



Resilience Within and Resilience Without: Mindfulness and Sustainability Programming Using an Embedded Engineering Librarian Approach

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Abstract

Students are facing an increasingly chaotic world in part due to global climate change and environmental degradation, causing rising levels of stress and anxiety. Mindfulness and sustainability programs were initiated over three years by a faculty-librarian collaborative team to assist first-year engineering students in building environmental literacy and personal resilience skills. The faculty-librarian team established in class and out of class themes, games, assignments, and programming using an embedded librarian approach. Sustainability programming included environmental movie nights with curricular links and conversations about climate change using the World Café methodology. These activities allowed students time outside of class to engage with topics in an interdisciplinary manner as they were open to students in all departments and the public. Mindfulness interventions were introduced in the fall 2019 semester and included thought awareness, breathing techniques, a Biodot® activity, and an introduction to meditation. Overall, 98% of the 58 students completing a survey in the fall 2019 semester felt the mindfulness techniques were at least a little bit helpful, and 64% felt the techniques would help them fairly well to a tremendous amount. Introducing first-year engineering students to mindfulness techniques and strategies along with sustainability topics, may help students cope with stress and anxiety about environmental challenges and their early college transition, in addition to providing strategies for resilience. These are skills that engineers can benefit from for the rest of their lives.

Introduction

An increasing number of students are suffering from anxiety, even before the added stress of college life. Meanwhile, the media bombards students with images of impending doom about the climate crisis and environmental collapse, potentially increasing the sense of helplessness, fear, or anger. Fostering a sense of personal resilience through contemplative practices and engagement with sustainability topics in and out of the classroom was the goal of this librarian and professor collaborative team. The team created a culture of awareness for both sustainability and mindfulness via an in-class embedded librarian model and sustainability library programming over three years.

First-year students are in a state of transition, not only in their educational setting but often also in their living arrangements. This transition may be accompanied by stress and anxiety without much instruction on stress resilience. Cultivating an attitude of mindfulness and utilizing mindfulness-based practices such as breathwork, meditation, and intention-setting are useful skills for students to grasp early in their educational journey as engineers and to use in approaching inevitable setbacks. In an effort to destigmatize mental health issues related to the college transition and train nascent engineers in mindfulness techniques, an overarching theme of mindfulness with corresponding lessons was incorporated into the first-year engineering course during class time and with library programming outside of class time.

Literature Review: Why mindfulness and sustainability go together like birds of a feather

Mental health disorders are often reported amongst college students [1], [2]. The transition to college from high school includes a change of schools, a change of class formats and teaching styles, a change in social groups, increased responsibility, and usually a change in living arrangements amongst other transition issues specific to an individual. These changes, along with the stress of living in a permanently connected society, with information overload and possible worry about the finances of paying for college, and increasingly common disasters due to climate change, may all be factors causing the increase.

Demand for counseling services for mental health issues such as stress, anxiety, and depression are on the rise [3], [4]. Colleges are working to keep up with this demand as well as address the issue in other ways. For example, First Year Experience (FYE) or similar seminar courses can help with general transition issues [5] and may add modules on topics that address some of these issues specifically.

In addition to the personal stressors of life, research is now being done on how climate change is affecting mental health and wellbeing [6], [7]. Articles highlighting the rising incidence of eco-anxiety [6], [8] or climate change anxiety [9], [10] are increasing. Australian environmental philosopher Glenn Albrecht coined the term “solastalgia” to describe a displaced peoples’ deep sense of loss and anxiousness felt over the human-caused destruction of nature [11]. With increasing numbers of climate-related events happening across the globe, solastalgia is being faced and written about [12] by many. Climate events happening across the world can feel closer through images and stories in the media so that even those not personally affected feel a sense of loss.

Fostering a sense of resilience, or the capacity to bounce back after a setback, through the cultivation of contemplative practices such as mindfulness techniques may be one way to help students with both their life transition stressors and their stress about climate change. Mindfulness is the ability to bring awareness to the present moment, often through focusing on the breath, and has been a spiritual technique utilized by religious practitioners for centuries [13]. Mindfulness gained more mainstream popularity when Jon Kabat-Zinn introduced his Mindfulness-Based Stress Reduction (MBSR) program at the University of Massachusetts Medical School [14]. Mindfulness Centers are popping up at colleges and universities to help students and faculty to utilize these powerful brain technologies to reduce stress and anxiety in daily activities.

