

# INVESTIGATING THE EFFECTS OF MINDFULNESS ON THE CHANGE OF STATE ANXIETY LEVELS IN STUDENTS, AND THE MODERATING EFFECTS OF PERSONALITY TRAITS

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## ABSTRACT

University exposes students to many stressors, where anxiety can affect academic performance. State anxiety (SA), a real-time fluid change in emotion prompted by perceived physiological arousal, has been associated with lower overall test performance in student populations. SA has been suggested to correlate with personality traits, with specific coping styles which target anxiety sharing a strong relationship with situation specific coping responses. Mindfulness may decrease SA and improve academic attainment in student populations. However, little research has investigated the effectiveness of short-term mindfulness meditations in reducing SA in students. This study investigates the effects of a three-minute mindfulness intervention on SA levels in students and the associated moderating effects of personality traits. Anxiety scores from 83 university students were analysed using the State-Trait Anxiety Inventory, and personality scores using the Big Five Inventory. Statistical analysis suggested a significant main effect of a short-term mindfulness intervention on changes in SA. No significant effect of neuroticism nor conscientiousness was found on SA levels. Additional research should investigate use of short-term mindfulness interventions on changes in student SA before test-taking in academic settings. Suggestions are offered for potential avenues using short-term mindfulness meditations in reducing the effects of stressors experienced by students.

## INTRODUCTION

In the field of Psychology, the construct of anxiety has been conceptualized in many ways, having been defined as a trait, state, stimulus, response and drive (Endler, 1997; Lewis, 1970). Classical research has described anxiety as a multifaceted construct, consisting of both state and trait anxiety (Spielberger, 2013). Spielberger defined trait anxiety (TA) as one's predisposed tendency to respond in a certain fashion to stimuli, and state anxiety (SA) as a temporary change in emotion prompted by perceived physiological arousal.

Given its transitional nature, SA has been suggested to change over time, with a range of factors responsible for variations of an individual's levels of SA (Spielberger, 1985). Moreover, SA has been suggested to correlate positively with negative life events, low self-confidence and low self-esteem (Liu & Wang, 2017; He et al., 2011, Hoi Yan, 2006).

Higher levels of SA have also been suggested to worsen performance on a range of cognitive tasks: including attentional control and language proficiency as well as processing speed and accuracy (Derakshan et al., 2009; Phillips, 1992; Schell & Grasha, 2000). This moderating role of SA on performance may translate to settings of academic performance, with high SA shown to decrease processing efficiency, efficiency of working memory, and most notably, lower overall test performance (Eysenck et al., 2007; Ashcraft & Kirk, 2001; Hunsley, 1985).

Considering the construct's malleability to both situational antecedents and personality characteristics, as well as its subsequent effects on performance, research has investigated techniques to reduce levels of SA. In a study by Bahrke &

Morgan (1978), levels of anxiety were found to decrease through the use of acute physical activity, noncultic meditation and rest sessions. Since then, often with more appropriate sample sizes, many studies measured the effectiveness of self-administrated physiological techniques as a means of reducing SA. Muscle relaxation, yoga practice and even short-term physical exercises of twenty minutes have been evidenced to correlate positively with a reduction in SA scores over time (DeBerry et al., 1989; Telles et al., 2009; Raglin & Wilson, 1996).

Nevertheless, physiological techniques to reduce SA are limited to those with access to the necessary equipment and instructional methods to undergo the technique. Given its ubiquitous online accessibility and versatility to engage with in any setting, mindfulness has emerged as an employable option to reduce SA levels. Mindfulness (the bringing of attention to experiences happening in the present moment through meditation and training) serves as a concentrative meditation technique and is underlined by a focusing of attention, retreat from distracting stimuli and muscle relaxation (Plante, 2009).

Attending university can be a significantly stressful time, with growing recognition that stressors prompting SA are determinants of student mental health and academic performance. As SA can be reduced using proactive coping mechanism (Beauchemin et al., 2008, Pidgeon et al., 2014, Fan & Zhou, 2001), mindfulness could emerge as an employable solution to reduce SA for students with minimal intrusion within academic settings. Zeidan et al. (2013) observed reductions in SA after four days of a mindfulness intervention course. Furthermore, Beauchemin et al. (2008) found that specifically in student populations, a five-week

mindfulness meditation intervention resulted in lower SA as well as improving social skills and academic attainment.

