Assessing Stress Levels and Stressors Among Architecture, Engineering, and Construction (AEC) Students: Underpinnings for Mental Health Curricula Development

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Abstract

Even in this post-pandemic world, it cannot be overlooked that the global community has yet to fully recover from the long-term mental impacts of the pandemic and its associated challenges. Among these, the shift to remote learning and isolated lives has significantly affected students' mental health. While it is widely discussed that engineering students are more prone to mental health conditions, investigating the mental well-being of students specializing in Architecture, Engineering, and Construction (AEC) is also critical. This research focuses on examining the stress levels and identifying key factors contributing to stress, such as academic workload, anxieties related to job searches, and concerns over future professional prospects. In our previous research, we also highlighted the significance of mental health challenges among engineering students. Our previous study recommended integrating mental health resources into the engineering curriculum, particularly for civil and construction students [1]. Building on our prior research, this study aims to assess stress levels and explore the relationships between various stressors and demographic variables among AEC students. Following Institutional Review Board (IRB) approval, this study distributed the developed questionnaires to 74 AEC students. The study categorized stressors into three distinct groups: "Personal/family-related stressors", "Academic-related stressors", and "Industry/work-related stressors". Aligned with the study's objectives, the research customized and utilized the Perceived Stress Scale (PSS-4), comprising 10 questions for each group, to measure stress levels among the participants. This study underlines the importance of addressing mental health in AEC education, revealing personal and family-related stressors as primary concerns for students. It highlights the critical role of communication skills and the need for gender-sensitive approaches in mental health education. It suggests incorporating mental health topics into the curriculum, as recommended by students, to address stressors effectively and improve preparedness for workplace challenges. This approach aims to foster a resilient future workforce, ready to handle the professional environment's demands. Future research should build upon these findings, broadening the scope to include a wider range of engineering disciplines and engaging diverse stakeholders. This expanded approach aims to refine and enhance mental health support, leading to a more comprehensive and impactful curriculum for engineering students. While this study aims to understand the aforementioned stressors and their relationship with demographic factors, the study also endeavors to pave the way for future development of tailored mental health programs for the targeted group. The long-term goal is to enhance resilience, improve mental well-being skills, and encourage help-seeking behaviors among future AEC students and entry-level engineers. This will also help future engineers to communicate effectively and tolerate the world of industry.

Introduction

Mental health challenges in engineering students can arise from a combination of academic and non-academic pressures. Initially, students may struggle with life transformation, adapting to a new environment, and the sudden change in social support. Subsequently, academic pressures and workload add to these challenges [2]. As students advance to higher levels, particularly in senior classes, they may face dilemmas in job seeking and concerns about their future and plans. Compared to other disciplines, engineering students often experience significant stress, which can adversely affect their mental well-being and productivity. They may experience stress from multiple sources. Stress in engineering students often stems from a tough learning environment, time management struggles, and high academic expectations[3], [4]. While the willingness of students to seek help differs greatly, the engineering culture often hinders them from seeking help [5], [6]. Engineering students often hesitate to seek mental health care, fearing it may be seen as weakness or affect their job prospects, especially in sectors requiring security clearance. [7].

One of the most critical phase in curriculum development is the needs assessment [1], [8]. Although it is crucial to identify the key stressors among engineering students, there have been relatively few studies focusing on the self-reported problems and concerns of this group [9]. At the same time, their reluctance to seek help and the significant stigma associated with it could make understanding their needs more challenging. Entering the construction industry after graduation can be challenging due to its strict deadlines and high incidence of accidents, which place considerable pressure on all team members, including new engineers [10]. In the construction industry, the common diversity in backgrounds and languages can increase miscommunication leading to additional stress. Effective communication may pose a challenge for newly employed engineers, construction team members, and workers due to the significant contrast in environment compared to academia. Furthermore, miscommunication arising from this diversity can lead to project delays and diminished work quality [11]. It has been suggested that four common reasons lead construction workers to avoid seeking help: “Shame and Stigma”, Fear of Judgment by Peers”, “Fear of Negative Job Consequences”, and “Uncertainty about How to Access Care” [12]. Therefore, there is a pressing need for future engineers in this field to develop their skills in effectively communicating with workers.

Following our Work in Progress (WIP) study, which was the initial step in addressing the importance of need assessments in this area and exploring the potential of including mental health curricula into engineering programs [1], this study aims to continue investigating three main stressors among AEC students and assess the most significant one. Simultaneously, it seeks to identify potential relationships between these stressors and the students’ demographic information. The paper is structured as follows: The literature review section delves into mental health conditions, stressors, and various risk factors among engineering students. The methodology section discusses the scientific approach and stress evaluation method employed by the study. The processes of data collection and analysis methods are detailed in subsequent sections. Finally, the results and discussion section present the findings derived from the completed questionnaire, leading to the conclusion section.

