Institutional Role in the Mental Health and Well-being of Undergraduate Engineering Students: Student and Faculty Perspectives

Mr. Muhammad Asghar, Utah State University

Muhammad Asghar is a graduate researcher and a Ph.D. candidate in the Engineering Education Department at Utah State University. He has a master's in clinical psychology, a master's in educational psychology, and a bachelor's in computer information systems engineering. His research interests consist of investigating undergraduate engineering students' mental health and well-being. He is also interested in research related to using different technical and non-technical methods to enhance the learning processes of undergraduate engineering students.

Dr. Angela Minichiello, Utah State University

Angela Minichiello is an associate professor in the Department of Engineering Education at Utah State University (USU) and a registered professional mechanical engineer. Her research examines issues of access, diversity, and inclusivity in engineering.

Mr. Assad Iqbal, Arizona State University

Assad Iqbal is a Postdoctoral Research Scholar at Arizona State University working on the National Science Foundation-funded research project i.e., Engineering For Us All (e4usa). Assad Iqbal is an information system engineer with a Ph.D. in Engineering Education and around 14 years of teaching experience in undergraduate engineering and technology education. His research interest is to explore, understand, and enhance ways to promote self-directed, self-regulated life-long learning among the undergraduate engineering student population. Various pieces of his research efforts are intended to converge into an inclusive instructional design for undergraduate engineering students.

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Muhammad Asghar [1,*], Angela Minichiello [1], and Assad Iqbal [2]

[1] Engineering Education Department, Utah State University, Logan, UT 84322, USA
[2] Engineering Education Systems & Design Department, Arizona State University, Mesa, AZ, 85212, USA
[*] Correspondence: m.asghar@usu.edu

Abstract

Background
Mental Health and Wellbeing (MHW) has been attributed to student success in higher education. While the role of institutions of higher education in the MHW of students is generally known, to the knowledge of authors, research about how students and their faculty perceive this role in undergraduate engineering education contexts is limited.

Purpose
The purpose of this study was to investigate the role of the institution (i.e., administration and faculty) in providing students with an overall positive experience in the college of engineering as perceived by students and their faculty.

Design/Method
This study reports on the analysis of the semi-structured interview data collected from undergraduate engineering students, and their faculty in the college of engineering at a Western land grant institution of higher education. As part of a larger project related to the MHW of undergraduate engineering students, these data were collected in response to a specific question about the institution's role in providing an overall positive student experience. Thematic Analysis of data collected from 13 interview participants (8 students and 5 faculty members) was conducted.

Findings
Thematic analysis resulted in three themes from student interviews addressing the need for 1) improvement in first-year student experiences, 2) delivering needed information about students' MHW and academics, and 3) improvement in the hands-on experiences of students. Resultant four themes from faculty interviews addressed: 1) effective faculty-student communication, 2) providing opportunities to increase positive academic and social experiences, 3) cognizance of students' situation, and 4) dissemination of MHW-related information.

Conclusions
Institutions of higher education play a vital role in the overall positive experiences of engineering undergraduates to support their MHW. While engineering undergraduates and their faculty agree on the need for improved dissemination of information to students, the faculty focus is on MHW-related information and students' desire for information more broadly including information relating to courses and hands-on experiences. Both agree that institutions need to be aware of the MHW need of students.

Keywords: mental health, wellbeing, students, undergraduate, faculty, engineering education

1 | BACKGROUND

The mental health of undergraduate engineering students is in disarray with the prevalence of high levels of several mental health issues. For example, high levels of anxiety [1, 2], depression [1-3, 4], stress [1-3, 5], and post-traumatic stress disorder [3] have been reported by engineering education researchers interested in the mental health and wellbeing (MHW) of engineering undergraduates. The prevalence of COVID-19 in recent years has exacerbated this already worst mental health situation of engineering undergrads across institutions of higher education [6, 7].

Engineering students blame an unsupportive overall engineering college environment to be a cause of their mental health challenges [8]. Research indicates that educational institutions can play a vital role in enabling students to confront challenges [9]. Systems like tutoring centers to support academic success and psychological services to support the MHW of students are usually available in institutions of higher education. But to what extent the undergraduate engineering students benefit from them may not be clear. Psychological counseling services may be beneficial when students end up having mental health problems [10] but may not help protect students from being exposed to mental health issues in the first place.

