

# Analysis of Student Survey Responses for use in Focus Groups Addressing Engineering Student Mental Health

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#### Introduction

#### Engineering Student Mental Health

College students across all fields experience common stressors such as changes in sleep or eating habits, demanding course loads, fear of poor grades, and adjusting to new environments [1], [2], [3]. However, engineering students face additional challenges that uniquely heighten their risk of mental health struggles. These include an exceptionally rigorous workload, a high volume of assignments that disrupts efforts to maintain a work-life balance, and intense pressure to excel, often stemming from themselves or their peers [4]. Research on the mental health of engineering students reveals that these challenges are not merely individual struggles but are deeply rooted in the norms and expectations of engineering culture [5].

#### **Engineering** Culture

Engineering culture has been defined as a "culture of stress" [6], [7], where students experience rigorous courses and high workloads. This can lead to the normalization of stress, where students, despite feeling overwhelmed, may believe their stress is not severe enough to justify seeking help. [6]. Additionally, they may receive cues from those around them validating success through sacrifice instead of byprioritizing their mental health, leading them to neglect their own well-being in favor of academic achievement [8]. By actively involving students in identifying their challenges and co-creating solutions, we can foster a more supportive environment that prioritizes academic success and mental well-being.

#### Participatory Research and Group Level Assessment

Participatory research is an approach that actively involves the target population in the research process to better address the community's needs. It is designed to foster meaningful engagement and ensure that community members play an active role as collaborators in the research [9]. Group Level Assessment (GLA) is a process that guides participants through brainstorming their challenges, thematically analyzing their responses, and developing action plans to address the issues they have identified [10]. The seven-step process of a GLA is shown below in Table 1.

#### Table 1. Description of Group Level Assessment process steps

Step	Description
Climate Setting	GLA process is described to participants
Generating	Participants respond to prompts placed around room on boards
Appreciating	Participants make notes on the boards to analyze the initial responses
Reflecting	Participants individually analyze the data and begin to find shared themes
Understanding	Participants share their identified themes in small subgroups and identify 3-5 main themes
Selection	All participants share themes from the previous steps to full group, and all themes are combined into "major themes"
Action	Participant subgroups develop plans to address an assigned major theme

While GLA is traditionally done fully in person, multiple projects have used GLA in a virtual environment [11], [12]. For these virtual GLAs, the Generating and Appreciating steps are typically moved to take place before the focus group to cut down on the time for the focus group itself. The remainder of the focus group is then conducted through a virtual meeting platform.

For the purpose of this project, we aimed to utilize the GLA focus group to better understand how to support undergraduate engineering students' mental health and sense of belonging. To best meet the needs of our participants, we chose to establish a hybrid GLA focus group. In this model, the generating and appreciating steps were moved to a virtual environment through a Qualtrics survey, providing students with more flexibility in completing these steps. The remaining focus group steps were held in person. Through this paper, we present the participant responses to the surveys used for the virtual portions of our hybrid GLA. It is important to note that the results presented through this paper do not represent the outcomes of participatory research but instead focus on the outcomes of survey-based research. Future work will present the outcomes of the GLA focus groups and highlight both priority action areas and interventions that were identified by student stakeholders.

## Methods

## Data Collection

To develop the survey prompts, we used Bronfenbrenner's ecological systems theory, which can be used to see how interactions between different actors in an individual's life affect their development [13]. The levels include: the microsystem, which consists of people that have direct contact with an individual; the mesosystem, which looks at interactions between members of the microsystem; the exosystem, which looks at the environment an individual is in; and the macrosystem, which looks at the broader society and culture an individual works in [13]. For the purpose of this study, we applied this model to the college environment and established the different levels related to important stakeholders and community influences within the engineering student environment (Figure 1).



## Figure 1. Ecological Systems Theory levels and associated actors within study

Using these levels, we developed fifteen open-ended prompts to understand how students' environment influences their mental health and sense of belonging. The list of prompts can be seen below in Table 2.

