Mindful Awareness Intervention Effects on Memory and Affect during Late Adolescence

Talia D Boxman, Florida International University
Martha Pelaez

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Talia D. Boxman and Martha Pelaez
Florida International University, USA

Abstract: The effects of a mindful awareness intervention on improving memory and affect levels amongst three late-adolescent participants was examined using an alternating treatments design. The results of the intervention demonstrated differing degrees of effectiveness for each participant, suggesting both psychological and educational applications.

Mindful awareness training has gradually become a popular intervention for many different problems and disorders (Baer, Carmody, & Hunsinger, 2012). Whereas the potential benefits of mindfulness have been mostly researched on the adult population, these benefits are only beginning to be explored amongst the adolescent population (Ciesla, Reilly, Dickson, Emanuel, & Updegraff, 2012). The adolescent time period, congruent with many life stressors and transitions, is a stage in life when individuals need special support in navigating through such conditions. Specifically, late adolescents in their Junior and Senior years of high school, must withstand the pressure of upcoming graduation, college, and future career planning, each of which necessitate students to perform well on school assignments and examinations as well as standardized college entrance exams.

Students experiencing negative affectivity such as worry, stress, anxiety, or depression can result from such immense pressure, which is only one of many elements that contribute to the criticality of the adolescent time period (Ciesla et al., 2012). When students ruminate, continually focusing on negative feelings (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008) rather than utilizing appropriate coping skills to manage their distress, they will likely face negative academic and emotional outcomes (MacCann, Lipnevich, Burrus, & Roberts, 2012).

Particularly, due to the process of rumination weakening their specific memory abilities (Sumner, Griffith, & Mineka, 2011), students may be unable to perform well on examinations that require them to recall information; ruminative thoughts can inhibit students’ ability to devote attention to processing information when they are focusing on such negative thoughts. It is therefore the purpose of this study to consider whether mindful awareness could serve as an effective intervention for late adolescents by buffering the negative effects of stress on their memory abilities and affect levels so that they can succeed intellectually and emotionally in their final years of high school.

Mindful Awareness

The practice of mindfulness, “the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment” (Kabat-Zinn, 2003, p. 145) has been applied in many different realms of psychological and educational theory. In a study conducted by Hözel et al., (2011), anatomical magnetic resonance (MR) images of participants’ brains who had taken part in a mindfulness intervention showed an increase in gray matter in regions associated with psychological functions such as learning, memory, and emotional regulation. Meiklejohn et al. (2012) reported similar findings in eight different studies involving adolescent high school students which demonstrated the ability of mindfulness training to lead to improvements in cognitive skills such as memory,
attention, and academic skills, and also improvements in emotional aspects such as decreased anxiety and stress and overall enhanced mood levels.

Mindfulness training (MT) can consist of a variety of techniques used independently or in combination to achieve the goal of becoming more mindfully aware. Techniques can involve individuals practicing daily mindfulness exercises at their own will (van Vugt, & Jha, 2011) or can follow a formally developed program such as the Mindfully Based Stress Reduction (MBSR) method (Hözel et al., 2011). Regarding MT in the educational field, Flook et al., (2010) delivered a program called Mindful Awareness Practices (MAPs) in a school setting which led to findings showing improvements in participants’ behavioral regulation and metacognition skills. Fodor and Hooker (2008) describe how to implement a progressive MT intervention that schools can incorporate into their curricula: first, students are taught to practice awareness of their external environment, then they are instructed to practice awareness of their own bodies, and last, they are guided through mindfulness meditation exercises that will help them develop less judgmental thinking patterns. Effective application of these types of steps in a mindfulness intervention can lead to overall benefits of enhanced attentional and memory skills, (Lykin, Baer, & Gottlob, 2012), less negative affect, and improved psychological well-being (Roberts-Wolfe, Sacchet, Hastings, Roth, & Britton, 2012).

