Board 278: Faculty and Staff Ideas and Expectations for a Culture of Wellness in Engineering

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Faculty and Staff Ideas and Expectations for a Culture of Wellness in Engineering

Mental health challenges are a growing concern in engineering education. A culture that promotes wellness in engineering could support both student and faculty psychological health. As part of a larger, ongoing project on the mental health and wellness of undergraduate engineers, our team has investigated how stress and culture interact in engineering education to produce environments that promote hardness over wellness. We posit that faculty and staff are influential stakeholders in defining the culture of academic programs, thus making them important sources of information for understanding the associated core shared beliefs and assumptions. The goal of this paper is to qualitatively analyze what faculty imagine or believe a culture of wellness would look like in engineering. To collect their perceptions of mental health and wellness in engineering culture, our team conducted interviews with faculty and staff informed by the engineering cultural framework proposed by Godfrey and Parker. Participants (N=28) worked primarily with undergraduate students and represented a range of engineering disciplines, from biomedical engineering to engineering physics, as well as a variety of institution types and sizes. Specifically, responses to the question "What do you think a culture of wellness in engineering or your department would or should look like?" were separated from the rest of the data for thematic analysis. We developed a codebook, applied it to the data, and used thematic analysis to identify topics grouped by motif, resulting in three overarching themes representing the data. With a focus on actionable patterns of meaning, the three themes are (1) Building a Supportive Community, (2) Improving Work and Academic Policy, and (3) Supporting Self-Care with Student Wellness Resources. Participants expressed their views on what a culture of wellness might look like and suggested ideas that they believe would be beneficial to implement. These suggestions included aspects of a caring community, mindful policy change, and support for students through wellness resources. Implementing participant suggestions regarding a culture of wellness could lead to changes in the existing culture, which would support engineering student mental health and wellness. To better understand how engineering culture and undergraduate wellness interact, future work will expand interviews to include engineering student views on a culture of wellness. These interviews will be analyzed and synthesized with prior work, which will facilitate the identification of strategies to promote wellness in engineering. Culture is built by the minute actions of all participants, thus identifying individual perceptions of well-being in the engineering community is critical to working towards a culture of wellness that is productive and rewarding for all involved.

Disclaimer

The research presented here discusses mental health, and as part of that, mental health concerns and suicide. The contents of this project and subsequent discussion may be emotionally and/or intellectually challenging to engage with, so please engage as much or as little as you may need. Additionally, this paper cannot and should not be used in place of medical advice or other professional guidance, and it cannot and should not be considered a therapeutic tool. The information presented in this work does not substitute for the knowledge, skill, and expertise of qualified health care professionals. If you feel you should take a break or stop engaging with this work, please prioritize your own well-being, and mental health resources can be found at https://www.mentalhealth.gov/ and https://www.nami.org/ [1].

Introduction

Mental health and wellness in college students is a growing concern, with over 60% of students in 2021 meeting the criteria for one or more mental health issue and an almost *threefold* increase in thoughts of suicide among undergraduates from 2007 to 2021 [2], [3], [4]. Undergraduate engineering students in particular experience increased levels of stress, anxiety, and depression, while engineering majors are ranked in the lower quartile for measures of student flourishing [5], [6], [7]. Concerningly, engineering undergraduates are also less likely to seek out resources or help for mental health concerns [8], [9]. Research has identified common factors that could contribute to this crisis, such as heavy workloads, lack of time, inflexible demands, problems with sleep, inconsistent mental health support, and a culture of devalued self-care [10], [11], [12], [13], [14]. Combined with previous descriptions of the engineering landscape as predominantly masculine, White, and meritocratic, the culture of engineering education is one that trivializes mental health, normalizes high stress levels, idolizes rigor, and glorifies suffering through undue hardship [15], [16], [17], [18].

In this paper, we use the framework proposed by Schein (1985) to define culture as a multidimensional phenomenon involving the environment, all members of the group, and the culture itself [19]. On all cultural levels, as depicted in Figure 1, individuals are influenced by the culture as they interact with it and each other, and group members in turn influence the culture through their actions and responses. Cultural artifacts or other accessible symbolic manifestations of culture describe the first dimension, and this includes how group members interact with artifacts in typical practice and the typical behavior for responding to other members or objects. The second level of culture defines the average values and shared norms held by group members that guide interactions at the first level. Lastly, the third dimension of a culture is the set of standard assumptions and prevailing beliefs that sustain the behaviors and artifacts at the outer two levels. Engineering culture has been defined using this framework by first delineating artifacts in the first level, then interpreting common cultural values from students' interactions with these artifacts, before finally identifying the tacit knowledge underpinning the first two dimensions [20]. This third level describes a culture's oft subconscious solutions to external changes or internal merges (i.e., enculturation), but prior definitions lack elements of mental health, and research suggests beliefs and behaviors that promote wellness are not part of traditional engineering culture [21], [22].

