Mindfulness and Experiential Avoidance: Targeting Avoidance Behaviors with a Short-Term Focused-Breathing Exercise

A Senior Honors Thesis for the Clinical Psychology Major, Department of Psychology

Marina Rakhilin
Tufts University, 2018

Advisor: Heather Urry, PhD

Thesis Committee:
Heather Urry, PhD
Lisa Shin, PhD

Author Note

I would like to thank the Tufts Summer Scholars program (Dr. Anne Moore and Ashley Wilcox) and the Reid family for funding this project as of the May 2017; your support has significantly expanded the possibilities for the scope and depth of this endeavor. In addition, I would like to extend a warm thanks to Lara Vujović and Dr. Heather Urry, both of whom have provided invaluable guidance throughout the course of proposing, executing, and presenting this research. I am also extremely grateful to the members of the Emotion, Brain, and Behavior Laboratory at Tufts; I thank the graduate students (Gizem Altheimer, Victoria Floerke, and Lara Vujović) for helping me set up the daunting data collection process and I thank the undergraduate students (Erin De Guzman Berja, Nathalie Dumornay, Darcy Hinck, Crystal Li, Sara Schiff, Jamie Tebeau, Chloe Weiner, Emma Wolfe, and Angelie Xiong) for the many hours they devoted to meticulously collecting and processing data for this project; this project could not have been completed without your care and hard work. I would also like to formally thanks Drs. Carlin, Ahrens, Arch, Craske, Smith, and Kirby for sharing their materials and expertise. Finally, I thank the members of my thesis committee (Dr. Heather Urry and Dr. Lisa Shin) for taking the time to read and review my work.

Additionally, please note that the hypotheses, data collection methods, and analysis plan was preregistered on the Open Science Framework and are now available for publicly viewing (https://osf.io/gw89y/register/565fb3678c5e4a66b5582f67).

Abstract

Previous research suggests that mindfulness holds promise as a treatment for anxiety-related disorders because it aids individuals in lowering their experiential avoidance (EA). In other words, mindfulness helps individuals approach stimuli which seem unpleasant, thus supporting adaptive exposure-based behaviors rather than strengthening avoidance behaviors. The current study is a partial replication of a previous study (Carlin & Ahrens, 2014) designed to investigate whether engaging in a brief mindfulness-based focused-breathing exercise would result in decreased avoidance behavior. Undergraduate students were randomly assigned to listen to a mindfulness or mind-wandering audio file. They were then shown a fear-inducing film clip and subsequently given a series of frustrating math problems to solve. This study expands previous research by measuring avoidance behavior via three distinct indicators: persistence in the frustrating math task, willingness to repeat this task in the future, and latency to start working on each math problem. This study investigates whether a mindfulness induction inhibits experiential avoidance across all three aforementioned markers of EA. Participants in the mindfulness group were more willing to re-experience unpleasant stimuli as compared to participants in the control group; however, there was no effect of group on persistence or latency. These results demonstrate that this short focused-breathing exercise may increase an anxious person's willingness to re-experience unpleasant stimuli. More research is needed to compare the effects of different mindfulness inductions on avoidance behaviors after an anxiety-inducing situation.

Mindfulness and Experiential Avoidance:

Targeting Avoidance Behaviors with a Short-Term Focused-Breathing Exercise

Mindfulness is a thriving new sub-field in psychology with over 500 scientific articles published on the topic of mindfulness in 2012 alone (Shonin, Van Gordon, & Griffiths, 2013), and yet it is still a contested concept at its core. Sauer et al. (2013) suggest that while conceptual pluralism is inevitable, most authors do agree on a two-factor model that describes mindfulness as a combination of attention and acceptance. Bishop et al. (2004) further explains how these two components produce mindfulness: 1) attention is self-regulated via learning to sustain attention and switch attention instead of engaging in secondary elaborative processing (e.g., going on mental tangents or rumination) and 2) one must be oriented to experience and observe sensations with an attitude of curiosity and acceptance. Mindfulness-based interventions focusing on cultivating attention and acceptance have been shown to ameliorate many conditions such as chronic pain, binge eating, depression, substance use, panic attacks, and generalized anxiety disorder (GAD; Davis & Hayes, 2011; Grossman, 2004).

Just as mindfulness seems to target a facet of mental health underlying many various areas of psychopathology, so too does the concept of experiential avoidance, which is closely but negatively associated with mindfulness. Experiential avoidance (EA) is defined as attempts to avoid, suppress, or otherwise alter the form or frequency of aversive private experiences (e.g., upsetting emotions, thoughts, memories; Hayes et al., 1996). In other words, EA is an affect-related regulatory process that represents a generalized risk factor for psychopathology (Esteve et al., 2012). EA is significant in that it influences the likelihood of substance use relapse, mediates the relation between trauma and psychological distress, and predicts the severity of symptoms in GAD (Chawla & Ostafin, 2007).

Individuals seeking to lessen their anxiety in particular may have a lot to gain from unlearning habits of EA via practicing mindfulness. Since EA involves avoiding stimuli (internal and external) which are anxiety-inducing, it leads to short-term relief: the stressful stimulus is no longer present. In the long-term, however, EA leads to low psychological flexibility, an increasing fear of the anxiety-inducing stimulus, and potentially functional impairment as a result of repeated efforts to avoid exposure to the aforementioned stimulus (Hayes et. al, 1996; Cisler et al., 2009). In other words, EA negatively reinforces avoidance behavior, but also impedes the processing of anxiety-inducing stimuli that is necessary for the successful extinction of the anxiety response (Newman & Llera, 2011). Mindfulness is relevant in that mindful individuals tend to experience and accept a level of present discomfort, thus lowering the impulsive urge to avoid or escape and decreasing anxiety in the long-term.

Despite the large amount of research on experiential avoidance, there are significant limitations to the common practice of self-report measures; recent research suggests that EA is more accurately understood as a multidimensional construct consisting of avoidance strategies (Lewis & Naugle, 2017). In a review, Chawla and Ostafin (2007) explain that a fundamental limitation to the current research on EA is the "lack of theoretical integration and refinement with regard to operationalizing and assessing experiential avoidance." In response, Zettle et al. (2012) suggest that we understand EA as a functional response class, or a set of behaviors that differ from one another topographically but serve the same function (Barrett, Johnston, & Pennypacker, 1986; Millenson & Leslie, 1979). Thus, patterns of behavior should be conceptualized as EA to the extent that their escape or avoidance function allows one to limit contact with the aversive (but safe) experience. Whereas distraction, reappraisal, repression, and self-deception require further use of self-report measures, focusing on behavioral avoidance

would allow for the EA field to expand beyond pure reliance on self-report. However, there are no set standards for measuring behavioral avoidance. This current study seeks to expand the literature on EA by measuring persistence, willingness to re-experience, and latency to begin as three measures of EA that can be observed and recorded within a one-session study.

Persistence

One commonly used measure of behavioral avoidance is the length of time a participant chooses to continue a certain aversive experience - in other words, their persistence. Accordingly, studies on this topic have measured participants' persistence in challenging tasks such as withstanding submerging one's hand in cold water, electrical stimulation, breathing CO_2 enriched air, serial addition, and mirror-tracing tasks (Liu, Wang, Chang, Chen & Si, 2013; Masedo & Esteve, 2007; Zeidan et al., 2010; Levitt, Brown, Orsillo, & Barlow, 2004; Eifert & Heffner, 2003; Feldner, Zvolensky, Eifert, & Spira, 2003; Daughters et al., 2005). For example, Arch and Craske (2006) hypothesized that a short focused-breathing induction would increase participants' persistence in an unpleasant task. Greater persistence was determined towards the end of the study, when participants were viewing the most negatively rated slides and were told they could stop at any point. The focused-breathing group were significantly more likely to view all the slides than those in the unfocused attention group. For another example, Evans et al. (2009) challenged a sample of undergraduates to solving 11 difficult anagrams as quickly as possible (Nes, Segerstrom, & Sephton, 2005). They measured trait mindfulness and found that the *nonreactivity* and *nonjudging* facets of mindfulness were indeed significantly related to persistence whereas the *observe* facet was not. Thus, their usage of the term mindfulness leaned heavily on its component of acceptance, which was associated with persistence. This is in line with Teasdale, Segal and Williams' (1995) theory of metacognitive awareness which suggests

that judgmental and reactive thoughts in response to a difficult task lead to less persistence because they promote self-criticism, frustration, and impulsive decisions to quit.