Research on both the psychological and physiological effects of mindfulness interventions with college and university students are proliferating. Recent studies indicate that salivary cortisol (stress hormone) levels decrease after students are exposed to a mindfulness intervention [15]–[17]. Other studies show teaching mindfulness interventions to college students to be beneficial to stress [18], depression [19], and rational coping [20]. Qualitative and mixed methods studies [21], [22] have shown a general overall sense of wellbeing emerged from mindfulness work.

Background: the college and the course

Merrimack College, located in a suburban area north of Boston, is a private, co-educational, Catholic college in the Augustinian tradition. The institution has an enrollment of more than 4000 undergraduate and graduate students. It offers undergraduate programs in Civil, Electrical, and Mechanical Engineering as well as graduate programs leading to M.S. degrees in Civil and Mechanical Engineering, and Engineering Management.

Civil and Mechanical Engineering students normally take Introduction to Engineering in the first semester of their first year. Electrical Engineering majors usually take a different introductory course, except during the Fall 2017 semester, when all three engineering majors were combined due to a sabbatical. The course includes two days of lecture per week with a hands-on lab on the third class meeting of the week. The engineering majors are combined into interdisciplinary teams on lab day to complete a project creating a fully operational windmill.

Background: library involvement with mindfulness and engineering students

An assortment of mindfulness and sustainability initiatives began at the library to help foster a culture of awareness around caring for the environment and contemplative practices. With the support of an internal grant, the library was able to create a small, dedicated meditation space and offer mindfulness programming in the mediation space including classes in MBSR, breathwork, and meditations for stress and anxiety. First-year engineering students were encouraged to attend via a passport incentive program all three years.

Environmental Programming

Environmental movie nights were implemented in the Fall 2017 semester. Movies selected directly related to the curriculum for first-year engineering students. For example, *The Island President* was selected as the first movie night as it is a suggested film for *Copenhagen 2009* [23], a *Reacting To The Past* game about climate change that was part of the Fall 2017 and Fall 2019 semesters. Environmental movie nights took place on Wednesday nights at 7 PM at the library with the librarian and the professor in attendance. Movies were also open to the wider campus community and the public. Students were encouraged to attend via a passport program.

Climate Change World Café

In addition to the environmental movie nights, first-year engineering students were invited to take part in a World Café on climate change during the Fall 2018 semester. One way to foster resilience is through communication as students are bombarded with information about climate change without the opportunity to digest, reflect, and consider steps for action. The simple act of sitting down at a table with others to have a face to face interaction and conversation is no longer the norm. The World Café Method was developed with principles of design to help create an atmosphere for discussion. This happens by contextualizing the conversation from the beginning, creating a welcoming space, figuring out questions that are relevant to participants, fostering a sense of community such that participants will contribute, and finally connecting diverse conversations, and sharing the insights of the group [24].

The World Café on climate change was hosted by the students in the Fall 2018 FYE themed course entitled *Women in STEM: Race to Save the Planet*, which was a one-credit course composed mainly of first-year engineering students and facilitated by the librarian. The students created a café type atmosphere in the library and encouraged the participants to discuss issues surrounding climate change by offering a series of thought-provoking, discussion-inducing questions. Students in the introductory engineering course were encouraged to come via the passport program and invitations from their classmates.

In class mindfulness programming

In Fall 2019, students from all three engineering majors were combined to complete mindfulness programming in class early in the semester with a mindfulness guest speaker. Dave Dishaw of ROAM, LLC was trained in Mindful Outdoor Leadership at the Kripalu Center in Stockbridge, Massachusetts and is also a retired engineer. The students were first introduced to mindfulness topics, including awareness of one's thoughts, breathing techniques, and meditation by Mr. Dishaw. Then half of the students went for an outdoor mindful experience with Mr. Dishaw while the other part of the class watched a brief TED talk video [25] about mindfulness with the professor or the librarian before switching. Towards the end of the class period, all students were together to discuss their experiences and how they may incorporate mindful techniques into their lives going forward.