Method

Participants and Setting

In this study, it was hypothesized that a mindful awareness intervention would enhance short-term memory and improve affect. In addition, it was expected that participants’ performance in the mindfulness phases would be better than in the alternating induced ruminative phases. There were three participants in this study. The first participant was a 17 year and 0 month-old female in her Junior year of high school, the second participant was a 17 year and 5 months-old male in his Senior year of high school, and the third participant was a 17 year and 6 months-old female also in her Senior year of high school. A functional behavior assessment (see Appendix A) for each participant was conducted. All three participants showed that their tendency to ruminate over personal worries could interfere with their mood, abilities to study for exams, and achieve academic success. The mindfulness intervention was therefore hypothesized to be the antecedent behavior which could consequently lead to decreased negative affect and increased attentional and memory skills as the outcome.

The setting for this study was each of the participants’ respective homes. A notebook and pen was provided for participants to record their ruminative thoughts and a computer was provided to facilitate for the participants the mindfulness mediation treatment and the The Short-Term Memory Checker game (Neutral, 2008). Delivery of the intervention and all data collection took place at each participant’s home in order to best resemble the setting where participants would normally complete their studying and related school assignments.

Dependent Variables

Memory skills. An internet game called The Short-Term Memory Checker (Neutral, 2008) was used to measure memory skills (see Appendix B). First, the participants viewed and were told to memorize two, four, six, eight, or ten images at a time (depending on the level of the game) and then continued to the next screen filled with a total of 49 different images including the ones the participants had just seen. Participants had to complete the task by clicking on only the images they had seen on the previous screen. The average accuracy (percent correct) of items recognized and the average time (in seconds) to store and recognize the items were recorded.
Affect levels. Participants’ overall affect levels were defined through their self-reported responses on the Positive and Negative Affect Schedule (PANAS) Questionnaire (Watson, Clark, & Tellegen, 1988). Twenty different word items describing feelings or emotions (e.g., “distressed,” “irritable,” “alert,” “interested”) were presented and participants assigned each item a rating from 1 (very slightly or not at all) to 5 (Extremely) as to the extent to which they were experiencing that emotion at the present time (see Appendix B).

Independent Variables

Induced Rumination. Participants focused on negative and worrisome thoughts. They were given three and a half minutes to record these thoughts in a private journal anytime the thoughts occurred in their minds.

Mindful Awareness. A mindfulness meditation exercise was implemented through an audio-visual clip on the internet where the participants were guided through three and half minutes of mindfulness meditation. The meditation consisted of serene images of nature and a woman’s voice, (identified as a having a Ph.D in mental health related field) guiding the viewer or listener through several exercises aimed at achieving a mindful presence. Examples included: letting go of tension within the body, becoming aware of what thoughts, feelings, or perceptions are going through the mind, noticing any feelings associated with those thoughts and simply being aware of them without trying to judge them, and focusing on movements of breath in the rise and the fall of the abdomen. (O’Grady, 2012).

Experimental Design

The study was conducted using an alternating treatment design without baseline. This design was chosen for its several advantages as outlined by Richards, Taylor, and Ramasamy (2014): (a) the two treatments can be alternated a fast pace and compared against each other for effectiveness, (b) the treatments can be implemented immediately because no baseline is needed, (c) the two different treatments are counterbalanced which helps to prevent carry-over effects, and (d) after the most effective treatment is determined, it can be continued because there is no requirement to withdraw the intervention.

Procedure

The current study procedures, including observation, data collection, and data analysis were conducted by the graduate student researcher with the guidance of the professor. Each participant experienced the exact same procedure in the exact same order. The only variable that changed from the “B” phase to the “C” phase was the treatment delivered, either induced rumination (“B”) or mindfulness meditation (“C”). In both treatment phases, the participant always had to complete five attempts of The Short-Term Memory Checker game immediately following the treatment. Both the “B” and “C” phase were repeated four times for a total of eight, counterbalanced, alternating treatment sessions.

Pre-Test and Post-Test assessment of affect levels. The participant was asked to complete the PANAS Questionnaire according to how he/she felt in the current moment.

Implementation of the “B” phase - induced rumination. The participant was asked to record any of their negative or worrisome thoughts as they occurred in a private journal for a total of three-and-a-half minutes. Immediately following, the participant was instructed to play the short-term memory checker game for a total of five attempts.

Implementation of the “C” phase - mindfulness meditation. The participant was presented with a guided meditation video for three-and-a-half-minutes. The researcher explained that the participant could either watch the video, or close his/her eyes and just listen to the
meditation. Immediately following, the participant was instructed to play \textit{The Short-Term Memory Checker} game for a total of five attempts.