In the present study, we attempted to highlight the perceptions of undergraduate engineering students and their faculty about the role educational institutions can play in providing a supportive environment to students. Such an environment should not only assist students facing mental health challenges but may also provide a shield to prevent such difficulties. In addition to student perceptions, we were also interested in faculty perceptions because our recent research suggested students perceive faculty to be the most important factor in their MHW across several psychological domains including cognitive (academic satisfaction and academic efficacy), social (school connectedness), and emotional (college gratitude) [11]. Mental health research may use phrases like mental illness and mental problems to indicate adverse mental health, and/or mental wellness and mental wellbeing to refer to prosperous mental health. Therefore, for consistency purposes, throughout this paper, we use Mental Health and Wellbeing (MHW) as a balancing phrase as suggested by the authors [12].

The present study was part of a larger study with several other publications [11-14]. The focus of the larger study was the subjective wellbeing (SWB) of undergraduate students. SWB is people's perceptions of their emotions, domain satisfaction, and overall life satisfaction [15]. We inquired about what factors were perceived by undergraduates to contribute towards their overall wellbeing. Among five interview questions asked from both undergraduate students and their faculty who participated in the larger study, one question was about the role of their institution in the wellbeing of engineering undergraduates.

2 | PURPOSE

The purpose of the present study is to investigate the perceptions of undergraduate students and their faculty about the institutional role in the mental health and wellbeing of undergraduate engineering students. The study is guided by the following research question (RQ) asked during the interviews.

RQ: How can higher education institutions positively contribute to the MHW of undergraduate engineering students?

Interviews with undergraduate engineering students and their faculty were conducted to produce qualitative data and a thematic analysis of the data was conducted for the study findings.

3 | THEORETICAL ORIENTATION

Corresponding to the recent call to support wellbeing and thriving in engineering education [16, 17], this study purposefully investigates the positive role institutions might play in this regard. We posit our study in the teachings of positive psychology. Positive psychology is a psychology sub-discipline that deals with positive human experiences and how they can help them thrive. Learnings from positive psychology can help prevent or lessen negative psychological experiences [18, 19]. In the words of Seligman and Csikszentmihalyi, the founder of positive psychology [20]:

> "The field of positive psychology at the subjective level is about valued subjective experiences: well-being, contentment, and satisfaction (in the past); hope and optimism (for the future); and flow and happiness (in the present). At the individual level, it is about positive individual traits: the capacity for love and vocation, courage, interpersonal skill, aesthetic sensibility, perseverance, forgiveness, originality, future-mindedness, spirituality, high talent, and wisdom. At the group level, it is about the civic virtues and the institutions that move individuals toward better citizenship: responsibility, nurturance, altruism, civility, moderation, tolerance, and work ethic" (p. 5).

With the conceptualization of this study through positive psychology, we attempt to be able to know about the positive role the institutions can play to support an overall environment of wellbeing and thriving for undergraduate engineering students. We argue that if institutions can provide such an environment, the MHW of engineering undergraduates can be improved to such an extent that the possibility of ending up with mental problems may be lessened.

4 | METHODS

This research study was conducted in the college of engineering at a Western land grant institution in the USA after its approval from the Institutional Review Board (IRB). A total of 13 semi-structured interviews were conducted to collect qualitative data. Eight undergraduate engineering students were purposefully selected while five of their faculty were selected through convenience sampling based on the availability of any faculty members. The following interview question was used to answer our research question.

Interview question: What can the institution (administration and faculty) do to provide students with an overall positive experience in the College of Engineering (in support of their MHW)?

Thematic analysis of the qualitative data was conducted as suggested by Creswell and Poth [21].

