

Engineering Students Coping With COVID-19: Yoga, Meditation, and Mental Health

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Abstract: In 2020, we conducted a nationwide online survey of undergraduate engineering students in the United States to examine how the novel coronavirus pandemic was affecting engineering students' mental health and what strategies they were using to cope with mental health challenges. The survey was a compilation of validated mental health instruments that screen for depression, anxiety, somatoform disorders, eating disorders, non-specific psychological distress, and post-traumatic stress disorder. Given that prior research has shown that yoga and meditation can help people suffering from anxiety, depression, and post-traumatic stress disorder, we were interested in exploring the subset of respondents who said that they were using yoga and/or meditation to cope with mental health challenges during the pandemic. The research questions addressed in this paper are: 1) What are the demographic characteristics of students who used yoga and/or meditation to cope with mental health challenges of the 2020 novel coronavirus pandemic? and 2) Does the mental health of the students who used these strategies differ in any from the mental health of students who did not use yoga and meditation coping strategies? Based on 669 responses from students at 140 different universities, we found that there were 20 survey items for which the yoga/meditation group fared statistically significantly differently than the non-yoga/meditation group. These 20 items appeared in the screens for depression, anxiety, somatoform disorders, eating disorders, non-specific psychological distress, and post-traumatic stress disorder. For example, yoga and meditation practitioners were significantly less likely to have experienced feelings of hopelessness during the prior 30 days, as well as to have experienced feelings of being so depressed that nothing could cheer them up. A causative relationship cannot be claimed, but the correlations we found align with prior research showing that yoga and meditation can support many aspects of mental health.

Introduction

University students are facing unprecedented situations caused by the COVID-19 pandemic. For many, all aspects of life have been impacted: school, home, work, relationships, and recreation. Having to move off campus and losing access to university facilities and resources, having to engage in distance learning for the first time, having to shelter in place and practice physical distancing, losing income, and dealing with illness and death are just some of the challenges students faced in 2020. This is on top of everyday stress related to the engineering curriculum [1]. It is to be expected that all of this would take a toll on mental health. Indeed, early studies on the pandemic's impacts have found significant detriment to some students' mental health [2], [3].

As part of a larger mental health survey, we asked engineering students what strategies they were using to cope with mental health challenges caused by the pandemic. While prior research has identified strategies that engineering students used to cope with stress during pre-pandemic times [4], we know of no other research that has examined this question during the pandemic or in relation to mental health challenges other than stress. Our findings, therefore, provide new insights into an unexplored aspect of engineering students' mental health experiences.

Given that prior research has shown that yoga and meditation can help people suffering from mental health challenges, such as anxiety, depression, and post-traumatic stress disorder, we were interested in further exploring the subset of respondents who said that they were using yoga and/or meditation to cope with mental health challenges during the pandemic. The research questions addressed in this paper are: 1) What are the demographic characteristics of students who used yoga and/or meditation to cope with mental health challenges of the 2020 novel coronavirus pandemic? and 2) Does the mental health of the students who used these strategies differ in any way from the mental health of students who did not utilize yoga and meditation coping strategies?

The paper begins with a literature review of the effects of yoga and meditation on mental health for both general populations and relevant specific populations. The survey methods are then described. Following that, the 20 survey items for which the yoga and meditation group scored statistically significantly better (or different) are presented, after which implications of the findings for relevant groups of stakeholders are discussed. The paper concludes with a summary of pandemic and post-pandemic considerations.

Literature Review: Yoga, Meditation, and Mental Health

General populations

Around the world, research on general populations, as well as young adults specifically, has shown that yoga and meditation can improve many aspects of mental health [5]–[7]. One such line of research has compared yoga with other interventions and found yoga to be as effective as, or better than, other interventions at improving mental health. For example, in Australia, a 10-week randomized comparative trial comparing hatha yoga to relaxation found yoga to be as effective as relaxation on some measures (reduced stress and anxiety) and better than relaxation on mental health scores overall [8]. Likewise, a study in Sweden compared the effects of ten sessions of Kundalini yoga to ten sessions of cognitive behavioral therapy and found that both groups showed similar levels of improvement in stress, stress behavior, anger, and exhaustion, among other measures [9].

