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RESEARCH ARTICLE

Impact of Practicing Mindful Breathing in Class

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ABSTRACT

Many community college students experience high levels of stress due to the demands of coursework and stressors outside of the classroom. Contemplative practices such as deep breathing can reduce stress and increase focus, but students may not be familiar with or feel that they have time to engage in these practices. We hypothesized that introducing students to mindful breathing in our accounting and biology classes would help students manage stress during the semester, reduce test anxiety, and improve student performance.

To test this hypothesis, we introduced some sections of our courses to mindful breathing techniques such as square breathing, alternate nostril breathing, and victorious breathing and set aside time at the start of each class to allow students to engage in these practices. At the end of the semester, we surveyed students to assess their past and present experiences with contemplative practices and their perceptions of the benefits of mindful breathing. We also asked students to rate their levels of exam stress and to rate the general feelings of stress they experienced during the semester, comparing their responses with responses from students in control sections that were not introduced to mindful breathing. The survey results indicated that mindful breathing was a new practice to some students and a familiar practice to others. Most students felt that the practice of deep breathing at the start of each class helped them reduce stress, develop a sense of connectedness, and improve focus. However, there was no consistent difference in self-reported exam stress or general stress between students in sections with and without in-class contemplative breathing. There was also no difference in course performance, as reflected by overall course grade, between sections with and without in-class contemplative breathing. Although it was not the focus of this study, we observed that in-class contemplative breathing practice seemed to improve the learning environment and helped build trusting relationships with students.

INTRODUCTION

College can be a time of growth and personal transformation, but college students, including community college students, experience significant levels of stress (Pierceall & Keim, 2007). Stress can interfere with cognitive processes (Sandi, 2013) and therefore potentially impact student success and retention. Regular use of contemplative practices like deep breathing can reduce anxiety and stress (Chiesa & Serretti, 2009). Deep breathing increases the supply of oxygen to the brain and is thought to stimulate the parasympathetic nervous system, which promotes a state of calmness (Gerritsen & Band, 2018). Deep, mindful breathing can be practiced anywhere with minimal training, which makes it a potentially powerful tool for helping students manage stress.

There is a large body of literature on the benefits of deep breathing and mindfulness at all levels of education, from third grade (Larson et al., 2010) to postbaccalaureate programs (Paul et al., 2014). Some of this existing work examines mindfulness workshops that students attend outside of their formal coursework. For example, one study evaluated a 3-session mindfulness workshop conducted at a large metropolitan university with a large population of non-traditional college students – a demographic similar to many United States community colleges. Participants in this study reported better ability to manage stress, concentrate, and relax after taking the workshop; a few students even reported that they believed taking the workshop would allow them to stay enrolled in college where they otherwise might have stopped taking classes (Goretzki & Zysk, 2017).

Other studies show that bringing mindfulness interventions into the classroom can improve students' emotional engagement with coursework. For example, Paul et al. (2014) studied the impact of engaging postbaccalaureate students in deep breathing meditation techniques in medical school preparatory classes. Students reported having less test anxiety, less nervousness, and better concentration after a semester of engaging in deep breathing in class. At community colleges, in-class mindfulness interventions have been shown to be effective in reducing math anxiety (Samuel & Warner, 2019), reducing writing anxiety (Britt et al., 2018), and improving positive reappraisal in a communication course (Huston et al., 2011).

Fewer studies have examined the effects of mindfulness on course performance, and they tend to have focused on specific tasks. For example, 2 studies found that short mindfulness interventions before lectures increased performance when students were quizzed on newly-learned lecture material later in the same class period, suggesting mindfulness either improved focus during lecture or improved short-term memory (Ramsburg & Youmans, 2014; Calma-Birling & Gurung, 2017) although a later study was unable to replicate this finding (Baranski & Was, 2019). At the community college level, a mindfulness intervention was shown to reduce mechanical errors on a writing task (Britt et al., 2018), but the effect on overall course grades was not examined.

In the present study, we hypothesized that engaging students in deep breathing for 5 minutes at the beginning of each class period would allow students to build new skills in contemplative practice and help students feel more calm, focused, and connected. We also hypothesized that contemplative breathing practice would measurably reduce exam stress, reduce stress outside of the classroom, and improve student performance in the course overall.

METHODS

Experimental Design

Each instructor (AK, LR, and CD) selected one section to engage in mindful breathing practice throughout the semester. Students in the section engaging in mindful breathing were led in 5 minutes of deep breathing at the beginning of each synchronous online class period. Students were free to engage or not engage in deep breathing and were not required to have cameras on during this time. For each section that was engaged in mindful breathing, a comparable section of the same course taught in the same

modality by the same instructor but not led in mindful breathing during class time was selected as a control group. Courses involved in the study were ACCT 101 (Principles of Accounting I), BIOL 110 (Biology I: Molecules and Cells), and BIOL 221 (Human Anatomy and Physiology II).