4.1 | Participants and recruitment

An online screening survey was developed to recruit a diverse pool of participant sample. Student screening survey consisted of questions regarding the major, gender, ethnicity, year of study, generation (first or continuing), and traditional/non-traditional status. Horn [22] identifies seven characteristics of students to determine if they are traditional minimally/moderately/highly nontraditional: "(1) their high school or equivalent credential, (2) if they started college within the first 12 months of their graduation from high school, (3) their eligibility for any financial assistance, (4) if they were single parents, (5) if they had any dependents other than a spouse, (6) their enrollment status, and (7) their employment status". Following Horn [22], students were considered to be traditional if they possessed none of these characteristics, minimally non-traditional if they possessed one of these characteristics, moderately non-traditional if they possessed two or three of these characteristics, and highly non-traditional if they possessed four or more of these characteristics. Announcements through the canvas course pages with the help of the undergraduate faculty were made to ensure student participation in the screening survey. In addition, flyers with the same announcement were displayed in the college of engineering building with a QR code leading to the screening survey. A $25 Amazon Gift card was offered to students who were to be selected through the screening survey. Eight students, with diverse demographics (see Table 1) were selected and interviewed based on the data acquired through the screening survey. These sample demographics are comparable to the overall demographic composition of the student population in the college of engineering. According to the university's Office of Analysis, Assessment, and Accreditation, of the total undergraduate enrolment currently (n = 1906) in the college of engineering, approximately 91% are White, while 16% are Women.

Table 1.

Interview student participants' demographics

Participant ID	Engineering Major	Gender	Ethnicity	Year of Study	First Generation	Traditional/Non-Traditional
Student 1	Mechanical and Aerospace Engineering	Man	Latinx White	3rd Year	Yes	Minimally Non-Traditional
Student 2	Mechanical and Aerospace Engineering	Woman	White	3rd Year	Yes	Traditional
Student 3	Civil and Environmental Engineering	Man	Latinx White	2nd Year	No	Minimally Non-Traditional
Student 4	Civil and Environmental Engineering	Woman	White	2nd Year	Yes	Moderately Non-Traditional

Student 5	Mechanical and Aerospace Engineering	Man	White	1st Year	No	Minimally Non-Traditional
Student 6	Civil and Environmental Engineering	Man	White	4th Year	Yes	Moderately Non-Traditional
Student 7	Bioengineering	Women	Asian White	4th Year	No	Moderately Non-Traditional
Student 8	Electrical and Computer Engineering	Man	White	3rd Year	No	Minimally Non-Traditional

As for the faculty, emails were sent to all faculty members in the college of engineering who were teaching undergraduate engineering courses. We heard back from nine faculty members, of whom five (see Table 2) agreed to be interviewed when a follow-up email communication was made making it a convenience participant sample. It is pertinent to mention here that the faculty and student participant were recruited separately. They may or may not have come in contact in a class setting with each other during undergraduate engineering courses.

Table 2.

Interview faculty participants' demographics

Participant ID	Gender	Ethnicity	Levels Taught	Departments Where Undergraduate Courses Taught
Faculty 1	Woman	White	2nd Year	Bioengineering, Mechanical, and Aerospace Engineering
Faculty 2	Man	White	3rd, 4th and 5th Years	Civil and Environmental Engineering
Faculty 3	Man	White	1st and 2nd Years	Bioengineering, Civil and Environmental Engineering, Electrical and Computer Engineering, Mechanical, and Aerospace Engineering
Faculty 4	Man	White	2nd, 3rd, 4th and 5th Years	Electrical and Computer Engineering
Faculty 5	Man	White	2nd, 3rd, 4th and 5th Years	Mechanical and Aerospace Engineering

One female and four male faculty members agreed to participate in the study. The faculty interview participants were all white with their combined experience of teaching at all undergraduate engineering educational levels and in all majors at the college of engineering.

4.2 | Data collection and analysis

We prepared an interview protocol to guide our Zoom-based online semi-structured interviews. Each participant signed an informed consent form before an interview could have been initiated. Interviews were only audio recorded to ensure the privacy and confidentiality of the participants. Interview audios were transcribed with Trint [23], an online audio transcription service. Transcribed data was first verified and then de-identified before its analysis could be commenced.

An iterational and cyclical qualitative data analysis involving two coders was carried out as advised by Saldaña [24]. Initially, interviews were read and reread to come up with descriptive codes. The interview data was then converted to individual excerpts and line-by-line coded. These codes were then categorized and organized into subsequent superordinate categories to identify any emerging themes.

