BEING PRESENT FOR THE FUTURE: EXPLORING MINDFULNESS AND PROSPECTIVE MEMORY

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ABSTRACT

Although mindfulness research has become a trending topic in cognitive science, there is a gap in the literature that fails to explore the relationship between mindfulness and prospective memory (i.e., the ability to remember to execute a future intention). To explore this relationship, students in either a mindfulness condition or vocabulary control condition were asked to complete 10 self-concordant academic tasks (both time-based and nontime-based) over the course of five days. The percentage of academic tasks completed was calculated to measure prospective memory completion. Prospective memory performance was compared between groups and between task type. Trait mindfulness was also measured and explored as a predictor of performance. Performance between conditions was equivalent. Time-based task performance was significantly worse across conditions, and mindfulness did not seem to produce any changes in the ability to complete either task type. Significant correlations were, however, observed between trait mindfulness and prospective memory performance.

DEDICATION

This thesis is dedicated to my family and loved ones who have supported me throughout this process and who understand the amount of time and effort that my thesis required. Thank you for your patience and understanding.

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LIST OF ABBREVIATIONS

PAM, Preparatory Attentional Processing and Memory

MBSR, Mindfulness-based Stress Reduction

ANOVA, analysis of variance

NFC, Need for Cognition scale

ARCES, Attention-related Cognitive Errors scale

BFI-2, Big Five Inventory

FFMQ, Five Facet Mindfulness Questionnaire

GRE, Graduate Record Examination

COVID-19, coronavirus disease of 2019

LIST OF SYMBOLS

N, total sample of participants

n, subset of sample of participants

M, mean

SD, standard deviation

SE, standard error

CI, confidence interval

F, ANOVA test statistic

t, t-test statistic

p, significance value, the probability that the result is due to random chance

η_p^2, partial eta squared, a measure of effect size

f^2, Cohen's f^2, a measure of effect size

d, Cohen's d, a measure of effect size

CHAPTER I

INTRODUCTION

Far too often we set an intention for the future and forget to do it. For instance, remembering to stop by the store on your way home, send an email at 8:00 a.m., submit an assignment on Wednesday, or take your medicine after lunch are all examples of common intentions we set. Remembering to execute these intentions is called *prospective remembering* and failing to remember and execute set intentions can have dire consequences. For example, Dismukes (2012) explains how disastrous events have occurred on airstrips when air traffic controllers and pilots forget to execute a set task. Failing to execute a task can either be a minor inconvenience or a devastating accident; therefore, it is ultimately beneficial to search for methods to improve prospective memory performance. Following the growing scientific interest, this study will investigate how mindfulness (i.e., nonjudgmental and purposeful present-moment awareness) may serve as a form of training for the improvement of prospective memory performance.

Prospective Memory

Prospective memory can be summed as an intention and its corresponding action. However, there are multiple phases that are associated with this process. A general overview of this process is described by Ellis (1996) including the following phases. Prospective memory begins with the formation of an intention. Deciding what to remember to do is the initial step.

Then, one must *intend* to do it. For example, "I will take my medicine at noon" is the formation of an intention with its corresponding completion parameter. Afterwards, there is a retention interval. This phase indicates that there is a time frame in which the intention is held in memory and not being performed or recalled. During this phase, extraneous tasks (i.e., ongoing tasks) are being attended. Next, there is a period of time where retrieval of the prospective memory is expected; this is the performance interval. Naturally, performance of the intended action follows this phase, in other words, the successful or failed execution of the intention. Lastly, there is an evaluation phase of the performance after the set parameter. This phase involves reflecting on the success or failure of the prospective memory task. In summation, the whole process involves *encoding* an intention, *storing* and maintaining that intention, and *retrieving* it upon the correct parameters (Ellis, 1996).