Table 2. List of prompts sent to	participants in	Generating survey
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Level	Actor	Prompt
Student	Student	As an engineering student, what do you think you could do better to support your mental health?
		As an engineering student, what do you think you could do better to support your sense of belonging?
		As an engineering student, how do you impact your mental health?
Microsystem	Classmates	What do you think your engineering classmates could do better to support your mental health?
		What do you think your engineering classmates could do better to support your sense of belonging?
		How do your engineering classmates impact your mental health?
	Instructors/	What do you think your Engineering Instructors or Advisors could do better to support your mental health?
	Advisors	What do you think your Engineering Instructors or Advisors could do better to support your sense of
		belonging?
		How do your Engineering Instructors or Advisors impact your mental health?
Mesosystem	Classroom	What class expectations impact the mental health of engineering students?
	Expectations	What do you think should change about engineering class expectations?
Exosystem		What do you think your Engineering Department or College could do better to support your mental health?

	College/ Department	What do you think your Engineering Department or College could do better to support your sense of belonging?
Macrosystem	Engineering	What aspects of engineering culture impact the mental health of engineering students?
-	Culture	What do you think should change about engineering culture?

Participants were sent the prompts through a Qualtrics survey and asked to provide one or two short answer responses (5-10 words) to each prompt. After participants completed the survey, we collected their responses and consolidated them into a second survey. In this second survey, we asked participants to select which prompts they felt were important, which we defined as impacting a substantial number of people, significantly impacting a small number of people, deserving attention and action, resonating with a participant's experience, or a participant really liking a response. Participants were able to select as many responses as they wanted to indicate importance.

# Participants

This study considered undergraduate engineering students enrolled at the University of Kentucky during the Fall 2023 semester. After obtaining approval from an institutional review board, participants were recruited via email. Students were first recruited based on expressing interest after participation in prior mental health-focused research. A second set of recruitment emails were also distributed to the listservs for various STEM-based student organizations. Of the 69 student participants recruited for the first survey, 53 participants completed both the first and second surveys, and 60 participants attended one of the five in-person focus group portions. Participant demographics for all participants are listed below in Table 3.

		Total	Percentage
Gender identity			
	Man	22	31.9%
	Woman	40	58.0%
	Gender expansive (e.g., nonbinary, gender fluid, etc.)	3	4.3%
Racial or Ethnic Ba	ckground		
	Biracial or Multiracial	2	2.9%
	Black or African American	4	5.8%
	Latinx or Hispanic	7	10.1%
	Asian or Asian American	8	11.6%
	White or Caucasian	46	66.7%
Sexual Orientation		·	
	Heterosexual	45	65.2%
	Lesbian	2	2.9%
	Bisexual	6	8.7%
	Pansexual	3	4.3%
	Asexual, Aromantic	2	2.9%
	Queer	1	1.4%
	Prefer not to answer	2	2.9%
Hometown			

# Table 3. Study Participant Demographic Information (N=69)

Rural	15	21.7%
Suburban	39	56.5%
Urban	9	13.0%

#### Analysis

Once all five of the engineering GLAs had been conducted, two research team members independently went through the survey responses and coded them to identify themes across groups. Then team members compared their codes, consolidated similar codes, and discussed any responses that were miscoded until they reached consensus. Within each code, we determined a frequency, which represented the number of times that a code was applied across all of the prompt responses. Further, we calculated a code-specific importance score that reflected how frequently each response within a code was identified as important by one of the focus group participants. To calculate this importance score, we first determined how many times participants identified the responses within each code category as important. This total was then divided by the number of participants who had the opportunity to score each response as important. For example, consider a category with two items, where 5 of the 10 participants indicated the first item was important and 9 of the 12 participants indicated the second item was important. To calculate the category's final importance score, we summed the importance scores (5 + 9 = 14)and divided by the total number of participants across both GLAs (10 + 12 = 22). The resulting importance score for this category would be 0.636 (14/22), which represents the average percent of participants who saw items in this category as important.

