Mindfulness Therapy and its Effects on Working Memory and Prospective Memory

By

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Abstract

Purpose: Mindfulness therapy is an increasingly popular practice that involves acute awareness of the present moment (Fletcher & Hayes, 2005). Recent research has also shown that practitioners show improvements in a range of cognitive skills (Mrazek, Franklin, Phillips, Baird, & Schooler, 2013). In particular, individuals in past literature have shown significant benefits in their working memory when practicing (Mrazek et al., 2013). Working memory is a cognitive ability that has also been correlated with an individual's prospective memory during high stress situations (Jha, Stanley, Kiyonaga, Wong, & Gelfand, 2010). This raises the question; can mindfulness therapy impact both your working memory and prospective memory? Searching this can lead to potential benefits in aiding individuals with memory deficits. In particular, elders who suffer from dementia are more prone to prospective memory loss (Zimmermann & Meier, 2006). Therefore, if benefits of mindfulness therapy are supported in this study, further research could be performed for the elder population.

Methods: Participants were 65 undergraduate students from the University of Michigan-Dearborn. The students were evaluated for their level of mindfulness practice by a survey followed by three computerized exams. All individuals received two lexical decision tasks in randomized order, followed by the automated operation span task. These tasks measured the individuals' ability to briefly retain information (working memory capacity) as well as completing a future task (prospective memory).

Results: Results from this study showed support for previous working memory research suggesting that mindfulness therapy has a significant correlation with higher working memory (Mrazek et al., 2013). The research also showed that regular engagement in mindfulness also results in notable changes in how we complete future intentions, prospective memory. In particular it was displayed that individuals who practice specifically meditation have an improved focal prospective memory and a reduced ability in nonfocal prospective memory.

Conclusion: All individuals who practice mindfulness displayed a better working memory compared to those who do not. Individuals who explicitly practice meditation also have a change in their prospective memory. Those who practice meditation showed an improvement in their focal cues but a noteworthy impairment in their nonfocal cues. This suggests that those who practice meditation are so focused on the present that it impacts their ability to perform certain nonfocal future tasks. These findings are discussed in a larger framework of applications to individuals with declining cognitive abilities and/or high prospective memory demands. (e.g., medication adherence.

Chapter 1

Introduction

Mindfulness therapy (MT) is a therapeutic state of being fully aware of the present moment (Fletcher & Hayes, 2005). It implies being centered with a focus on nothing but what is with you at that time. There is no judgment, elaboration, or emotional reactivity to what one's attention focuses on. Common reasons to practice MT are to have a connection with a belief, such as a religion, to improve physical and mental health, to improve concentration, and to increase self-awareness (Greeson, 2008). While there are many practices that meet the definition of mindfulness, common ones practiced include mediation, prayer, yoga, or breathing techniques.

Mindfulness has been used for centuries, originating in various cultures, making it very arduous to label one particular historical group as the pioneers. Society has generally viewed the practice to originate from Buddhism and Hinduism, and while they are both cultures that have factually participated in mindfulness for eras, research has shown that it has a past in several other cultures as well (Trousselard, Steller, Clavene, & Canini, 2014). However, even though it is practiced in many cultures, mindfulness has

historically been perceived as an eastern civilization practice, specifically East Asian (Doidge, 2007). As Richard E Nisbett, a social psychologist from the University of Michigan has stated "western civilization uses more of an analytical lifestyle, by focusing on the object, its attributes, and applying rules based on its categories. This practice requires a formal logic. Eastern civilization, specifically East Asians, have more of a holistic lifestyle. In this stance, they focus on the object and its surrounding field. They bring everything into the picture. This eliminates concern of categorizing rules and allows them to look at each case individually" (Richard E. Nisbett, Research Interests; Research Programs, para. 2, n.d.).

This difference in cultures has created an impact on the medical practice in both societies. In the western culture, the medical field operates more at an approach of solving the problems with empirical data and medication, focusing primarily on the issue at hand (Chan, Ho, & Chow, 2008). On the other hand, the eastern culture practices are more commonly looked at holistically, in which medical issues are treated as a whole, taking into account mental, social, and physical factors (Chan et al., 2008).

