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Emelyn Falley

*University of Montana, Missoula*

MacKinzie Tilleman

*University of Montana, Missoula*

Phillip Thomas

*University of Montana, Missoula*

Janeal McDonald

*University of Montana, Missoula*

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# The Effects of Mindfulness-Based Interventions on Working Memory Capacity

Emelyn Falley, MacKinzie S. Tilleman, Phillip Thomas, & Janeal McDonald

Department of Psychology



## Introduction

What is mindfulness?

- Mindfulness is characterized as being completely present in the current moment. Example: focusing on breathing sensations in the present moment while letting all other thoughts flow freely without judgment (Bhikkhu, 2007).

What is working memory capacity?

- MBIs have been shown to have potential positive implications for attention and working memory capacity, or the limited workspace that alternates between processing demands and storage (Mrazek, Franklin, Phillips, Baird, & Schooler, 2013).

Why mindfulness-based interventions?

- MBIs have also been shown to increase working memory capacity (WMC), increase positive affect, and protect WMC from erosion during high stress situations (Jha, Stanley, Kiyonaga, Wong, & Gelfand, 2010).

Why this study?

- Although previous research (e.g. Chiesa, Calati, & Serretti, 2011) suggests the effectiveness of MBIs for increasing WMC, some limitations and negative results demonstrate a need for more research regarding mindfulness interventions.

**Purpose of study:** To determine if mindfulness-based interventions result in greater increases in working memory capacity than a comparison relaxation condition and control condition.

## Method

**Participants:**

- Participants ( $n=26$ ) were recruited from Introduction to Psychology classes through an online research sign-up system (SONA), or through an undergraduate research assistant's recruitment presentation to the classes. The participants were limited to adults, ranging in age from 18-25 years ( $M=19.37$ ,  $SD=1.54$ ), with no prior history of a traumatic head injury (including concussions), which allowed the researchers to control for certain cognitive abilities.

**Treatment groups:**

- Participants were randomly assigned to one of three conditions: experimental, comparison, or control. The experimental condition consisted of participants listening to an audio recording that guided them through a mindfulness exercise (MBI), the comparison condition entailed listening to an audio that guided them through a relaxation exercise (RBM), and the control involved participants listening to an audio of white noise while reading a news article. Participants in this condition received a different article each time they completed the intervention to prevent fatigue.

**Procedure:**

- Participants completed a total of six sessions over six weeks. During the first session participants received a battery of diagnostic tests, including the Operation Span Task (OSPAN), to assess cognitive abilities, then finished with a demographic survey. During the second through final sessions, participants completed their assigned intervention and demographic survey, and additionally completed the OSPAN and other measures during the fourth and final sessions to track any changes in cognitive abilities.

## Discussion and Implications

What happened?

- Results from analyses showed that participants in the MBI group did not have significantly greater increases in working memory capacity than participants in the RBM and control groups.
- Although working memory capacity steadily increased in the RBM group, these increases were not great enough to be significant.

Why did this happen?

- There are a variety of possible explanations for these results, but the foremost reason to consider is the small sample size. There may not have been enough power for the analysis to find significant differences. However, the experiment is continuing to recruit participants and collect data, so future analyses may show different results.
- Although the increase was not significant, participants in the control group showed an overall increase in working memory capacity. This could be because the reading task assigned to participants better held the attention of participants/reduced mind wandering, thus resulting in better performance on the OSPAN.
- Similarly, while working memory capacity continually increased in participants of the RBM group, the results were insignificant. This suggests that a relaxation based intervention may be more effective for participants, but more participants and more data are needed before any conclusions can be made.

Other possible limitations?

- Participants completed their assigned intervention and OSPAN in a separate room from the researchers, meaning researchers were unable to monitor participants' effort during the sessions. It is possible some participants gave their intervention or the OSPAN more attention and effort than other participants.

Why does it matter?

- Research studies examining mindfulness interventions are part of an effort to develop evidence-based techniques and interventions that improve cognitive abilities in students of all ages.
- By developing techniques to improve these cognitive abilities there are numerous possible positive implications for students, including better learning outcomes and greater overall academic success.

Conclusions about mindfulness?

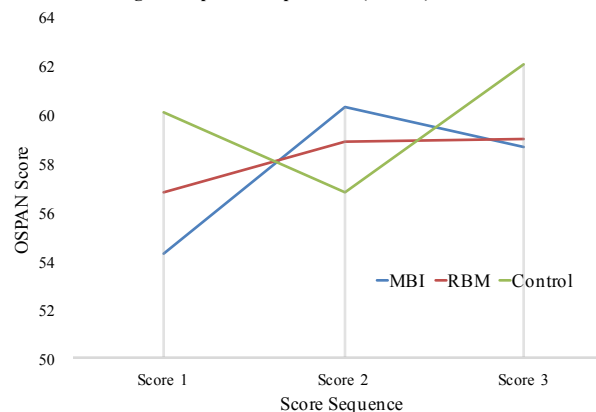
- Further research must be conducted in order to confirm or refute mindfulness-based interventions as effective; however, researchers predict that a greater sample size would lead to statistically significant results for the present study.

## Results

Operation Span Task (OSPAN) Scores Across Sessions

Treatment	<i>n</i>	Score 1 <i>M (SD)</i>	Score 2 <i>M (SD)</i>	Score 3 <i>M (SD)</i>
MBI	8	54.25 (18.65)	60.25 (12.59)	52.63 (4.69)
RBM	10	56.80 (15.58)	58.80 (13.00)	59.00 (10.53)
Control	8	60.00 (11.50)	56.75 (11.29)	62.02 (12.47)

Changes in Operation Span Task (OSPAN) Scores Over Time



- Researchers conducted preliminary one-way ANOVAs and found that there were no significant differences between groups in regard to age;  $F(1,18)=1.07$ ,  $p=.367$ , and gender;  $F(2,5)=0.35$ ,  $p=.966$ , at the beginning of the study.
- A repeated measures ANOVA was used to measure changes in OSPAN scores between treatment groups over time, but no significant differences were found;  $F(2,3)=.061$ ,  $p=.941$ . There were also no significant differences between scores within treatment groups.

- Due to computer error, scores for the second session and third session of two separate participants were lost. Researchers averaged the two scores and replaced the missing scores with this average in order to include data from these participants in statistical analysis.

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