Although the literature supports the use of mindfulness as an intervention to reduce SA, established research has so far overlooked two opportunities. Firstly, the literature has focused on the effectiveness of longitudinal intervention programs, and not one-time mindfulness meditation sessions. Secondly, anxiety orientated specific coping styles have been suggested to correlate with situation specific coping responses, which may affect the effectiveness of mindfulness as an intervention (Endler et al., 1994). The effects of such moderating factors have yet to be investigated. In a correlational study measuring the relationship between SA and personality traits, it has been suggested that SA is negatively correlated to extraversion (the extent to which one possesses the traits of sociability, talkativeness, assertiveness, and excitability) and conscientiousness (the extent to which one possesses the traits of carefulness and diligence) and positively correlated to neuroticism (the extent to which one may be prone to feelings of anxiety, worry, fear, anger, frustration, envy, jealousy, guilt, depressed mood, and loneliness) (Asghari et al., 2013). Without knowing of the individual's disposition to cope effectively by using mindfulness as an intervention technique, it may be difficult to determine the individual's response to the intervention.

This study therefore addresses a gap in the research by analysing the effectiveness of a one-time three-minute mindfulness intervention within a student population, while measuring the impact of personality traits as a moderator of this effect. The importance of this research could be practically applied to assess mindfulness as a SA reducing strategy to improve academic performance amongst university students. Moreover, it may provide answers as to whether students of varying personality types experience different results by using this technique, suggesting if it is an efficient and worthwhile intervention for all university students to engage in.

Improving upon the previously conducted aforementioned studies, the contributions of this study to the field are threefold. Firstly, a one-time mindfulness meditation intervention will be used, whereby SA will be measured both before and after the intervention. This will provide us with a measure of changes to SA in real time, as opposed to longitudinal interventions spanning days or weeks. Secondly, the effectiveness of the intervention will be measured explicitly within a student population, using the State-Trait Anxiety Inventory (Spielberger et al., 1983) and the UCLA Body and Sound Meditation mindfulness intervention (Winston, 2017). Thirdly, the study will analyse the extent of changes in SA across students on a spectrum of two personality traits associated with variations in SA (conscientiousness and neuroticism) measured using The Big Five Inventory (Goldberg, 1993).

These design aspects considered, the findings will answer two important questions. Firstly, the effect of a one-time mindfulness meditation session will have on students' changes in SA in real time. Secondly, how individual differences in personality moderate the intervention's effect. Understanding the effectiveness of longitudinal mindfulness interventions on SA in students (Zeidan et al., 2013; Beauchemin et al., 2008), it is hypothesised that participants who are administered the UCLA Body and Sound Meditation mindfulness intervention will show a greater decrease in levels of SA after completing the session, as compared to a control group. Additionally, given the moderating role of personality on SA (Asghari et al.,

2013), it is hypothesized that participants with high levels of neuroticism (higher than the sample's 50th percentile) will typically have higher levels of SA before the intervention as compared to participants with low levels of neuroticism lower than the sample's 50th percentile), and all participants high in neuroticism will show no effect of lowering SA levels after completing the intervention, regardless of their experimental condition. Moreover, it is hypothesized that participants with high levels of conscientiousness will have lower levels of SA before the intervention as compared to participants with low levels of conscientiousness, and will show a greater decrease in SA levels after completing the intervention in comparison to participants with low levels of conscientiousness, who will show less of an effect of the intervention. The effect of a mindfulness intervention on changes in participants' levels of SA will be more pronounced for those who are high in levels of conscientiousness, such that those who did undergo a mindfulness intervention would show a greater decrease in SA than those who did not undergo a mindfulness intervention. This effect would be higher in the people who scored high in levels of conscientiousness.

## METHOD

### Data Collection

The data was collected in a survey format using Qualtrics ([www.qualtrics.com](http://www.qualtrics.com)). Surveys measuring participants' SA levels and personality traits were administered to 103 university students via an email link. The sample of students was sourced using convenience sampling. Using Qualtrics' random assignment function, participants were randomly given one of the two conditions of the study, receiving the mindfulness intervention session or no mindfulness intervention session.