Later in the semester, the librarian came to class to remind students of mindfulness. Students were given a Biodot®, which is a small, easy to use biofeedback tool [26]. Biodots® are tiny circles that can be applied to the skin and change colors based on temperature as capillaries constrict when people are stressed or worried [26]. The Biodots® were administered at the beginning of class, and students were asked to record the color of their Biodot® into a Google Form. The librarian then walked students through two easy breathing techniques that could be used to help them calm themselves and bring their awareness to their breath and bodies. Students were instructed to record the color of their Biodot® after the mindful breathing lesson and throughout the class period, which consisted of watching the final projects of student-created videos.

Embedded Librarian

In each of the Fall semesters from 2017-2019, at least one class period of the introductory engineering class was devoted to learning information literacy skills led by the librarian. Each semester the students were encouraged to get their passport checked in a visit to the librarian out of class time to ask a question and/or to get their passport checked at an environmental movie night. In the Fall 2017 and the Fall 2019 semesters, the librarian was thoroughly embedded in the introductory engineering course. The librarian was embedded more heavily in those years as *Copenhagen 2009* [23], a climate change game, was included in the curriculum, which necessitated student use of library resources to prepare for the game. In the Fall 2017 semester, the librarian attended as many class meetings as possible alternating between the two sections. For the Fall 2018 semester, the librarian was not fully embedded. That semester consisted of a one-shot instructional session, passport visits from the students to environmental movie nights, and checkoffs for visiting the librarian's office to ask a question. In the Fall 2019 semester, the librarian attended the class to help introduce the game and information literacy skills, on game

days, on student presentation days, on windmill competition day, and on both the mindfulness programming days.

Statistical Analysis and Outcomes

A total of 79 students across the two sections of Introduction to Engineering in Fall 2019 were exposed to mindfulness programming at two times during the semester. A post-activity Google Forms survey was conducted online to assess how these students felt about both the interventions, and participation was incentivized by having it count as a quiz.

The survey results indicate that most students found the activity at least a little bit helpful, either for themselves or for their classmates. Interestingly, even students who did not report the activity as tremendously helpful through the Likert scale questions, responded in the long-answer questions that they did see value. Students reporting that mindfulness would help them “a little bit” or “fairly well” actually had more to say about the ways they saw a mindfulness practice helping them in college as indicated by sample responses to the first two questions “in what ways do you see a mindfulness practice helping you in college,” cross-referenced to specific answers to the question “how do you feel a mindfulness practice will help you cope with the challenges and stress of college life?” (Table 1).

Table 1. Student responses to “Based on your experience today, how do you feel a mindfulness practice will help you cope with the challenges and stress of college life?” n=58			
Response	Number	Percent	Sample quotes from “In what ways do you see a mindfulness practice helping you in college?”
Not at all	1	2%	<ul style="list-style-type: none"> • Not being so stressed and overwhelmed
A little bit	21	34%	<ul style="list-style-type: none"> • It’s a nice, and sometimes quick, way to relax when you notice yourself getting stressed. It is also easy to just stop and take a few breaths to calm yourself down if you start getting stressed in class or during a test. • Being aware of the physical complications of stress that are often overlooked
Fairly well	31	55%	<ul style="list-style-type: none"> • I can see using this when I get really overwhelmed with work and want to just shut down and not do anything. • When a stressful moment comes I know now how to calm myself down and just take a second look at things from a different perspective.
A tremendous amount	5	9%	<ul style="list-style-type: none"> • Helps me to relax. • Relieving stress, managing depression and anxiety

Students were also asked how likely they were to develop their own mindfulness practice (Table 2). The majority expected to explore developing a practice of some kind. Even students reporting a 2 of 5 on the Likert scale listed practices that are likely to help them manage stress and anxiety such as exercise, walking, and awareness.