Meta-analyses also show positive effects of yoga and meditation. One analysis of yoga regimen trials found that 25 of the 35 studies resulted in significant decreases of stress and anxiety [10]. Another meta-review looking specifically at yoga as a treatment for trauma effects and PTSD reviewed 13 literature reviews covering 185 different studies and found that “the evidence regarding yoga as an intervention for the effects of trauma as well as the mental health symptoms and illnesses often associated with trauma is encouraging but preliminary” [11, p. 35]. Both meta-studies noted that while promising, the existing literature has limitations and is in need of further rigor, larger samples, and more control group studies. One challenge of comparing and drawing conclusions across studies is that yoga does not mean the same thing across all studies (i.e., the interventions are comprised of different types and styles of practice).

University students

In addition to research on the general population, there is also growing interest in exploring the effects of yoga and meditation on undergraduate and graduate students’ mental health and

incorporating yoga and meditation programming into university services [12]. Compared to research on general populations, however, there appear to be fewer randomized control studies for university student populations. One that was conducted compared a mindfulness intervention group and a yoga intervention group to a non-intervention group of undergraduate students from no specific major who had been diagnosed with depression and/or anxiety; it found significant improvements in depressive, anxiety, and stress symptoms in both the yoga and meditation groups [13]. Other studies have shown similar improvements on markers of mental health in the studied group. For instance, students (as well as staff and faculty) in “helping professions” (psychology, nursing, and nutrition) participated in a ten-week yoga and meditation program that effectively lowered their academic-related stress [14]. Similar effects have also been demonstrated with medical students [15], [16]. Additionally, a specific practice called iRest yoga-nidra has been shown to significantly reduce stress, worry, and depression in a group of undergraduate students from no specific major [17].

Interestingly, yoga has been shown to not only improve mental health, but also to improve academic performance [15]. A study of medical students in India found that their anxiety decreased following a yoga practice on exam days. Moreover, compared to the control group, the yoga group had significantly fewer exam failures following yoga practice. They also benefitted from “better sense of well-being, feeling of relaxation, improved concentration, self-confidence, improved efficiency, good interpersonal relationship, increased attentiveness, lowered irritability levels, and an optimistic outlook in life” [15, p. 218]. Additionally, in related research on mindfulness, engineering education researchers have explored relationships between mindfulness, innovation, and self-efficacy [18], [19].

Other relevant specific populations

While not conducted specifically with university students, there is a third body of research on another specific population that has relevance for engineering education. Veterans choose engineering majors at a rate of 1.5 times than that of non-engineering majors [20], and often have different mental health challenges than the general student population [21], including higher rates of PTSD. Moreover, women veterans often have different mental health challenges than men veterans [22]. Therefore, findings on the use of yoga and meditation to treat PTSD in veterans is germane. Yoga, meditation, and mindfulness practices are widely used in Veterans Affairs PTSD treatment programs [23]. Yoga treatment programs have helped veterans with PTSD improve a wide range of PTSD symptoms, including hyperarousal symptoms, overall sleep quality, depression, and finding mental stillness [24], [25], including in comparison to control groups [26]. Related population-specific research on women with PTSD (non-veterans) showed similar reduction in PTSD symptoms in women for whom other treatments had not been effective [6].

Methods

Data collection

The data reported in this paper came from a nationwide online survey of undergraduate engineering students in the United States. Data was collected between May and July 2020. The purpose of the survey was to understand the impact of the COVID-19 pandemic on engineering students’ mental

health, the strategies they were using to cope with mental health challenges during the pandemic, and their perceptions of their universities' responses to the pandemic. The survey consisted of demographic questions, closed-choice mental health instruments that are widely-used and previously validated, and four open-ended response questions for which respondents could enter anything they wanted. The mental health instruments were the Kessler 6, which screens for non-specific psychological distress; the Patient Health Questionnaire (PHQ), which screens for depression, anxiety, somatoform disorders, eating disorders, and alcohol abuse; the Primary Care - Post-traumatic Stress Disorder (PC-PTSD) instrument, which screens for the prevalence of Post-Traumatic Stress Disorder (PTSD); and The Social Readjustment Rating Scale (SRRS), which measures baseline stress. The open-ended response question for this paper was: *What strategies have you used to cope with mental health challenges during the pandemic?* Findings from other parts of the survey are reported elsewhere [2], [3].