### Participants

83 university students participated in the study. For purposes pertaining to anonymity and protection of personal identity, no demographic data was collected. Participants completed the State-Trait Anxiety Inventory twice (one before the mindfulness / no mindfulness intervention and one directly after).

Participants were compensated through the provision of credits to the final grade of their quantitative research module. As part of a quantitative research module, Institutional Review Board (IRB) approval was not requested for this study, and therefore is not IRB approved. By filling out the surveys, participants provided informed consent concerning the use of their information for the basis of this study. No personal information was collected and participants' data was kept anonymous during data collection and analysis. There are no potential risks or benefits to the health and wellbeing of the participants through sharing their data. Participants reserve the right to withdraw their results from the study.

### Measures

The UCLA Body and Sound Meditation mindfulness intervention served as the independent variable. The control group who did not receive this intervention were showed a screen with a 186 second timer which counted down to 0 before they were allowed to continue. During this time, they were instructed to take a break from the study. These interventions were embedded and implemented through the Qualtrics administered questionnaires.

SA scores were measured using the SA subset of the aforementioned State-Trait Anxiety Inventory (STAI) as data pertaining to measures of SA (and not trait anxiety) was used for the purpose of this study. The 20-item scale consists of a series of statements where the participant self-reports the extent to which they agree to the statement using a four-point Likert scale. For example, "I feel clam", "I feel strained", "I feel presently worried" (Spielberger et al., 1983). Ranging from 20-80, scores on the scale between 34-36 are within normal range, with scores below 34 indicating low SA and 36 indicating high SA (Bekker et al., 2003). For the purpose of our study, SA scores will not be measured as absolute values on this scale, but instead as changes in scores from before and after the intervention. Moreover, only the SA subset of the STAI was used to measure SA, as changes in TA will not be measured. Changes in SA scores were calculated by subtracting the new scores from the original scores from the STAI. The STAI's internal consistency has been evaluated by using Cronbach's alpha, returning a mean value of 0.86, indicating high reliability (Quek et al., 2004).

The personality traits of neuroticism and conscientiousness were measured as moderators to changes in SA, measured using The Big Five Inventory. This self-report questionnaire consists of 44 items where the participant indicates how much they agree with each statement presented to them. For example, in the case of neuroticism: "I see myself as someone who..." "gets nervous easily", "is emotionally stable, not easily upset" (Goldberg, 1993). Due to the niche qualities and presumed similarities in personality traits of this sample size, local comparison norms and a median split were used to calculate high and low scores for each personality trait. Scores above the 50th percentile were considered high in neuroticism, and conscientiousness and below the 50th percentile as low. The Big Five's internal consistency has been evaluated using Cronbach's alpha, returning a mean value of 0.83, suggesting high reliability (John & Srivastava, 1999).

### Design

A mixed factorial experimental design was used when measuring the effect of mindfulness intervention on SA scores. A 2X2 Analysis of Variance (ANOVA) Prime analysis (mindfulness vs. control) x (high vs. low neuroticism) on SA levels was conducted. A 2X2 ANOVA Prime (mindfulness vs. control) x (high vs. low conscientiousness) on SA levels was conducted. The purpose of the 2X2 ANOVA was to compare mean scores between both groups and understand if there was an interaction between the two independent variables on the dependent variable.

### Procedure

Participants were sent an email link which directed them to the Qualtrics website, where they were presented with the questionnaire. They were asked to complete all questionnaires on their own, after having provided informed consent. Participants were briefed on their right to withdraw and remain anonymous in the study. Participants were then split into either experimental condition, using Qualtrics' randomizer function at the start of the study. Participants firstly completed the 44-item Big Five Inventory (measuring personality traits neuroticism and conscientiousness), and were then directed to complete the first 20 items of the State-Trait Anxiety Inventory. After this, the experimental condition was directed to and instructed to take part in the UCLA Body and Sound Meditation mindfulness intervention, whereas the control group was instructed to take a break while a 186

second timer counted down to 0 before progressing with the study. During the UCLA Body and Sound Meditation mindfulness intervention, participants listened to an audio file where a narrator, in accordance to the principles of mindfulness, provided participants with instructions on how to focus their attention to the present moment and be aware of their surroundings, with a focus on kinaesthetic and auditory sensations. After the intervention, participants once more filled out the first 20 items of the State-Trait Anxiety Inventory. Participants were then told of the experiment's completion and debriefed on the purpose of the study through an online form.