#### **Results and Discussion**

Analysis of the participants' responses to the prompts allowed us to identify the most frequent (mentioned by the most people) and most important (identified as important by the most people) responses. Here, we present the results for common themes that were identified across each level of our ecological systems model – themselves, their peers, their instructors and advisors, the expectations they face in the classroom, their department or college, and engineering culture.

## The effects of students on themselves

Students were asked to identify how they could support their own mental health and sense of belonging. Many students felt that they could improve their mental health by better managing their courseload through seeking academic help, developing better time management skills, establishing a better schedule, and reducing their perfectionistic tendencies. For example, one student said that they had "sacrificed hobbies, fun activities, and sleep for better grades." Students also felt that they could better support their mental health through integration of better self-care activities such as eating better, socializing with their peers or integrating more breaks into their schedules. One student said that they could better support their mental health by "allocating sections of [their] day to de-stress and take [their] focus off engineering. Like reading a book, going to the gym, etc." For both improving their mental health and their sense of belonging, students felt that they could better themselves by working on their confidence, reducing the amount of pressure that they place on themselves and improving their social skills.

# Table 4. Summary of themes identified from student-focus prompts. Themes are presented with definitions, frequency of responses that fit the theme, and average importance score.

Theme	Definition	Frequency	Importance
As an engineering student, w	hat do you think you could do better to support your mental health?		

Physical Health	Sleep, exercise, eating better, less caffeine.	15	0.589
Academic Help/Improvement	Academic improvement, but also seeking help for improvement.	5	0.558
Social Life Improvement	Make new friends, spend time with friends, and socialize outside of the classroom.	11	0.483
Taking Breaks	Taking breaks in general, but also more time towards leisure.	23	0.537
General Help	Seeking non-specific help.	7	0.457
Forgiving of Oneself	Limiting oneself, perfectionism, pressure, and be confident.	12	0.478
Time Management	Less procrastination and working more effectively.	10	0.604
As an engineering student,	what do you think you could do better to support your sense of belonging?		1
Friends/Acquaintances	Make friends that share the same interests and socialize with them in and out of the classroom and, make an effort to be personal with professors.	30	0.472
Social Events	Get more involved in activities and events on campus to socialize with peers.	11	0.561
Work on Oneself	Be confident, improve social and academic skills, spend less time in isolation or make time for social events, get out of one's comfort zone, and reassure oneself that they belong.	17	0.451
As an engineering student,	how do you impact your mental health?		
Physical Health	Sleep, diet, and exercise all impact mental health.	10	0.459
Work/Life Balance	Mental health can be improved and often prioritized when there is a good work/life balance present.	16	0.439
Procrastination	Avoiding procrastination can help one's mental health.	7	0.459
Workload There is often a large amount of coursework, which negatively impacts mental health.		12	0.429
Perfectionism	Creating too much stress around assignments and grades, comparing yourself to others, and not being confident in your work.	17	0.453

The effects of their peers

Students were asked to identify how their engineering classmates could support their own mental health and sense of belonging as an engineering student. Many students expressed a desire for their classmates to be more supportive, inclusive, friendly, and understanding both inside and outside the classroom. One student stated that "meaningful interactions with engineering classmates improve [their] mental health." These interactions included conversations about struggles the students are facing, as well as group activities. These interactions could be academic, such as study groups, or nonacademic such as social gatherings or clubs. In addition, students felt a desire for more collaboration between their classmates and less competition. Many students felt that they compared themselves to their peers, with one student saying this comparison made them feel "stressed or inadequate." However, other students acknowledged that this competition can be positive, stating that "seeing [their] classmates do well encourages [them] to work even harder." To address this, students wanted to work more collaboratively with peers, assisting one another and building a sense of community.