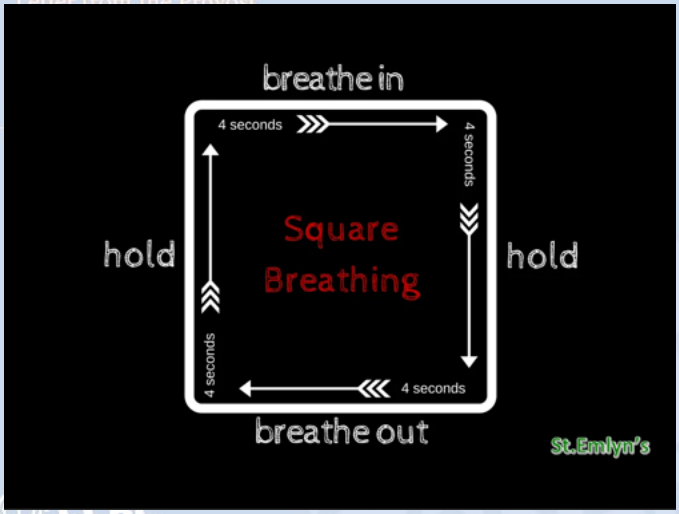
Students in both the mindful breathing and control sections were invited to participate in a survey assessing feelings of stress following their final exam. Responses to 2 Likert-type questions asking students to rate emotional and physiological feelings of stress during the final exam were averaged and used to calculate an exam stress score for each student (0-4, with 0 indicating "no stress" and 4 indicating "very severe stress"). A question asking students to rate their overall feelings of stress during the past semester was used to calculate the general stress score for each student (0-4, with 0 indicating "no stress" and 4 indicating "very severe stress").

Students in the mindful breathing section were also invited to participate in a survey to assess their experiences of contemplative practice and stress management over the course of the semester. This survey included Likert-type questions asking students to rate their agreement with statements about mindfulness and a question where students were asked to select ways they had found mindfulness helpful from a list of options or to enter their own response. The survey also included open-ended qualitative questions about previous and current experiences with contemplative practices and suggestions for use of contemplative practice on college campuses.

Both surveys were administered using Microsoft Forms and responses were de-identified as they were collected.

Breathing Techniques

Square Breathing



Steps:

1. Come to a comfortable seated position, sit up tall and close your eyes.
2. Imagine a square in front of your closed eyes.
3. Begin by slowly exhaling all of your air out.
4. Then, gently inhale through your nose to a slow count of 4.
5. Hold at the top of the breath for a count of 4.
6. Then, gently exhale through your mouth for a count of 4.
7. At the bottom of the breath, pause and hold for the count of 4.

Alternate Nostril Breathing

Steps:

1. Sit in a comfortable position with your legs crossed.
2. Place your left hand on your left knee.
3. Lift your right hand up toward your nose.
4. Exhale completely, use your right thumb to close your right nostril.
5. Inhale through your left nostril, then close the left nostril with your fingers.
6. Open the right nostril and exhale through the right nostril.
7. Inhale through the right nostril and then close this nostril.
8. Open the left nostril and exhale through the left nostril.
9. This is 1 cycle; you may repeat these steps 11-21 times and complete the practice with an exhalation on the left.

Victorious Breathing (Vagal Breathing)

Steps:

1. Inhale and exhale deeply through your mouth. Touch the tip of your tongue to the roof of your palette behind your front teeth.
2. On your exhalations slightly contract the back of your throat, as you do whisper “ahhh” as you exhale. Imagine your breath fogging up a window.
3. As you become comfortable with your exhalations, maintain the slight constriction of the throat on your inhalations. You will notice your breath making an “ocean” sound you hear inside a seashell. This stimulates the vocal cords (supplied by branches of the vagus nerve), which promotes relaxation and efficient breathing.
4. Gently close your mouth and begin breathing only through your nose. Keep the same constriction in your throat as you did when your mouth was open.

5. Concentrate on the sound of your breath; allow it to soothe your mind. It should be audible to you, but not so loud that someone standing several feet away can hear it.

Statistical Analysis

Exam stress scores and general stress scores were analyzed using a 2-way ANOVA with *course* (ACCT 101, BIOL 110, or BIOL 221) and *in-class mindful breathing* (in a section with in-class mindful breathing, or not in a section with in-class mindful breathing) as explanatory variables.

Overall course grades for students in sections that did and did not use in-class mindful breathing were also analyzed. Grades for students who dropped, withdrew, or failed due to non-attendance were recorded as zeros. Because of the non-parametric nature of course grades, a Mann-Whitney U-test was used for each course to compare grades for sections with and without mindful breathing. Two-way ANOVA and Mann-Whitney U-tests were performed in R Studio using R version 3.5.0.