## RESULTS

### Preliminary Analysis

Descriptive statistics showed participants who underwent the mindfulness intervention exhibited a decrease between the first recorded SA score and the second SA score ( $M_s = 2.10$  vs.  $M_s = 1.95$ ) after the mindfulness intervention. There was a mean difference of  $M_s = -0.151$  in the changes of SA scores.

### Data Collection

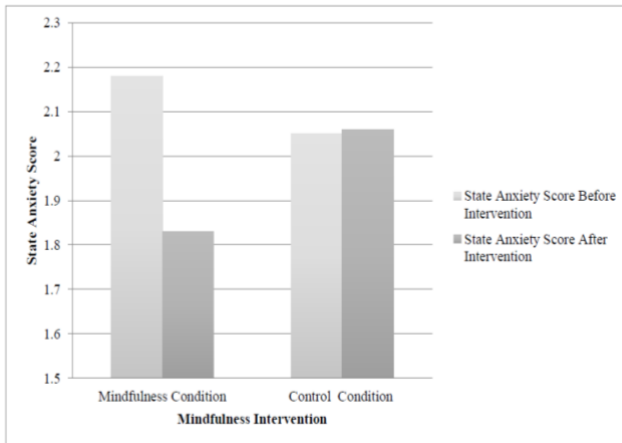
The relationship between initial levels of SA (prior to the mindfulness intervention) and neuroticism was examined using a Pearson correlation. Results showed that participants' level of neuroticism was significantly correlated to their initial level of SA ( $r = .521, p < .000$ ).

Similarly, the relationship between initial levels of SA and conscientiousness was examined using a Pearson correlation. Results indicated that participants' level of conscientiousness was not significantly correlated to their initial level of SA ( $r = -.095, n.s.$ ).

### ANOVAs

The data was analysed using a 2 (mindfulness / no mindfulness intervention) x 2 (personality type) ANOVA on SA levels.

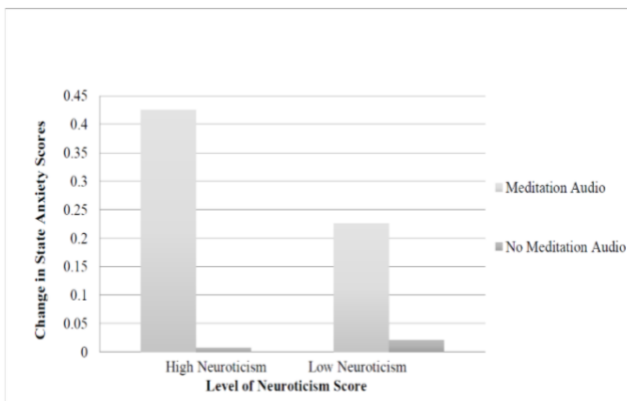
A 2 x 2 between subjects ANOVA, mindfulness / no mindfulness intervention x personality type revealed that the main effect of mindfulness intervention on SA scores was significant [ $F(1, 79) = 18.33, p < 0.000$ ], such that level of anxiety was significantly different for those who underwent the mindfulness intervention ( $M = -0.3408$ ) as compared to those who did not undergo the mindfulness intervention ( $M = 0.0078$ ) (Figure 1). These results suggest that a short-term mindfulness intervention has an effect on reducing SA. Specifically, the results suggest that when participants undergo a mindfulness intervention, their levels of SA decrease directly afterwards, as opposed to those that did not undergo the mindfulness intervention.



**Figure 1: Participants' state anxiety scores measured both before and after the mindfulness intervention and control condition (no intervention).**

A 2 (mindfulness / no mindfulness intervention) x 2 (personality type) ANOVA on self-reported SA was conducted. The main effect of high neuroticism scores on anxiety was not significant [ $F(1, 79) = 0.145, p > 0.05$ ], such that those who underwent the mindfulness intervention with greater levels of neuroticism did not report significantly greater decreases in SA than those who had lower levels of neuroticism ( $M = -0.425$  vs.  $-0.225$ ). However, an effect of neuroticism on SA levels after the intervention was yet observed, with SA levels decreasing by  $-0.425$  (high neuroticism) and decreasing by  $-0.225$  (low neuroticism) after the mindfulness intervention (Figure 2). These results hence suggest that neuroticism had a marginal effect, though not a significant effect on reducing SA when administered a mindfulness intervention.