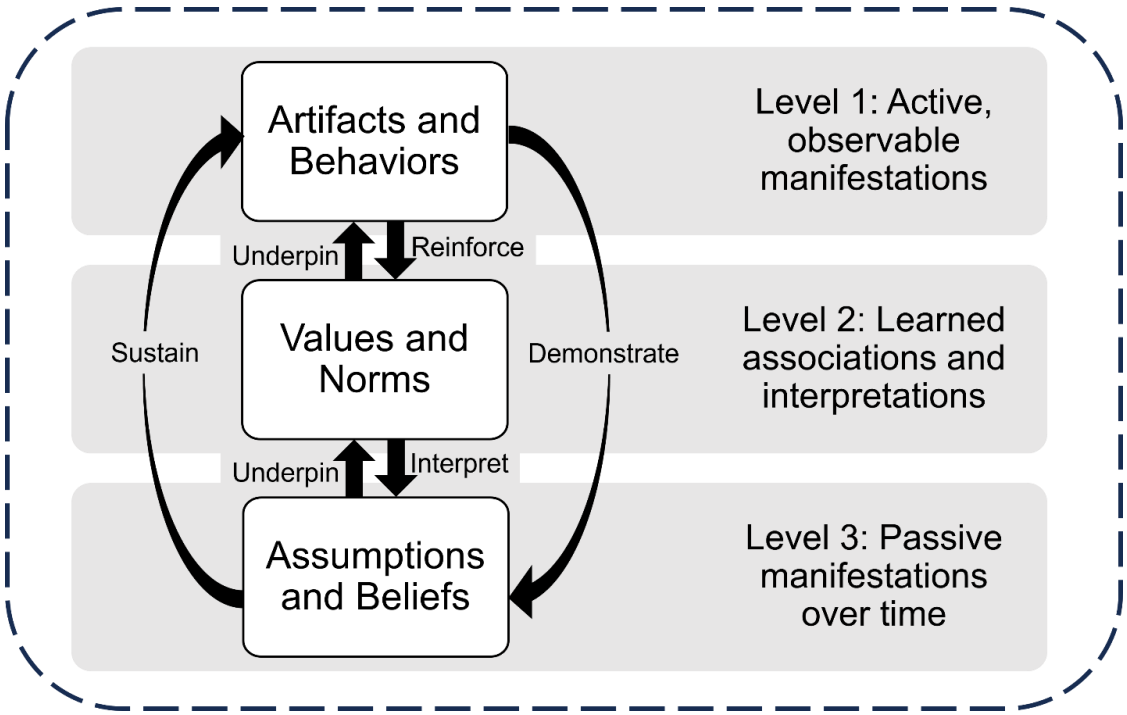

Figure 1: Multilevel model of culture, the framework implemented in this research, as initially defined by Schein (1985). Community members interact with culture and each other at all levels.

The main goal of our project is to address the overarching research question, "*How can we dismantle a culture of high stress in engineering and instead foster a culture that promotes wellbeing?"* Overall, we aim to deepen our understanding of undergraduate engineering student stress experiences to inform development and improvement of actions that support undergraduate engineering student mental health. In this paper, we focus our attention on actions that support student mental health and explore faculty and staff perceptions of what a culture of wellness could or should be like in engineering. Faculty and staff significantly influence engineering culture as stakeholders and through the influence of their relationships with students [20], [23], [24]. As the culture of engineering shifts to promote wellness, student, faculty, and staff psychological health will improve [25], [26]. Because culture forms from the continuous actions and reactions of group members, exploring faculty and staff perceptions of wellness in the engineering community is needed to move towards a culture that supports the productivity, satisfaction, and thriving of all members [27], [28], [29]. Here, we use the multilevel model depicted in Figure 1 to investigate a culture of wellness in engineering as described by faculty and staff. We interviewed a total of 28 participants across 18 institutions in the United States and present our findings on faculty and staff perceptions of wellness in engineering culture.

Methods

The qualitative study discussed here is one part of a larger multi-study, mixed-method project exploring the relationships between engineering culture and undergraduate student stress. In this study, we performed interviews with faculty and staff in engineering to better understand undergraduate engineering student experiences from the perspective of those with increased cultural power [30], [31]. We asked participants about their time working with undergraduate

engineers as well as their own personal experiences as undergraduate students with an emphasis on stress and overall mental health. Here, we isolated data relating to faculty and staff thoughts on a culture of wellness in engineering to identify what they believe could or should be done to promote wellness.

Participants

We recruited participants for interviews through a multi-institutional listserv dedicated to engineering education research and by advertising in one institution's college of engineering newsletter. The advertisement specified that participants must be engineering faculty and staff who work with undergraduate students, and we offered participants a $50 digital gift card as compensation. A total of 28 faculty (n = 24) and staff (n = 4) participated in interviews and all research was approved by the focal institutions' Institutional Review Boards.

All participants had specific interactions with undergraduate engineering students, e.g., when teaching, leading research, advising, or other regular activities. In our data, engineering staff held roles mostly related to student support through career advising and engineering faculty were instructors with varying responsibilities, the most common being research. Participants represented a wide range of engineering disciplines as well as institution size and type, indicated in Tables 1 and 2 according to Carnegie classification [32]. A total of 18 universities across the United States are included in our data.

Table 1. Carnegie institution classification of interview participant universities.

Carnegie Institution Classification	**Percent of Participants (n = count)**
Doctoral Universities: Very high research activity (R1)	64% (n = 18)
Doctoral Universities: High research activity (R2)	11% (n = 3)
Doctoral/Professional Universities (D/PU)	4% (n = 1)
Master's Colleges and Universities: Larger programs (M1)	21% (n = 6)

Table 2. Carnegie institution size of interview participant universities. Reported as the number of students with equivalent full-time enrollment.