Institutional Review Board Approval

This work was approved by the Institutional Review Board (IRB) of the Community College of Baltimore County.

RESULTS

Students Differed in their Previous Experiences with Contemplative Practices

We analyzed the responses to the qualitative survey questions to better understand the prior experiences that students had with contemplative practices. Many students reported some experience with contemplative practices, especially deep breathing. Students had previously engaged in contemplative practices in different ways. Several students reported using smartphone apps (e.g., the meditation app Headspace) or other online resources for contemplative and meditative practices. Several students mentioned participating in kinetic contemplative practices such as yoga or qigong or including contemplative practices as part of a workout routine. One student said that they had been taught deep breathing by a family member when they were young. Another student mentioned using Lamaze breathing during childbirth.

For some students, however, the mindful breathing in class was their first experience with contemplative practices. Some of the students who were new to mindful breathing reported incorporating the practice into other areas of their lives after their experience with it in class. One student said: "I never tried contemplative techniques before. This semester I used contemplative breathing outside of class. I used this breathing technique when extremely stressed. When slowly inhaling and exhaling, I would imagine a square with my eyes closed." Another said: "This was the first time doing these techniques. I did [use contemplative practices] for work when it would be stressful."

Students Feel that Mindful Breathing Improves their Mental and Emotional Well-Being

Most students (71.7%) "agreed" or "strongly agreed" that contemplative breathing helped them reduce feelings of anxiety and stress over the semester. Most students (58%) also "agreed" or "strongly agreed" that contemplative breathing helped them focus or stay motivated. Of the 53 survey respondents, 23 indicated that "improved learning" was an additional benefit of contemplative practice, 22 indicated that "feeling a sense of connectedness to the world around you" was a benefit, 17 indicated that "deeper happiness and sense of well-being" was a benefit, and 14 indicated that "better health due to improved breathing" was a benefit.

Self-Reported Feelings of Exam Stress and General Stress were not Different with In-Class Mindful Breathing

To further assess the effects of in-class mindful breathing on student stress, we asked students in classes with and without in-class mindful breathing practice to rate their levels of exam stress following their final exam, and to rate the overall feelings of stress they had experienced during the semester. An exam stress score, reflecting feelings of stress on the final exam, and general stress score reflecting feelings of stress over the course of the semester, was calculated for each student based on responses to Likert-type questions. We analyzed these results using 2-way ANOVAs with *course* (ACCT 101, BIOL 110, or BIOL 221) and *in-class mindful breathing* (section with in-class mindful breathing, or section without in-class mindful breathing) as explanatory variables (Figure 1).

For both exam stress and general feelings of stress, we found a main effect of *course* but no effect of *in-class mindful breathing*. The interaction term between explanatory variables was not significant and was therefore excluded. We conclude that although students in different courses reported different levels of stress, likely due to the different student populations that these courses serve, being in a section with in-class contemplative breathing practice does not affect self-reported exam stress or general feelings of stress.

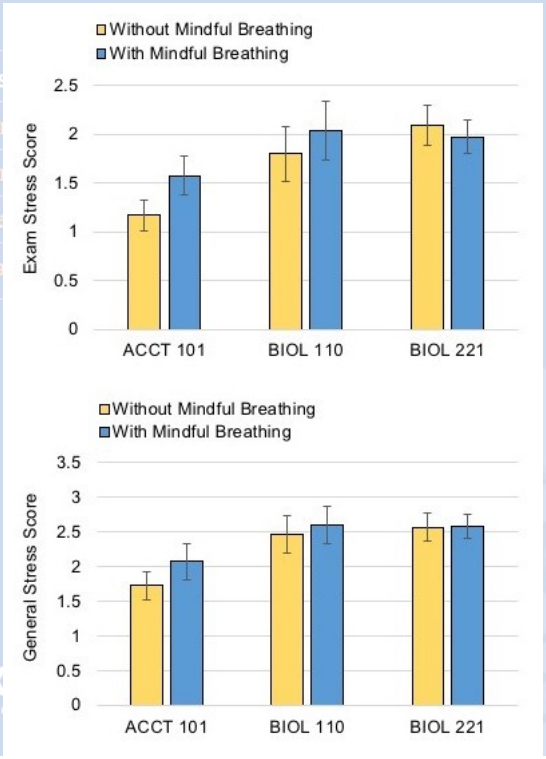


Figure 1: Self-reported feelings of exam stress and general stress for students in sections with and without in-class mindful breathing. Graphs show the mean exam stress score (top) and general stress score (bottom) for students in ACCT 101, BIOL 110, and BIOL 221 sections with and without in-class mindful breathing. Error bars = standard error. Two-way ANOVA reveals a main effect of *course* ($p < 0.05$) but no effect of *in-class mindful breathing* on both the exam stress score and general stress score. n = 11-21 students per condition (i.e., per combination of *course* and *in-class mindful breathing*).