Researchers have proposed some cognitive processes that underlie prospective memory. For instance, McDaniel and Einstein (2007) contend that information processing in prospective memory is split between monitoring and spontaneous retrieval. According to Scullin et al. (2013), these attributes are fundamental to the Dynamic Multiprocess Framework of prospective memory. Based on this theoretical framework, there are two interplaying systems supporting prospective memory, where one requires effortful top-down processing (i.e., strategic monitoring) and the other functions as a bottom-up process (i.e., spontaneous retrieval; Scullin et al., 2013; Shelton & Scullin, 2017; Shelton et al., 2019). The Preparatory Attentional Processing and Memory (PAM) theory is another prominent information processing framework. As opposed to the Dynamic Multiprocess Framework, the PAM theory contends that spontaneous retrieval cannot support prospective remembering. Therefore, the PAM theory outlines the importance of attentional readiness and the observation and prioritization between tasks and responses, which is parallel to strategic monitoring in the Dynamic Multiprocess Framework (Scullin et al., 2013; Smith et al., 2017). Thus, if there is a link between mindfulness and attention, it can be expected that a possible influence in prospective memory performance may occur from mindfulness training. In other words, the monitoring process in prospective memory may be bolstered if mindfulness practice improves attentional capacity.

In addition to attention, there are cognitive constructs that researchers have addressed as relevant to prospective memory. Researchers have highlighted parallels between cognitive flexibility and prospective memory, indicating that there may be a similar, underlying functioning between the two constructs (Mahy & Munakata, 2015). Similar to prospective memory, cognitive flexibility is considered to be more of a cognitive system than a cognitive skill and is characterized by a flexible frame of mind including the ability to multitask, switch behaviors, and change thought processes (Ionescu, 2012). For example, participants may have to exercise their cognitive flexibility when given a set of rules that change depending on the context (e.g., sorting cards by shape in early trials vs sorting cards by color in subsequent trials; Frye et al., 1995). In prospective memory, individuals balance the ebbs and flows of new, changing information with their previously determined intentions. For example, an individual may set an intention to water their plants when they get home. When they arrive, they find that their significant other is ill. In this example, the individual must be flexible in their ability to switch between behaviors, thoughts, and tasks in the face of new information. Thus, cognitive flexibility is related to task-switching, and Bisiacchi et al. (2009) have found that inhibition plays a significant role in task-switching paradigms in prospective memory. Cognitive inhibition has been defined as the ability to ignore, stop, or limit attention to a particular mental process–at least in part and with or without the conscious intention to do so (MacLeod, 2007), and researchers have pointed out a strong correlation between cognitive inhibition and prospective memory performance (Schnitzspahn et al., 2013). Therefore, cognitive flexibility and cognitive inhibition appear to be relevant to prospective memory functioning.

Finally, prospective memory tasks are divided into two broad categories: event-based and time-based (Kvavilashvili & Ellis, 1996). For instance, stopping by the gas station on your way home is an event-based task. Event-based tasks are composed on the basis of a cue (e.g., gas station) that is monitored in the environment. Additionally, the event-based cue can elicit spontaneous retrieval in the absence of monitoring. Time-based tasks, on the other hand, are centered on performing the intention at a specific moment in time. An example of this sort of task would include attending a meeting at 3:00 p.m. Event- and time-based tasks differ in attentional requirements and costs, where time-based tasks are more susceptible to cognitive load detriments (i.e., require more effort), more prone to failure, and more sensitive to monitoring (Khan et al., 2008). Thus, it stands to reason that if mindfulness were to play a role in prospective memory, it would influence by means of attentional monitoring and in turn be more likely to support time-based tasks.

Mindfulness

Mindfulness is often defined in the literature as “paying attention, on purpose, in the present moment, non-judgmentally” (Kabat-Zinn, 1994). Dr. Jon Kabat-Zinn is well-known for being the founder of Mindfulness-based Stress Reduction (MBSR), an 8-week program often used in the clinical field as a coping mechanism to a broad range of disorders including anxiety, depression, and chronic pain (Grossman et al., 2004). Mindful practices have been found to be associated with increased levels of overall well-being and reduced stress (Carmody & Baer, 2008). Additionally, effects remain consistent when compared to self-reported levels of mindfulness (Carmody & Baer, 2008; Grossman et al., 2004). Therefore, mindfulness can be assessed through self-report measures (i.e., trait mindfulness) as well (Baer et al., 2004; Heeren et al., 2011). Indeed, mindfulness is a contemplative practice rooted in Buddhism; however, today, mindfulness, in its secular form, is not a novel concept to the western scientific world (Barinaga, 2003).