Mindfulness, being viewed as a form of holistic health, is rapidly drawing interest to the medical community in western civilization (Sauer, Lynch, Walach, & Kohls, 2011). While research on MT has frequently displayed a benefit on mental health disorders such as anxiety, depression, and coping strategies (Grossman, Neimann, Schmidt, & Wallach, 2004), there is still plenty to be studied when it comes to MT and its impact on an individual's memory.

Working Memory and Mindfulness Therapy

One heavily researched topic on the human brain and MT is on an individuals working memory. Working memory capacity (WMC) is a form of short-term memory in which an individual temporarily stores and manages information that is needed to carryout a task (Cowan, 2008). WMC is the ability to hold information in your mind for a few minutes up to a few hours. An example of WMC would be going to the grocery store without a list and recalling specific items you told yourself you needed before you left the house. Given that MT seemingly involves a change in awareness, and possibly attention, cognitive researchers have started to draw an interest in its possible effects on WMC. It is possible that something such as meditation can help block out irrelevant demands on attention (e.g., a TV playing in the background) in order to better focus on a target, such as a phone number that must be remembered until it is dialed or written down or a mental grocery list that must be recalled accurately in order to later make dinner. In a recent study, individuals were watched to see if a two week MT class would have an influence on their cognitive performance (Mrazek, Franklin, Phillips, Baird, & Schooler, 2013). The study showed that MT was able to improve the participants GRE reading scores, as well as their WMC, and even decreased the individuals distracting thoughts during the performance of these tasks. These results suggested that while completing an operation span task (OSPAN) those who performed MT were able to reduce their mind wandering, indicating that MT could be a strategy for improving task focus and performance.

Research has also shown that MT helps prevent deterioration of WMC in high stress situations (Jha, Stanley, Kiyonaga, Wong, & Gelfand, 2010). Military individuals who were involved in high stress situations were placed in either a group of high MT practice or low MT practice. Individuals with the high MT practice had less WMC deficits due to stress compared to those who had a low MT practice, suggesting that MT can help protect the impairment of WMC linked with high stress situations (Jha et al, 2010). All of this research indicates that MT can have a positive impact on an individual's WMC. Given the ubiquity of WMC in general cognitive abilities (Engle, 2002) it may be possible that MT practice has more far reaching effects than have yet been explored.

Working Memory and Prospective Memory

In the example above, we discussed how arriving at the grocery store and remembering those items on your mental list was a form of WMC. However, prior to this happening, you have to remember to stop at the grocery store on your way home from work. Moreover, when walking through the aisles you may rely on the visual appearance of the milk aisle to remind you to pick up coffee creamer. Remembering to perform actions or intentions in the future is named prospective memory (PM; Walter & Meier, 2014). Research examining the link between WMC and PM shows that while the two forms of memory are not the same and may not be based in the same memory structure, PM does appear to require WM when PM demands are particularly high (Basso, Ferrari, & Palladino, 2010). For example, an easy PM task might be remembering to put

on my shoes when I leave in the morning. Since this is part of my normal routine and my shoes are sitting right by the front door (a cue to remind me of my intention), it should be very easy for me to remember this task. By contrast, remembering to deliver a message to a colleague may be more difficult because that colleague may remind me of many things, thus the intention to deliver the message might not be recalled upon seeing their face (the cue). Because research has indicated that MT can improve WMC and WMC supports high demand PM, this study aims to connect MT directly to improvements in PM with the long-term goal of applications of MT therapy to aid individuals with high PM demands.

Prospective Memory and Mindfulness Therapy

With any intention that we must complete, we rely on a variety of reminders, or cues, to tell us that it is time to perform the action. Sometimes these reminders are directly in the focus of our attention and are a part of our already existing task demands. I have to water my porch plants about once every week but this is variable depending on several factors (e.g., outside temperature). In order for me to remember to perform this action, I have to notice these cues (distressed plants, high temperature) as relevant to an intention (watering) when I go out on the porch. Because these cues might not be something I naturally think about every time I walk out the front door, they are likely outside of the focus of my attention. Einstein, McDaniel, Thomas, Mayfied, Shank, Morrisette, & Breneiser, (2005) call these cues nonfocal and have shown that they are not only harder to detect but also require greater attention to monitor one's environment

for the appearance of the cues. By contrast, I could choose to create a focal cue to aid in remembering to water my plants. For example, I might hang a note on the inside of the front door that says "water the plants." Because I am sure to see this every time I open the front door, I have placed the reminder in the focus of my attention, thus increasing my probability of remembering to complete the intention.