The survey was distributed to undergraduate engineering students through a number of channels, including listservs and social media platforms for California State University Engineering Deans, several American Society for Engineering Education division and regional email lists, the Society of Women Engineers, and GradCafe's Engineering Student forum. To incentivize participation, we offered \$5 Amazon.com gift-cards to the first 1,000 survey respondents to provide valid .edu email addresses.

Data analysis

We began with an open coding approach to determine what strategies respondents were using and if any patterns or themes emerged. Overall, the responses spanned a wide range of common coping strategies that likely mirror those of the general population. Examples included exercising, getting outside, getting away from screens, reading, finding ways to stay connected to family and friends, playing video games, drinking, and drugs. Because the lead author has a long-standing interest in yoga and meditation and is a certified yoga instructor, she noticed that a relatively high number of respondents listed yoga and/or meditation as a coping strategy, and we decided to examine whether or not the mental health of those respondents differed in any significant way from those who used other strategies.

Thirty respondents were included in the "yoga group." It included all respondents who listed "yoga" and/or "meditation" as a coping strategy, as well as 3 respondents who listed "self-regulation" with no further elaboration on what that meant. For simplicity, we will refer to this group as the "yoga group" throughout the rest of this paper. The data was also searched for other relevant keywords (mindful/ness, hatha, vinyasa, breathing, breath work, pranayama), but no additional relevant responses were found. All respondents besides these 30 were included in the "other" non-yoga group. Responses from the two groups were compared for each mental health screen and each screening item using Welch T-Tests to check for statistical differences. All analysis was conducted using R [27].

Limitations

The nature of how this open-ended response data emerged means that we know very little about the details of the yoga group's practices. We do not know what styles of yoga or meditation they

practiced, how often they practiced, how long practices lasted, where they practiced, or if they already had a yoga or meditation practice prior to the pandemic. We do not know if their practice was part of a university-sponsored program. Additionally, the yoga group is quite small (n=30), and findings should be interpreted accordingly.

Findings

The characteristics of the yoga group are presented in Table 1.

Table 1. Demographic characteristics of yoga group

Characteristic	Number
Male	20
Female	10
White	15
Hispanic or Latino	7
Asian	5
Black or African American	2
Native Hawaiian or Pacific Islander	1

The yoga group attended 16 different institutions in 11 different states (16 in CA, 3 in NY, 2 in OH, 2 in TX, and 1 each in AZ, CO, FL, GA, KY, MA, and MI). Three of the 16 institutions were private. The students were in 9 different engineering and computer science disciplines (8 in CS, 7 in mechanical, 4 in civil, 4 in ECE, 2 in environmental, 2 in biomedical, and 1 each in aerospace, industrial and systems engineering, and mechatronics). There were no significant differences between the yoga and non-yoga group in terms gender, race or ethnicity, or sexuality.

Overall, there were 20 survey items for which the yoga group scored better, or significantly different, from the other group. In the remainder of this section, we describe those differences organized by instrument.

PHQ – depression, anxiety, somatoform disorders, and eating disorders: For the Patient Health Questionnaire, there were sixteen items, presented in Tables 2 and 3, for which the yoga group scored statistically significantly better. In Table 2 the means are based on a Likert scale from 0 to 3 in which 0 indicated “not at all”, 1 indicated “several days”, 2 indicated “more than half the days”, and 3 indicated “nearly every day”.