Willingness

Another behavioral measure of EA is one's willingness to experience or re-experience an aversive stimulus. This factor is after all, core to the self-perpetuating and maladaptive function of EA, which is defined as attempts to escape or avoid aversive private experiences. In other words, one could theorize persistence (or lack thereof) as escaping an unpleasant situation and one could theorize willingness as anticipatory avoidance of a future unpleasant situation. An ideal measure of EA would likely have both: when pressured into an unpleasant situation, one might try to escape, and subsequently one would avoid entering such a situation again. Salkovkis (1991) explains that such preventative, safety-seeking behavior is what prevents the disconfirmation of threat-related cognitions and is key to the maintenance of anxiety disorders. As compared to studies of mindfulness and persistence, there are markedly fewer studies of mindfulness and willingness measured simultaneously. For one example, Levitt et al. (2004) hypothesized that participants with panic disorder receiving a brief acceptance intervention would be significantly less anxious and less likely to avoid (i.e., more willing to experience) anxiety-inducing stimuli than those who received a brief suppression intervention or no intervention. On average, the acceptance group was significantly more willing to return and re-experience a CO_2 exposure challenge (CO_2 is an anxiogenic stimulus), as compared to the suppression group. However, this study lacked any measures of persistence and the results of this study cannot be generalized beyond a population with panic disorder.

Latency

Given the contradictory conclusions in terms of the effect of mindfulness on persistence and willingness, it would be beneficial to include another behavioral measure of EA. One commonly used measure of avoidance in rats and mice is response latency to initiate a behavior, as measured in seconds or minutes (Riccio, Rohrbaugh, & Hodges, 1968; McIntyre, Hatfield, & McGaugh, 2002; Roozendaal, de Quervain, Schelling, & McGaugh, 2004). Mindfulness (specifically the acceptance facet) would theoretically aid participants in their openness to unpleasant experiences and quicken the decision to begin. However, the literature on the intersections of mindfulness or EA on latency to begin anxiety-inducing tasks is very scant. One unique example of a study investigating persistence, willingness, as well as latency alongside mindfulness is Eifert and Heffner (2003), who studied all three behaviors only to find mixed results. These researchers compared the effects of a mindful induction versus a control treatment in the context of high anxiety-sensitive females exposed to several short periods of CO_2-enriched air. Participants who had experienced the mindfulness induction treatment were indeed more persistent and they were more likely to report willingness to re-experience as compared to the control group. In terms of latency, there were no significant differences between groups in terms of latency to begin Trials 1 and 2, but the control group took significantly longer to begin Trial 3 than the acceptance group. Thus, participants in the acceptance group seemed to exhibit less EA, but these results were mixed and not uniform across all trials. Overall, this difference between the acceptance and control group suggests latency may be a useful additional measure of EA.

Current Study

Prior literature on the relationship between mindfulness and EA is limited to studies examining indirect relationships between the two concepts, or else correlational relationships

between trait (rather than state or learned) mindfulness and EA; very few look at the effect of inducing a state of mindfulness in non-meditators. Of the 11 articles published about mindfulness and EA since 2010, 7 only examined indirect links between mindfulness and EA, such as whether factors of mindfulness were associated with less disgust and whether disgust then predicted avoidance (Reynolds, Consedine, & McCambridge, 2014). Another 1 of the 11 studies compared expert meditators to novices for their sample (Alda, et al., 2016), and 2 studies only examined the correlational association between trait mindfulness and EA; while such studies give some insight into the relationship of these variables, they cannot make causal claims that individuals can learn mindfulness and use these skills to then decrease their avoidance behaviors. Only one recent study induced a short-term state of mindfulness and examined the causal effect of group (mindfulness or a control) on avoidance behaviors (Carlin and Ahrens, 2014).

Carlin and Ahrens (2014) simulated a state of internal distress in to investigate whether engaging in a brief focused-breathing induction would result in less avoidant behavior. 100 undergraduates were randomly assigned to one of four groups in a 2 (a focused-breathing mindfulness audio group or a mind-wandering control audio group) × 2 (fear film or neutral film) design before being asked to solve frustrating math tasks for an unspecified amount of time. Researchers tested for the effects of group, film condition, and the interaction of group and film on the categorical variable of whether participants quit the math problem task or not using a logistic regression. As predicted, the mindfulness group was significantly more likely to persist; a post hoc analysis indicated that for participants viewing the fear-inducing film, hearing the mindfulness audio resulted in these participants being almost twice as likely to persist the full 20 minutes than those hearing the mind-wandering audio. However, after the control film, there was no difference between groups in persistence on the math task. Interestingly, researchers found no

significant effect of group on willingness. Thus, this study contains conflicting results: on the one hand, mindfulness seemed to aid participants in persisting on a frustrating task, but on the other hand, it did not aid them in being open to future such experiences.

This current study sought to replicate the Carlin and Ahrens (2014) study and address some of its limitations regarding sample size, manipulation checks, and the number and types of behavioral measures of avoidance. By changing the experimental design from a 2 × 2 experiment to a 2 × 1 experiment, we were able to increase the number of participants in each group. We randomly assigned participants to either a mindfulness or control group, then exposed all of them to a clip from a horror movie, followed by math questions. We added several additional manipulation checks to the experimental design, including physiological measures of stress to test the efficacy of the fear-inducing video as well as state mindfulness checks to test the impact of the mindfulness and mind-wandering instructions on self-report state mindfulness throughout the experiment. We are also interested in addressing a further degree of nuance in the definition of EA: we will continue to measure persistence (as a dichotomous and continuous variable) and willingness, and we will add a measure of latency to the dependent variables, because these three variables have so rarely been studied in concert. It is hypothesized that participants in the mindfulness group will exhibit greater persistence (as found in Carlin and Ahrens' original study), greater willingness to re-experience unpleasant stimuli (as found in Levitt et al. (2004)), and a shorter latency to begin the unpleasant task (as found in Eifert and Heffner (2003)).

Method

Participants

One hundred and thirty-nine college students participated in this study; a power analysis focusing on the primary hypothesis indicated that we needed to recruit at least 138 participants, 69 in each of two groups. This would give us 80% power to detect effect sizes of at least d = .48 with alpha = .05. Some students were recruited from introductory psychology classes and others were recruited from the general undergraduate population and compensated with cash payment. Approximately 14% of the sample enrolled in the study for payment, while the majority enrolled in the study seeking class credit. 53% were female-identifying and 44% were male-identifying (1 person identified as non-binary and 3 participants declined to answer). 50.4% reported identifying as White or Caucasian; 28.8% as Asian; 5.8% identified as Hispanic or Latinx; 3.6% as African American or Black; 2.2% as Middle Eastern; and 6.5% as mixed race (2.9% did not report race/ethnicity). The median age of participants was 19 years old (mean=19.71, SD=3.78), with an age range of 17 to 56 years old (See Table 1 for demographics).

Participants were randomly assigned to one of two groups, mindfulness or mind-wandering. These participants were all exposed to the fear-inducing video, because Carlin and Ahrens (2014) only demonstrated an effect of group on EA for participants exposed the fear-inducing video, not the neutral video. Participants who enrolled in the study for research credit received 1.5 hours' worth of research credit in addition to a chance to win the lottery for an additional 0.5 hours' worth of research credit. Participants who enrolled in the study for money received 1.5 hours' worth of pay in addition to a chance to win an additional 0.5 hours' worth of pay. Every participant had a 1% chance of winning this lottery, and their chance of winning increased an additional 1% for every math question correctly answered. This reward system was devised to parallel that used by Carlin and Ahrens as closely as possible; the original study offered all participants a chance of winning a lottery for $100 by the same chances as described

above. However, the Institutional Review Board does not allow students to earn cash money in experiments that they enrolled in for class credit; thus, there were differential but similar bonus prizes offered to the participants in this study who enrolled for payment and those who enrolled for credit. Procedures were approved by the university's Institutional Review Board.

Materials

Mindfulness Induction. The mindfulness induction was a 15-minute focused breathing induction developed by Arch and Craske (2006). The audio directs the participants to focus on accepting thoughts and bodily sensations as they breathe in and out; these instructions are repeated every 2 or 3 minutes. The mind-wandering induction was also 15-minutes in length, and participants in this group were directed to let their mind wander; the audio reminds listeners to not focus on anything in particular every 2 to 3 minutes (Arch and Craske, 2006). This control audio was designed in order to expose the participants in this group to a similar audio recording in terms of length and voice; however, this audio did not encourage any attention or acceptance of thoughts, feelings, or sensations. For the purposes of this study, the original audio file was re-recorded with another female-sounding voice in order to generate a clearer audio recording.