The two coders worked independently sharing approximately equal coding responsibility while both reviewing all transcripts. Each coder verified the codes, categories, and themes of the other coder at each step of the thematic coding analysis. Regular in-person meetings were held between the two coders to discuss any disagreements and to develop a consensus.

4.3 | Limitations

As with most qualitative studies, the findings from this study are not generalizations and may not have statistical significance [25] due to a smaller participant sample. It should be noted that this was not a quantitative study. Therefore, we did not make broader claims as a result of the findings of this study but we did intend to produce transferable and reliable results with implications for the target undergraduate engineering student population.

Though we did attempt to recruit ethnically diverse student and faculty samples from the college of engineering, the outcome was limited by the availability of such a diverse participant pool. The educational institution is a White majority. No Black student responded to our screening survey while only White faculty participants agreed to participate in the study.

5 | FINDINGS

RQ: How can higher education institutions positively contribute to the MHW of undergraduate engineering students?

To answer the above study RQ, thematic analysis of both student and their faculty interviews was conducted separately. Thematic analysis resulted in three emergent themes from student interviews addressing the need for 1) improvement in first-year student experiences, 2) delivering needed information about students' MHW and academics, and 3) improvement in the hands-on experiences of students. Resultant four themes from faculty interviews addressed: 1) effective faculty-student communication, 2) providing opportunities to increase positive academic and social experiences, 3) cognizance of students' situation, and 4) dissemination of MHW-related information. The following describes these themes in detail.

5.1 | Themes from student interviews

Themes are explained in order of the frequency with which they appeared during student interviews.

5.1.1 | Need for improvement in first-year students' experiences

To positively influence students' MHW in undergraduate engineering, the student participants suggested their institution take steps when students were in their first year. They thought that exposing students to hands-on experience, while they were in their first year, was important for them to engage with their course content. More steps need to be taken to do so. If students were informed more effectively about what engineering major career choices they could make in the coming years while they were in the first year of their studies, they will be able to make better career decisions. For example, one of the study participants said the following:

> *"During the introductory classes, inform students about different types of engineering fields so students can decide which discipline they want to go to."* (Student 5).

Some participants were also of the view that undergraduate engineering study is too much to be completed in four years. They expected their institution to work on extending the duration of an engineering undergraduate engineering degree to five years and allow students to plan it properly while they are in their first year.

5.1.2 | Need for delivering needed information about student's MHW and academics

Study participants expected their institutions and faculty to be more cognizant of the MHW of their students. They perceived engineering undergraduate studies to be tough and stressful with many students suffering from mental health problems. For example, a study participant had the following views.

> *"A lot of students are stressed a lot of the time, so any opportunities, they have to help students remember to be mindful. Mental and emotional support is needed. Reminding students to drink water during the class could be really helpful."* (Student 2).

Simple steps taken by the institution to help remind students to be mindful could prove vital to positively influence the MHW of engineering undergraduates. For example, as stated by the study participant above, reminding students in the class to take it easy and just have a glass of water may have far going positive implications.

Study participants expected their institution to be more communicative with them. They expected the institution to more actively provide students with information about dealing with MHW issues, engaging in more hands-on experiences, and their courses for better academic and personal outcomes. Dissemination of course-related information appeared to be most important to the students. One participant expressed her feeling as below:

> *"I would say to help have more of a positive experience is giving out more information. Think about classes (like when you sign up for classes like what's being provided and information about the classes). I guess for me I had to take an extra semester because I wasn't ever told that a class that used to be offered every semester was going to change to every other semester."* (Student 7).

Students may not be aware of how and where to get course-relevant information. If such information is not accessed timely, it may have devastating effects on their academic career. For example, the above student had to take an extra semester just because some very basic course information was not delivered to them when it was needed the most. The college of engineering administration may facilitate seminars and presentations delivering such information. Faculty, who act as the front people for the institutions could play their role in delivering such information.