While both of these cues are a form of PM, one can be easier than the other to use. In previous research it has been shown that during a lexical decision task, a focal task, which required an individual to click a button when they saw the exact word "PACKET", resulted less interference (to the LDT, as indexed by slower reaction times) compared to a nonfocal task in which an individual was required to click a button every time they saw a word containing the "TOR" syllable (Scullin, McDaniel, Shelton, & Lee, 2010, Einstein et al., 2005). These studies supported the hypothesis that PM retrieval in nonfocal settings required more attention than in focal settings.

Purpose of the Present Study

Given MT has been effective in improving WMC (Mrazek et al., 2013, Jha et al., 2010, Quach, Jastrowski, &Alexander, 2016) and WMC has shown to support nonfocal PM performance (Einstein et al., 2005); we are predicting that individuals who practice MT will show significant improvements in nonfocal PM. It is also expected to replicate past literature by

showing that people who practice MT will have a higher WMC. Specifically, we are predicting the following:

1. Given the relationship between working memory and prospective memory, it is hypothesized that there will be a higher level of both in those who practice mindfulness therapy. This should be evidenced by both higher WMC scores on the AOSPAN task and a higher proportion of cues detected in a nonfocal PM task.
2. There should be no differences in focal PM between those who do and do not practice MT because those tasks are less supported by WMC (Einstein et al., 2005)

Chapter II

Participants

Sixty-five individuals were recruited from the University of Michigan-Dearborn campus. Recruitment was done through SONA, the universities research participation website, by fliers throughout the campus, and through the mindfulness meditation group on campus. The participants were male and female and ranged from 18-60 years of age. Sixty-two of the participants received class credit through SONA for participating in the experiment, while the other three were entered into a raffle for one $25 gift card. Participants were excluded if they (1) were not of age or (2) were unable to read, write, or understand English.

Measurement/Instrumentation

The materials used in this study consisted of a consent form, a questionnaire, a computerized automated version of the operation span task (AOSPAN; Unsworth, Heitz, Schrock, & Engle, 2005), two computerized lexical decision tasks (LDT) that included either focal or nonfocal PM cues, and a debriefing form. AOSPAN is a modified version of the OSPAN, which creates less intervention with the experimenter and is just as accurate (Unsworth et al., 2005).

Procedure

The University of Michigan-Dearborn ethics committee, IRB-Dearborn, ethically approved this research study. SONA, a University of Michigan-Dearborn research participation system, was created to draw students from the University of Michigan-Dearborn to sign up for the study. Students who registered for the study received course credit for their participation. A brief description of mindfulness was provided and the students were given the option of signing up as either one who does practice MT or one who does not. The student was required to be present for the study in order to receive the SONA credit. If an individual did not meet the criteria to participate, or was not comfortable in participating, they were still eligible for the drawing or to receive SONA credit. The study took one hour of the participant's time.

Flyers were also created for the study and were posted around campus. These flyers provided information on the study and requested only MT participants to sign up. They were provided an email on the flyer to set up a day and time to participate. The students not receiving credit through SONA were entered into a drawing for one $25 Visa gift card.

After arriving to the study, the participant was asked to fill out a consent form to follow protocol of the University of Michigan-Dearborn. Two different forms of consent were created; one was for individuals who were participating through SONA and the other for individuals who were not participating through SONA. The individuals who did not receive SONA credit were handed a slip to fill out with their name and email for the Visa gift card drawing. At the end of

the research, slips were drawn randomly and the winning participant was contacted to receive their Visa gift card.

Once the participant filled out the consent, a verbal yes/no agreement was given to confirm they had read the consent and were eligible to participate. After the participant agreed to this, the study began.

Next the participants in both groups filled out the brief survey to provide information about their mental health, physical health, and history on MT. This included questions on whether or not they practice mindfulness, what forms they practice, if they find themselves religious, if so, do they consider religion to be mindful, and questions on their health and well being.

After completing the survey, the experimenter reviewed the responses to make sure the participant was categorized in the right group; either one who practices MT (mindful group) or one who does not (nonmindful group). If they originally indicated that they practice mindfulness when signing up for the study but then denied practicing mindfulness on paperwork, or vice versa, the individual was allowed to complete the study, however, their data was placed in the correct group. Out of our sample of 65 individuals, 30 of these people did not practice any form of mindfulness and out of the remaining 35 who said that they did practice mindfulness, 20 did so primarily by prayer, 12 primarily by meditation, and 3 primarily by yoga.