Literature Review

Internationally, it has been demonstrated that mental well-being among higher education students is generally lower than that of the general population [5], [13]. In a mental health study of engineering students from five Western US universities, results obtained from 700 completed survey questionnaire indicated that 28.4% of participants were potentially suffering from a diagnosable mental health condition, while an additional 55.2% exhibited symptoms of moderate psychological distress [14]. Another study conducted in 2022 reported a 50% increase in mental health conditions among American college students from 2013 to 2021 [15]. As reported by the Centers for Disease Control and Prevention (CDC), suicide was identified as the third leading cause of death among college-aged individuals (ages 18 to 24) in the years 2020 and 2021 [16].

Engineering culture and values, dictating the essence of being an engineer, significantly shape help-seeking attitudes, leading to varied confidence levels among students in seeking assistance.[6]. Engineering students looking for support with mental health issues face three primary challenges. These include physical barriers like time and location constraints, cultural barriers such as the normalization of stress and stigma, and informational barriers due to a lack of knowledge [6]. According to the research, various identity aspects like culture, race/ethnicity, and gender influence students' likelihood of seeking help [17]. In addition, curriculum challenges, cultural and racial issues, irrational expectations, and prolonged study hours contribute to the anxiety experienced by a significant number of engineering students [18]. Although the number of women in engineering is on the rise, the American Society for Engineering Education (ASEE) indicates that women earn fewer than half of the bachelor's degrees in the majority of engineering fields, with civil engineering at 27.1%. [19]. In this environment, adherence to masculine norms like self-reliance, prioritizing work over personal relationships and emotional control is linked to a lower likelihood of seeking psychological help [20]. In addition to fostering a supportive environment for engineering students and normalizing the behavior of seeking help, there is a need to focus on another crucial aspect. Specifically emphasizing and improving access to mental health resources will significantly contribute to enhancing the overall conditions for engineers [3].

Gender influences stress levels, with female students typically experiencing heightened stress and anxiety [21]. Research indicates that race and ethnicity significantly impact the mental challenges faced by women in Science, Technology, Engineering, and Mathematics (STEM) [22]. Additionally, first-generation students often face increased mental challenges, and they tend to report higher levels of depression [21]. Research suggests that undergraduate students, especially women, sexual and gender minorities, ethnic minorities, and members of other marginalized groups, are more likely to experience severe mental health challenges [23], [24]. Striving for a high Grade-Point-Average (GPA) can cause negative psychosocial effects, including mental strain, physical fatigue, anxiety, and poor work-life balance. A study highlighted the significant impact of grades on students' mental, emotional, and physical health [18]. It also noted that grades often overshadow the learning of critical engineering concepts needed for post-graduation careers [18]. A study among undergraduate engineering students indicates that within engineering majors, electrical engineering students experience the most mental health conditions, followed by those in engineering physics, civil engineering, and aerospace engineering [23]. Year of study is another factor influencing and fluctuating anxiety levels among undergraduate students. Research has found that by their final year, numerous

students feel overwhelmed by complex and extensive course projects [23], [25]. Moreover, anxieties regarding student debt and financial stability tend to escalate, further impacting their mental well-being. [25]. Significant transition periods, such as graduation and the commencement of professional careers, can also impact the mental health of engineering students [23]. While many undergraduate AEC students in the US gain industry experience before graduation, the industry environment may also contribute to additional mental strain. It has been widely proven that construction workers are more prone to mental health conditions[26], [12]. Therefore, it is vital to prepare for the unique challenges new engineers face in the professional world, emphasizing the need for specialized communication skills.

There are multiple methods to assess stress levels in individuals. The Perceived Stress Scale (PSS), developed initially by Cohen and colleagues in 1983, stands as a globally recognized tool for evaluating perceptions of stress [25], [26]. This scale requires subjects to evaluate their experiences in the month preceding the time of their self-report [27]. While some studies have modified the 4-item version of the PSS to enhance reliability for their specific research purposes [25], the PSS-4 scale offers the distinct advantages of being quick to complete, making it an ideal assessment for online surveys [27]. Furthermore, Lee suggested that using the modified PSS-10 as opposed to the PSS-4 does not necessarily improve reliability. The study emphasized that the characteristics of the study play a more significant role in determining reliability than the scale of the PSS itself [26]. The PSS4 utilizes Cohen's original scale, offering a range of response options: 0 (Never), 1 (Almost Never), 2 (Sometimes), 3 (Fairly Often), and 4 (Very Often). A higher score on this scale indicates a greater level of stress experienced by the participant [6].

Methodology

This cross-sectional study adopted a mixed-methods approach, utilizing both quantitative and qualitative methods in the form of an online survey. It encompassed a range of closed-ended questions for rating purposes, as well as open-ended questions, to comprehensively gather information from students. The survey is composed of three principal sections: "Demographic Information", "Rating for Stressors", and "Mental Health Skills".