Overall Course Performance was not Different between Sections with and without In-Class Contemplative Breathing Practice

To assess whether in-class contemplative breathing practice affects overall performance in class, we compared grades for students in sections with and without in-class contemplative breathing. Table 1 presents the median, 25th, and 75th percentile course grades for sections with and without in-class mindful breathing. Drops, withdraws, and failures due to non-attendance were coded as 0s. Due to the non-parametric nature of these data, a Mann-Whitney U-test was used to compare grades for sections with and without in-class mindful breathing for each course. No significant differences were found in any of the three courses.

The median grades for the two ACCT 101 sections differed dramatically, with the section with in-class contemplative breathing showing better performance than the section without in-class contemplative breathing; however, this effect did not reach statistical significance (Table 1). For the other courses, BIOL 110 and BIOL 221, there was little difference in median grades between sections with or without in-class contemplative breathing (Table 1). Overall, we do not find strong evidence that contemplative breathing improves student grades.

Table 1.
Overall Course Grades for Sections with and without In-Class Mindful Breathing

Section	Number of students	Median grades (25th-75th percentile)	Statistical significance by Mann-Whitney U-test
ACCT 101 - with mindful breathing	22	80.0 (67.5 - 90.6)	not significant (p = 0.063)
ACCT 101 - without mindful breathing	20	57.6 (0 - 82.6)	
BIOL 110 - with mindful breathing	21	79.5 (73.0 - 82.5)	not significant (p = 1)
BIOL 110 - without mindful breathing	22	77.3 (61.0 - 87.2)	
BIOL 221 - with mindful breathing	25	89.5 (84.2 - 92.2)	not significant (p = 0.617)
BIOL 221 - without mindful breathing	25	88.26 (82.5 - 91.0)	

Students and Instructors Feel that Contemplative Breathing Changes the "Tone" of Class

Although we did not ask students about whether in-class contemplative breathing practice changed how they felt about the course, some student comments to survey questions raised this point. One student said: "I did not particularly find the breathing to working for me, but being in an environment where the professor was open to such an idea made for a much more calming time during class." This comment was consistent with our own personal observations, which we discuss below.

DISCUSSION AND CONCLUSION

Many students face competing responsibilities and challenges while they are in college and experience high levels of stress. Prolonged stress has physical, psychological, and emotional effects on health and can interfere with learning and concentration. For many students and instructors, COVID-19 has exacerbated feelings of stress. The pandemic not only changed the modality of the courses, which altered teaching and learning mechanics, but for many also caused additional stresses like job loss, infection with COVID-19, increased responsibility for family members, and the anxieties of navigating through the pandemic. Engaging in deep breathing gave our classes a way to practice mindfulness as a tool to manage stress and improve focus in class, in spite of the additional challenges presented by COVID-19. Deep breathing may have felt even more powerful during a pandemic that affects the respiratory system, promoting a sense of gratitude for each breath and a sense of strengthening the respiratory system.

In this context, our results show that a majority of students felt that deep breathing was a useful tool for managing stress and improving mental and emotional well-being. Although mindful breathing in class did not measurably change self-reported feelings of exam stress or overall stress or grades compared to control sections, most students agreed or strongly agreed that mindful breathing was helpful in managing feelings of stress and maintaining focus. These results show that students are generally receptive to techniques like mindful breathing and feel these techniques are useful.

Anecdotally, we also noticed that setting aside time for mindful breathing in class created a shift in tone and improved trust between students and instructors. This sentiment was reflected in some of the responses to qualitative survey questions (as noted in the Results) and was also evident in some of the informal conversations we had with students. One of us (CD) found that introducing in-class mindful breathing practices created a starting point for further discussions about mental health and other difficult topics with individual students. Students mentioned they felt a sense of belonging in the class and were more relaxed during class, and experienced an improved learning environment. We consider these important benefits in any classroom and especially important given the unique challenges of remote teaching.

We do note some limitations of the current study. Although we had 6 sections and 3 different courses involved in the study, which lends some generalizability to our findings, our sample size for each course may have been too small to detect meaningful differences between sections with and without in-class mindful breathing, especially in course grades. We also note that all of our sections were taught in a remote synchronous format, and our findings may not generalize to other modalities. There are also other potential benefits of mindfulness practice that we did not analyze, such as effects on submission of assignments in time, cheating and plagiarism, and student attendance. We also note that other mindfulness practices like journaling, drawing, meditation through movement like yoga, can be introduced into the classroom for a more holistic approach to mindfulness, which may have additional benefits.

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