Meta-analyses examining the connection between mindfulness and various cognitive faculties have indicated that mindfulness can have beneficial effects to, or positive correlations with, many facets of cognition including attention, intelligence, self-regulation, meta-awareness, and memory (Chiesa et al., 2011; Eberth & Sedlmeier, 2012; Tang et al., 2015). Of these constructs, attention is arguably the most prominent. Mindfulness is formally practiced through meditation. In mindfulness meditation, one typically sits in a comfortable position and focuses on the breath, on the body, on sounds, or on thoughts that arise. Therefore, mindfulness meditation inherently requires attention; naturally, researchers have explored the relationship between mindfulness meditation and various forms of attention.

Jha et al. (2007) found that mindfulness was associated with efficient top-down attentional selection. Participants in their study included meditation naïve individuals (i.e., individuals without meditation experience), individuals with meditation experience, and a control group who did not receive mindfulness training. The participants were assessed using the Attention Network Test that measures conflict monitoring, alerting, and orienting. The experienced group outperformed the naïve group in conflict monitoring, suggesting that meditation experience influences prioritization of competing tasks and responses. Furthermore, the meditation naïve individuals were placed in an 8-week mindfulness program. The meditation naïve group significantly improved in orienting compared to the control group, which did not receive any mindfulness training, indicating that mindfulness training can increase attentional focus by directing and limiting attention. Lastly, Jha et al. (2007) showed that mindfulness experience was related to reduced alerting scores, which suggests that mindfulness can enhance individuals' attentional readiness. Thus, there is an apparent link between the attentional faculties of prioritization of tasks (i.e., conflict monitoring), attentional preparedness (i.e., alerting), and the controlling of attention (i.e., orienting). Similar research, conducted by Ainsworth et al. (2013), showed that conflict monitoring was improved in mindfulness meditation conditions, specifically when resolving conflict between relevant and irrelevant tasks. However, Ainsworth et al. did not find mindfulness to be related to alerting or orienting. Overall, systematic reviews of the relationship between mindfulness and cognition yield optimistic results towards a link to attention (Chiesa et al., 2011; Tang et al., 2015). Specifically, the aforementioned abilities (e.g., prioritization of task, attentional preparedness, and attentional control) should be most relevant to the fundamental principles of strategic monitoring in the prospective memory retrieval process.

Researchers have also looked at how facets of executive functioning relate to mindfulness. For example, Moore and Malinowski (2009) examined the impact of mindfulness meditation on cognitive flexibility using the Stroop Task and the D-2 Concentration and Endurance Test. Their results showed that both trait mindfulness and state mindfulness were positively correlated with attentional performance, particularly suggesting that mindfulness influenced the ability to maintain and switch attentional focus. This finding has been supported from the work of additional research (Colzato et al., 2012; Colzato et al., 2015). Furthermore, Colzato et al. (2016) found that focused attention meditation enabled the ability to suppress currently irrelevant stimuli–another applicable aspect of attention to strategic monitoring. As previously mentioned, strategic monitoring requires effortful, conscious processing. Irrelevant stimuli serve as distractors in the ability to maintain conscious awareness, and this is evidenced by the comparison of *focal* and *nonfocal* prospective memory tasks. A nonfocal prospective memory task is characterized as being *irrelevant* to the ongoing task, which is any activity that is being attended to while waiting to carry out prospective memory intentions (Park et al., 1997; Scullin et al., 2010). Researchers have observed that nonfocal prospective memory task performance is significantly worse than focal prospective memory performance, suggesting that nonfocal prospective memory tasks require an individual to split their attention between the prospective memory task relevant cues and the relevant ongoing task information (Scullin et al., 2010). In other words, performance can decline if the ongoing task is irrelevant to the prospective memory task. Therefore, the findings from Colzato et al. (2016) suggesting that focused attention meditation can aid in suppressing irrelevant stimuli, have pertinence in the ability to suppress ongoing task information that is irrelevant to the prospective memory task at hand. The researchers suggest that focused attention meditation enhances cognitive persistence (i.e., the ability to overcome difficulty when attempting to complete a task), which can also be tied to cognitive flexibility and goal execution (Colzato et al., 2016; Teubner-Rhodes et al., 2017).