The demographic section of the questionnaire gathered basic personal and social data from students. This study categorized potential stressors experienced by engineering students into three main groups: "Personal/family-related stressors", "Academic-related stressors", and "Industry/work-related stressors". Following questions regarding demographic information, the survey asked participants about their feelings and thoughts during the past month, up to the moment when they were taking the survey. This part of the survey asked students to rate their level of stress in three distinct categories. Ten questions, based on the original PSS, were developed for each category, but tailored to align with these stressor groups and the target population. Figure 1. illustrates the sections of the questionnaire and their subcategories. The third section of the survey aimed to gather students' views on mental health skills, particularly emphasizing which abilities, if developed, would contribute positively to their mental well-being in both academic and industry-related contexts.

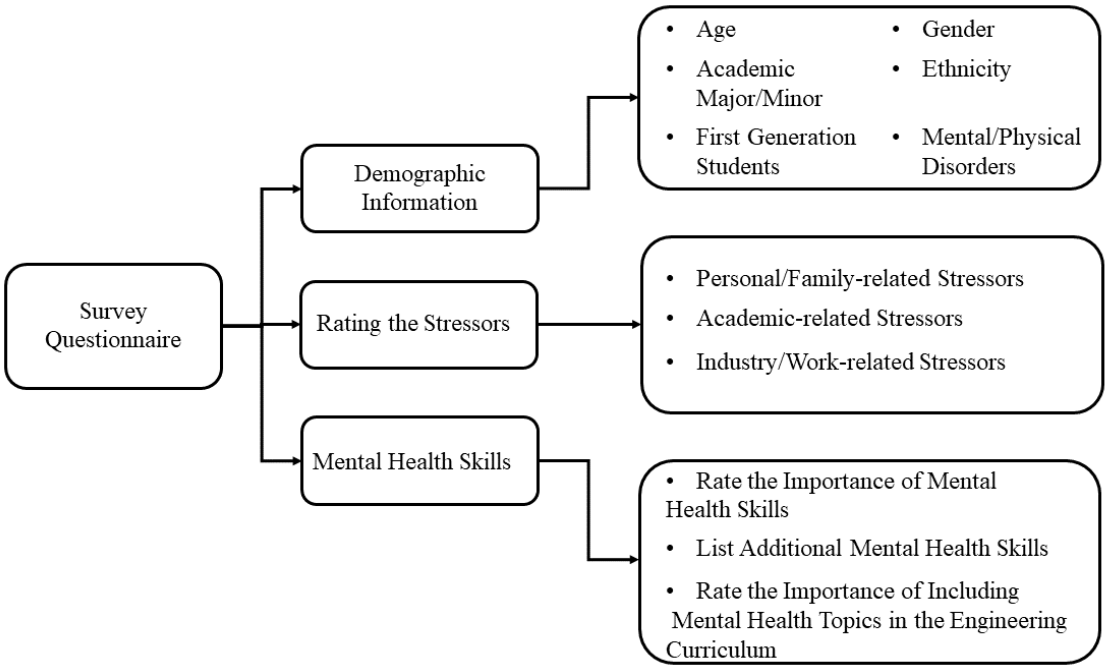

Figure 1. Structure of the Survey Questionnaire: Main Parts and Subsections

Data Collection

This study was approved by IRB (# 23-11-7093) on December 2023 and the survey questionnaire was distributed in January 2024 to undergraduate students enrolled in "Construction Cost Estimating" and "Safety Engineering and Management" courses at one university in the US. The Department of Civil, Construction, and Environmental Engineering offers a variety of majors. However, these two classes are specifically available to students in Civil, Construction, and Architectural Engineering. A total of 74 students received invitations to participate in the survey, which was distributed via email. These emails contained a link to the survey on Qualtrics and a QR code, both of which facilitated direct access to the online questionnaire. Prior to the distribution of the survey, the purpose of the study was briefly introduced to the students in person at the beginning of the sessions in both classes. Through this approach, coupled with the provision of scientific information about the significance of mental health and the proved reluctance to seek help among engineering students, the authors sought to raise awareness of this critical issue. The goal was to encourage student engagement and participation in this study. It must be noted that students were instructed to skip the questions related to industry-work related stressors if they lacked any kind of industry-related experience. Out of the 54 questionnaires received, 50 were fully completed and subsequently included in the data analysis. Notably, 7 students reported not having any kind of industry experience.

Data Analysis

In accordance with the PSS-4 scoring guidelines, the study evaluated the stress levels of each participant. Following these instructions, the scores are interpreted as follows:

- Scores ranging from 0 to 13 are considered indicative of low stress.
- Scores ranging from 14 to 26 are categorized as moderate stress.
- Scores ranging from 27 to 40 are viewed as representing high perceived stress.