Table 2. Student responses to “How likely are you to start or expand a mindfulness practice?” n=58			
Response	Number	Percent	Sample quotes from “If you plan to start or expand your mindfulness practice, what ways will you use to do so?”
1: Not at all	1	2%	<ul style="list-style-type: none"> I don’t have any plans to start mindfulness
2	9	16%	<ul style="list-style-type: none"> Breathing, going on walks, taking one thing at a time, etc. Utilize awareness more often Sitting down and observing closing my eyes Exercise more
3	25	43%	<ul style="list-style-type: none"> I’ll probably start doing the breathing exercises we did in class because they helped me clear my mind Tell my roommates, teammates and friends. I will most likely use it secretly but by maybe being in a empty and quiet room and just think. Taking a step away from things to calm down and relax and come back to complete the task when I am calm and have confidence in myself.
4	19	33%	<ul style="list-style-type: none"> I will look into mindfulness practices such as meditation and forms of therapeutic art. I will use the breathing technique and try to be self aware of myself so I can take mental step backs to assess situations in a calm manner. relax more often, put my phone down more
5: Definitely	4	7%	<ul style="list-style-type: none"> By always taking a deep breath before making decisions. I think I felt my best when I was practicing yoga daily, so I plan to get back into it. meditation, breathing more, relaxing outside, taking moments to just shut my eyes and breathe.

Finally, we asked the students, “Did you enjoy the activity today? Should we do it again next year?” as an open-ended question. Coding the responses for whether the students suggested

doing it again to “yes,” “no,” or “other,” we found that of the 58 students answering the survey, 40 (68%) responded yes, and 18 students (31%) either did not answer the question or answered in a way that was not interpretable as clearly yes or no.

For the Biodot® exercise, we conducted a separate Google Forms quiz, to which 67 out of 79 students responded. To the question, “Will you use breathing techniques to help you with stress in the future?”, 32 students (48%) responded “maybe”, 29 (43%) “yes”, and 6 (9%) “no.” There were several interesting comments, including “Engineers are commonly in stressful environments that they cannot just leave, so its [sic] good to learn ways to distress [sic] such as a breathing activity or a mindfulness activity.” During the class time of the Biodot® exercise, we watched videos created by the students. Several students mentioned that they noticed themselves impacted by displaying their videos, for example, “As my video approached, the more stressed I became, which was shown through the Biodot®. However, as funny parts of other videos occurred, my stress levels decreased.” Reinforcing the meditation techniques with this second intervention, Biodots®, allowed us to debrief again and remind the students of the effectiveness of breathing and meditation close to finals week.

As both surveys counted as a non-anonymous quiz towards the course grade, and only 58 of 79 students in the course responded to the survey described in Tables 1 and 2, the results may be slightly skewed. At the end of the semester, we used the Student Assessment of Learning Goals instrument to collect anonymous feedback on various aspects of the course. This instrument allowed us to know who had responded, but not which responses were connected to which respondents. Student answers to the question 6.7.7, “HOW MUCH did each of the following aspects of the class HELP YOUR LEARNING?... Meditation Exercises,” the respondents were fairly evenly distributed across the Likert scale (Table 3). This provides support for the view that students will be able to use these exercises in their academic career and beyond to be aware of and to manage their anxiety and mental health.

Prompt	Percent
1. No help	18%
2. A little help	15%
3. Moderate help	11%
4. Much help	20%
5. Great help	16%

Discussion

Young people and college students, in particular engineering students, deal with many sources of anxiety, stress, and disengagement. This can impact their success and retention. There exist many methods to address these issues, including mindfulness, biofeedback, breathing techniques, and awareness [27]. A few recent studies and conference presentations have explored the impact of mindfulness on engineering students [28]–[30] in particular. However, young people may not be aware of these techniques, and nowhere in the curriculum is there generally space to introduce these techniques and concepts to students.

In this study, we tried several interventions in and out of the classroom. When asked, students mentioned that the interventions helped them to manage stress and reported planning to use the interventions in future stressful situations. Introducing mindfulness may be one way to help students be more resilient now and as they proceed in their engineering careers, where many of them will be asked to address and find solutions to climate issues. Additional studies in this area are necessary to develop a body of evidence to support adding mindfulness interventions to the curriculum.

Next Steps

Based upon the successes with the first-year engineers, we plan to continue introducing these concepts to incoming engineering students and to expand the program to other majors, such as nursing and biology.

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