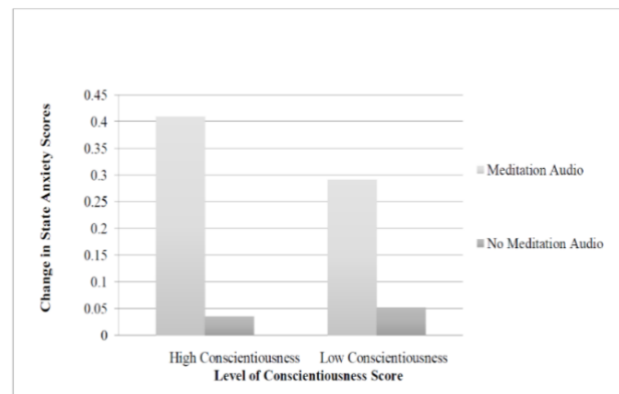
There was not a significant interaction between mindfulness / no mindfulness intervention and neuroticism scores on SA scores [ $F(1, 79) = 1.231, p > 0.05$ ], such that the effect of mindfulness on SA was not affected by an individual's level of neuroticism in the study. These results suggest that there was no significant interaction between an individual's level of neuroticism in the study and the effectiveness of the mindfulness intervention.



**Figure 2: Changes in state anxiety between groups who received the mindfulness intervention and no mindfulness intervention and the extent of those differences in those with scores of low neuroticism and high neuroticism.**

A (mindfulness / no mindfulness intervention) x 2 (personality type) ANOVA on self-reported SA was conducted. The main effect of high conscientiousness scores on anxiety was not significant [ $F(1, 79) = 0.145, p > 0.05$ ], such that those who underwent the mindfulness intervention with greater levels of conscientiousness did not report significantly greater decreases in SA than those who had lower levels of conscientiousness ( $M = -0.409$  vs.  $-0.291$ ). However, an effect of conscientiousness on SA levels after the intervention was yet observed, with SA levels decreasing by  $-0.409$  (high conscientiousness) and decreasing by  $-0.291$  (low conscientiousness) after the mindfulness intervention (Figure 3). These results hence suggest that conscientiousness has a marginal effect, but not a significant effect on reducing SA when administered a mindfulness intervention.

There was no significant interaction between mindfulness / no mindfulness intervention and conscientiousness score on SA scores [ $F(1, 79) = 1.731, p > 0.05$ ], such that the effect of mindfulness on SA was not affected by an individual's level of conscientiousness in the study. These results therefore suggest



that there was no significant interaction between an individual's level of conscientiousness in the study and the effectiveness of the mindfulness intervention.

**Figure 3: Changes in state anxiety between groups who received the mindfulness intervention and no mindfulness intervention and the extent of those differences in those with scores of low conscientiousness and high conscientiousness.**

## DISCUSSION

### Main Findings

This study sought to investigate the effect of a short-term mindfulness meditation intervention on the change in levels of SA amongst university students, and the effect of neuroticism and conscientiousness on the extent of these changes. This study demonstrates that self-reported SA scores significantly decrease after the implementation of the mindfulness intervention. The implementation of a short-term mindfulness intervention had a significant effect in lowering participants' levels of SA, hence supporting our hypothesis. Furthermore, participants with higher levels of neuroticism displayed higher initial levels of SA and did not show an effect in lowering SA, supporting of our hypothesis. However, there was no relationship found between higher levels of initial SA and conscientiousness, contrary to our hypothesis; although participants' with high levels of conscientiousness saw levels

of SA decrease after the intervention as opposed to those with lower levels of conscientiousness, though this result was not significant. Additionally, the effect of mindfulness on SA was not affected by an individual's level of conscientiousness in the study. Therefore, no significant effect was found for the moderating effect of neuroticism and conscientiousness. These findings support previous findings suggesting that mindfulness can be used to reduce anxiety, though specifically for SA in real time. It does not support suggestions that Big 5 personality traits may serve as moderators of these changes however.