In the scoring process, reverse coding was applied to certain items. This means that, although a score of 4 (Very Often) typically signifies the highest level of stress on this scale, for items phrased in a positive tone, a score of 4 instead indicates the lowest level of stress. This adjustment ensures that the scale accurately reflects the respondent's perceived stress levels by accounting for the positive or negative framing of each statement. Below are the first two questions from the section on personal-family related stressors, demonstrating the application of reverse coding based on the tone of each question: 1) "In the past 30 days, how often have you felt nervous and stressed?" Given its negative tone, a response of 4 (Very Often) on this question indicates a high level of stress. 2) "In the past 30 days, how often have you felt confident about your ability to handle your personal problems?" Due to its positive tone, a response of 4 (Very Often) for this question is interpreted as the lowest level of stress.

For the final section of the survey, which aimed to compare mental health skills and identify the most important one from the students' perspective, basic descriptive statistics were conducted. Additionally, to assess the relationship between gender and the perceived importance of integrating mental health topics into engineering education, a Two-Sample T-test was employed using Minitab 21.4.1.

Results and Discussion

Out of 50 responses received, 43 came from male students while 7 were from female students. The survey showed a homogenous age distribution, mainly in the early twenties, with an average age of 21.98 years and a standard deviation of 1.11. As depicted in Figure 2, ages ranged from 20 to 26, with a mode of 21 years and a median indicating half were 22 or younger. The age variance was 1.24, highlighting a uniform age sample.

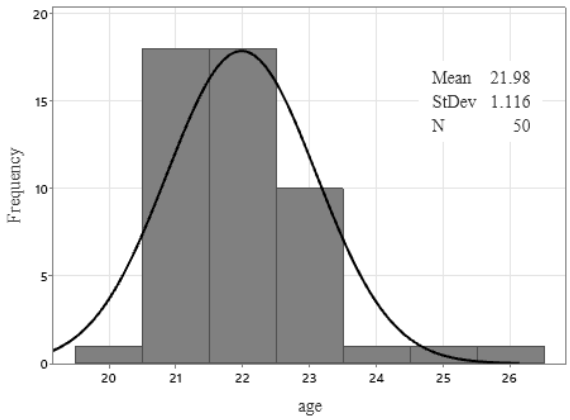

Figure 2. Histogram of Participants' Age

From the results, 92% of the participants identified as White (46 respondents), 4% as Black or African American (2 respondents), and Asian and Hispanic or Latino were represented by 2%

each (1 respondent for each group), indicating a predominant White majority and limited ethnic diversity. In addition, it was determined that 14% of the participants identified as first-generation students, with 7 affirming this status. Conversely, a substantial majority of 86%, equating to 43 respondents, indicated that they are not first-generation students. The completed responses revealed that Civil Engineering was the major for 33 students, while Construction Engineering had been chosen by 16 students. Moreover, there was one student pursuing an Architectural Engineering. Merely two students reported having diagnosed mental disorders. Additionally, while 49 students reported having no physical disabilities, one student chose not to answer the question regarding physical disabilities.

The comparison of the three stressor categories aimed to ascertain their prevalence among participants. By aggregating the final scores for each participant, we were able to compare the overall results. The data analysis revealed that personal-family related stressors were the most prevalent, accounting for 36% of the responses. This was closely followed by academic-related stressors at 33%, and finally, industry-work related stressors, which accounted for 31% of the responses.

The study also aimed to evaluate the level of stress among participants by considering different stressors, in accordance with the PSS-4 scoring criteria. Personal/Family-related stressors emerged as the only category where participants reported a high level of stress, affecting 6% of the students. The classification of stress levels experienced by participants into three distinct stressor categories is detailed in Table 1.

Table 1. Analysis of Participants' Stress Levels

		Personal/Family-related Stressors		**Academic-related Stressors**		**Industry/Work-related Stressors**	
		Number of Participants	Percentage	Number of Participants	Percentage	Number of Participants	Percentage
Level of Stress	Low	23	46%	25	50%	17	40%
	Moderate	24	48%	25	50%	26	60%
	High	3	6%	0	-	0	-

As illustrated in Table 1, high stress levels were not prevalent among participants for Academic-related and Industry/Work-related stressors. However, the results indicate that 60% of participants experienced moderate stress due to Industry/Work-related stressors, compared to 50% for Academic-related stressors. Although the students are not yet fully integrated into industry roles, a significant proportion experiencing moderate stress underscores the necessity of enhancing their awareness of future work environments and potential challenges. It highlights the importance of equipping AEC students with the knowledge and skills required to manage workplace stressors effectively.

Table 2 presents a comparative evaluation of stress levels among the students from Construction and Civil Engineering majors who participated in the study. Despite the variance in cohort sizes, with 16 Construction Engineering students and 33 Civil Engineering students, the relative proportions offer a telling perspective. Among the findings, both majors reported considerable proportions of moderate stress levels in personal/family-related and academic-related stressors, with approximately 56% and 50% in Construction Engineering, and around

45% and 48% for these stressors in Civil Engineering students. Remarkably, for industry/work-related stressors, Civil Engineering students reported a higher proportion of moderate stress at approximately 65%, compared to 56% in Construction Engineering. Notably, the presence of high stress levels was only reported within the Civil Engineering group, suggesting a need for additional support mechanisms within this cohort. These comparisons, while indicative, should be interpreted with caution due to the difference in group sizes.