Film. Researchers presented participants with a 3.5-minute clip from *Silence of the Lambs* (during which the lead chases a suspect throughout the house and finds a decaying body in a bathtub), which was identical to the fear-inducing film used in Carlin and Ahrens' (2014) study. In previous research, this film clip had a mean fear rating on a 0–8 scale of 3.87 for male participants (n=31) and 4.45 for female participants (n=40; Rottenberg, Salters, & Gross, 2007).

Math. The math task consisted of 9 frustrating math problems, identical to those used by Carlin and Ahrens (Smith & Kirby, 2009). The math problems were originally chosen because

researchers expected no participants to be able to complete all of them in the allotted time; indeed, no participants were able to finish the entire math task. Participants completed two practice problems with the guidance of the research assistant and then were told to complete the later problems independently. Participants were not told the number of problems in the task or the duration of the task. They were instructed to type 'X' and enter if they wished to end the task entirely, but they were not allowed to pass a problem to move on to the next one.

Measures

Avoidance Measures

Experiential avoidance was evaluated via four objective measurements of behavioral avoidance before, during, and after the frustrating math task.

Persistence. Persistence in the math task was measured as both a dichotomous variable (e.g. whether the participant decided to quit early or persisted the full 20 minutes until the research assistant ended the task on their behalf) and as a continuous variable (e.g. how many seconds elapsed between the start of the math task and the point when they decided to quit).

Willingness. Willingness to re-experience was measured via a four-point questionnaire and one in-person question at the end of the session after the math task. First, participants were asked whether they would be willing to complete a second math task immediately; second, they were asked them whether they would be willing to do so within the next week; third, they were asked whether they would be willing to do so in the next couple months; and fourth, they were asked whether they are willing to provide an email for us to contact them to schedule this future task. Next, research assistants asked them in-person to actually provide an email address for the scheduling process.

Latency. Latency to begin the math task was measured in terms the milliseconds elapsed between the 'Press ENTER to begin the math task' screen, which is shown prior to each math problem, and when participants press 'ENTER.' This score is averaged among all the math problems the participant attempted to solve.

State Mindfulness Measure. State mindfulness is intended to measure one's temporary state of mindfulness within the past 15 minutes. To measure state mindfulness, participants answered the Five Factor Mindfulness Questionnaire Short Form (FFMQ-SF; Bohlmeijer, ten Klooster, Fledderus, Veehof, & Baer (2011)), a 24-item questionnaire with each item being rated on a scale from 1-never or very rarely true to 5-very often or always true with respect to the prior 15 minutes. The reliability FFMQ-SF was assessed by each mindfulness factor, which had a Cronbach's alpha level of .75 and higher. Validity was confirmed via strong Pearson correlations between the FFMQ-SF facets and other constructs such as acceptance, openness, neuroticism, anxiety, depression, and positive mental health; the content validity and psychometric properties were sufficiently preserved in this short form measurement tool (Bohlmeijer et al., 2011). In the current sample, we examined the internal consistency reliability within all 5 factors across all 3 points of administration of the FFMQ-SF; we found that those 15 reliability Cronbach's alpha scores ranged from .56 to .85, and 8 scores were above 0.7. Although some of these measurements were less than ideal, overall the reliability is acceptable.

Manipulation Check for Film. Self-reported affect was measured at baseline and after the anxiety-inducing film. To measure affect, we use a questionnaire asking about the greatest amount of each of 9 emotions participants experienced while watching the film on a scale measuring from 0 –none at all/none to 8 –extremely/a great deal. This questionnaire was derived from that used during the film validation studies by Rottenberg et al. (2007), and is the same

scale used by Carlin and Ahrens (2014). This survey asks about participants' experiences of nine emotions: amusement, anger, anxiety, disgust, fear, happiness, interest, sadness, and surprise. It was administered twice during the experiment: at baseline and after the fear-inducing film clip. Then, the measures of anxiety and fear were averaged at each time-point to create a composite score. This score was used as a manipulation check to evaluate the effect of the fear-inducing video.

Physiological Measures. Heart rate and electrodermal activity (EDA) were measured to index autonomic arousal at each point of the experiment, thus providing an additional manipulation check for the fear-inducing video. Additionally, these measures were taken in order to explore whether there were physiological differences between groups, because prior mindfulness research has found mixed results in terms of the physiological effects of mindfulness induction (Crescentini, Chittaro, Capurso, Sioni, & Fabbro, 2016; Levitt et al., 2004). Heart rate (not reported herein) was measured via electrocardiogram (EKG) electrode, which were applied under each collarbone. EDA was measured via electrodes applied the distal parts of the participant's index and middle fingers of their non-dominant hand. An additional ground electrode was placed on the back of the participant's neck.

Measures for Future Follow-Up Analyses

Several additional measures were administered at the end of the experiment for the purpose of collecting data on variables that may have influenced participants' persistence, willingness, or latency. These data have not yet been analyzed and presented in this document, but the measures are described below.

Trait Mindfulness Measure. After completing the math task, participants were asked to fill out the FFMQ-SF once more with respect to how they felt on average over the last month.

Personality Measure. Participants' personality traits were measured via the 15-item Big Five Inventory-2 Extra Short Form (BFI-2-XS; Soto & John, 2017). The BFI-2-XS measures five domain scales: extraversion, agreeableness, conscientiousness, negative emotionality, and open-mindedness. The item responses can range from 1-disagree strongly to 5-agree strongly. At the level of the five domains, the BFI-2-XS seems to retain about 80% of the BFI-2 domain scales' reliability, self-peer agreement, and external validity.

Attitudes towards Math Measure. Participants' attitudes towards math are measured via the Short Version Attitudes Toward Mathematics Inventory (SHORT ATMI; Tapia & Marsh, 2004; Lim & Chapman, 2013), which consists of four subscales: enjoyment of mathematics, motivation to do mathematics, self-confidence in mathematics, and perceived value of mathematics. This scale consisted of 40 items, measuring from 1-strongly disagree to 5-strongly agree. The SHORT ATMI has high correlation with the original ($r = .96$) and the validity was demonstrated through inter-correlation between subscales; Cronbach's alpha analyzing internal consistency was 0.97 overall (Lim & Chapman, 2013).

Experience in Math Measure. Participants are asked two questions with short-form answers: how many math courses they had taken while at a university, and the length of time that has passed (in months) since they last engaged with a math course.

Procedure

In recruitment, participants were told that the purpose of this study was to learn how different activities affect mathematical problem-solving to further our understanding of emotion,

cognition, and behavior. Two research assistants conducted the experiment for each participant; during the first part of the experiment, a research assistant would explain the informed consent form and ask the participants to lock their phone, watch, and other time-telling devices in a cabinet; the participant would keep the key to this cabinet until the end of the experiment. From this point onwards, participants sat in a sound-proof booth and the door was closed during each section of the experiment except for when research assistants provided instructions in-person; participants could communicate with a research assistant at any point via an intercom system.

After participants consented to participate in the study, the first research assistant would attach physiological sensors (this process took approximately 10 minutes), take a 2-minute baseline measure of the participant's SCL and EKG measures, provide the first set of questionnaires, and run the 15-minute audio recording. Participants were randomly assigned to either the mindfulness or mind-wandering group by the computer program, and only the first research assistant was in the experiment room to hear the audio recording and respond to the participant if need be. The second research assistant left the room and was unaware of which audio the participant had heard. Finally, the first research assistant would then provide the second set of questionnaires and subsequently introduce the second research assistant.

Then the second research assistant presented the fear-inducing film clip, administered a third set of questionnaires, and then introduced the math task. Participants were informed that their chances of winning the lottery (either the lottery for 0.5 psychology participation credits for class or for $7.50 for the paid participants) would increase with every math question correctly answered. The participants were not told how long the math portion of the experiment would take, but the research assistant would stop them after 20 minutes if they had not quit by that time-point. The E-Prime program timed each participant's latency to begin each math question.

After the math task, participants completed a series of questionnaires, beginning with questions about their willingness to re-experience the task at a later time. Then, participants answered the FFMQ-SF for trait mindfulness, the BFI-2-XS, the SHORT ATMI, and survey questions about their demographics and prior math experience. Subsequently, the research assistant would ask the participant in-person to leave an email on a sheet of paper if they wished to be contacted to complete a second, similar math task. For a visual demonstration of study procedures, see Figure 1.