\textbf{The Short-Term Memory Checker game (5 attempts).} The first attempt always began with the presentation of two images for the participant to remember and then recognize on the following screen (see Appendix B). If the participant correctly selected the images previously seen, he/she progressed to the next level of two additional images (four) to remember. The following level would present six items to remember, followed by the next level with eight, and so on. If the participant did not correctly select all of the images presented on the previous screen, he/she was instructed to attempt the same level again. This process was repeated for a total of five attempts for each treatment phase.

In order to determine average accuracy, the researcher first calculated the percent correct for each of the five attempts. Then, the five percentages were averaged together to determine the mean accuracy of each phase. In order to determine rate of responding, the researcher placed a timer out of the view of the participant and recorded the amount of time the participant took for each of the five attempts. The researcher then divided the time (in seconds) by the number of items recalled to find the average amount of time the participant spent per item remembered in each phase. The researcher then averaged the five rates to determine the mean rate for the phase.

\textbf{Inter-observer Agreement}

An independent peer observer was included in the study for reliability purposes. The observer collected data for three out of eight totals phases (37.5 \%) for each participant in order to determine if the primary observer was administering the procedures and collecting data with fidelity and consistency. The peer observer simultaneously collected data on amount of items each participant recognized in each attempt and amount of time taken to complete each attempt. The number of agreements was divided by the number of agreements and disagreements and multiplied by 100 in order to establish the inter-observer reliability of 87\%, 100\%, and 93\% for participants 1, 2, and 3 respectively.

\textbf{Visual Analysis}

Richards, Taylor, and Ramasamy (2014) explain that visual analysis can be used to identify changes across treatment conditions and state that it appears “sufficient for revealing strong and robust intervention effects that can literally be seen in many instances” (p. 321). In alternating treatment designs, the percentage of non-overlapping data (PND) is displayed by viewing how the data paths remain separate or intersect with one another. The less overlap there is between the data paths, the more significant difference there is between the two treatment outcomes. Also, as stated by Pelaez (2013), if one treatment consistently results in improved response levels, then the design can be said to have good experimental control. The data collected in the present study uses the above guidelines to determine if there is a functional relationship between the independent and dependent variables.

\textbf{Results}

\textbf{Memory Skills}

Through visual analysis of figure 1, it can be seen that during the “C” phase (mindfulness mediation) in comparison to the “B” phase (induced rumination), participant 1 achieved a higher average accuracy on \textit{The Short-Term Memory Checker} game for 50\% of the sessions and also demonstrated a slower response rate (storing and recording the information) in 75\% of the sessions. Participant 2 achieved a higher average accuracy on \textit{The Short-Term Memory Checker} game for 75\% of the sessions during the “C” phase in comparison to the “B” phase and demonstrated a slower response rate during the “C” phase for 75\% of the sessions (figure 1).
Participant 3 achieved a higher average accuracy on The Short-Term Memory Checker game for 75% of the sessions during the “C” phase in comparison to the “B” phase and demonstrated a slower response rate during the “C” phase for 50% of the sessions (figure 1).

**Affect Levels**

On the PANAS questionnaire, participant 1 decreased on her overall positive affect (PA) score by 2 points (31 to 29) and decreased on her overall negative affect (NA) score by 2 points (13 to 11). Participant 2 decreased on his overall PA score by 12 points (33 to 21) and increased on his overall NA score by 3 points (14 to 17). Participant 3 increased on her PA score by 1 point (33 to 34) and decreased on her NA score by 1 point (14 to 13). On the specific positive word-item “distressed,” participant 1 decreased her rating by 1 point (2 to 1), participant 2 increased his rating by 1 point (2 to 3), and participant 3 indicated no difference (1 to 1).

**Discussion**

The current study explored the effectiveness of a mindful awareness intervention on the memory skills and affect levels among late adolescents. Three participants, two high school Seniors and one high school Junior, were administered the intervention in each of their respective homes. The intervention produced different levels of effectiveness for all three participants as is seen upon the visual analysis of the data.