Carnegie Institution Size (full-time students)	**Percent of Participants (n = count)**
Very Large (>10,000)	4% (n = 1)
Large (5,000-9,999)	54% (n = 15)
Medium (2,000-4,999)	32% (n = 9)

Small (500-1,999)	11% (n = 3)

Of the total participants, more than 75% self-identified as educators, 60% as mentors, and 50% as researchers. The represented voices had a wide range of experience, with some being in their role for a couple of years and others for more than a couple decades. Roughly 70% of participants used feminine pronouns and 30% used masculine pronouns, and no other demographic information outside of academic position was collected to preserve confidentiality. In this paper, we use randomly generated pseudonyms and gender-neutral pronouns to discuss participants.

Data Collection

Towards our goal of understanding faculty and staff ideas of wellness in engineering culture, we developed semi-structured interview protocols [31] informed by the cultural framework of engineering proposed by Godfrey and Parker [20]. We used a semi-structured protocol to augment the richness of our data and the first four interviews were used to inform further question development and refinement. Specifically, the goal of this paper is to qualitatively analyze and synthesize what faculty and staff imagine a culture of wellness would be like in engineering. During the spring semester of 2022, we performed virtual interviews with participants via Zoom. We collected consent forms prior to data collection and interviewed each participant once. Interviews lasted for 41 minutes on average, and cameras were kept on during interviews to encourage conversation while only audio data was saved. The question of interest was emergent from initial interviews, thus all but 2 participants were asked about an engineering culture of wellness using the exact same wording: "*What do you think a culture of wellness in engineering, or your department would or should look like?*" We analyzed the 26 responses to this prompt separately from the aggregate data to produce the results presented here.

Data Analysis

Because our overall goal is to develop a culture of wellness in engineering, we chose an action-oriented approach for initial data analysis. The fourth author performed primary data interrogation using rapid analysis as it is well-suited for summarizing data from semi-structured yet consistent collection [33]. In brief, transcribed responses to the central question were first summarized via template domains with emphasis on generating a comprehensive understanding of each individual collection episode. Then, we used the summaries to inform matrices of the data with a focus on how individual responses are related to other collection episodes. Both summaries and matrices were reviewed and used to identify preliminary key points and potential themes via iterative code development.

Rapid analysis provides a robust starting place for delving further into data by identifying regions of richness while sustaining accurate approximations of the realities detailed by participants. After implementing this method as described above, the preliminary codebook was applied to all transcripts and subsequently probed using thematic analysis [34], [35]. Our team reviewed the codebook and discussed potential modifications while using comments attached directly to the data points to note sections of interest in the themes or other feedback. The first

author then modified the existing codes to reflect the team's discussion, such as combining similar concepts (e.g., Community and Collaboration includes "relationships", "community", and "collaboration") or adjusting code names to be more precise (e.g., "social health" was changed to Connections and Interactions). The revised codes were applied to participant responses and definitions of each code were informed by each branch of data analysis. In total, we generated 16 codes mapped onto 3 unique themes describing faculty and staff ideas on a culture of wellness. The final codebook structure with associated definitions is present in the Appendix.

Results

We identified three overarching themes with associated subcodes present in the data as summarized in Table 3 and further described in the Appendix. The first theme, named Building a Supportive Community (*5 codes*), provides descriptions of cultural aspects that participants believe promote the wellness of community members. Second, the theme named Improving Work and Academic Policy (*4 codes*) consists of productive developments and other potential systemic changes that improve overall wellness. The third and final theme includes resources that participants believe should be available to students as well as advice on maintaining good health, and so we named it Supporting Self-Care with Student Wellness Resources (*4 codes*). The following sections describe each theme's set of codes that, when combined, provide insight into how wellness can be promoted at each level of engineering culture.

Table 3: Summary of themes (left) and associated codes (right) taken from data on faculty and staff perceptions on a culture of wellness in engineering. Full definitions for each code are available in the Appendix.

Theme	Code
Building a Supportive Community	Embrace Humanity
	Cultivate Community Support
	Minimize Shame
	Vulnerability and Communication
	Care and Compassion
Improving Work and Academic Policy	Teaching Methods and Mindsets
	Rigor and Intensity of Workload
	Curricular Policy Changes and Discussions
	Expectations in Engineering
Supporting Self-Care with Student Wellness Resources	Self-Care
	Wellness Advocacy
	Connections and Interactions
	Physical Health and Mental Health

Building a Supportive Community

When asked about a culture of wellness, participants provided a range of thoughts on how to Build a Supportive Community. Among these responses, most salient was the desire for an environment where the inherent humanness of community members is welcomed and appreciated. To accomplish this, one frequent recommendation was to *Embrace Humanity*, which in practice includes acknowledging the variety of student backgrounds and experiences as not only valid but also as valuable sources of knowledge. For example, one approach to this topic as suggested by Stephanie was "being holistic and realizing that there's human stuff in everything we're doing." Adding more context, this was further expanded on by Ken:

> [Wellness is] where we consider the unique assets of our students as not only something that should be embraced, but also something that should be encouraged for students to use. Because that way, by using their individual unique assets, that's what will help them innovate and come up with the most creative solutions that are meaningful to them and the communities that they come from. (Ken)

Ken believed a culture of wellness could be achieved if engineering coursework included students' personal motivations and celebrated their diverse skillsets. This asset-based mindset [36] was echoed in the data relating to pedagogies and curriculum choices which will be discussed more in the following section on improving policy.