Table 2. Comparative Analysis of Stress Levels Among Construction and Civil Engineering Students

	Construction Engineering Students (n=16)			**Civil Engineering Students (n=33)**		
Level of Stress	Personal/Family-related Stressors (n, %)	Academic-related Stressors (n, %)	Industry/Work-related Stressors (n, %)	Personal/Family-related Stressors (n, %)	Academic-related Stressors (n, %)	Industry/Work-related Stressors (n, %)
Low	7 (43.75%)	8 (50.00%)	7 (43.75%)	16 (48.48%)	17 (51.52%)	9 (34.62%)
Moderate	9 (56.25%)	8 (50.00%)	9 (56.25%)	15 (45.45%)	16 (48.48%)	17 (65.38%)
High	0 (0.00%)	0 (0.00%)	0 (0.00%)	2 (6.06%)	0 (0.00%)	0 (0.00%)

While identifying the key stressors impacting students' lives is crucial, it is equally important to assess the most significant reasons within each category that notably affect the participants' mental well-being. Within the category of Personal/Family-related stressors and as illustrates in Figure 3, general anxiety, financial concerns, and the urgency to find a job were identified as significant reasons affecting participants' stress levels. Furthermore, the results revealed that conflicts with family and/or friends regarding one's future career plans were identified as the least significant reason contributing to stress.

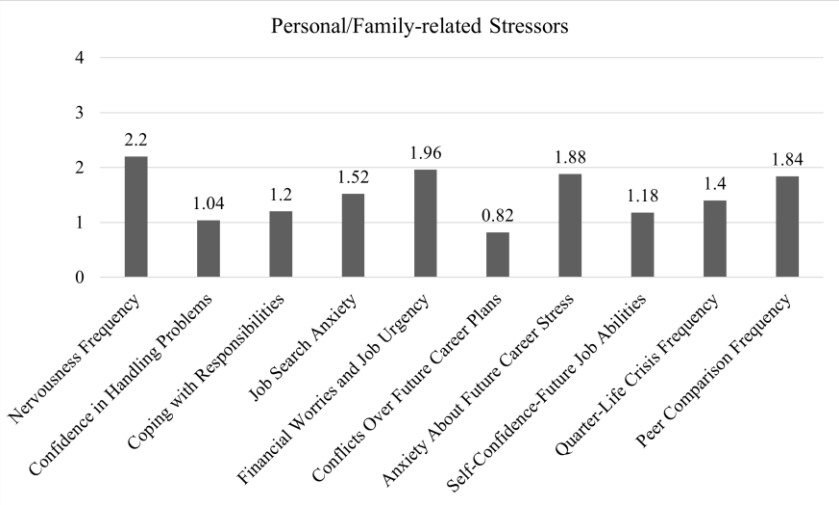

Figure 3. Key Factors Contributing to Personal/Family-Related Stress Among Participants

Within the category of Academic-related stressors, as depicted in Figure 4, "Discussing Mental Health Openness", and "Mentor Discussion Comfort" were the significant reasons that affect participants' stress levels the most, with average scores of 2.86 and 2.71, respectively. This

finding highlights the importance of creating an environment where individuals feel comfortable and supported in talking openly about their mental health challenges. Openness in discussing mental health refers to the degree to which people can freely express their feelings, experiences, and concerns regarding their psychological well-being without fear of stigma or negative judgment. Conversely, “Race Discrimination Anxiety”, and “Bullying Experience” were shown to be the least contributing factors to stress, with the lowest average scores among the measured factors. The data in Figure 5 suggests that “Work Issues Counseling Attendance” is the predominant industry/work-related stressor. This indicates that despite limited industry experience, students are already apprehensive about potential work-related issues, and it appears they may be hesitant to seek help. Being open about mental health challenges in the workplace is another source of stress for student participants. This could stem from insufficient communication skills and existing stigma around mental health, which may make it difficult for employees to discuss these issues openly at work.