Yet another finding relating to goal execution comes from research supporting that mindfulness can improve awareness of unexpected stimuli in goal-directed tasks by reducing inattentional blindness, or the inability to recognize an item that is in plain-sight when attention is occupied by another stimulus (Jensen et al., 2011; Schofield et al., 2015). Along those lines, Gallant (2016) conducted a meta-analytic review of empirical research and determined that there is a consistent finding of the executive function, inhibition, being enhanced through mindfulness practice. Although not as consistent, Gallant (2016) has also pointed out advantages for updating and shifting, two more executive functions. Research has demonstrated that executive functioning is predictive and relevant to prospective memory performance across various age ranges too (Martin et al., 2003; Zuber et al., 2019). Finally, there is evidence that mindfulness training increases individual's time sensitivity, which is fundamental to successful completion of time-based tasks (Droit-Volet et al., 2015; Wittmann et al., 2014).

Mindfulness and Prospective Memory

A review of findings in the literature on mindfulness and memory demonstrates that research has been conducted in the areas of working, semantic, procedural, autobiographical, and episodic memory (Levi & Rosenstreich, 2019). Yet there is an evident scarcity in the literature on the relationship between mindfulness and prospective memory. Only two studies have attempted to directly bridge the gap between mindfulness and prospective memory. Girardeau et al. (2020) found that only one facet of trait mindfulness (out of five) was related to prospective memory performance. Furthermore, the researchers did not find their 15-minute mindfulness meditation training to enhance prospective remembering. However, Wang et al. (2012) found that an 8-week mindfulness program significantly reduced reaction times on a Stroop task and prospective memory task compared to a waitlist control group; however, the findings from Wang et al. (2012) did not reveal a direct enhancement to prospective memory accuracy (i.e., performance measured by percentage of tasks completed). Reaction times are often measured in prospective memory as an index of strategic monitoring, wherein reaction times are compared when a prospective memory task is present versus when it is not, and reaction times are comparatively slower in conditions in which a prospective memory task is present, suggesting that strategic monitoring requires more attention when a prospective memory task is present (Marsh et al., 2003). Girardeau et al. (2020) were also the only researchers to examine trait mindfulness as a predictor of prospective memory performance. Clearly, results are inconsistent and scarce. Additionally, the methodology between these two studies is quite distinct. Girardeau et al. (2020) used a single 15-minute mindfulness session and measured performance by the number of intentions completed, whereas Wang et al. (2012) used an 8-week mindfulness program and measured performance by reaction times.

In summary, there appears to be a connection between mindfulness and the cognitive and attentional capacities of alerting, orienting, conflict monitoring, cognitive flexibility, cognitive persistence, inhibition, inattentional blindness, and time sensitivity (Colzato et al., 2016; Droit-Volet et al., 2015; Jha et al., 2007; Moore & Malinowski, 2009; Schofield et al., 2015). These aspects of attention and cognition have also been found to be relevant to prospective memory (Bisiacchi et al., 2009; Khan et al., 2008; Martin et al., 2003; Schnitzspahn et al., 2013; Smith et al., 2017; Zuber et al., 2019). So, it follows that mindfulness could play a beneficial role in the performance of prospective memory task completion by way of cognitive and attentional influence, specifically when there are attentionally-demanding time-based tasks occurring. Mindfulness research is growing; however, there appears to be an unexplored area of interest within the realm of prospective memory. Although mindfulness and prospective memory can certainly be linked through the cognitive and attentional theories, only two studies have attempted to bridge the gap between these two trending areas and found significant results (Girardeau et al., 2020; Wang et al., 2012).