# Table 5. Summary of themes identified from peer-focus prompts. Themes are presented with definitions, frequency of responses that fit the theme, and average importance score.

Theme	Definition	Frequency	Importance
What do you think your engine	eering classmates could do better to support your mental health?		
Supportive	Be supportive, help each other, be accepting, and encouraging.	13	0.433
Understanding	Be understanding of everyone's thoughts, feelings, and emotions.	7	0.479
Teamwork/Competition	Be collaborative, do not be competitive, or encourage success and avoid pressure.	10	0.480
Socializing Outside of Classroom	Socializing outside of the classroom to take breaks, destress together, or get to know one another better.	9	0.624

Communication	Be open to talk to one another about topics related to the classroom, check-in on one another, be vulnerable, and practice effective social skills.	17	0.480
Study Group	Make study groups and offer inclusion in those groups.	7	0.506
What do you think your engin	eering classmates could do better to support your sense of belonging?		
Conversation	Be willing to talk about struggles or to create light conversation in and out of the classroom.	12	0.472
Activities	Invite peers to join activities or social gatherings outside of the classroom and encourage them to attend and invite peers to study groups or clubs/organizations within the engineering department.	15	0.480
Working Together	Create study groups or work together in class to create conversation and encourage and assist one another.	13	0.383
Friendly/ Understanding	Be welcoming and friendly to peers.	7	0.507
Be Inclusive	Be inclusive to all genders, ethnicities, and cultures, be aware of others feelings, speak kindly, and be inviting, accepting, and nonjudgmental.	14	0.474
How do your engineering class	mates impact your mental health?		
Comparison	Comparing yourself to each other can have either a positive or negative impact on mental health. It can create a drive to do better or create a sense of competition and incompetence.	16	0.369
Understanding/ Supportive	Being understanding and supportive of peers and their struggles both in and out of the classroom can impact mental health.	13	0.424
Socializing	Spending time with classmates outside of the classroom.	4	0.500

The effects of their instructors and advisors

Students were asked to identify how their instructors and advisors could support their own mental health and sense of belonging as an engineering student. Students wanted support from professors, both academic and emotional. Academically, students stated that they wanted less work and that professors needed to keep in mind that they are often in several engineering courses at the same time and have responsibilities outside of school. Also, students wanted more clarity on assignments, as well as opportunities for extensions. Emotionally, students wanted instructors to be more supportive inside the classroom, desiring "constructive feedback instead of harsh criticism." They also wanted to develop a more personal connection with their professors, for professors to be more empathetic to struggles students may face and to overall "be understanding of the stress students have in college."

Table 6. Summary of themes identified from instructor-focus prompts. Themes are
presented with definitions, frequency of responses that fit the theme, and average
importance score.

Theme	Definition	Frequency	Importance
What do you think your	Engineering Instructors or Advisors could do better to support your mental h	ealth?	
Fewer Assignments	Consider the workload that is placed on students and try to reduce it.	9	0.495
Understanding	Have empathy, provide grace, be patient, and be aware of mental health issues and life outside of the classes.	14	0.636
Extensions	Provide more extensions for assignments or have grace and spacing out the amount of assignments that are due at any particular time.	11	0.535
Connection	Be open and honest about sharing mental health struggles or struggles in general, get to know students, and be friendly and supportive.	10	0.528
Life Outside of Class	Be aware that students have a life outside of the classroom and do not assign work over breaks.	4	0.550
Other Courses	Be aware that students have other courses and try to collaborate to reduce the amount of total workload.	6	0.620
Clearer Assignments	Provide clarity on expectations, learning outcomes, and deadlines.	4	0.622
What do you think your	Engineering Instructors or Advisors could do better to support your sense of h	elonging?	
Be Positive/ Supportive	Encourage participation, be supportive and understanding, and provide constructive feedback.	14	0.489