Table 2. Salient PHQ items

Item	p-value	Yoga mean	Other mean
Over the last 2 weeks, how often have you been bothered by feeling down, depressed, or hopeless?	0.0053	0.1034	0.3541
Over the last 2 weeks, how often have you been bothered by moving or speaking so slowly that other people could have noticed? Or the opposite – being so fidgety or restless that you have been moving around a lot more than usual?	0.0247	0.1034	0.2962
Over the last 2 weeks, how often have you been bothered by thoughts that you would be better off dead or of hurting yourself in some way?	0.0102	0.1111	0.3504

Table 3. Salient PHQ items

Item	Yoga % yes	Other % yes
Do anxiety attacks bother you a lot or are you worried about having another attack?	14	36
During your last bad anxiety attack, did you have chest pain or pressure?	17	39
During your last bad anxiety attack, did you feel as if you were choking?	14	32
During your last bad anxiety attack, did you have hot flashes or chills?	14	34
During your last bad anxiety attack did you have nausea or an upset stomach, or the feeling that you were going to have diarrhea?	14	38
During your last bad anxiety attack, did you feel dizzy, unsteady, or faint?	17	42
During your last bad anxiety attack, did you have tingling or numbness in parts of your body?	10	34
During your last bad anxiety attack, did you tremble or shake?	21	41
During your last bad anxiety attack, were you afraid you were dying?	7	26
In the last 3 months, have you often made yourself vomit in order to avoid gaining weight?	0	16
In the last 3 months, have you often fasted in order to avoid gaining weight?	7	24
In the last 3 months, have you often exercised for more than an hour specifically to avoid gaining weight after binge eating?	14	32
Have you vomited, taken more than twice the recommended dose of laxatives, fasted, or exercised for more than an hour after binge eating in order to avoid gaining weight as often as twice a week on average?	14	36

Kessler 6 – non-specific psychological distress: For the Kessler questionnaire, there were three items for which the yoga group had statistically significant differences from the other, non-yoga, group. Table 4 presents the two items for which the yoga group scored significantly better. The

means are based on a Likert scale from 0 to 4 in which 0 indicated “none of the time”, 1 indicated “a little of the time”, 2 indicated “some of the time”, 3 indicated “most of the time”, and 4 indicated “all of the time”.

Table 4. Salient Kessler items

Item	p-value	Yoga mean	Other mean
During the last 30 days, how often did you feel hopeless?	0.0105	1.034	1.617
During the last 30 days, how often did you feel so depressed that nothing could cheer you up?	0.0321	0.857	1.349

The third salient Kessler item was: “During the past 30 days, how many times did you see a doctor or health care professional about these feelings?”. It was an open field for respondents to enter a number. The mean for the yoga group was 0.414 times and the mean for the other group was 2.483. For this item, while we cannot necessarily claim that fewer times is better, the difference was statistically significant.

PC-PTSD – Post-traumatic stress disorder: For the Post-Traumatic Stress Disorder screening, there was one item, presented in Table 5, for which the yoga group scored statistically significantly better.

Table 5. Salient PC-PTSD item

Item	Yoga % yes	Other % yes
In the past month, have you had nightmares about it (traumatic experience) or thought about it when you did not want to?	21	42

Discussion

First, before proceeding to discuss the findings related to the research questions, it is worth noting that overall the mental health of engineering students in our study is a cause for concern. Scores on some of these measures indicate serious problems in the sample’s mental health. These findings warrant more attention from researchers, administrators, student service providers, and faculty.

A causative relationship between practicing yoga or meditation and having better mental health cannot be claimed from our data, but the correlations we found align with prior research showing that yoga and meditation can support many aspects of mental health. As prior studies on general populations, students, and veterans have found, our findings also suggest that anxiety, depression, other psychological distress, eating disorders, and PTSD may benefit from these practices. Specifically, they might help students cope with some aspects of these challenges caused by the COVID-19 pandemic. While overall screen rates were not statistically significant between the two groups, yoga and meditation do appear to ameliorate some of the worst symptoms, such as self-harm thoughts, nightmares about traumatic events, and hopelessness. They also appear to consistently moderate somatic experiences related to anxiety and disordered eating, which aligns with the mind-body and body image benefits that yoga and meditation are known to have [28], [29]. Additionally, the finding that the one salient PTSD item related to better sleep also aligns

with past findings that sleep quality is one of the largest areas of improvement for veterans with PTSD who practice yoga [24].