Present Study

The main goal of this study was to further examine the relationship between prospective memory and mindfulness. This study was the first to explore this relationship in a naturalistic setting and expanded upon prior research by using an intermediate mindfulness training of 5-days, compared to the 15-minute induction and the 8-week intensive. Conducting a naturalistic study was an important addition to the literature because of its relevance and representativeness of the real-world, so the results of this study were more likely to translate to the everyday lives of the participants. Therefore, there were practical implications in this study, where techniques such as meditation could have demonstrated to be useful in producing successful completion of academic goals. Specifically, academic task completion was an important feature to examine for a sample of college students who certainly balance a multitude of prospective memory intentions in a single day. Moreover, this study was able to extend the literature by focusing on the meditation dosage gap to determine how much meditation might be needed to be effective as well as aided in establishing the effects of mindfulness in a more naturalistic setting. This study was able to inform the theories behind the effects of mindfulness, established a better understanding of the sort of behaviors that enhance prospective remembering, and provided evidence for the theoretical cognitive underpinnings supporting both constructs (i.e., the attentional composition).

Based on prior studies and theoretical connections, I developed four hypotheses. I hypothesized that individuals in the mindfulness condition would outperform an active control group in overall prospective memory performance. Additionally, I hypothesized that average time-based task performance would be significantly worse than nontime-based task performance. In the present study, the term *nontime*-based is being used as opposed to event-based since participants were not asked to report an event-based cue. Moreover, I hypothesized that the mindfulness meditation effects on prospective memory performance would be greater for time-based tasks compared to nontime-based tasks. In other words, I predicted that time-based task performance would be better in the mindfulness condition compared to the control condition. Lastly, I hypothesized that trait mindfulness, determined by a questionnaire, would predict prospective memory performance.

CHAPTER II

METHODOLOGY

Participants and Design

Data was collected from a sample of 58 undergraduate participants who were recruited to participate in this study. A power analysis was conducted using G*Power (Faul et al., 2009) for a repeated measures ANOVA main effect between participants, within-participants, and within-between interactions (hypothesis one, two, and three). Assuming a moderate effect size (d = 0.25 Power = 0.80;), a sample size of 98 participants was needed to detect a significant effect between groups, and a sample size of 34 was needed to detect a significant within group effect or interaction effect. Furthermore, for hypothesis four (regression analysis) a sample size of 43 would provide sufficient power to find an effect from the combined predictors (f^2 = 0.15; Power = 0.80; Predictors = 5).

Exclusion criteria for this study included being unable to download the required phone applications, being unable to take pictures of their tasks, being unable to use a functional webcam for the Zoom meeting, if English was not their first language, or if they were not a full-time student. Six participants were excluded from the analyses for failing to complete the informed consent or due to meeting one of the aforementioned exclusion criteria. The final sample of participants (N = 52) consisted of White (n = 38), Black (n = 5), Hispanic (n = 1), Asian/Pacific Islander (n = 1), and mixed-race (n = 7) participants. Additionally, the sample of participants was predominantly female (n = 42) and the average age of the participants was 20.54 (SD = 3.1). Most students were recruited from the University of Tennessee at Chattanooga (n = 50), and some students were recruited from Dalton State College (n = 2). The majority of students (n = 43) were sourced through the University of Tennessee at Chattanooga's Psychology department SONA system, which is the department's participant registration system. SONA participants were compensated with extra credit upon completion of the study. Importantly, since the number of participants was not met in order to have adequate power to observe between-group effects, participant recruitment is still ongoing.

This study used a 2 (Condition: mindfulness/control) x 2 (Task type: time-based/nontime-based) mixed-factor design, with mindfulness meditation and vocabulary (active control) serving as the between-participants conditions and prospective memory task type (time-based vs nontime-based) serving as the within-participants condition. This study was designed as a field experiment, so participants were randomly assigned to each group. Furthermore, this study spanned the course of five days for each participant.

Materials

Initial Survey

Participants in this study completed an initial survey which consisted of a Need for Cognition scale (NFC; Cacioppo et al., 1984), Attention-Related Cognitive Errors Scale (ARCES; Smilek et al., 2010), the Big Five Inventory (BFI-2; Soto & John, 2017), and the Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2004). Those who participated in SONA completed the NFC, ARCES, and BFI-2 as part of their SONA pre-screening registration. The data from the NFC, ARCES, BFI-2 scales was collected but was not analyzed in the present study. The initial survey also included demographic questions and asked whether English was their first language.