Related to the humanism of the prior code, a second common suggestion was to *Cultivate Community Support*. This includes encouraging those in the community to assist one another and actively promoting a desire to help through things like mentoring programs, resources on how to provide support, and tailored trainings. Some believed the culture should ubiquitously support all members, such as Alexis expressed when describing a culture of "People supporting each other, and [where] people really feel that they are going to be supported from others as well." Other participants felt that a community of support required an overall feeling of common unity through building positive relationships and prioritizing collaboration over competition. This was described by Audrey as "a very supportive, collaborative environment. I don't think it's cutthroat. . . . it's collaborative. We are a community, we treat it like a family, per se." In contrast, some were concerned about their own institution's sense of community, as echoed by Alice who said, "I do see that students and faculty oftentimes have a very transactional relationship, where the students are seeing their faculty as [only] someone that they learn from." They went on to elaborate how this damages opportunities for support as, "Oftentimes, because of this transactional relationship, they don't even see faculty as resources." Alice believed one way to promote a culture of wellness was through strengthening relationships between students and faculty, much like a description of positive community building that was provided by Gina:

> Taking that time to build those personal relationships in the workplace, and with students, and with each other, and that sort thing can play a lot into it, because the more you are able to have those relationships and that positive culture, the better. Then I'm not just sitting by myself all the time trying to do engineering. So, I think that's a big part of it, because big workloads can be lessened by having people cheering you on. (Gina)

By cultivating a supportive community, Gina felt confident in their ability for high achievement while maintaining positive mental health.

To promote a supportive community that appreciates humanity and collaboration, participants largely agreed it is necessary to *Minimize Shame*. A common thread among the data was the concept of "normalizing" certain behaviors, such as discussing mental health, being vulnerable, and seeking help. This cannot be achieved while shame holds power in a community through judgement and unfair criticism. This process was identified by Stephanie, who said, "We're all going to have stressors and things that are really negatively impacting us. And [to] make it more normal to share those in a way that's supportive and not something that makes you a bad engineer." Stephanie recognized that struggling is not indicative of a "bad engineer" but instead a common experience for those in the community. This was expanded on further by Stacy, who explained, "I think that 'shame' piece of things is a big one. I think, even in my department where we're trying to do things really well, we sometimes fall back on shaming students as a tool to motivate them." The concept of shame as a motivator is prevalent in engineering, so much so that some engineers might worry exhibiting signs of struggling diminishes their overall quality as an engineer. Others discussed the creation of a space for students to experience and learn from failure without fear of retribution. As Mark described, "I think wellness is . . . a safe space to fail and being able then to recover from that." Effective development requires trial and error, and a culture focused on wellness should encourage this kind of learning rather than shame it.

Diminishing the power of shame could contribute to an environment that participants commonly described as cultivating wellness, like Jane outlined, "something where students feel as if they can be vulnerable with everyone." *Vulnerability and Communication* between members of the community is characterized by open dialogue without judgement or fear of retribution. One way to have these productive and positive interactions is by actively being vulnerable with everyone, even (or especially) when one person holds more power than the other, such as faculty and staff do with students. For example, Jason imagined a situation where their students are comfortable with identifying needs and expressing concerns if they are not being properly addressed: "[I hope] that they have the ability to question me and to direct me appropriately and to say, '*Jason, I don't think that is in my best interest*.' It probably isn't in those words, but to be able to say, '*This is what I need right now*,' and to have that need responded to." Jane further elaborated on how competition directly inhibits vulnerability, thus harming potential positive interactions between group members. They described how socially constructed rivalries can decrease opportunities for wellness:

> Going back to that competitive streak that happens in our college, where students are like, '*I did this, I did this, I did this*…' and [other] students feel like, '*Oh, I only did this*.' But I also think that you really relate to people when they share or show their vulnerabilities to you. I think when you can relate to someone, you feel really comfortable. (Jane)

As Jane signified, competition between students can lead to some feeling like they are not "good enough" to succeed rather than acknowledging their own achievements (i.e., "I *only* did this" versus "I accomplished this"). The resulting shame decreases opportunities for shared celebration and vulnerability, further degrading comfort and trust among group members.

Finally, some participants identified *Care and Compassion* as a core part of wellness in a culture. Here, compassion is used to describe caring about other's wellness, practicing empathy, working to understand other perspectives, and other techniques for relating to distinct individuals. One way this can be implemented was suggested by Mark, who said, "Wellness means that we're cognizant of not over-scheduling in terms of meetings, classes, workload, things like that." Similarly, we use care to demonstrate actionable items that are done in response to the presence of compassion, such as maintaining flexibility, working to be accommodating, and in general doing more than the status quo. This concept mirrors the humanism of prior codes, as explained by Louise, "I think . . . treating each other a little more human sometimes and adding that flexibility and accommodation would be beneficial for everybody." While embracing humanity contributes to compassion, consciously acting on it requires the care described in this code. Sarah elaborated on how this could manifest as they described community members connecting on a more personal level by making an effort to "check in on one another and say, '*Hey, how are you doing?*' Like, '*How are you feeling today?*' People who ask those questions and not just, '*Hey, what'd you get on that test?*'" Deliberately and repeatedly making the decision to care about each other was considered key to creating a culture of wellness by some participants.

