspect of engineering education may have been more prominent in the findings if Black participants were represented. Nor is every feature identified in this paper detrimental to every student; however, we contend they are important for understanding the state of many engineering students’ mental health. Further, we contend it offers insight into attrition from engineering programs, as several of the participants were taking a year or semester off of school while considering switching out of engineering, and one had left engineering entirely at the time of the interview due to their mental health challenges.

There appears to be growing interest in interventions designed to support the mental health of engineering graduate and undergraduate students in recent years [3], [22]. However, adaptation to a problematic system should not be the (only) goal, nor should hiding these problems. Some universities told us they would not participate in the original survey study because they did not want engineering to look bad and increase the difficulty of recruiting engineering students, likely anticipating some of the very findings reported here. However, hiding these problems from potential students should not be the goal either. Rather, engineering education stakeholders should move toward changing features that can be changed. The interviewees told us they wanted to do these interviews because they wanted things to change – they wanted engineering education to be better for future engineering students. Indeed, many of the aspects identified in this paper are not unchangeable, inherent, necessary, or worth protecting.

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