Next the participants completed two variants of a PM task. Each PM task included both a LDT to serve as a background ongoing task, as well as an instruction to detect cues embedded within the LDT. Both LDT trials consisted of 53 real words irrelevant to the intention, 58 non-words, and 4 cues, creating115 total trials in each LDT. Software randomly determined the order of presentation for words and nonwords, which differed between LDT tasks. PM cues always occurred on trials 25, 50, 75, and 100 in both the focal and nonfocal LDT, but participants were not aware of when PM cues would occur. Before starting these LDTs with PM cues, participants completed a practice LDT consisting of 20 total trials, 10 words and 10 nonwords, which did not occur in later LDTs. LDT instructions asked participants to make a keyboard response to indicate if a letter string was a real English word or not.

After the practice LDT was given, participants received either the nonfocal or focal LDT (order was counterbalanced across participants). PM instructions asked participants to also look for special words, PM cues. If they detected one of these cues, they were asked to make a word/nonword response first and, in the waiting screen between trials, to make a special keyboard response (i.e., press the "/" key) to indicate they had detected the PM cue. Each PM task included four cues. We chose to use the same cues indicated as focal and nonfocal by Einstein and McDaniel (Einstein et al., 2005). Nonfocal cues were four words containing the syllable "TOR" (dormitory, tornado, history, and tortoise) and the focal cue (which was repeated

four times) was the single word PACKET (McDaniel, Shelton, Breneiser, Moynan, & Balota, 2011).

In order to have a measure of executive attention, or working memory capacity, we used an automated version of the Operation Span Task which is simply a computerized variant of the operation span measure (Unsworth et al., 2005). The AOSPAN gives participants letters presented individually on a computer screen followed by a simple arithmetic task, followed then by a serial recall of those letters. The AOSPAN then calculates the participants overall WM capacity as a function of the sum of all the total correctly recalled letters. For example, if they were able to recall four letters in order out of all four letters they were shown in the earlier display before the arithmetic task, four is added into their total. If on the next round the participant successfully does a sequence of seven, than seven is added into the total, giving them a total of 11 so far. The higher the total, the higher WM capacity the individual has.

After the survey and all three tasks are completed, the individual was debriefed, released from the laboratory, and appropriate credit was granted.

Chapter III

AOSPAN Results

Many of the findings we see in previous literature are that people who practice MT tend to have higher measures of WMC (Teper & Inzlicht, 2012). To support the past literature, an independent-samples t-test was conducted with the AOSPAN data to compare the nonmindful individuals' WMC to mindful individuals' WMC. With a marginally significant difference in the scores for nonmindful (M = 35.9, SD = 12.69) and mindful (M = 43.18, SD = 17.98) participants; $t(61) = -1.840$, $p = 0.071$, the results supported the previous findings that individuals who practice some form of MT have higher WM capacity or executive control (Teper & Inzlicht, 2012). In the original data, two participants experienced either software errors or did not understand instructions because their resulting AOSPAN scores were 0 and 2, neither of which were reflective of any WMC. One additional participant scored a very low score of 5, which is unlikely to reflect actual WMC. With these participants excluded from the above analyses, the difference in AOSPAN meets traditional metrics of statistical significance (p =.05). We chose not to eliminate the participant scoring a 5 as it is theoretically possible to have such a low score, even if highly unlikely.

AOSPAN: Religion vs Meditation vs Yoga

Given that the majority of the individuals in our mindfulness group actually practice religious prayer and not meditation or yoga for their MT, a one-way ANOVA was entered to see whether or not this difference was reflected in AOSPAN scores. An independent-samples t-test comparing AOSPAN between individuals that pray and those that practice meditation or yoga was not significant, suggesting that any form of MT appears to improve WMC as measured by the AOSPAN.

Like stated prior, WMC has shown to affect PM (Basso et al., 2010) and the hypothesis of this study looks at it being a particular impact on the nonfocal PM where detecting cues is somewhat difficult. Individuals with higher WMC are thought to be better at this task. We predict then an interaction, such that individuals who practice MT would have an increase in their nonfocal PM performance, but not necessarily any increase in their focal PM performance.