Be Personal	Have conversations with students about classwork and things outside of the classroom, have regular check-ins, and get to know students' names.	16	0.468
How do your Enginee	ring Instructors or Advisors impact your mental health?		
	The amount of workload that is assigned to students, such as how many	12	
	exams, how many classes are taken at the same, and amount of deadlines		

The effects of their instructors' expectations

Students were asked to identify how class expectations their professors had impacted their mental health and what changes they felt should be made. Students felt that engineering courses were challenging and often contained "difficult materials...with unclear expectations." In addition, students felt that the courses contained too many assignments, especially when they had multiple engineering courses at once. Students felt their courses had "unreasonable amounts of difficult homework" and that they should "space out assignments more and reduce overlapping due dates." They also felt pressured to achieve perfection within their courses, perform well on every assignment, maintain a high GPA, and be experienced with materials they felt they had not been effectively taught. To combat these feelings, students said that they wanted their professors to provide a greater sense of balance with academic workload and understand they have other responsibilities. They also want faculty members to help normalize failure and recognize that "failure is normal, it does not make you a bad student or any less smart."

Theme	Definition	Frequency	Importance
What class expectations	impact the mental health of engineering students?		
Workload	There is a lot of workload for courses, including the time commitment, deadlines, and trying to balance multiple courses at one time.	26	0.488
Perfectionism	There is a high expectation for perfectionism: maintain perfect grades, always knowing the answer, pressure to be better than others, and pressure to succeed all the time at everything.	12	0.541
	There is an expectation to do well in all classes, be completive, have high GPAs, and to know content that has not yet been taught. Expectations may also not be clear	21	
Expectations	at times.		0.502
Grades	Grading and the weight of grades are harsh and unfair.	7	0.500
Difficulty of Course	Courses are often very difficult, because there are a lot of weed out courses, stressful assignments, difficult material, and unclear explanations.	10	0.490
What do you think shoul	d change about engineering class expectations?		
Workload	The workload is extremely high, including lots of assignments and strict deadlines. Professors should try to provide more balance and allow for a social life.	17	0.449
Understanding/ Supportive	Understand that students are all going through different things and learn differently and be supportive when failure does occur.	8	0.582
Perfectionism	The expectation that everyone needs to be the "smartest" and that failure is not acceptable.	9	0.468

Table 7. Summary of themes identified from expectation-focus prompts. Themes are presented with definitions, frequency of responses that fit the theme, and average importance score.

The effects of their college

Students were asked to identify how their engineering department or college could support their own mental health and sense of belonging as an engineering student. Broadly, students felt that their college could offer more resources. These resources included mental health resources, with one student wanting to "create a mental health counselling center specifically for engineering students." In addition to mental health resources, students wanted access to housing, tutoring, clubs, organizations, and social events. Students also wanted more information and communication around resources that already existed. They felt that it would be helpful for faculty and leadership in engineering to be more open with students and willing to discuss topics such as mental health. They also stressed the importance of recognizing that students also need breaks by limiting the assignments due over breaks and generally being more understanding and supportive of students.

Table 8. Summary of themes identified from college-focus prompts. Themes are presented
with definitions, frequency of responses that fit the theme, and average importance score.