While none of the participants always scored higher on their average accuracy following the mindfulness independent variable than they did on the rumination independent variable, the results do indicate considerable evidence of a functional relationship between the independent and dependent variables. Particularly, participants 2 and 3 demonstrated better accuracy after the mindfulness treatment for the majority of the treatment phases. Also, for the majority of the mindfulness treatment phases, participants 1 and 2 displayed a pattern of a slower response rate. With respect to changes in affect, participant 1 and 2 did not have an overall improvement in their moods although participant 1 did indicate feeling less “distressed” following the treatment sessions. Participant 3 however, did display total improvement in overall mood by both increasing in her positive emotions and decreasing in negative emotions.

The functional behavior assessment (see Appendix A) for all three participants showed that each were susceptible to worrisome and ruminative thoughts, typically found in late adolescence, which could further lead to negative outcomes in their academic skills (memory) and mood (affect). Thus, the purpose and findings of this study extends to practical applications in both the psychological and educational fields.

The outcome of the study suggest that the mindful awareness intervention resulted in beneficial effects for the participants to a certain extent, yet the results are not completely conclusive due to their lack of perfect consistency within each subject and across all three subjects as well. Perhaps the lack of conclusive results for all three participants is related to characteristics specific to the mindfulness meditation video; perhaps it was not long enough in duration or was not perceived by the participants as a legitimate source to which they would give sincere attention each time; these factors could have both negatively affected the participants ability to consistently benefit from the mindfulness intervention. In order to increase the consistency and internal validity of the study, additional research should be conducted regarding how to most effectively structure and deliver the mindfulness interventions to the adolescent population.

Further exploration of the participants’ tendency to have a slower response rate during the mindfulness phase is also suggested for this study. A possible interpretation of this data...
pattern is that the mindfulness meditation video may have produced a relaxation effect for the participants and consequently influenced them to work less quickly on the memory game task. Regarding the affect levels, because that the PANAS questionnaires were only administered as a pre and post-test measure, it is questionable as to what extent the changes in the participants’ ratings following the treatment sessions were influenced by the ruminative phases as opposed to the mindfulness phases. In order to better isolate the participants’ responses, a replication of this study could be conducted where the participants rate the extent to which they are feeling certain emotions at the completion of each of the 8 sessions rather than only before and after the entirety of the treatment processes.

Once more consistency is achieved and clearer interpretations of response rate and affect results are established, the study can be replicated on a larger population in order to establish generalizability. Altogether, the findings of this study have the ability to provide numerous academic and emotional benefits to the adolescent population at large. Mindful awareness, when practiced and applied, has the potential to effectively buffer the effects of stressful life events and lead to positive developments in academic success and mental health.

References


MINDFUL AWARENESS INTERVENTION

Graphs: Average Percent Accuracy

Graphs: Average Rate (seconds)
APPENDIX A

Functional Behavior Assessment: Part 1 (Description)
Participant 1 – DOB: 11/03/96 - Participant 2 – DOB: 05/05/96 – Participant 3 – DOB: 06/11/96
Data Source – Student Interviews
Description of Behavior (No. 1): Ruminative thought processes

Setting(s) in which behavior occurs: Extends to any setting (i.e., home, school, etc.)

Frequency: Often, especially when distressed about school or life events.

Intensity: Interferes with ability to focus on the present moment. Negatively affects memory abilities and mood/affect.

Duration: Intermittent – sometimes lasts for only minutes sometimes can last an entire day.

Describe Previous Interventions: None.

Educational Impact: Interferes with students’ ability to focus on/be attentive to school work.

Part 2 (Function)
Function of behavior (No. 1) Specify hypothesized function for each area checked below.

Affective Regulation/Emotional Reactivity:

Figure 1. Data from alternating treatment design study
Distress could lead to anxiety and depression which could in turn direct even further rumination.

**Cognitive Distortion:** Negative interpretations of events.

**Reinforcement:**
Antecedents: Life events perceived to be stressful or emotionally straining.
Consequences: Rumination over negative emotions and thoughts.

**Communicate Need:** Trying to address and cognitively process stressful life events.

**Curriculum/Instruction:** Heavy load of assignments, standardized testing, college applications, and complex peer relationships serve to direct the problem behavior of ruminating.