5.1.3 | Need for improving hands-on experiences of students

Hands-on experiences were considered to be an important part of college life. They were perceived to contribute to better MHW as they provided students to see the practical real-world applications of their courses. Students wanted improvement in the laboratory like providing more state-of-the-art laboratory equipment. The study participants were of the view that they should be able to engage in research work to gain practical hands-on experiences. For example, one of the participants said the following.

> *"The college of engineering should have more research opportunities available for students in professors' labs. There might be many such opportunities available but the students may not know about them. Professor could announce them in their classes I guess."* (Student 3).

As will be highlighted in the next section, there is a need for transparency in the communication process between faculty and students. As highlighted in the above student participant quote, the faculty could inform their students about the availability of hands-on experience such as undergraduate research and internships if they have any such information. On an institutional level, such information could be delivered through weekly emails, presentations, and industry events.

5.2 Themes from faculty interviews

Themes are explained in order of the frequency with which they appeared during faculty interviews.

5.2.1 | Need for effective faculty-student communication

The most prevalent theme during the faculty interviews was the need for effective faculty-student communication. As can be seen in the following excerpt, simply sitting down with students, being polite with them, and listening to them to know if they have MHW and/or other issues that you can help them with, can be very beneficial for students.

> *"So, the biggest thing that I have found that I can do is really just talk with the students. I'm listening to their needs, listen, you know, giving them you know meaningful feedback when they need it." (Professor 1).*

One faculty interviewee was of the view that the faculty and administration should take the lead and initiate communicative channels with the students as the students themselves might be reluctant to do so. In their words:

> *"By talking with them and meeting with them. So, I would say, the more we can do to have students sit down with faculty and our administrators, you know one on one in small groups and talk about you know things how they're doing is beneficial, I think, too often students are reluctant to actually go talk with folks where we are busy." (Professor 2).*

Meeting one on one and small group meetings with students was suggested to be an effective way and beneficial for them.

5.2.2 | Providing opportunities to increase positive academic and social experiences

The faculty had some valuable suggestions for the college administration to help improve positive academic and social experiences for the engineering undergraduates at the college of engineering. One of the suggestions to enhance the academic experiences of students was as follows.

> *"For the administration, one of the things that I see in our undergraduate education that is a perpetual difficulty for students is being able to get help on the fundamentals of they may not have done well in their initial classes, for whatever reason. For example, in calculus or in mathematics, or physics. Some of these classes, prepare them for classes in our regular engineering curriculum. They may not have done well and they don't feel prepared." (Professor 4).*

In the above excerpt, the faculty member emphasized the importance of supporting students with their fundamental courses like calculus, mathematics, and physics as they provide the foundation for more advanced courses. Students who do not get adequate help during their fundamental courses may have difficulties succeeding in their academics thereafter.

Speaking of the provision of positive social experiences to students, one of the suggestions was to organize evening classroom get-togethers.

> *"Support mechanisms for success, try to set up classrooms in the evening, where groups can meet and study. That might be something that can be done, and all of that, I think, goes to their mental well-being. If anything, that's sometimes just a vent source right if you're getting so frustrated and you can sit around for a half hour with your group of friends and talk about "man that was such a bad test" or something. Maybe it's an esteem outlet or something like that. So, encouraging them to do that kind of stuff whatever it might be, I mean everybody has different triggers that help them to relieve stress." (Professor 3).*

In the above excerpt, the faculty participant suggested focusing on and providing opportunities for social interactions between students and their peers. Students might have faced difficulties during their classes in regular classes. To get a proper outlet to dispose of their frustration and stress, they may be facilitated to set down with their peers in classrooms in the evening and talk about their faced difficulties during their daily routines. Sharing their stressful academic experiences in these informal social settings with their peers may help students process and relieve them from their stressful academic experiences.

Among other suggestions for the institutional administration, the faculty viewed facilitating student clubs, offering some financial support to students, and supporting student engagement events to be worth their consideration.

5.2.3 | Be cognizant of students' situation

Being aware and cognizant of the student's academic and psychological situation was perceived to be very important and needed attention by the faculty. As shown in the following excerpt, one of the faculty interviewees suggested that it is not only important for the faculty to know that engineering is a tough endeavor, but they should also let their students know that they (faculty) see their students' efforts and hard work and that it is normal to be overwhelmed.