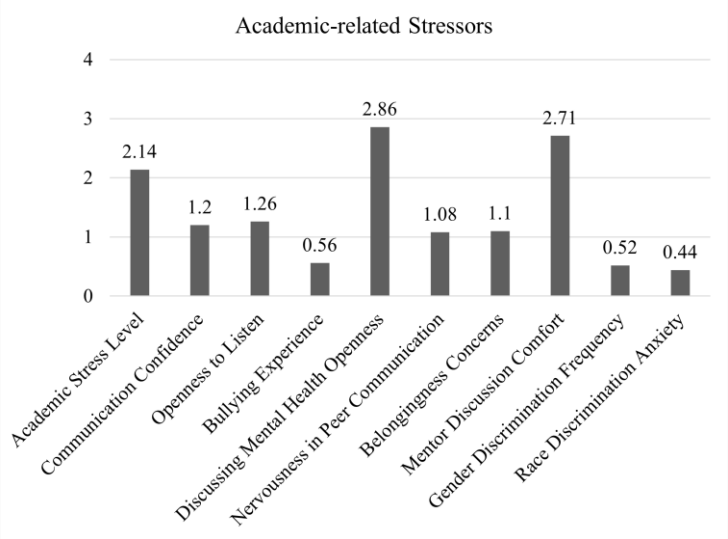

Figure 4. Key Factors Contributing to Academic-Related Stress Among Participants

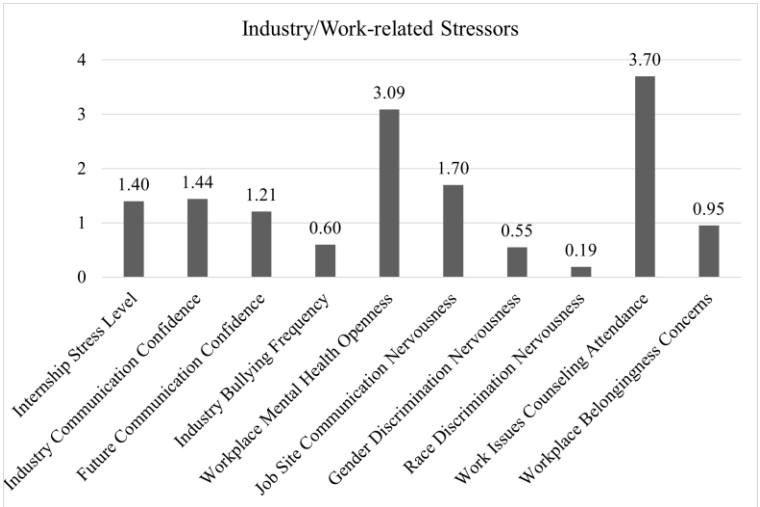

Figure 5. Key Factors Contributing to Academic-Related Stress Among Participants

Mental Health Skills

Students were requested to rate on a scale of 1 to 5 the importance of enhancing their abilities in the following areas: “Stress Management Skills”, “Self-awareness and Self-reflection Skills”, and “Effective Communication Skills”, to promote and maintain the mental health of themselves and their colleagues in both academic and industry settings. According to the results and as shown in Table 3, “Effective Communication” was identified by students as the most critical skill they believe needs improvement to maintain and promote mental well-being.

Table 3. Comparative Importance of Mental Health Skills Among Students (Sample Size N= 50)

Skills Category	Mean Score	Standard Deviation	Median
Stress Management Skills	4.02	0.915	4.00
Effective Communication Skills	4.50	0.735	5.00
Self-awareness and Self-reflect Skills	4.06	0.890	4.00

In addition to rating the abovementioned skills, students were asked at the end of the survey to specify any other skills they believe are essential for enhancing mental well-being. Notably, two students specifically mentioned “Happiness” as a skill that needs to be learned to enhance mental well-being. While many students emphasized various soft skills, three of them highlighted the importance of “All Soft Skills”. Based on the responses, the study categorized “Empathy”, “Respectful Boundaries”, “Creative Thinking”, “Determination”, “Sustenance”, “Self-Worth”, and “Finding a Job You Enjoy” into the “Miscellaneous” group of skills. “Work-Life Balance”, which includes “finding the ability to relax and take breaks”, and “finding positive hobbies outside of work”, was mentioned by five students. The workload of undergraduate study appears to have led to challenges in managing time, as eight students explicitly identified “Time Management” as an essential skill to learn. One student specified that a significant source of stress is procrastination or waiting until the last minute to start tasks. Despite the high ratings for “Communication Skills” as depicted in Table 3, participants strongly underscored the importance of further developing these skills. While some responses simply mentioned communication skills, others highlighted “Openness”, “Talking with a mentor”, and “The ability to ask for help in any environment”. From the results, a significant portion of participants (20 students) did not specify any additional required skills. This could indicate that, while they may be struggling with mental health conditions, they are unsure how to address or manage their concerns and stressors. Furthermore, this situation highlights a pressing need within engineering education to develop a curriculum focused on increasing students’ awareness of mental health issues, alongside potential interventions, and coping strategies.

At the end of the survey, participants were asked to rate the importance of integrating mental health topics into undergraduate engineering education on a scale of 1(Not at all important) to 5 (Extremely important). Based on the survey questionnaires incorporated into this study, participants only identified as either female or male, with no other gender categories being selected. A Two-Sample T-Test was performed to compare the importance placed on including

mental health topics in the engineering curriculum, as rated by female and male students. Results revealed a higher median response for females compared to males, suggesting a higher central tendency among female respondents in rating the importance of integrating mental health topics into engineering education. This analysis indicated that while most of the male students considered the inclusion of this topic moderately important, female engineering students generally attributed greater importance to the integration of mental health topics into their education.