Lexical Decision Task Results

We ran a two-way, mixed measures, factorial analysis of variance (ANOVA) to compare the proportion of times participants detected focal and nonfocal cues between individuals who did and did not practice a form of mindfulness. The main effect cue type (focal vs. nonfocal) was significant F (1,60) = 9.38, p = .003. This gives further support that people in all groups do detect cues more often when they are directly focusing their attention (focal cue) on one specific word such as “PACKET”, compared to when they are looking for the presence of a syllable such

as “TOR” in multiple words (nonfocal cue). This replicates a large literature on cue detection in focal and nonfocal PM tasks (Einstein et al., 2005)

We did not find a trend towards an interaction between type of cue and type of MT (prayer, meditation, yoga), $F(2, 60) = 2.04$, $p = .14$. Although not significant, the individuals who prayed detected cues at roughly identical rates as those in the nonmindfulness group, regardless of type of cue. Given this similarity in performance, this analysis was repeated, but we excluded individuals who practice MT only through prayer. It was also decided to exclude the three individuals who practiced yoga as a form of MT, given that the sample size was so minute. Comparing nonmindfulness individuals to the meditation individuals, a marginally significant interaction was found, $F(1,41) = 3.53$, $p = .068$). Specifically, the nonmindfulness group performed as expected with a marginally higher performance in focal versus nonlocal PM. The MT meditation group, by contrast, showed an unexpected significant improvement in *focal* PM along with a similarly unexpected tradeoff evidenced by significantly lower performance in *nonfocal* PM.

These results indicated an interesting finding that was contradictory to the hypothesis that those who practice meditation MT will have a greater ability to detect nonfocal cues because of an increase in WMC (i.e., AOSPAN). Although we did replicate the increase in AOSPAN from meditation, we found the opposite interaction in cue detection. That is, rather than showing an increase in nonfocal cue detection, those who practice meditation showed an increase in focal

cue detection. Also surprising was an apparent tradeoff such that meditation participants were also significantly worse at nonfocal cue detection. An interpretation of this will be further explored in the discussion.

Chapter IV

Discussion

The present study demonstrated support for our first hypothesis: that our research would replicate previous literature (Jha et al., 2010, Mrazek et al., 2013, Quach et al., 2016) and suggests that those in a university population who practice some form of MT have a higher WMC compared to those who do not. This further proves that individuals who practiced MT had better success manipulating brief memories held in their mind. We decided to look at WMC a little further and found that it does not matter how or why the individual is practicing MT (prayer, yoga, meditation), all individuals practicing MT had a significant difference of improvement in their WMC.

When detecting cues in our environment, those that require a different set of processing demands than our normal activities (nonfocal cues in this case), may be more like multitask performance. As described prior, WMC involves being able to multitask better, therefore we hypothesized that those who have a higher WMC would also have a higher PM cue detection in nonfocal tasks. Although MT did improve WMC in our sample, the effects on PM were not as expected. That is, MT did not improve nonfocal PM. In fact, with the meditation group it resulted in a decline in the ability to detect

nonfocal cues. Moreover, meditation led to a greater improvement in detecting focal cues, however, an explanation for this effect might be found by examining the particular task demands on MT.

If you look at how meditation specifically focuses attention on a single item to clear one's mind, it is primary a task about focusing on a single item or attribute. Practicing meditation might work a bit like stretching a particular muscle where these individuals are now better at focusing on simple, single items. By doing this, however, they may also be ignoring a different metaphorical muscle group (i.e., the 'muscle' supporting monitoring for nonfocal cues), causing this muscle group to atrophy or become weaker. In this case, the participants who practiced meditation MT, actually atrophied their ability to monitor for nonfocal cues through their practice of meditation. The new hypothesis is that these individuals have actually decreased their abilities in nonfocal PM and are now worse than those who do not practice MT meditation. However, because meditation individuals practice focusing, detection of focal PM cues improve considerably. As such, meditation appears to result in a tradeoff in performance with gains in focal PM and concomitant losses in nonfocal PM.