> *"I think engineering, it's really stressful especially once you get in the major um I think. Making sure that they feel seen and heard. You know, making sure that you know they know that it's normal to feel overwhelmed by kind of the tough workload and that that we appreciate the work that they do. I mean that can just be verbal pep talks." (Professor 5).*

It was considered important for the students to know that their faculty is aware of their situation. It was suggested that the faculty engage with their students and reassure them that they are aware of students' situation caused by heavy workload and that they appreciate the efforts they are putting to complete their academic tasks.

5.2.4 | Dissemination of MHW related information

As we saw in student interviews, dissemination of MHW-related information was considered important by the faculty as well. Students need to be informed that there are support systems within the institution that can help them with their MHW needs if required. One of the faculty participants adopted the following strategy in his class.

> *"In connections, when I teach that class, we do a pretty good job of saying here's the different institutions here at our university that can help you if you have mental health difficulties. Like you know CAPS (counseling and psychological services) and different organizations like that might be of help." (Professor 3).*

Students spend most of their time in their classes. Therefore, dispensing MHW-related information during lectures may be very beneficial for students.

6 | DISCUSSION

The need for dissemination of information by the institution in support of students' MHW was highlighted by both faculty and students such dissemination of information was perceived to positively contribute to the overall MHW of engineering undergraduates. Across campuses and colleges, dissemination of MHW and other academic support-related information through comprehensive and organized means has been advised by the Hunt Institute of public education as well [26]. Dissemination of such information could be vital to create MHW awareness in higher education and hence result in reduced stigmatization of students suffering from mental health problems [27].

Students expected institutional intervention to improve their first-year experiences. MHW and lifelong learning skills integration in first-year engineering courses have been advised by researchers for student success [28]. In its simplest form, the integration of MHW and personal learning reflections in first-year engineering courses may have positive effects. Research literature supports that such practices have been received positively by both engineering undergraduates and their faculty [29].

Students expected their institutions to strive more to improve hands-on experiences i.e. more state-of-the-art equipment in labs and individualized instructional support. Such experiences have been reported to contribute to positive student experiences and improved MHW. For example, engineering practice opportunities provided to engineering undergraduates create a sense of gratitude toward engineering colleges in these students and ultimately contribute to their wellbeing [11].

We learned from the faculty interviews that they realized the need to be cognizant of the stressful and challenging academic situation in undergraduate engineering and were in support of improving the faculty-student communication process for positive contributions to the MHW of their students. Faculty support has been reported to be vital to psychological constructs such as academic satisfaction, academic efficacy, school connectedness, and college gratitude of engineering undergraduates [11]. These constructs contribute to human subjective wellbeing [30], or a state of happiness and life satisfaction where we think and feel that our life is going well and not bad [31].

7 | CONCLUSIONS, IMPLICATIONS, AND FUTURE RESEARCH

Institutions of higher education can play a vital role in the overall positive experiences of engineering undergraduates to support their Mental Health and Wellbeing (MHW). However, more vital is understanding the perspectives of the two most important stakeholders (i.e., students and faculty) on what is perceived to be most important for students' MHW. It was interesting to find a better awareness among both students and faculty about MHW issues and their perceptions of how to facilitate and address these issues in their educational institutions.

More communication and improved dissemination of important information (that could help students' MHW) were deemed important by both students as well as faculty. However, faculty

specifically emphasized MHW related information being effectively disseminated and their perceived communication needs also focused on helping directly with students' MHW. While students perceived a broader array of information and communication needs including academics and course-related information in addition to their MHW-related needs. The dissemination of these types of information has implications for engineering undergraduates. Such information is important for them to be aware of their mental health and helps them to seek proper professional MHW help if required. Information, other than MHW e.g., academic-related information is important for engineering undergraduates' persistence and success. High attrition rates in undergraduate engineering are common. The current research highlights the importance of faculty-to-student interaction. The faculty-to-student interaction may not only help facilitate students with MHW needs but will also help faculty understand their academic and social needs.