Conclusion

The study concludes that mental health is a multifaceted issue among AEC students, with personal/family-related stressors being the most prevalent. Anxiety over work-related issues, even before full immersion in the industry, points to a significant gap in the preparedness of students to cope with future workplace challenges. The reluctance to seek counseling for these concerns, coupled with the difficulty in discussing mental health openly due to stigma and communication barriers, underscores the need for a more supportive educational and professional environment. The study identified communication skills as crucial for improving mental well-being among Civil and Construction Engineering students. The research implies that in engineering education, while academic and professional abilities hold value, the crucial aspect of equipping students with improved soft skills should not be neglected. Educating students on effective communication methods can substantially impact their overall mental health. The significant difference in the perceived importance of integrating mental health topics into engineering education between students may reflect differing experiences or awareness levels. The findings demonstrate a consensus among students on the inclusion of mental health topics in their curriculum, despite differing attitudes toward the significance of learning about mental health. Implementing the insights from this research into engineering education could lead to the development of well-being courses tailored to address the identified concerns and stressors. Future curricula could benefit from including industry-related specifications and providing practical tips for managing stress, promoting a healthier transition from education to the professional environment. To effectively support AEC students' mental health, it is essential to address personal, academic, and work-related stressors through targeted strategies within the curriculum. For personal stress, initiatives like mindfulness sessions and emotional intelligence workshops can enhance students' resilience. Academically, offering time management courses and stress reduction techniques helps manage workload pressures. Enhancing soft skills, crucial for both academic success and career readiness, involves communication and teamwork workshops, coupled with real-world project experiences. To mitigate work-related stress, career counseling, industry engagement through webinars, and practical advice on navigating job markets are key. These strategies collectively aim to prepare students not just for professional challenges but also to enhance their personal development and academic performance, creating a well-rounded educational experience. The end goal is a more mentally robust engineering students and workforce, equipped not only with technical skills but also with the resilience to thrive in the face of industry challenges.

Future research should be expanded to include various universities and different engineering disciplines to evaluate specific stress factors and gather insights from both current engineering students and future engineers regarding mental health education. Additionally, future studies could extend these investigations into the industry to illuminate the mental health situation among new engineers and the potential challenges they face in the industry. Findings from this study could be beneficial for future mental well-being courses in engineering colleges, identifying coping strategies in regard to different concerns and stressors, and enabling the incorporation of industry-related specifications and tips on managing related stressors.

References

[1] S. Khorshid and S. Song, "Work in Progress: Assessing the Need for Mental Health Curricula for Civil, Architecture, and Construction Engineering," presented at the 2023 ASEE Annual Conference & Exposition, Jun. 2023. Accessed: Jan. 20, 2024. [Online]. Available: https://peer.asee.org/work-in-progress-assessing-the-need-for-mental-health-curricula-for-civil-architecture-and-construction-engineering

[2] J. F. Mirabelli, A. J. Kunze, J. Ge, K. J. Cross, and K. Jensen, "Work in Progress: Identifying Factors that Impact Student Experience of Engineering Stress Culture," presented at the 2020 ASEE Virtual Annual Conference Content Access, Jun. 2020. Accessed: Feb. 07, 2024. [Online]. Available: https://peer.asee.org/work-in-progress-identifying-factors-that-impact-student-experience-of-engineering-stress-culture

[3] N. Ban *et al.*, "Identifying common perceived stressors and stress-relief strategies among undergraduate engineering students," *ASEE Annu. Conf. Expo.*, Jan. 2022, Accessed: Jan. 18, 2024. [Online]. Available: https://par.nsf.gov/biblio/10338239-identifying-common-perceived-stressors-stress-relief-strategies-among-undergraduate-engineering-students

[4] M. Asghar, A. Minichiello, and S. Ahmed, "Mental health and wellbeing of undergraduate students in engineering: A systematic literature review," *J. Eng. Educ.*, vol. n/a, no. n/a, doi: 10.1002/jee.20574.

[5] J. E. Tait, L. A. Alexander, E. I. Hancock, and J. Bisset, "Interventions to support the mental health and wellbeing of engineering students: a scoping review," *Eur. J. Eng. Educ.*, vol. 49, no. 1, pp. 45–69, Jan. 2024, doi: 10.1080/03043797.2023.2217658.

[6] 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," *J. Eng. Educ.*, vol. 112, no. 4, pp. 963–986, 2023, doi: 10.1002/jee.20551.

[7] K. Beddoes and A. Danowitz, "In Their Own Words: How Aspects of Engineering Education Undermine Students' Mental Health," presented at the 2022 ASEE Annual Conference & Exposition, Aug. 2022. Accessed: Jan. 15, 2024. [Online]. Available: https://peer.asee.org/in-their-own-words-how-aspects-of-engineering-education-undermine-students-mental-health

[8] E. Salas and J. A. Cannon-Bowers, "The science of training: a decade of progress," *Annu. Rev. Psychol.*, vol. 52, pp. 471–499, 2001, doi: 10.1146/annurev.psych.52.1.471.