Applying This to Everyday Life

This study looked at the University of Michigan-Dearborn population. This indicates that those in an educational background have displayed an improvement in WMC as well as focal PM cues when practicing meditation MT. This can be further hypothesized to support the

students in their educational success. A future idea would be to inform students and individuals at a university setting on the potential benefits of MT and improving your memory. It does need to be recognized that this population may also be at an advantage compared to those who are not in an educational setting. It is a possibility that being a student could have even more of a positive impact in the WMC and PM cues as well as MT. It would be suggested that if this study was to be taken further, looking at individuals outside of the university could be useful. It would also be recommended to find a larger sample size in future research.

Future Research Ideas

If you look at people who forget things from the past, (e.g., where they left their key), that by society is acceptable. Everyone is forgetful. This is retrospective memory failure. PM failure however, has a very different interpretation in society. If you were supposed to do something, call somebody, pick something up on the way home, and you do not perform this task, you are viewed as unreliable by society. This is a difficult classification of failure. PM is also a huge problem in the elder population. It is not uncommon for PM to be less efficient in elder adults compared to younger adults, and this attribute is thought to be due to a decrease in an elder's cognitive resources (Zimmermann & Meier, 2006). However, in certain neurological diseases, PM can be impaired at an unhealthy rate. One common form is in dementia, particularly Alzheimer's disease.

While there is currently research on medications that potentially help delay loss in PM in these neurological conditions (Andrade & Radhakrishnan, 2009), there is insufficient research on mindfulness therapeutic ways to help prolong PM loss. Like MT helped improve individual's WMC, could a simple task of meditation help improve a dementia patient's PM? In particular, can it aid elders who are suffering from PM loss to perform certain daily tasks such as taking their medicine?

From an application standpoint, this means we should be a little cautious. You would not want to encourage everyone to practice MT to improve his or her PM. At this point we need to further replicate this finding, but from the standpoint of using this to improve elder's lives and improve their PM, it has to be done with the inclusion of knowledge or notification of how these reminders are going to be placed. If the goal is to improve their medication adherence or to perform certain tasks, it makes sense to give older adults notes as reminders. However, our data suggests that if you are going to couple this with MT meditation, improvements will only come when the notes are placed in the focus of their attention, in which case, they should have dramatic improvements in detecting those reminders and then performing the tasks (i.e., taking their medication on time). By contrast, if the cues are outside the focus of their attention, then our research suggests that the individuals who practice MT meditation will actually be worse at identifying these nonfocal cues and performing the task

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Tables

Table 1

Working Memory Capacity AOSPAN absolute score

Form of MT	n	Minimum	Maximum	Mean	(SD)
Nonmindful	30	10	56	35.90	(2.32)
Prayer	19	15	75	46.12	(4.10)
Meditation	11	9	68	40.64	(6.06)
Yoga	3	28	40	34.00	(3.46)

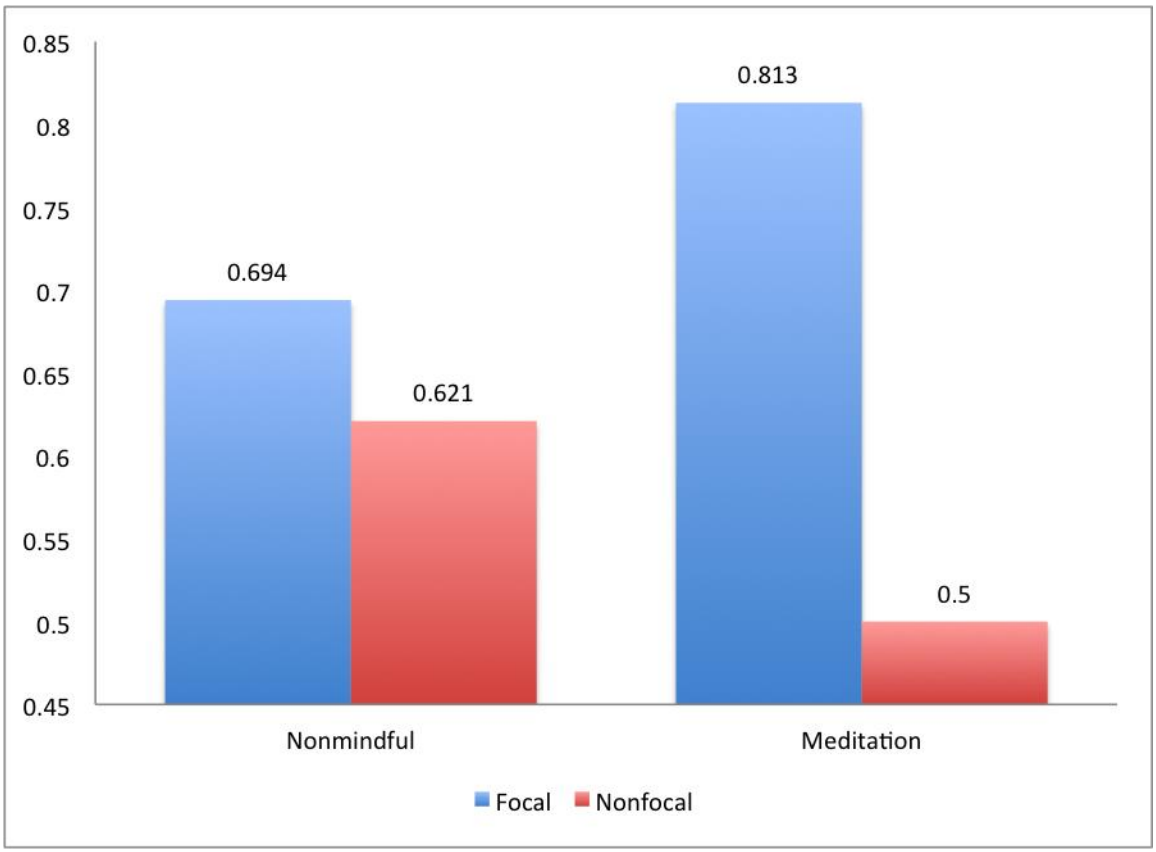
Note: WMC in AOSPAN is measured by the sum of total correctly recalled series