Results

Preliminary Analyses

Manipulation checks for the film. Participants responded to a measure of affect; their responses as to fear and anxiety were averaged at each timepoint; we used a two-tailed alpha of .05. We ran a two-way ANOVA and found that time was a significant predictor of the variation in self-reported fear/anxiety ($F(1, 136) = 87.86$, $p < .001$). After watching the fear-inducing film clip, participants reported significantly higher fear and anxiety than they reported at baseline (see Figure 2). There was no significant effect of group on the variation in self-reported fear/anxiety ($F(1, 136) = .34$, $p = .56$) and no significant effect of the interaction between time and group on the variation in self-reported fear/anxiety ($F(1, 136) = .084$, $p = .77$). Participants in the mindfulness group and participants in the mind-wandering group responded similarly to the fear-inducing film clip in terms of self-reported fear and anxiety.

In addition, SCL measured at baseline, during the audio manipulation, during the film clip, and during the math task were compared in order to test whether participants demonstrated autonomic arousal in response to the film clip; we used a two-tailed alpha of .05. A two-way ANOVA demonstrated that time was a significant predictor of the variation in SCL ($F(3, 402) =$

100.99, $p < .001$). Participants were significantly more stressed in terms of SCL during the film clip as compared to the audio manipulation; see Figure 3. There was also a significant effect of group as a predictor of the variation in SCL ($F(1, 134) = 6.10$, $p = .015$) and a significant effect of the interaction between time and group on the variation in SCL ($F(3. 402) = 3.70$, $p < .012$). The mindfulness group had higher SCL as compared to the mind-wandering group at each time-point in the experiment. The group differences were significant at baseline, during the film clip, and during the math task. The group differences in SCL were not significant during the audio manipulation.

Manipulation check for state mindfulness. Participants were asked to self-report state mindfulness at baseline, after the audio manipulation, and after the film clip. We executed a series of two-way ANOVAs to examine the differences in each of the five factors of mindfulness before and after the audio manipulation; only the *observe* factor of state mindfulness followed the expected pattern. Time was a significant predictor of the variation in the *observe* factor of mindfulness ($F(2, 268) = 15.75$, $p < .001$), group was not a significant predictor of the variation in the *observe* factor ($F(1, 134) = .53$, $p = .47$), but the interaction between time and group was a significant predictor ($F(2, 268) = 6.21$, $p = .002$); see Figure 4. Participants in the mindfulness group reported similar scores on the *observe* factor at baseline as compared to those in the mind-wandering group; however, those in the mindfulness group reported significantly higher scores after the audio manipulation. Additionally, it is interesting to note that the mean differences on the *observe* factor between the mindfulness group and the mind-wandering group dissipate after the film clip (mean difference = -.094, $p = .56$). Those in the mindfulness group do demonstrate effects of the audio manipulation on the *observe* factor of mindfulness, but these effects do not last after exposure to the fear-inducing film clip.

The other four factors of state mindfulness (*describing, acting with awareness, non-judging* of inner experience, *and non-reactivity* to inner experience) were not significantly predicted by group, although it was expected that the mindfulness audio induction would affect every factor of mindfulness.

Main Analyses

The main goal of the current study was to examine whether the focused-breathing audio would inhibit EA more so than the mind-wandering audio. We hypothesized that those in the mindfulness group would exhibit more persistence in the frustrating math task, more willingness to re-experience a similar task in the future, and less latency to begin. Across all groups, 36% of participants quit the math task prior to the unspoken 20-minute deadline. A series of 20 regressions were used to examine the effects of the five factors of mindfulness, group (mindfulness or mind-wandering), and the interaction of factor and group on four indices of EA (persistence as a binary variable, persistence as a continuous variable, willingness to re-experience, and latency to begin). Because we had 5 factors of mindfulness, we used a Bonferroni correction, leading to an alpha level of 0.01 rather than 0.05.

The mindfulness induction affected just one of four indicators of EA; group as a predictor explained 3.8% of the variance in the willingness scores (R^2=.038, $F(1, 135) = 5.36$, $p = .022$). Mindfulness participants reported more willingness to re-experience the frustrating math task than mind wandering participants (See Figure 5). Group was not a significant predictor of persistence (as a dichotomous or continuous variable) or of latency (See Figures 6-8).

Exploratory Analyses

There were no statistically significant differences in age, gender, or race/ethnicity as a function of group assignment (See Table 1). In addition, we examined whether there was a

difference in persistence (as a continuous variable measured in seconds) between groups amongst only those participants who quit early. Originally, we compared mean persistence between groups including those who persisted for 20 full minutes, which may have skewed the data. There was no statistically significant difference between groups in terms of persistence amongst those who quit early, $t(48) = .67$, $p = .82$. We also examined whether there was a group difference in latency to begin the first math problem. Originally, we averaged latency to begin across all the math problems a participant attempted. There was no statistically significant difference between groups in terms of latency to begin the first math problem, $t(137) = .35$, $p = .99$.

Discussion

The current study asked whether a focused-breathing mindfulness induction could impact the avoidance behaviors of participants recently exposed to a fear-inducing video. Participants in the mindfulness group were more willing to re-experience a similar math task in the future; however, contrary to hypotheses, participants in the mindfulness group were not more likely to persist in the math task and they did not exhibit less latency to begin as compared to participants in the mind-wandering group. In contrast, Carlin and Ahrens (2014) originally found only an effect of group on persistence, and no effect of group on willingness to re-experience.

While participants in the mindfulness group exhibited higher willingness to re-experience the math task as compared to those in the mind-wandering condition, a manipulation check of state mindfulness suggested that only the *observing* factor of mindfulness was successfully induced. Participants in the mindfulness condition did not show increased scores in *describing*, *acting with awareness*, *non-judging* of inner experience, or *non-reactivity* to inner experience. In addition, this increase in the *observing* factor dissipated after the fear video. It would seem that

participants in the mindfulness group did not experience four of five factors of mindfulness, and it is likely that they were not still experiencing increased *observe*-related mindfulness by the time the math task started. That said, there was an acceptable internal consistency reliability for the FFMQ-SF within our sample; this was likely not the reason that state mindfulness was not observed as expected. Thus, it is not clear that it was mindfulness (as defined by the FFMQ-SF) that led to an increase in willingness to re-experience.

Despite the effects of the mindfulness induction on willingness to re-experience, there was only a significant effect of the induction on one facet of mindfulness, *observing*; this may have to do with the similarities between the mindfulness instructions and the observing-related questions on the FFMQ-SF. Most of the instructions consisted of surveying bodily sensations such as touch and pressure on the body, how breathing feels in the abdomen, and the audio finishes by refocusing the participants on their body, posture, facial expression, and other parts of the body. This instruction is reflected in the skills surveyed by the observing factor from the state mindfulness questionnaire, which asks participants about bodily experiences (e.g., "I pa[id] attention to physical experiences such as the wind in my hair or sun on my face") as well as about their perceptions of sounds, smells, and visual elements in their environment; these features all relate to bodily sense perceptions. In this sense, the impact of this focused-breathing exercise on the *observing* factor is very logical.

One limitation of this study was that the mindfulness induction was not equally based in awareness and acceptance, the two general components of mindfulness as a broader concept (Bishop et al., 2004). Although the recording mentions accepting that some thoughts will intrude and that participants should simply continue without trying to change their experience, such mentions were brief and not the main teaching of this focused-breathing exercise. Thus,

mindfulness skills such as *describing* (which focuses on identifying feelings*), non-judging* (which focuses on accepting experiences and thoughts without trying to change them), *non-reactivity* (which focuses on accepting thoughts and letting them go) and *acting with awareness* (remaining present in the moment) were not practiced as much as the skill of *observing* in this particular mindfulness induction. Potentially, had the mindfulness group participants been able to practice the other four factors of mindfulness, they would have been more likely to persist in the math task or begin the problems with a shorter latency. For example, a participant who has recently learned to accept and let go of intrusive thoughts such as "I am so bad at math" and "I need to go prepare for class tonight" might maintain more attention on the current task at hand and stop the frustration from escalating, thus potentially persisting and moving along with less hesitation.