Theme	Definition	Frequency	Importance
What do you think your Ei	agineering Department or College could do better to support your mental	health?	
Understanding	Be understanding that students are under a lot of stress and be kind.	5	0.500
Social Events	Have events outside of the classroom to push a sense of community and work with class schedules to plan these events.	12	0.485
Breaks/Time Off	Homework shouldn't be assigned over breaks, finals should be spaced out, grace should be given to those that need it when the coursework is heavy, and lessen workload in general.	10	0.504
General Resources	Provide general resources to students and aid them when they need it.	9	0.327
Mental Health Resources	Provide mental health resources targeted towards engineering, provide mental health days, create support groups, prioritize mental health over coursework, and advertise resources.	21	0.444
Housing/Comfortable Spaces	Provide spaces that are appealing to students for both studying and relaxing and provide better housing situations.	8	0.330
Communication	Be personal with students, discuss stigmas surrounding mental health or other triggering events, and send out information about resources that can be found on campus.	5	0.466
Tutoring	Provide more tutoring or academic resources for students that are easily accessible.	4	0.500
What do you think your Er	ngineering Department or College could do better to support your sense of	belonging?	
Events	Host more large-scale group activities in and out of the classroom, including mixers, tailgates, seminars, and conferences.	27	0.423
Clubs/Organizations	Provide more opportunities for clubs and organizations to students.	3	0.419
Advertisement	Make groups, activities, and clubs more well-known to students by referring students to these organizations or sending out emails.	9	0.386
Understanding/ Supportive	Be understanding and supportive to all students in any circumstance.	5	0.511

The effects of engineering culture

Students were asked to identify how engineering culture had impacted their mental health and what changes they felt should be made. Students felt that they were under pressure to meet the expectations of what it takes to become an engineer. They felt that that the discipline itself was extremely difficult and required a lot of work, which limited the free time they had. They also felt they were expected to compete with one another to achieve perfection, with one student feeling that "pressure to perform well consistently makes even small mistakes feel big." In addition, they felt pressure not to ask for help or be seen as struggling. To change these expectations, they wanted engineering culture to place greater emphasis on relaxing and taking breaks, as well as to change the expectations of perfection and the stereotype that engineers do not struggle. Overall, they wish that engineers could "embrace being okay with needing help."

# Table 9. Summary of themes identified from culture-focus prompts. Themes are presented with definitions, frequency of responses that fit the theme, and average importance score.

Theme	Definition	Frequency	Importance	
What aspects of engineering culture impact the mental health of engineering students?				
	There is a stereotype that you must be constantly working either through	16		
Workload	assignments, exams, or internships, which can lead to burnout.		0.514	
	There is no free time or time for a social life because of the large amount of	13		
Lack of Free Time	work.		0.593	
	The major itself is difficult and there is a mentality that the major should be	8		
Difficulty of Major	difficult, which can lead people to overcompensate.		0.507	

Competition	Peers are extremely competitive and there is a constant pressure to be the smartest or do better than others.	11	0.508
Competition			0.308
	There is the idea that everyone must always be the best, there should be	12	
	getting perfect grades, failure is not acceptable, and you must be the		
Perfectionism	"smartest."		0.529
	There are expectations that you should always work hard, have the best	11	
	outcomes, that you should already have experience, and know everything or		
Expectations	be the "smartest."		0.565
	Everyone acts as is they are not struggling and are not open about the issues	10	
Mentality	they face and the mentality is to survive and achieve at all costs.		0.490
What do you think sho	uld change about engineering culture?		
What do you think sho	and change about engineering culture.	11	
Breaks	Promote relaxation and taking breaks or socializing.	11	0.563
~ ~		5	
Perfectionism	Decrease the normalization of a perfectionist mindset.		0.563
	Decrease the stereotypes surrounding who should and who can be an	7	
	engineer, why people choose engineering, and the idea that engineers do not		
Stereotypes	struggle.		0.447
••	Be open-minded towards struggles and failing, have a more positive and	20	
Attitudes	encouraging outlook, and be okay with asking for help.		0.486

## Discussion

Through coding analysis of survey responses from 53 undergraduate engineering students, this paper identified several themes regarding factors influencing their mental health and sense of belonging. Students felt that improving time management and achieving a better work-life balance could enhance their well-being, while fostering a stronger sense of community and reducing competition among classmates would help them feel more connected. They emphasized the importance of faculty support, both mentally and academically, and advocated for better access to campus resources, including social, health, academic, and housing services. Many students also reported that the heavy workload and pressure to perform contributed significantly to their stress, and they called for a cultural shift in engineering to prioritize asking for help and taking breaks. Together, these themes highlight that the high workload and de-prioritization of taking breaks impacts student mental health and wellbeing. Engineering, for many students, can be seen as encompassing a student's "whole life" [14]. This workload can prevent students from being able to effectively prioritize their mental health, as they are concerned with achieving expectations set by themselves or those around them [4]. Interacting with individuals around them, such as professors who are often perceived as unsympathetic to the challenges students face [15], can discourage students from prioritizing rest or seeking help. By providing opportunities for students to de-stress and promoting a more supportive environment, we can help them better manage their workload.