We suggest focus group based future research work consisting of both engineering undergraduate and their faculty. Such focus groups may facilitate a dialogue between both the participant types and may inform about similarities and gaps existing between the perceptions of both relating to the MHW needs of engineering undergraduates and the role the educational institutions can play in meeting such needs. Faculty suggestions pointed out the need for the provision of informal social settings for students to interact with their peers. However, the specifics of such social settings may need to be further investigated to ensure such social settings are beneficial for engineering undergraduates without threatening their MHW.

REFERENCES

1. B. Coley and M. Jennings, “The price of persistence: Investigating the impact of pursuing engineering on undergraduate student mental health,” presented at the IEEE Frontiers in Education Conference, Covington, KY, USA, 2019.
2. M. Deziel, D. Olawo, L. Truchon, and L. Golab, “Analyzing the mental health of engineering students using classification and regression,” *Educational Data Mining.*, 2013.
3. A. Danowitz and K. Beddoes, “Characterizing mental health and wellness in students across engineering disciplines.” presented at the Collaborative Network for Engineering and Computing Diversity Conference Proceedings, Crystal City, VA, USA, 2018.
4. M. E. Goodwin, “The impact of depression on academic success and academic help-seeking attitudes,” presented at the ASEE Virtual Annual Conference, 2020.
5. K. J. Jensen and K. J. Cross, “Engineering stress culture: Relationships among mental health, engineering identity, and sense of inclusion,” *Journal of Engineering Education*, vol. 110, no. 2, pp. 371–392, Apr. 2021, doi: https://doi.org/10.1002/jee.20391.
6. A. Minichiello, O. Lawanto, W. Goodridge, A. Iqbal, and M. Asghar, “Flipping the digital switch: Affective responses of STEM undergraduates to emergency remote teaching during the COVID-19 pandemic,” *Project Leadership and Society*, p. 100043, Feb. 2022, doi: https://doi.org/10.1016/j.plas.2022.100043.
7. O. Lawanto, A. Iqbal, W. Goodridge, A. Minichiello, and M. Asghar, “Emergency remote learning: Developing an understanding about online learning features and Students’ feelings,” *International Journal of Engineering Education*, vol. 38, no. 5-B, pp. 1629–1642, 2022.
8. Wilson, M. Wright, L. Hargis, E. Usher, J. Hammer, and H. Shannon, “Identifying Common Perceived Stressors and Stress-Relief Strategies among Undergraduate Engineering Students.,” presented at the 2022 ASEE Annual Conference & Exposition, Minneapolis, MN, USA, 2022.
9. M. E. DeRosier, E. Frank, V. Schwartz, and K. A. Leary, “The Potential Role of Resilience Education for Preventing Mental Health Problems for College Students,” *Psychiatric Annals*, vol. 43, no. 12, pp. 538–544, Dec. 2013, doi: https://doi.org/10.3928/00485713-20131206-05.
10. L. Bolier, M. Haverman, G. J. Westerhof, H. Riper, F. Smit, and E. Bohlmeijer, “Positive psychology interventions: A meta-analysis of randomized controlled studies,” *BMC Public Health*, vol. 13, no. 1, Feb. 2013, doi: https://doi.org/10.1186/1471-2458-13-119.
11. M. Asghar, A. Minichiello, A. Iqbal, “Perceived Factors Contributing to the Subjective Wellbeing of Undergraduate Engineering Students: An Exploratory Study,” *International Journal of Environmental Research and Public Health*, vol. 19, no. 23, p. 16284, Dec. 2022, doi: https://doi.org/10.3390/ijerph192316284.