Improving Work and Academic Policy

Plain descriptions of a culture of wellness were not the only responses collected from participants, as many of them provided thoughts on Improving Work and Academic Policy of an institution. Among the data, participants most saliently discussed pedagogies in engineering classrooms, curriculum and student workload, and cultural expectations. Most common were opinions on *Teaching Methods and Mindsets*, meaning participants frequently discussed how instructors approach education, course content, and various pedagogies and assessment methods. One idea was to provide students with realistic advice on planning and studying, as Lila described offering "little tips on how to do school, how to manage projects, how to be a person in the class. And that took like five, maybe ten minutes." Others mentioned how some standards in academia can create tension between students, with Audrey providing further context: "I don't think it's something like grading on a curve, for example. We don't grade on a curve, and grading on a curve can create that cutthroat atmosphere." When done in the classroom, these relatively small actions can positively impact student wellness. Care and compassion were further included in this code as some participants suggested strict assessment policies can restrict student learning. For example, Stacy talked about co-teaching with an instructor who enforced guidelines that they felt demotivated students:

> Flexibility in how people can learn and the tools that they can use. Like, I had a moment where . . . my co-instructor lost it because the students weren't using one function within the software, but had figured out another function to get the same outcome. . . . But the instructor was upset because they hadn't used this other feature that they specifically wanted them [the students] to use. It was like, all that ends of doing is shutting down exploration. (Stacy)

Stacy alluded to the previously mentioned care aspect when they described implementing flexibility in the classroom, and with compassion they are worried that a rigid gradebook could possibly discourage creativity and discovery.

Like a rigid gradebook, aspects of engineering hardness were reflected in *Rigor and Intensity of Workload*. Often, participants depicted the discipline as one of high expectations with minimal capital provided to undergraduate students. Some participants felt the discipline should provide additional resources to students to help them achieve these extensive goals, believing that "if we can give the support to allow our students to have high achievement, I think that that is great for their self-esteem and for their health," as Emily stated. However, others felt the intense demands of engineering can cause community members to feel overworked and/or overstressed. Rosa provided an example:

> If you do the math on [the needed credits and workload per semester], they're working way more than 40 hours a week, right. They're working more than you can reasonably expect any human to work and not have breakdowns. If they're going to do this every semester for four years straight, they're going to have mental health issues. . . . They're going to be stressed and exhausted. (Rosa)

Rosa explained how they felt the required credits and associated hours of work per class credit were unreasonable to expect of students while maintaining proper wellness. Others further expanded that this stress load is not experienced identically among all students, causing some undergraduates to feel less confident and supported. Ashley described, "I think that it's letting a lot of students fall through the cracks, just because they're trying to keep up with unreasonable workloads and expectations, and it doesn't necessarily need to be that way." Ashley felt the current intensity of engineering coursework was needless and harmful to both student learning and development as an engineer; they proposed curriculum should be designed with a "very holistic approach" of "mindfully considering all the aspects that go into how to train an engineer, because it's not all about what courses they need to complete." Others echoed this desire for revised or redesigned engineering curriculum for undergraduate students that better suited their needs as diverse modern-day engineers.

As with the pedagogies employed in individual engineering classrooms, participants provided their thoughts on engineering *Curricular Policy Changes and Discussions*. General, structural, or systemic issues are brought up in this code, as well as discussions on institution-wide policy change. All participants agreed that, in general, the engineering curriculum is rigorous, and some described the workload as being too intense for student wellness. "So, you know, if they talk about not being able to have all three of those things [good grades, social life, and health], well let's make some adjustments," Shelley asserted. They described a balancing act that undergraduate engineers must constantly perform to succeed (i.e., studying enough, making friends, and getting enough sleep) and responded with a call for change. As Ashley touched on in the prior section, some felt that meeting the student at their level with a holistic approach was the most effective educational approach.

One way to support this environment was with a "cohort-based approach" as suggested by Kara, who felt their department's "strong sense of community" was partly due to their program being "not bigger than the size of a tribe, meaning not more than about 120 to 150 people in it." They further elaborated that while decreased class sizes are difficult and expensive to accomplish, it can help to create an environment where wellness can flourish. Meanwhile, others believed there

should be an increase in systematic resource provision, mainly through the introduction of lessons on schedule planning and time management. For example, as advised by Tiffany, "I think, more so than other disciplines, time management is probably a greater focus area, because with the engineering coursework, there's a lot of rigor. . . . I think because of that, engineering students specifically have more work than most students on campus." Some participants, like Shelley, believed the expectation of labor should fall mostly on the institution, while others, like Tiffany, felt that an institution should encourage and support students in managing that labor themselves.

While discussion of curricular and institutional issues does occur, some participants were concerned about the productivity of these conversations. As said by Steve, "I think these conversations happen, but these conversations just happen from a very 60,000 feet perspective. And there's no further follow up on what someone is doing about it." Discussion is valuable to effective change, but without real action the problem will not be properly addressed. Further, discussions typically do not include the voice of students despite their crucial role academic policy. As Margaret wondered, "What role does the department play in that [discussion]?" Engineering faculty and staff that want to engage students in discussions about policy and problems might not know how to do so in an appropriate way.