These themes also highlight the importance of students finding support from their peers, their professors, and their college. Finding support from peers is already seen as an important coping strategy for students under stress, as students are better able to connect with those who they perceive as going through similar experiences to them [16]. However, interactions with faculty or college-provided resources are often perceived as less helpful. Faculty members are primarily viewed as academic resources rather than sources of personal support, partly due to the limited closeness of their relationships [16]. College resources also present challenges, such as difficulty accessing them or long waitlists, which can be especially problematic when immediate assistance is needed [17]. Encouraging professors to take a more active role in supporting students and improving access to college resources are critical steps toward helping students better manage the stressors they face during their academic journeys [18], [19].

#### Limitations

It is important to understand how both the student population and the study methods may influence the findings presented through this paper. This research study was conducted at a large, public, predominantly White research institution located in the United States. As such, 67% of participants identified as White and 65% of students identified as heterosexual. Interestingly, despite the College of Engineering at the University of Kentucky being 75% men, 58% of the students who participated in this study identified as women. This is likely due to the topic of mental health, which was advertised during the recruitment for focus group participants. Moving forward, it is important that efforts aim to amplify the perspectives of students who are marginalized in engineering through focus groups targeted with students from these populations. Further, it is important to understand how these findings might differ across institutional context, where students at a liberal arts college or minority serving institution might have different experiences related to their mental health and sense of belonging. Finally, while the GLA focus group is participatory in nature, the data shown and analyzed in this paper represent findings from a survey research study. As such, researchers were involved in the coding and identification of important themes throughout this study. As a result, the findings highlighted here might differ from those that were identified as most important by student stakeholders. Future work will aim to publish the findings of the full GLA focus group, which will highlight key areas that students believe are most important for mental health and sense of belonging intervention. Further, this paper will propose student support interventions that were identified by the student stakeholders.

#### **Conclusion and Implication**

By analyzing students' responses to prompts about mental health and sense of belonging, we identified key factors contributing to their stress. Engineering students often feel burdened by a large and challenging workload, compounded by pressure to compete with peers and achieve perfection without taking breaks or seeking help. Despite these challenges, students recognize several ways to support their well-being and foster change. They can prioritize self-care by scheduling downtime for breaks. Colleges can improve access to resources and organize social events to help students build connections with their peers. Professors can foster stronger relationships with students and adjust classroom expectations to create a more supportive environment. Together, these efforts can transform engineering culture into one that values asking for help, taking breaks, and prioritizing mental health.