Additionally, the mindfulness group did not experience a heightened *observing* skill throughout the entire experiment; in fact, the increase in the *observing* factor abated after the film clip was shown. Thus, it is key to examine other potential reasons that the mindfulness group would be more willing to re-experience considering the fact that the effects of the mindfulness induction on *observing* appear to have dissipated before the math task started. Outside of the intended state mindfulness induction, there are other factors that may have affected the two groups differently such as the length and content of these audio files (the same transcriptions were used in the current study and in the original study; only the voice on the recording changed). While the two files are equal in duration (15 minutes), it is interesting to note that the mindfulness induction consists of approximately 640 words whereas the mind-wandering induction consists of approximately 160 words. Accordingly, more of the mind-wandering audio consists of silence, while the mindfulness induction is more similar to a steady

stream of talking, with some short pauses for the participants to put their hand on a different part of their body or to take a breath in and out. The mindfulness induction consists of far more specific instructions, and the mind-wandering induction does not give many unique instructions, rather the sporadic instruction serves only to interrupt a participant's train of thought occasionally. One potential reason that those who had experienced the mindfulness induction also exhibited greater willingness to re-experience the math task is that these participants had spent more time in the lab following instructions, which may have made them more likely to acquiesce to further requests. It would behoove future studies to use a sham mindfulness induction that has a greater verbal similarity between the control and experimental group in terms of length of the transcription and the type of content in order to circumvent this confound.

Our primary hypotheses were significantly influenced by the results of Carlin and Ahrens (2014), but in effect, this study was not able to confirm their finding that mindfulness has a positive effect on persistence; instead, we found that this mindfulness induction has a positive effect on willingness, an effect they did not find originally. This discrepancy between the current study and the original study could have multiple explanations; the current study procedures differed from the original study in a few ways. First, this study included physiological sensors, which were applied to the fingers and below the collarbones of the participants directly after the consent process. As a result, participants in this study may have had higher stress levels at baseline due to this additional interaction with research assistants and due to these unusual sensations of these sensors on their skin. Additionally, participants may have been more self-aware of their bodily sensations given that they could see that their physiological reactions were being monitored; the consent forms mentioned that the activity of their heart and fingertip sweat glands were being monitored. It is unclear whether other environmental factors were

significantly different from the environment in which Carlin and Ahrens executed their original experiment; researchers in the current study also made use of a sound-proof experiment booth, which may have also increased participant stress initially as they became acclimated to the unusual environment and the intercom system.

Given the heightened physiological stress and potentially greater self-consciousness of participants in the current study, we would expect participants to fail to persist, or quit the math task earlier. A similar study by Feldman et al. (2014) found that increased task-induced skin conductance reactivity was associated with a lack of persistence in a 5-minute distressing mirror tracing task. Participants who experienced this increased physiological stress were more likely to quit the task; such a result indicates that participants in our study may have been more likely to quit than those in the original study in which they likely experienced less stress and self-awareness due to the sensors. However, group condition did not affect participants' likelihood of quitting or persisting; potentially, participants may have been too stressed to attempt to use the mindfulness skills learned previously during the audio manipulation. This conclusion would be supported by the self-report state mindfulness data which suggests that the impact of group on state mindfulness was absent when participants began the math task.

The increased physiological stress in this study may have affected willingness as well, although there is little prior research investigating the impact of stress on willingness to re-experience emotions or stimuli. In contrast to current results, Levitt et al. (2004) found that individuals in the acceptance group experienced less anxiety as compared to control groups as well as more willingness to re-experience. In that sense, the association between the current mindfulness induction and greater willingness to re-experience is contradictory, because the mindfulness group experienced more, not less, stress. That said, Levitt et al. (2004) examined an

acceptance-based induction and the current study focuses the induction on breathing and bodily awareness, which may partially account for some of the disparate results.

Prior studies have mixed results on the effect of mindfulness inductions on willingness to re-experience, and these results vary at least in part due to the method in which data on willingness is collected. For example, Levitt et al. (2004) found that participants with panic disorder who were assigned to the mindfulness group were more likely to be willing to re-experience the stimuli; Eifert and Heffner (2003) also found mindfulness group participants to be more likely to want to re-experience the stimuli, but only nominally, and when these participants were asked to come in person in order to re-experience the stimuli, there were no group differences between those who came and those who avoided re-experiencing the task. In the current study, participants were asked about their willingness to re-experience the frustrating math task on a five-point scale. Thus, willingness scores varied from 0 (not willing to re-experience the task at any time) to 5 (willing to re-experience the task at any future time and willing to provide an email for scheduling purposes). Nearly a third of the participants had a score of perfect willingness, 5 (32.4%), but the majority of participants had a willingness score above 0 (87.1%), which seems to be a high percentage of willingness of some form. Previous studies indicate that willingness as expressed via speech or writing differs from willingness to return in-person, where perhaps the truer intentions of the participant become fully known. It is possible that due to the greater degree of nuance in our measure of willingness (as compared to the dichotomous yes/no willingness score used by Carlin and Ahrens) may have led to a greater sensitivity in evaluating the relationship between group and willingness to re-experience. Still, it would be useful for future studies to include a measure that takes into account how many participants truly returned to re-experience the task.

Another unexpected difference between the current study and the original study was that participants in the current study were more likely to persist in the math task as compared to participants in the original study; across all groups, 36% of the current sample quit the math task prior to the 20-minute endpoint, whereas 53% of Carlin and Ahrens' sample quit. This difference may indicate differences of motivation in the two samples. In the current study, researchers offered participants a bonus of 0.5 psychology participation credits for class or $7.50, whereas in the original study, participants would enter a lottery for $100. Given that the majority of the current sample was incentivized by class credit, not by a large cash prize, they may have had a different kind of motivation propelling them to expend time and effort on the math task to earn additional class credit. It is unclear whether a small amount of class credit was seemed a more probable lottery to win as compared to Carlin and Ahrens' $100 lottery system. Additionally, the $100 cash prize could be interpreted as a large reward that would perhaps be delivered at a later date, whereas the current study's smaller cash prize and small credit bonus represented immediate rewards upon winning the lottery. If so, this new reward system may have increased participants' persistence in the task and their willingness to repeat the task in order to presumably re-enter the lottery in the future in the hopes of an immediate reward to counterbalance the feelings of frustration elicited by the math task. However, both studies noted that one's chances in the lottery increased with the number of correct answers, so participants should have a similar understanding of the chances of winning either lottery. Of course, it is also possible that individual and demographic differences impacted participants' decisions to persist and their willingness to re-engage; the current study had differing statistics on gender, race/ethnicity, and age as compared to Carlin and Ahrens (2014). Factors such as gender, race, and age are known to affect the impact of a mindfulness induction and individuals' reactions to

anxiety-inducing stimuli (Mahoney et al., 2015; Brown-Iannuzzi, Adair, Payne, Richman, & Fredrickson, 2014).

Strengths and Limitations

This study expands on prior literature in mindfulness by examining the effect of a focused-breathing induction on both Carlin and Ahrens' original measures of EA, persistence and willingness to re-experience, as well as on the measure of latency to begin, a measurement of behavior mostly used with rat studies and with a CO2 inhalation study. By widening the scope of the dependent variables, this study takes a step towards characterizing these disparate measures of EA and their relationships with one another, thus bringing a new level of nuance to the umbrella-term "experiential avoidance." In addition, by using a combination of self-report data, physiological data, and behavioral data, the current study more fully captures the impact of the audio manipulation in terms of its direction, effectiveness, and duration. Thus, we were able to measure an effect of group on willingness to re-experience while clarifying that there are potentially variables of interest outside of the mindfulness induction influencing participants' decisions to re-experience the task. Next, we plan to include analyses of attitudes towards math, experience with math, and personality to determine whether these variables impact participant's decisions to persist and to re-experience or avoid the task in the future.

This study has tentative clinical implications; these initial results which suggest that a 15 minute focused breathing exercise may increase an anxious person's willingness to re-experience unpleasant stimuli could be relevant in medical contexts to impact patient decision making. For example, patients are often faced with medical procedures which are medically advisable but potentially unpleasant. If anxious patients spent 15 minutes listening to these focused breathing instructions, it is possible that they would be more likely to choose a non-avoidant behavior.

However, given that the mindfulness induction as measured in this study did not seem to result in a long-term impact, such a breathing exercise should take place shortly before making decisions to experience or avoid medical procedures. Potentially, a similar study could be executed in the context of medical patients making decisions in a hospital to determine the applicability and feasibility of such a focused breathing treatment tool in that population.

Nevertheless, this study has a number of limitations which could stand to be addressed in future research. For one, it is worthwhile to consider whether our measure of latency was valid; we averaged every intermediary period between problems. However, it may have been more accurate to simply measure participants' latency to begin the math task in its entirety, and such a measure would likely have a greater variance across participants and perhaps a greater sensitivity to change. Additionally, our study introduced greater variability in the results because in contrast to the original study, we recruited participants for class credit as well as for cash payment. Thus, participants had a variety of unknown factors motivating their avoidance behaviors outside of their group assignment. That said, the mindfulness manipulation in this study could be better matched with a control audio recording that was similar in word length as well as similar in length (e.g., a sham mindfulness induction rather than a mind-wandering induction). Not to mention, we may very likely expect different effects on EA depending on the type and effectiveness of the mindfulness induction; the current study was limited in that there was only a group effect on one of four mindfulness factors, *observing*. While this was a logical effect of a mindfulness induction that centered on focused-breathing and bodily awareness, future research studies should use manipulations which affect both the awareness and acceptance tenets of state mindfulness.