### **What Is Known About the Topic**

In academic settings within student populations, high SA has been suggested to decrease performance of a number of cognitive tasks and lower overall test performance (Eysenck et al., 2007; Ashcraft & Kirk, 2001; Hunsley, 1985). Previous research into the topic has established the use of mindfulness to reduce anxiety within student populations (Zeidan et al., 2013; Beauchemin et al., 2008). However, it does not demonstrate whether it reduces SA specifically, immediately after completing the mindfulness intervention. Moreover, previous research has highlighted the moderating role of personality on SA (Asghari et al., 2013). Nevertheless, this has not been investigated as a factor that could affect the effectiveness of an anxiety-reducing intervention.

### **What This Study Contributes**

Our study supports the evidence that mindfulness may reduce anxiety levels, this time however, using a student population and measuring state-anxiety levels immediately after the intervention, adding to the growing research of how to reduce anxiety levels in students. By measuring changes in SA levels post-intervention, we have a better understanding of how SA levels can be reduced, and how long it takes for them to do so. The findings serve as an important first step in understanding how reducing SA levels in a short period of time could potentially help students perform better cognitively in the face of a stress inducing task.

Furthermore, it should be noted that despite showing an effect, no significant effect was found for the moderating role of high or low levels of neuroticism and conscientiousness on affecting changes in levels of SA. A significant correlation between levels of neuroticism and SA was reported, but levels of neuroticism had no effect on the effectiveness on the mindfulness intervention. This suggests that individual differences should not influence the effectiveness of this short-term mindfulness intervention as a means of reducing SA.

As compared to previous research in the field, the results of this study suggest that a short-term mindfulness intervention can lower levels of SA, albeit through a one-time implementation, similarly to the longitudinal methods already reported to have shown success (Beauchemin et al., 2008).

### **Limitations of the Study**

Despite analysing data from 83 students, the mindfulness intervention was not explicitly administered in academic settings, as the survey was administered online and could be accessed by email off-campus. Inability to control for this confound suggests inconsistencies in participant presence in an academic environment.

Furthermore, participants who took part in the study were all students of Psychology. As a result, participants may have known of the potential effects of mindfulness and the scoring of the STAI and Big 5, and responded subject to demand characteristics. Such effects perpetuate a concern in using self-report methods, and could lead to misleading data (McCambridge et al., 2014).

It should also be noted that SA levels were not measured previous to completion of a cognitive task. While students showed a reduction in SA levels after the intervention, it is unclear if this may have been the case if another stressor was due to follow immediately after the intervention.

In terms of the mindfulness intervention, this study only used the UCLA Body and Sound Meditation mindfulness intervention. While this meditation shares likeness to many other forms of mindfulness interventions, it does not represent all available mindfulness techniques and their possible effects on changes in SA.

### **Potential For Future Research**

From here, confirmatory studies could build upon the findings and limitations of this study. Firstly, future studies should measure SA in more academic environments, such as classrooms and libraries, to assess its effectiveness within ecologically valid settings. Next, a more interdisciplinary study of mindfulness sessions should be investigated across general student populations. Furthermore, no assumed stressor was used in our study after the mindfulness intervention, unlike in academic settings where mindfulness meditation may be used preceding an exam. Future studies should also investigate whether SA scores decrease before an anxiety-inducing cognitive task and the extent of said reductions based on the level of anxiety exerted by the task. This may lead to the development of interventions designed to improve cognitive performance for students experiencing symptoms of anxiety.

### **Conclusion**

Students in university settings experience a range of stressors, with growing recognition that the effects of anxiety within students can affect academic performance. In SA, personality traits have been associated with levels of SA. Interventions such as mindfulness have potential to reduce SA in academic settings. Our results indicate that within a student sample, the administration of a short-term mindfulness meditation intervention reduces SA levels directly after the intervention's implementation. Furthermore, personality traits were not indicated to influence the effectiveness of this intervention. Further research should indicate the effects of such an anxiety-reducing intervention on the performance of cognitive tasks, specifically in academic contexts. Such directions for further investigation could improve our understanding of the implementation of effective interventions which reduce SA within student populations and also subsequently improve academic performance.

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