- L. Acharya, L. Jin, and W. Collins, "College life is stressful today Emerging stressors and depressive symptoms in college students," *J. Am. Coll. Health*, vol. 66, no. 7, pp. 655–664, Oct. 2018, doi: 10.1080/07448481.2018.1451869.
- [2] J. G. Bulo and D. M. G. Sanchez, "Sources of stress among college students," *CVCITC Res. J.*, vol. 1, no. 1, pp. 16–25, 2014.
- [3] S. E. Ross, B. C. Niebling, and T. M. Heckert, "Sources of stress among college students.," *Coll. Stud. J.*, vol. 33, no. 2, p. 312, 1999.
- [4] N. Ban *et al.*, "Identifying common perceived stressors and stress-relief strategies among undergraduate engineering students," *ASEE annual conference exposition*. Jun. 2022.
- [5] M. Asghar, A. Minichiello, and S. Ahmed, "Mental health and wellbeing of undergraduate students in engineering: A systematic literature review," J. Eng. Educ., Dec. 2023, doi: 10.1002/jee.20574.
- [6] K. J. Jensen and K. J. Cross, "Engineering stress culture: Relationships among mental health, engineering identity, and sense of inclusion," *J. Eng. Educ. Wash. DC*, vol. 110, no. 2, pp. 371–392, 2021, doi: 10.1002/jee.20391.
- [7] K. Cross and K. Jensen, "Work in Progress: Understanding Student Perceptions of Stress as Part of Engineering Culture," in 2018 ASEE Annual Conference & Exposition, Salt Lake City, Utah, Salt Lake City, Utah: ASEE Conferences, Jun. 2018, p. 31312. doi: 10.18260/1-2--31312.
- [8] N. Ban *et al.*, "'It's very important to my professors... at least most of them': How messages from engineering faculty and staff influence student beliefs around seeking help for their mental health," in *American Society for Engineering Education*, 2023.
- [9] B. A. Israel, A. J. Schulz, E. A. Parker, and A. B. Becker, "REVIEW OF COMMUNITY-BASED RESEARCH: Assessing Partnership Approaches to Improve Public Health," *Annu. Rev. Public Health*, vol. 19, no. Volume 19, 1998, pp. 173–202, May 1998, doi: 10.1146/annurev.publhealth.19.1.173.
- [10] L. M. Vaughn and M. Lohmueller, "Calling All Stakeholders: Group-Level Assessment (GLA)—A Qualitative and Participatory Method for Large Groups," *Eval. Rev.*, vol. 38, no. 4, pp. 336–355, Aug. 2014, doi: 10.1177/0193841X14544903.
- [11] L. Dorhout, "Making Plan B Work: Group Level Assessment Modified for Online Research," J. Particip. Res. Methods, vol. 4, no. 1, Feb. 2023, doi: 10.35844/001c.57699.
- [12] B. R. Guy and B. Arthur, "'I Am Not Alone': Impact of Participating in a Group-Level Assessment for Undergraduate Women Engineering Students," vol. 13, no. 2. p. 10, 2021.
- [13] U. Bronfenbrenner, *The ecology of human development*. London, England: Harvard University Press, 1979.
- [14] M. L. Sánchez-Peña, A. M. McAlister, N. Ramirez, D. B. Samuel, S. A. Kamal, and X. Xu, "Stigma of mental health conditions within engineering culture and its relation to help-seeking attitudes: Insights from the first year of a longitudinal study," *American Society for Engineering Education Annual Conference & Exposition*. 2023.
- [15] K. Beddoes and A. Danowitz, "In Their Own Words: How Aspects of Engineering Education Undermine Students' Mental Health," Minneapolis, MN: ASEE Conferences, 2022. [Online]. Available: https://peer.asee.org/40378
- K. J. Jensen, J. F. Mirabelli, A. J. Kunze, T. E. Romanchek, and K. J. Cross,
  "Undergraduate student perceptions of stress and mental health in engineering culture," *Int. J. STEM Educ.*, vol. 10, no. 1, p. 30, Apr. 2023, doi: 10.1186/s40594-023-00419-6.

- [17] C. J. Wright, S. A. Wilson, J. H. Hammer, L. E. Hargis, M. E. Miller, and E. L. Usher, "Mental health in undergraduate engineering students: Identifying facilitators and barriers to seeking help," *Journal of Engineering Education*. 2023. doi: 10.1002/jee.20551.
- [18] S. Wilson and D. Goldberg, "Strategies for Supporting Engineering Student Mental Health," *Chemical Engineering Education*, vol. 57, no. 2. 2023. doi: 10.18260/2-1-370.660-132290.
- [19] S. Wilson and K. Jensen, "Strategies to integrate wellness into the engineering classroom," *Chemical Engineering Education*, vol. 57, no. 4. 2023.