Described earlier in this work, a common assumption of the engineering experience is hard work with high achievement, and participants shared their thoughts on *Expectations in Engineering*. As mentioned by Emily, "We should expect a lot from our students and give them all the support they need to achieve a lot." However, some faculty and staff were concerned that the intensity of this pressure was counterproductive to positive wellness, such as Gina, who suggested, "Expectations are always the problem. We need to set more realistic expectations." The concept of success was not only comprised of tactile measurements like workload or GPA but also included ideas around what should be done by participants themselves or those in the community. While realistic or reasonable expectations were mentioned throughout the data, what it meant to succeed was different depending on the individual. For those striving to succeed in a culture, such as undergraduates studying engineering, a lack of clarity around expectations can cause unproductive distress. As Helen described when imagining wellness in the classroom:

> I think it would be nice if we could, for students, make sure everyone had clear expectations for what they should be able to do in their class. Which they should [do] with their objectives, but make sure those are clear, and being clear on the time commitments, and what the expectations are for quality of work and culture. (Helen)

As summarized by Helen, transparent and unambiguous expectations could improve student wellness. Additionally, expectations can vary wildly depending on the institution, discipline, and even classroom. Helen suggested direct communication of expectations to ameliorate this tension, while others believed the solution involved a more humanistic mindset. Harry explained their approach to a culture of wellness as "being more reasonable about what we expect of each other" and "realizing that everybody does want to do a good job [or] the best version of that. Nobody's trying to be lazy, it's just we're all tired." They believed that remembering the humanity in each other by acknowledging effort spent as a separate accomplishment from how the outcome matches expectations could be beneficial to wellness.

Student Self-Care and Wellness Resources

Outside of community building and curriculum discussions, promoting positive physical and mental health was a common element discussed by participants. Faculty and staff gave suggestions on how to support undergraduate engineering wellness through Student Self-Care and Wellness Resources. Most salient in the data was *Self-Care* itself, which includes aspects of emotional health and taking breaks. Participants described ways to improve their mental state, such as healthy outlets for emotions, emphasizing positives and celebrating successes, and taking breaks from work or spending time away from engineering. Margaret spoke of a group chat between students as a "healthy outlet" where they dedicate one portion to "shitposting and ranting" because, "at some point we all need to rant about our feelings." Working through negative thoughts with a group can be cathartic or helpful, but it is still crucial to be aware of your own emotional health. As mentioned by Ken, "I believe that wellness includes an element of self-awareness and recognition of oneself." Proper self-care and self-reflection can't occur without appropriate rest, thus breaks in working are necessary to accomplish both. An example of this in practice was given by Mark:

> One thing that I try to tell the students is don't do homework for one night a week. And if at all possible, blow off all of Saturday. Again, do as I say, not as I do, right? Get out and do something else. . . . But promoting, if not encouraging, everyone to do something not related to their job. (Mark)

Mark described how they directly instruct their students to take time away from work, even if they themselves do not follow that advice. Promoting self-care through actions like breaks from work and emotional aspect management was perceived as good for student wellness.
One common approach was through *Wellness Advocacy*, where descriptions of wellness are actively promoted, and individuals are encouraged to utilize wellness resources. This is echoed by Zoe when they recommended, "Having lots of events for that [supporting community], providing resources in terms of mental wellness and checking in." The goal of these resources is to support students, which Shelley explained in greater detail: "I think a culture of wellness would look like resources for our students [and] . . . offering opportunities for students to kind of find that wholeness within themselves." The thought of being "whole" or "balanced" was commonly connected to wellness by participants, aligning with the holistic mindset presented earlier. Ashley summarizes the concept as "being able to strike a balance between the different responsibilities that you have." The responsibilities held by individuals in a community will rarely be identical, so proper balance is helpful to maintain wellness.

Part of the aforementioned balance that was frequently mentioned by participants was *Connections and Interactions*. This was a vehicle to discuss the social health of community members and how to promote wellness through social opportunities for all community members. Some participants considered social engagement to be necessary for student thriving, as Rosa indicated, "They also deserve to have friends and personal lives, just like we would expect for ourselves." Mentorship was considered valuable in the data, as illustrated by Ted when they discussed memories of their own undergraduate education:

> I certainly would have loved it [a mentoring program] as an undergraduate. There was always kind of this disconnect between the faculty and the students. And I always felt like I was kind of left to my own devices to figure the whole thing out. (Ted)

As pointed out by Ted, peer to peer interactions were not enough to totally relieve cultural stress. Many participants felt that student wellness was hard to achieve without support from established community members like themselves (i.e., faculty and staff).