12. M. Asghar, A. Minichiello, D. Kane, O. Lawanto, J. Marquit, "Work in Progress: Proposing items for an Engineering Undergraduate Subjective Wellbeing Questionnaire (EUSWQ)," presented at the 2023 ASEE Annual Conference & Exposition, Baltimore, MD, USA, Jun. 2023.
13. M. Asghar and A. Minichiello, "Two sides of every psyche: Implications of positive psychology for 'mental health' research in engineering education." Journal of Engineering Education, vol. 112, no. 1, pp. 12-17, Dec. 2022, doi: https://doi.org/10.1002/jee.20493.
14. M. Asghar, D. Kane, A. Minichiello, W. Goodridge, "A Kickstart to Smart Living in Undergraduate Engineering: Proposing Goals and Objectives for a First Year Happiness and Wellbeing Course," presented at the 2023 ASEE Annual Conference & Exposition, Baltimore, MD, USA, Jun. 2023.
15. E. Diener, E. M. Suh, R. E. Lucas, and H. L. Smith, "Subjective well-being: Three decades of progress.," *Psychological Bulletin*, vol. 125, no. 2, pp. 276–302, 1999, doi: https://doi.org/10.1037/0033-2909.125.2.276.
16. K. Jensen, "The Time is Now to Build a Culture of Wellness in Engineering," *Studies in Engineering Education*, vol. 2, no. 2, p. 42, Jun. 2021, doi: https://doi.org/10.21061/see.67.
17. J. S. Ge *et al.*, "A Scoping Literature Review of Engineering Thriving to Redefine Student Success," *Studies in Engineering Education*, vol. 2, no. 2, p. 19, Apr. 2021, doi: https://doi.org/10.21061/see.9.
18. Tal Ben-Shahar, *Happier: Learn the Secrets to Daily Joy and Lasting Fulfillment (McGraw Hill professional)*. The Mcgraw-Hill Companies, Inc, 2007.
19. M. E. P. Seligman, *Learned optimism*. London: Nicholas Brealey Publishing, 2018.
20. M. E. P. Seligman and M. Csikszentmihalyi, "Positive psychology: An introduction," *American Psychologist*, vol. 55, no. 1, pp. 5–14, 2000, doi: https://doi.org/10.1037/0003-066x.55.1.5.
21. J. W. Creswell and C. N. Poth, *Qualitative inquiry & research design: choosing among five approaches*, 4th ed. Los Angeles Etc.: Sage, Cop, 2018.
22. L. Horn, *Profile of Undergraduates in U.S. Postsecondary Institutions*; National Center for Education Statistics: Washington DC, USA, 2002.
23. "Trint: Automated Transcription of Audio and Video, Powered by AI," *Trint*. https://trint.com/
24. J. Saldaña, *The Coding Manual for Qualitative Researchers*. Los Angeles: Sage, 2021.
25. M.C. Stoddart, *Generalizability and Qualitative Research in a Postmodern World*. Grad. J. Soc. Sci. 2004.
26. "Supporting Mental Health within Institutions of Higher Education · The Hunt Institute," *The Hunt Institute*, 2021. https://hunt-institute.org/resources/2021/06/supporting-mental-health-within-institutions-of-higher-education/

27. S. Yamaguchi, Y. Mino, and S. Uddin, “Strategies and future attempts to reduce stigmatization and increase awareness of mental health problems among young people: A narrative review of educational interventions,” *Psychiatry and Clinical Neurosciences*, vol. 65, no. 5, pp. 405–415, Aug. 2011, doi: https://doi.org/10.1111/j.1440-1819.2011.02239.x.

28. R. Paul, D. Dedemus, M. Boyce, and K. Johnston, “The ‘engineers have feelings’ project: integrating mental wellness and lifelong learning skills in first-year undergraduate engineering courses,” *Proceedings of the Canadian Engineering Education Association (CEEA)*, Jun. 2020, doi: https://doi.org/10.24908/pceea.vi0.14154.

29. R. Paul *et al.*, “Impact of integrating mental wellness and personal learning reflections into first-year undergraduate engineering courses,” *Proceedings of the Canadian Engineering Education Association (CEEA)*, Jun. 2021, doi: https://doi.org/10.24908/pceea.vi0.14973.

30. T. L. Renshaw and S. J. Bolognino, “The College Student Subjective Wellbeing Questionnaire: A Brief, Multidimensional Measure of Undergraduate’s Covitality,” *Journal of Happiness Studies*, vol. 17, no. 2, pp. 463–484, Dec. 2014, doi: https://doi.org/10.1007/s10902-014-9606-4.

31. E. Diener, E. M. Suh, R. E. Lucas, and H. L. Smith, “Subjective well-being: Three decades of progress.,” *Psychological Bulletin*, vol. 125, no. 2, pp. 276–302, 1999, doi: https://doi.org/10.1037//0033-2909.125.2.276.