Conclusion

The participants who had experienced the focused-breathing mindfulness induction were more likely to be willing to re-experience a similar math task. However, it is important to note that by the measure of FFMQ-Short Form for state mindfulness, these participants only experienced an increase in the *observe* factor of mindfulness which dissipated prior to the start of the math task. Thus, this increase in state mindfulness likely did not persist until the participants were asked for their willingness to re-experience the frustrating task and it is possible that other factors were involved in influencing the willingness measure of experiential avoidance. However, this short-term focused-breathing exercise is potentially an effective mechanism for increasing participants' willingness to re-engage with unpleasant stimuli, given that they are in an anxious or fearful state. Future studies would benefit from comparing the relationship between EA and this concrete mindfulness induction to the relationship between EA and other types of mindfulness inductions, such as body scans, relaxation instructions, or attention-control interventions.

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Table 1. *Participant demographics*

	Total sample (N=139)		Mindfulness Group (N=66)		Mind-wandering group (N=71)	
Variable	*n*	%	*n*	%	*n*	%
Age, mean (*SD*)	137	19.7 (3.8)	66	19.2 (1.7)	71	20.1 (5.0)
Gender						
Male-identifying	61	43.9	31	45.6	30	42.3
Female-identifying	74	53.2	34	50.0	40	56.3
Refused/non-binary	4	2.9	3	4.4	1	1.4
Race/ethnicity						
White/Caucasian	70	50.4	34	50.0	36	48.6
Asian	40	28.8	19	27.9	21	28.4
Hispanic/Latinx	8	5.8	4	5.9	4	5.4
African American or Black	5	3.6	2	2.9	3	4.1
Middle Eastern	3	2.2	3	4.4	3	4.1
Mixed race	9	6.5	4	5.9	5	6.8
Refused/unknown	4	2.9	2	2.9	2	2.7

Note. There was no significant difference in age between participants in the mindfulness group and participants in the mind-wandering group, $t(135) = 4.3$, $p = .17$.There was also no significant difference in gender as a function of group assignment $X^2(1, N = 135) = .32$, $p = .61$, as well as no significant difference in race between groups $X^2(5, N = 135) = 3.4$, $p = .64$.

Figure 1. *Procedure of the current study and times of survey administration/physiological measurements*