When discussing holistic aspects of human wellness, *Physical Health and Mental Health* were mentioned in addition to health of relationships between individuals in a culture. Some participants suggested that when vital needs are neglected, like not eating or sleeping, education will inevitably be less effective. This was mentioned by Audrey when listing resources in their department that benefit student wellness: "So if a student doesn't have food, they can go in [to the communal freezer] and they can have it, because if those basic needs aren't met, then there's no way a student is in a position to learn anything." They elaborated that this is "because their focus isn't where it needs to be to work." From their perspective, making an effort so that students had easy access to basic necessities promoted wellness in Audrey's department. Others expressed worry that a competitive culture in their discipline contributed to a decrease in student wellness through physical tests and similar feats. As Emily described, "So if we could get rid of that, . . . if it wasn't like a dick measuring contest to see who got the fewest hours of sleep, right. I think that could contribute to a wellness culture." An environment where individuals "brag" about their diminished physical health was thought to be the exact opposition to wellness culture. Conversely, some participants were more focused on the mental and emotional health of students. They might feel the role of the department or institution is to promote positive mental health, as illustrated by Zoe:

> I think a lot of that is the mental part of it. I couldn't imagine somebody saying, '*You need to go to sleep,*' or '*You need to eat more vegetables,*' or anything like that. . . . I think our commitment is to mental wellness and supporting students in a stressful time and during stressful times. (Zoe)

Some faculty and staff could feel apprehensive about addressing students' physical health, like Zoe stated. Overall, faculty and staff in our data collection were willing to support a culture of wellness in their department, though not all were eager or actively doing so already. The specific aspects of wellness varied between participants, such as what constitutes mental, emotional, physical, and social health, as did their ideas on how to effectively implement a culture of wellness. It is crucial to consider and understand all perspectives of a community when addressing change, and faculty and staff ideas on wellness in engineering culture contribute to both the current cultural environment and the future cultural movements.

Discussion

The responses collected from participants describe what faculty and staff imagine as part of a culture of wellness in engineering. Because culture is always present but difficult to define with precision, the associated influences on group members can go mostly unrecognized. In this work, we defined the perceptions and ideas held by characteristic stakeholders in engineering on how

to both support student wellness and implement cultural change. We further connect these results to related research on wellness in undergraduate engineering students.

Many of the codes characterized in the first theme, Building a Supportive Community, describe cultural norms participants wish existed in engineering. They also touch on the core assumptions that underpin current engineering culture and how these beliefs would manifest in a culture of wellness. Together, these build the second (i.e., norms) and third (i.e., assumptions) levels of a culture that would promote mental health and wellness as imagined by our participants. The second dimension of shared values around wellness includes *Minimize Shame*, where students learn what cultural aspects to associate with feelings of shame, and *Care and Compassion*, which details how things like accommodations and empathy are interpreted. For example, implementation of a culture that holistically encourages campus-based supports for students with learning disabilities has improved undergraduate STEM thriving, fostered opportunities for positive STEM stakeholder involvement, and overall augmented knowledge to support students with learning disabilities [37].

The norm of *Vulnerability and Communication* underpins the first level of positive and productive interactions that further reinforce a culture of wellness (i.e., behaviors) [38]. The third level includes *Embrace Humanity* and *Cultivate Community Support* which describe core beliefs that participants think could promote engineering wellness culture. Some faculty and staff believed a culture of wellness was characterized by assuming all members of the community were willing to help and support one another, and/or that working together through collaboration sustains community wellness, aligning with prior descriptions [39], [40]. Others suggested implementing wellness programs or similar training in mental health for engineering faculty, staff, and students to demonstrate a supportive culture, as proposed elsewhere [41]. Additionally, the desire for movement towards asset-based approaches indicates an underpinned belief in acknowledging and appreciating the wide range of student experiences.

In the next theme, participants discussed Improving Work and Academic Policy as first and second levels of culture, which aligns with predefined artifacts and practices in engineering such as syllabi, curriculum, and grading rubrics [20]. *Teaching Methods and Mindsets* and *Curricular Policy Changes and Discussions* demonstrate the passive manifestations of culture in the third level; these factors further illuminate how these cultural beliefs sustain the practices characterizing the first level. For instance, to establish a culture of wellness, an institution could intentionally cultivate a place where students, faculty, staff, and other engineering stakeholders can discuss mental health concerns and solutions [42]. In practice, an asset-based mindset in the third dimension of culture resulted in participants suggesting an asset-based approach to engineering pedagogies in the first dimension.

Participants identified a group of first level cultural artifacts that include the average student's intense and inflexible workload as *Rigor and Intensity of Workload*. While some offered additional artifacts as a solution (such as workshops on time management), others delved deeper to suggest a change in cultural norms (like asset-based mindsets). *Expectations in Engineering* are learned engineering norms reinforced by artifacts of rigor, such as harsh grading practices or systems that reward suffering through hardship [17], [22]. It is important to note that expectations of high achievement or rigorous curriculum are not inherently detrimental to

wellness; rather, students with sufficient support can thrive by engaging with difficult, real-world problems and employing their developed engineering expertise [43], [44].

Ideas for how faculty, staff, or other engineering stakeholders could support undergraduate engineering health were summarized in the third theme, Student Self-Care and Wellness Resources. While mental health and stress were the central topics of the holistic interview, mental health specifically was discussed less frequently than other aspects in relation to a culture of wellness. Many suggestions provided by participants were level one artifacts and behaviors of culture, like the actions characterizing *Self-Care* and *Connections and Interactions*. Lack of proper rest and relaxation has been shown to decrease wellness and even cause burnout, and diminished wellness can negatively impact student learning and achievement [13], [45], [46]. The advice presented in *Wellness Advocacy* underpins the solutions offered by the aforementioned artifacts and further promotes wellness as a shared norm in engineering culture. Further, it demonstrates an expectation of positive mental and physical health for group members. Faculty and staff suggested self-care in the form of healthy emotional outlets, celebrating positives, and taking breaks or otherwise having time away from work. Similarly, extracurricular activities [47], positive self-efficacy [48], mindfulness and meditation [49], [50], and meaningful breaks for downtime [51] have been shown to benefit student wellness. Aspects of *Physical Health and Mental Health* were considered important by participants, and while some actively promoted behaviors that reinforce wellness as valuable in the culture, some felt unsure about their role in maintaining student health.