[9] P. Yanik, Y. Yan, S. Kaul, and C. Ferguson, "Sources of Anxiety among Engineering Students: Assessment and Mitigation," in *2016 ASEE Annual Conference & Exposition Proceedings*, New Orleans, Louisiana: ASEE Conferences, Jun. 2016, p. 25845. doi: 10.18260/p.25845.

[10] C. Gómez-Salgado *et al.*, "Stress, fear, and anxiety among construction workers: a systematic review," *Front. Public Health*, vol. 11, 2023, Accessed: Jan. 28, 2024. [Online]. Available: https://www.frontiersin.org/articles/10.3389/fpubh.2023.1226914
[11] A. A. Abdallah, M. E. Shaawat, and A. S. Almohassen, "Causes of miscommunication leading to project delays and low work quality in the construction industry of Saudi Arabia," *Ain Shams Eng. J.*, vol. 15, no. 3, p. 102447, Mar. 2024, doi: 10.1016/j.asej.2023.102447.
[12] "Communication is the key to AEC firms' mental health programs and training," Building Design + Construction. Accessed: Jan. 31, 2024. [Online]. Available: https://www.bdcnetwork.com/communication-key-aec-firms-mental-health-programs-and-training
[13] T. Bonsaksen *et al.*, "Students' Mental Health, Well-Being, and Loneliness during the COVID-19 Pandemic: A Cross-National Study," *Healthc. Basel Switz.*, vol. 10, no. 6, p. 996, May 2022, doi: 10.3390/healthcare10060996.
[14] A. Danowitz and K. Beddoes, "A Snapshot of Mental Health and Wellness of Engineering Students Across the Western United States," in *2020 IEEE Frontiers in Education Conference (FIE)*, Oct. 2020, pp. 1–5. doi: 10.1109/FIE44824.2020.9273885.
[15] S. K. Lipson *et al.*, "Trends in college student mental health and help-seeking by race/ethnicity: Findings from the national healthy minds study, 2013-2021," *J. Affect. Disord.*, vol. 306, pp. 138–147, Jun. 2022, doi: 10.1016/j.jad.2022.03.038.
[16] "WISQARS (Web-based Injury Statistics Query and Reporting System) | Injury Center | CDC." Accessed: Jan. 18, 2024. [Online]. Available: https://www.cdc.gov/injury/wisqars/index.html
[17] K. Glanz, B. K. Rimer, and K. Viswanath, *Health Behavior: Theory, Research, and Practice*. John Wiley & Sons, 2015.
[18] E. Marquez and S. Garcia, "Keeping Calm and Staying Balanced: Exploring the Academic Pressures Faced by Engineering Students to Attain High Grades and Their Impact on Mental Health".
[19] "Engineering-and-Engineering-Technology-by-the-Numbers-2022-1.pdf." Accessed: Feb. 08, 2024. [Online]. Available: https://ira.asee.org/wp-content/uploads/2023/12/Engineering-and-Engineering-Technology-by-the-Numbers-2022-1.pdf
[20] J. Juvrud and J. L. Rennels, "'I Don't Need Help': Gender Differences in how Gender Stereotypes Predict Help-Seeking," *Sex Roles*, vol. 76, no. 1, pp. 27–39, Jan. 2017, doi: 10.1007/s11199-016-0653-7.
[21] K. J. Jensen and K. J. Cross, "Engineering stress culture: Relationships among mental health, engineering identity, and sense of inclusion," *J. Eng. Educ.*, vol. 110, no. 2, pp. 371–392, 2021, doi: 10.1002/jee.20391.
[22] D. R. Johnson, "Campus racial climate perceptions and overall sense of belonging among racially diverse women in STEM majors," *J. Coll. Stud. Dev.*, vol. 53, no. 2, pp. 336–346, 2012, doi: 10.1353/csd.2012.0028.
[23] M. L. Sánchez-Peña, "Stigma of mental health conditions within engineering culture and its relation to help-seeking attitudes: Insights from the first year of a longitudinal study".
[24] H. Xiao *et al.*, "Are we in crisis? National mental health and treatment trends in college counseling centers," *Psychol. Serv.*, vol. 14, no. 4, pp. 407–415, 2017, doi: 10.1037/ser0000130.
[25] M. Deziel, D. Olawo, L. Truchon, and L. Golab, "Analyzing the Mental Health of Engineering Students using Classification and Regression," presented at the Educational

Data Mining, Jul. 2013. Accessed: Jan. 31, 2024. [Online]. Available: https://www.semanticscholar.org/paper/Analyzing-the-Mental-Health-of-Engineering-Students-Deziel-Olawo/c763af55ef907db530a9cca589ce161e3994b1bd

[26] “CPWR Mental Health in the Construction Industry,” CPWR. Accessed: Jan. 31, 2024. [Online]. Available: https://www.cpwr.com/research/research-to-practice-r2p/r2p-library/other-resources-for-stakeholders/mental-health-addiction/