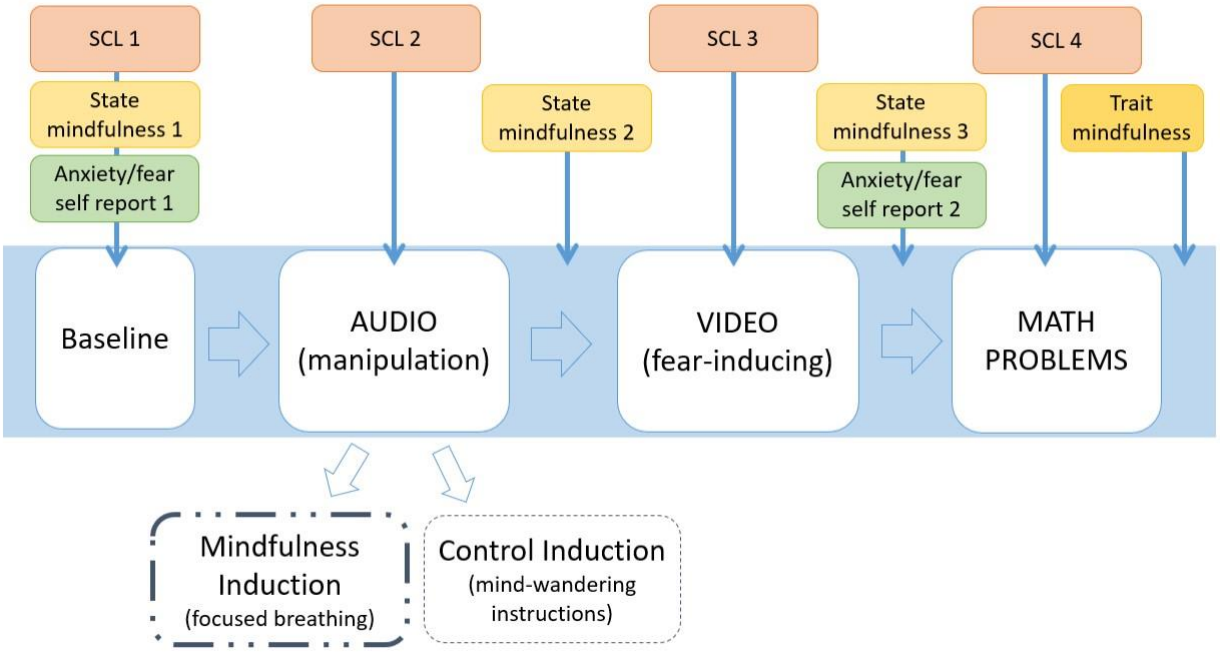

Figure 2. *Comparing the mean self-reported fear/anxiety between groups*

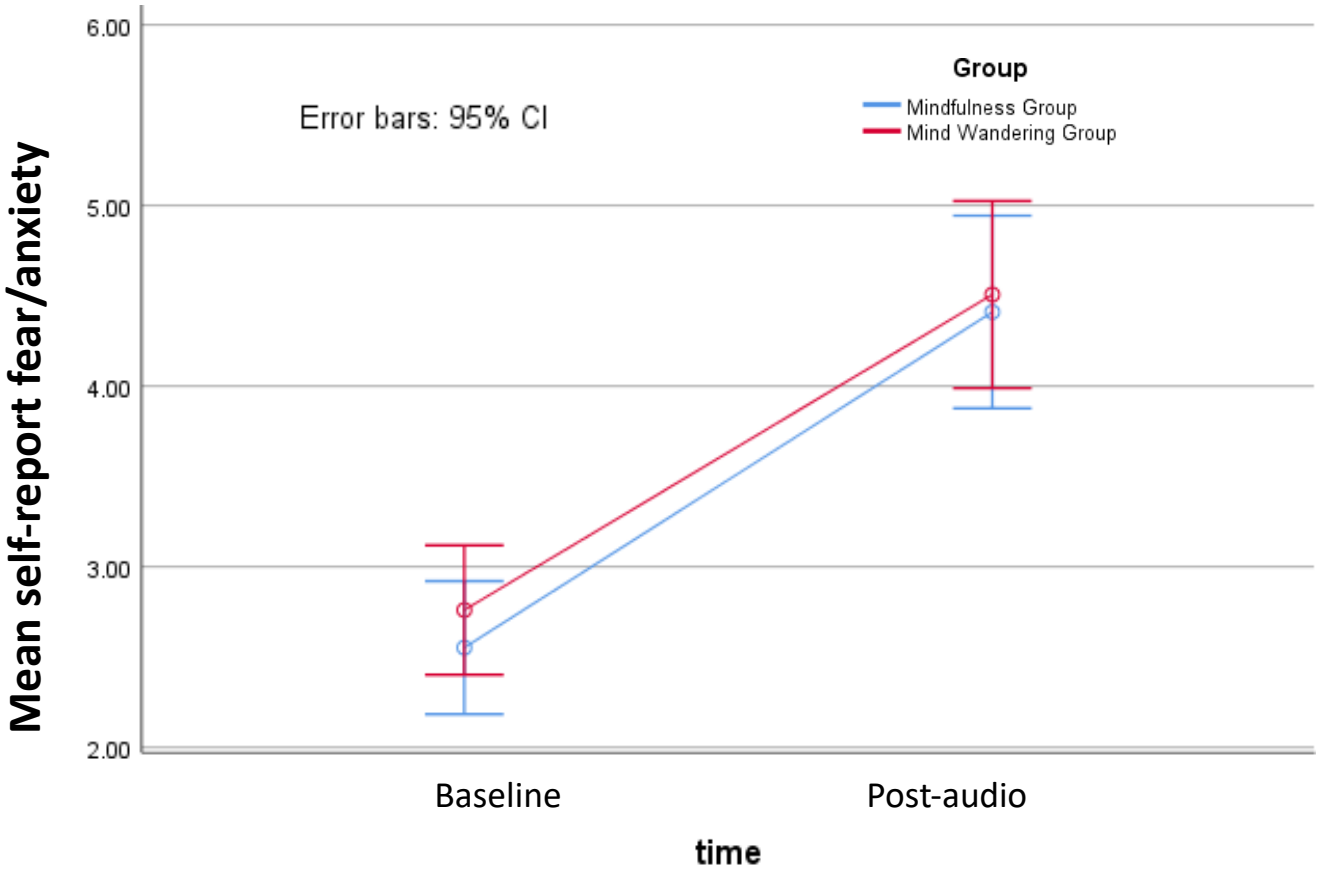

Figure 3. *Comparing mean SCL across time between groups*

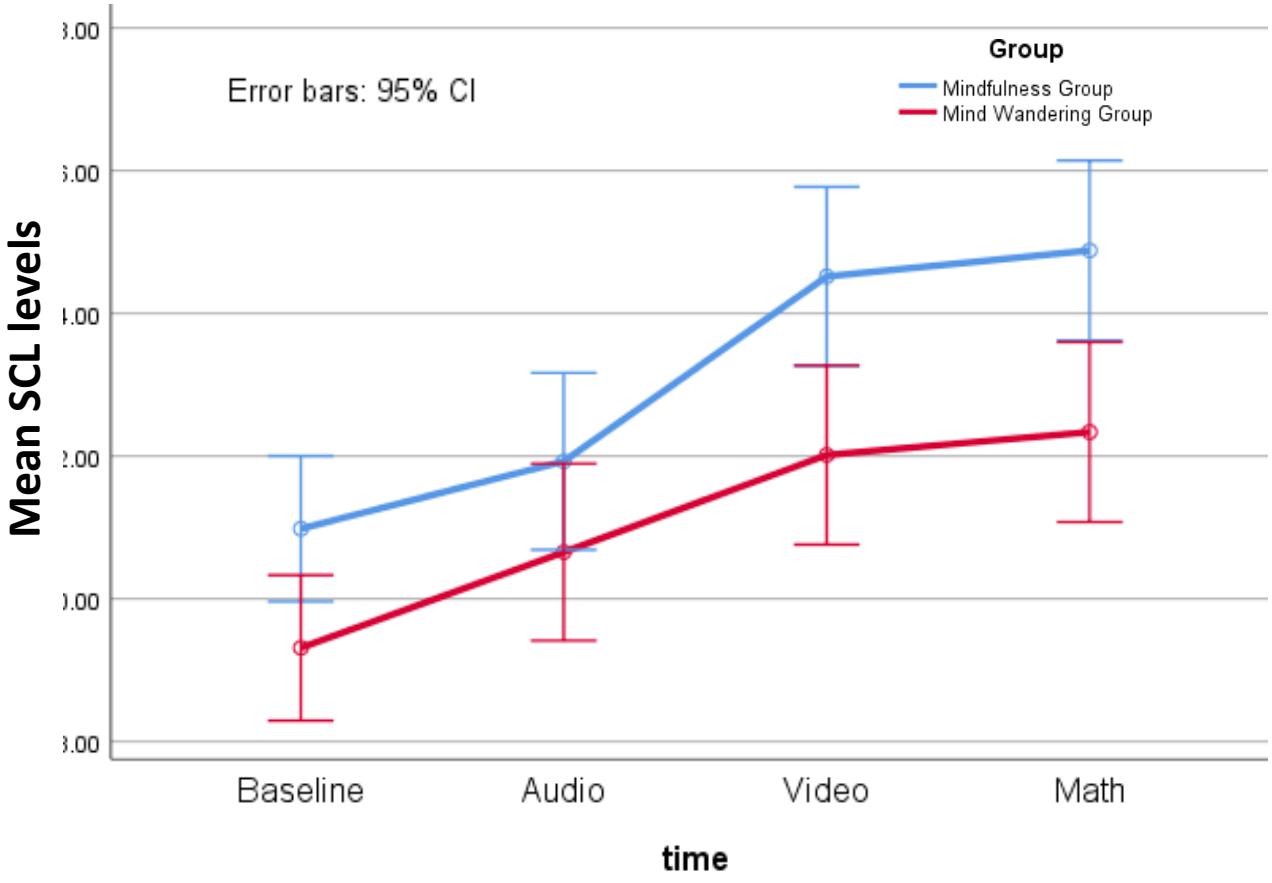

Figure 4. Mean *observe* factor state mindfulness scores across time