Table 2

Proportion of Cues Detected

Form of Focal MT	n	Mean	(SD)
Nonmindful	31	.6945	(.3911)
Meditation	12	.8125	(.2845)
Form of Nonfocal MT			
Nonmindful	31	.6210	(.4278)
Meditation	12	.5000	(.3989)

***Figure 1*. Estimated Marginal Means of Focal/Nonfocal between Meditation and Nonmindful groups**



Appendix A

Participant ID #:_____

Date:___/___/_____

Survey

This survey is to see how much mindfulness you feel you practice, as well as look at your overall health and wellbeing. **Mindfulness** is a mental state that is achieved by focusing one's awareness on the present moment, while calmly acknowledging and accepting one's feelings, thoughts, and bodily sensations, and is used as a therapeutic technique. Some different examples of mindfulness are meditation, yoga, or prayer. If you feel that you have a form of mindfulness outside of these examples, please include it!

1.) Do you practice any form of mindfulness?

Yes No

2.) If yes, please indicate what kind/s. _____

3.) Why do you engage in these practices? (check all that apply)

__Relaxation
__Concentration
__Improve Sleep
__Self-awareness
__Connection with oneself or religion
__Reduce Stress
__Improve physical health
__Improve mental health

4.) How many days per week do you practice? (if you practice more than one activity, please list the amounts separately) _____

Religious questions

These next few questions are based on religious practices. If you do not practice a religion, questions 6-8 do not need to be answered.

5.) Are you religious? If so please list your religion. (i.e. Christian, Buddhism, Jewish) Yes No Type _____

6.) Do you have an activity that you perform for this religion that you feel is mindful?

Yes No

7.) If yes, please indicate what mindfulness activity you perform _____

8.) How often do you practice this? _____

Health questions

These next few questions are based on your health. Please answer them to the best of your ability.

9.) Do you exercise frequently? If so, how often?
Yes No _____times per week/month (circle one)

10.) Do you feel that if you miss exercise, your ability to stay focused and remember to do things is affected?

Yes No

11.) On a scale of 1-10 (1 being completely out of shape, 10 being physically fit), what level of physical health would you rank yourself? _____

12.) On a scale of 1-10 (1 being very sad/upset/angry/down, 10 being very happy/content/blissful), what level of emotional health would you rank yourself? _____

Appendix B
Flyer

Do you frequently practice Meditation?

We want to know how it impacts your memory!

You may be eligible to participate in a study at the University of Michigan-Dearborn. The study is researching mindfulness and its impact on memory.

Interested? contact Sarah Letang: sletang@umich.edu

Participants must be 18-60 years old and will be entered to win one of four $25 Visa gift cards!