An asset-based mindset was present in multiple suggestions, indicating faculty and staff could desire shifting engineering from a purely meritocratic system to one that values diverse student capital [36], [52]. Other groups have implemented asset-based approaches in undergraduate engineering design and education with promising results for student success [53], [54]. Additionally, recent research has shown an asset-based approach to education can help faculty and staff meet students at a level where both the engineering students and the engineering stakeholders can have positive, productive discussions [55], [56]. Small actions, such as tweaking a course's syllabus to work with student needs instead of prioritizing content-coverage, can improve overall wellness [57], [58]. Another cultural shift is the call for increased flexibility in academic and personal matters, further promoting empathy as a shared value in engineering. Students feel that faculty who prefer inflexible directions over more empathetic options are less likely to be supportive of their mental health [59]. By examining experiences of community members, we can explore how shared beliefs and cultural norms manifest in engineering, providing space for wellness initiatives to be added.

Limitations & Future Work

Interview participants voluntarily elected to participate in research on student mental health and wellness, so it is probable that their values align closer to those that promote student wellness. Additionally, this work did not study disciplines outside of the United States and the majority of represented institutions were large with very high research activity. Future research could expand this work to include a more accurate depiction of institutions underrepresented in our data. We plan to collect experiences from a wide range of engineering stakeholders, including undergraduate students, to broaden potential perspectives and increase the depth of data on

engineering culture, stress, and wellness. Identity and feelings of inclusion can have large impacts on student experiences, and future work into stress and wellness should include voices of students who might feel excluded from engineering culture (e.g., students with learning disabilities [37] or LGBTQ students [60]). Continuing a connected branch of this overall research, we will gather longitudinal survey responses from undergraduate students about their experiences with stress and culture in engineering, and these results will be further used to inform future interviews with undergraduate engineering students.

Conclusion

Undergraduate engineering students are reporting increasing rates of mental health concerns while describing a culture that venerates stress and hardship. To address mental health concerns in engineering education and promote student thriving, we must work towards a culture of wellness as described by our study and other research on student wellness [27], [29], [61], [62]. Faculty and staff in engineering offer unique insights into engineering culture that provide pivotal opportunities to shift a culture of stress towards one that promotes wellness and thriving. By analyzing 26 interviews, we identified their suggestions for what this change could consist of, including ideas for building a community of support, improving academic policies, and supporting wellness resources. The results presented here offer insight into how to cultivate wellness in engineering culture.

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Appendix

Codebook with Themes and Definitions

The following full codebook includes overarching theme names and code definitions for each code identified from the data on faculty and staff perceptions of a culture of wellness.

Theme	Code	Definition
Building a Supportive Community	Embrace Humanity	Welcomes and appreciates the diverse range of student backgrounds and experiences, uses an asset-based mindset, and acknowledges humanity; humanism
	Cultivate Community Support	Encourages the desire to help those in the community, provides resources to community members for how to provide support, promotes mentoring and other positive relationships between all community members, and emphasizes sense of community and collaboration over competition
	Minimize Shame	Acknowledges that everyone struggles so there is no shame in struggling, provides a safe place to fail and to learn from failure, removes shame around mental health, seeking help, being vulnerable, etc.
	Vulnerability and Communication	Promotes wellness through being open and non-judgmental, encourages productive and positive interactions between community members over hostile or competitive interactions
	Care and Compassion	Care includes flexibility, doing more than the status quo, and accommodations; Compassion includes empathy, caring about other people's wellness, and understanding
Improving Work and Academic Policy	Teaching Methods and Mindsets	How instructors approach education in engineering, the pedagogies and assessment methods used, and course content
	Rigor and Intensity of Workload	Exemplifies rigor and hardness in engineering where individuals are overworked and overstressed; high demands with low resources or capital causes distress
	Curricular Policy Changes and Discussions	Sum of structural or systemic issues to be addressed, development of solutions, and institution-wide implementation of new policy; also includes who is involved in important conversations, what is done because of these conversations, how frequent do conversations occur, and avenues for having conversation

	Expectations in Engineering	Summarizes definitions of "success" and ideas of what should be done by oneself or those in the community, and explains how clear and direct expectations benefit all in the community
Student Self-Care and Wellness Resources	Self-Care	Includes things to be done to improve mental state, healthy outlets, emphasizing positives, taking breaks and/or time away from engineering, and that self-care in general is good for wellness
	Wellness Advocacy	Actively promotes wellness through descriptions of wellness, provision of resources, and encouraging use of resources
	Connections and Interactions	Describes benefits of social connections, how social opportunities promote wellness, and desire for more social events
	Physical Health and Mental Health	Summarizes how physical health is important to wellness and mental health, how stress is bad for mental health, feelings around supporting physical and mental health, and adjectives describing someone's mental state, mental and physical wellness, and health in general