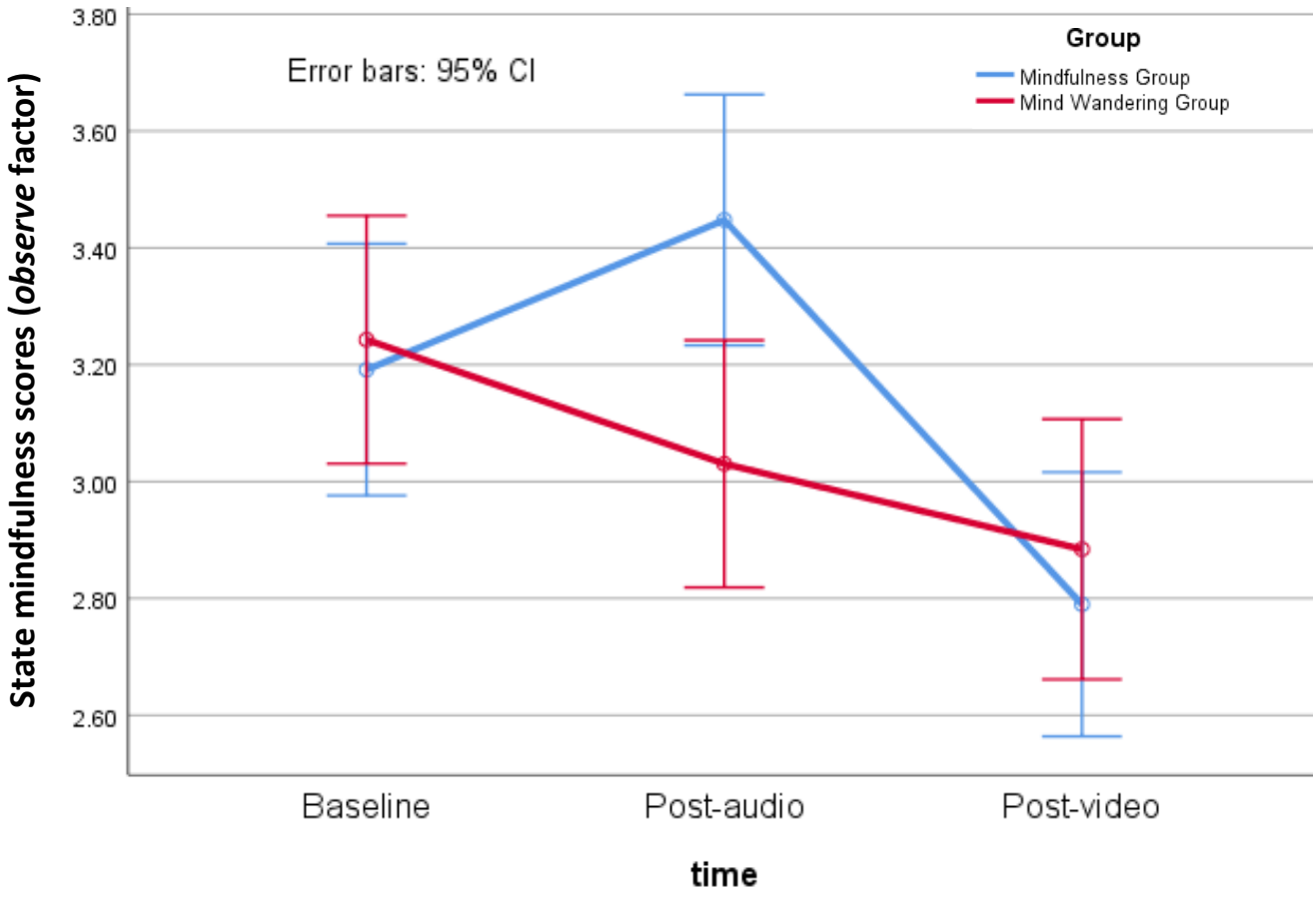

Figure 5. Mean willingness score by group

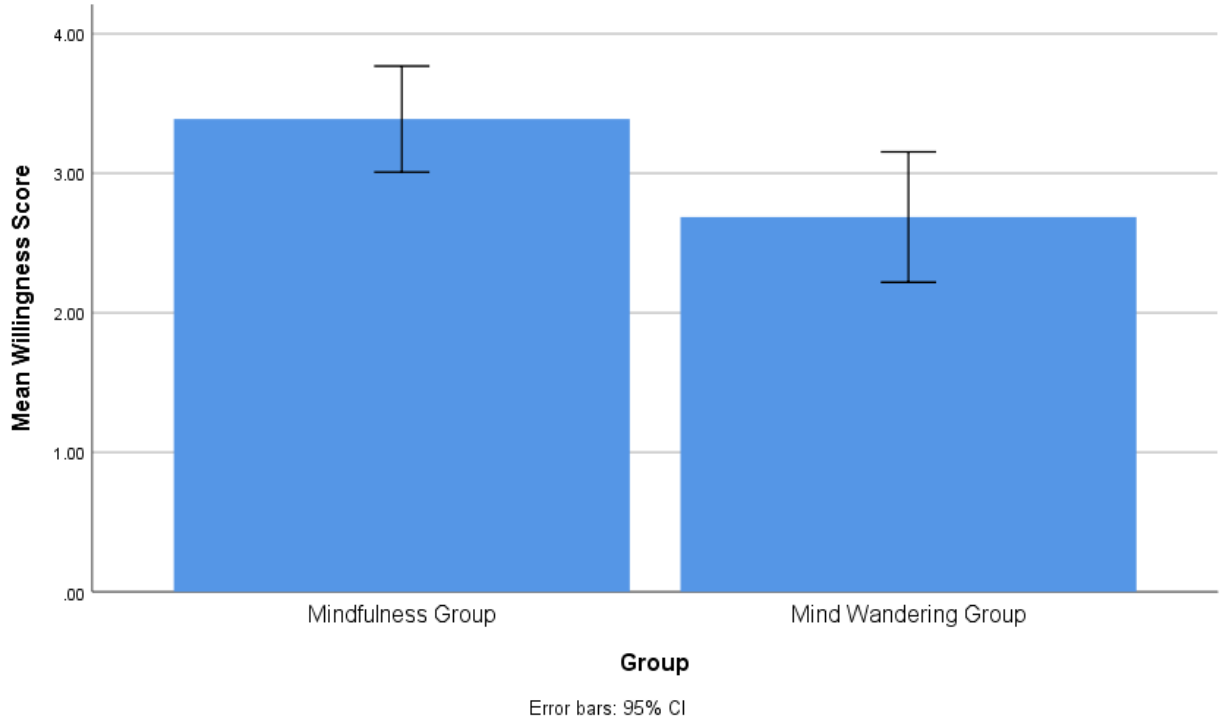

Figure 6. Mean persistence (dichotomous variable) by group

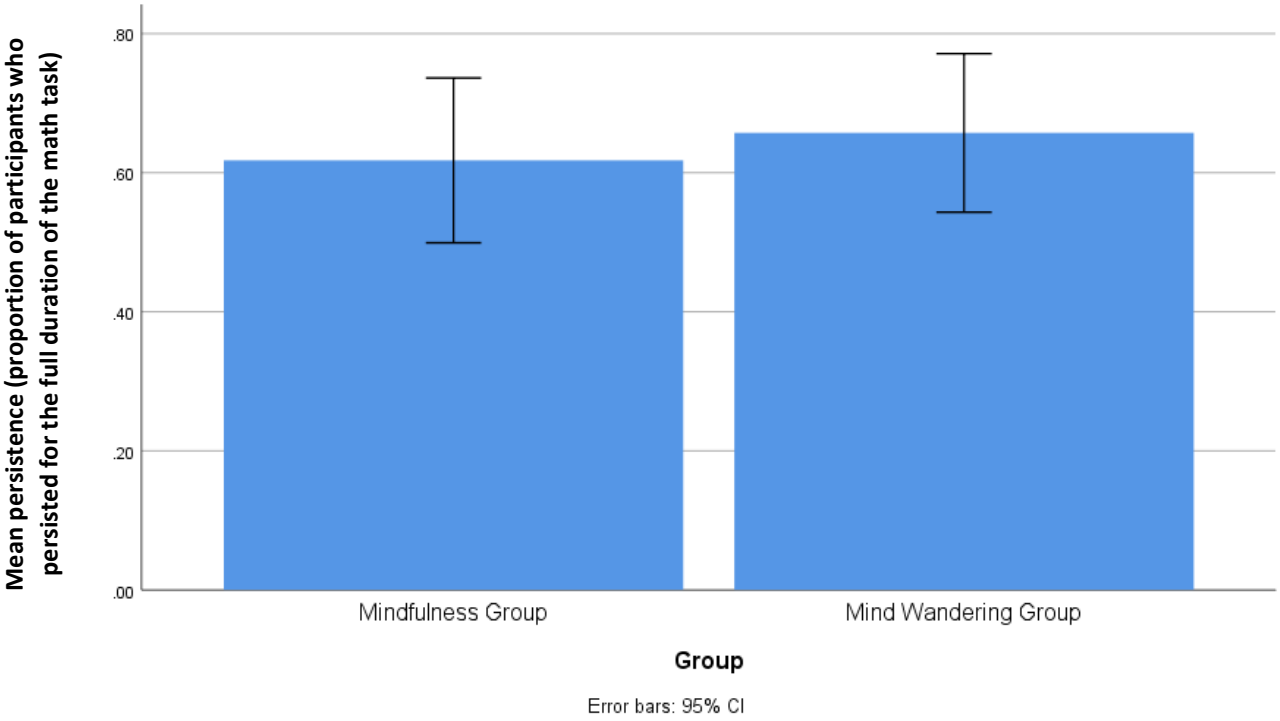

Figure 7. Mean persistence (continuous variable) by group

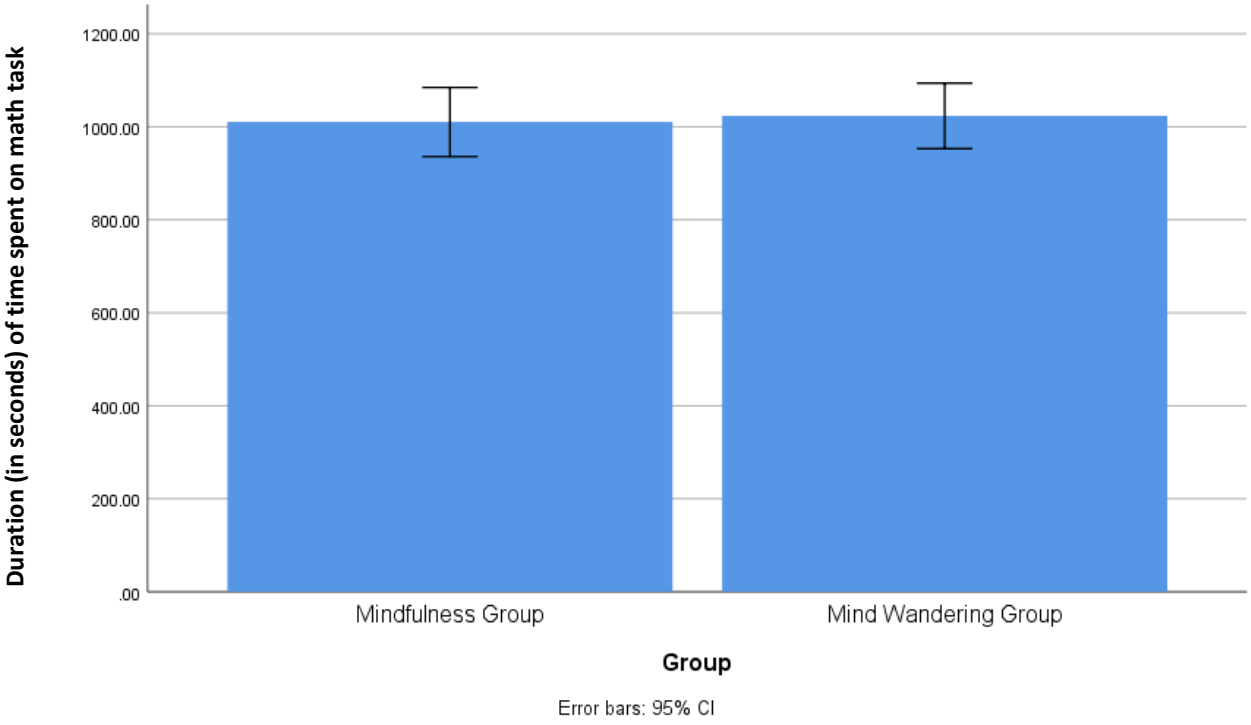

Figure 8. Mean latency by group