These findings have implications for individual students, university counseling centers, student health service centers, recreational centers, and residential engineering living-learning communities. Combined with prior literature, our findings provide evidence that investing time and resources into yoga and meditation practices and programs may be worthwhile for individuals as well as universities. However, as discussed below, those investments should be made with attention to the specific needs of individuals with mental health challenges.

Individual students could consider practicing yoga and meditation on their own. These practices have many features that make them widely accessible for individual practice, particularly during pandemics. They are essentially free; they can be done anywhere quiet and do not require a large or specific space; there is no need to interact with others; and there are styles that are accessible to anyone. While there are in person, fee-based group offerings in many locations, there are also many online, fee-based and no-cost options for learning and continuing yoga and meditation practices from home.

It is important to note that while general offerings online and in-person may be broadly beneficial, there are also specific practices and styles of yoga known to benefit specific issues and be more beneficial for some mental health challenges than others [5]. Conversely, particular practices can also potentially exacerbate some mental health challenges. For example, some practices that are beneficial specifically for anxiety can be detrimental for depression, and vice versa [30]. Therefore, in the context of mental health, it is advantageous to be aware of those differences and select practices with specific conditions in mind. For those interested in learning more about practices targeted to specific challenges, the book *Yoga for Emotional Balance* offers introductory, accessible practices specifically designed for depression and others designed for anxiety [30]. *Meditation Interventions to Rewire the Brain* presents scientific evidence behind using specific practices to treat specific conditions, as well as practices for stress, anxiety, and depression [5]. Additionally, the NeuroMeditation Institute offers online courses that use specific styles to address specific mental health challenges [31]. There are even books, online courses, and resources for those wanting trauma-sensitive practices, which are particularly important when considering yoga and meditation in the context of mental health [32]–[34].

University counseling centers, student health service centers, and recreational centers could consider offering online yoga and meditation courses to students, ideally at no cost to the students. Several articles offer advice for counseling centers wanting to make such offerings; although, they are not specific to online offerings during a pandemic. Adams and Puig present an example of incorporating yoga into college counseling and provide a list of resources for college counselors [35]. Milligan provides another example of a yoga for stress management program at a college counseling center and discusses logistics of setting up such programs [12]. For a discussion of incorporating yoga into group counseling, which some universities in our sample offer, Rybak and Deuskar's work may be useful [36]. Likewise, engineering living learning communities could consider offering yoga and meditation classes onsite (if they have decided it is safe to offer onsite programming). Other residential life staff have had success with such offerings in the past [12]. Long-term and frequent offerings will likely have the most benefit [6].

Ideally, the university offerings would include different styles of yoga and meditation to address various common mental health challenges, and would be taught with trauma-sensitive techniques, as noted above. For counseling centers, health and recreation centers, and living-learning communities who would like to offer yoga and meditation to support mental health, it is worth investing in teachers with advanced training who are knowledgeable about teaching for specific mental health conditions and trauma-sensitive practices. They should know who and what they are offering the courses for in order to avoid exacerbating existing problems .

Conclusion

These are the first findings on strategies engineering students are utilizing to cope with mental health challenges during the COVID-19 pandemic, and the characterization of students practicing yoga and/or meditation. The twenty survey items on which the yoga group scored statistically significantly better (or at least different) than the rest of the sample provide insight into the specific symptoms which may most benefit from yoga and/or meditation. Although this was a small sample, the findings suggest that more students may benefit from adding yoga and meditation to their coping strategies. Universities should consider offering a variety of online, and when it is safe, onsite, yoga and meditation classes. Given that mental health was a persistent and increasing challenge for university students even before the pandemic [37], [38], and that engineering students fare worse than other majors by some measures, our findings have relevance for both pandemic and post-pandemic times, and our recommendations are not limited to this pandemic. In other words, the benefits of yoga and meditation practices for students will not end when the pandemic does.

Acknowledgments

We are grateful to the individuals and organizations who helped us disseminate the surveys and to the students who responded. This material is based upon work supported by the National Science Foundation under grant EEC #2029206. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation.

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