Five Facet Mindfulness Questionnaire

The FFMQ, developed by Baer et al. (2004) was used to measure trait mindfulness. The FFMQ assesses trait mindfulness through a 39-item self-report questionnaire, where participants rate their tendency to engage in mindful behavior. Items on the FFMQ were answered on a 5-point Likert scale ranging from “never or rarely true” to “very often or always true”. The FFMQ is an empirically based scale that has been shown to be a valid measure of mindfulness, including in cross-cultural settings (Baer et al., 2008; Heeren et al., 2011). The FFMQ’s five facets of mindfulness include observing, describing, acting with awareness, nonjudging, and nonreactivity. The FFMQ was also the trait mindfulness measure used by Girardeau et al. (2020), in which they found that *describing* was related to prospective memory performance.

Prospective Memory Tasks

The prospective memory tasks consisted of self-concordant academic tasks (i.e., tasks that were personally important) that the participants came up with themselves. In total, participants had to come up with 10 personal academic tasks that they intended to complete within the following five days (i.e., two tasks per day–one time-based and one nontime-based). The tasks were expected to meet experimental requirements, which included being academic, being action oriented, being specific, and being measurable. In addition, the academic tasks reported by the students could not be routine, obligatory tasks (e.g., attending class). Participants were encouraged to look at their syllabi, planner, or schedule to come up with their tasks, and participants were also allowed to write down, use a calendar, or take a screenshot of the task sheet screenshared on Zoom to help them remember their tasks. The use of secondary sources to help remember their tasks and the materials used to come up with their tasks was noted by the researcher on the task sheet for each participant. However, the data on their sources and material was not analyzed in the present study. Prospective memory performance (i.e., accuracy) served as the dependent variable and was measured by the percentage of time-based tasks completed (out of five) and nontime-based tasks completed (out of five).

Participants reported the completion of each of their tasks using an online completion form via Qualtrics. Since this study was conducted as a field experiment over the course of five days for each participant, participants were required to submit photo evidence of their task completion. Participants were required to submit a completion form with photo evidence twice per day for five days, once for each time they completed a prospective memory task. For the nontime-based submissions, participants were asked to come up with one task per day, for five days. This task had to be completed within the 24 hours of the appropriate, aforementioned day. One of the exceptions to this rule was when a participant indicated wanting to complete a task at 12:00 a.m. In this case, I accepted cases that were on 12:00 a.m. the next day (e.g., Tuesday task is completed at 12:00 a.m. on Wednesday). The other exception to this rule is the 30-minute grace period provided to the participants. This period extended their window 15-minutes before and 15-minutes after their appropriate day (e.g., continuing with the previous example, a submission made at 12:14 a.m. would be appropriate).

Since the prospective memory tasks were all academic tasks, it would have been counterintuitive to the nature of an academic task to mark an early submission as a failure. Therefore, time-based tasks submitted on or before the time intention were counted as successes.

Again, a 30-minute grace period (i.e., 15-minutes before their time intention and 15-minutes after) was allotted to the participants in order to accommodate for submissions that were made a couple minutes before or after their intended time (e.g., a submission made at 3:08 p.m. would be acceptable even if their intention was to study at 3:00 p.m.). However, submissions that were made *earlier* than 15-minutes before the time intention set by the participant were also coded as successful–if submitted on the appropriate day (e.g., even if their intention was to study at 3:00 p.m. on Tuesday, a submission made at 10:00 a.m. on Tuesday would be appropriate).

Completion Forms

Participants were required to indicate if they completed their prospective memory task, to specify which task they completed, and to submit picture evidence of the completion of their task through an online form via Qualtrics. Two completion forms were created, one for the mindfulness condition and one for the control condition. The link to the form was provided to the participant at the end of their Zoom session. The two forms were identical, except for one mentioned mindfulness and the other mentioned vocabulary. Participants were asked to complete this form twice per day for five days, once for each time they completed a prospective memory task. Importantly, participants were told to submit the evidence for their time-based task exactly at the time they gave us. Participants would be asked which prospective memory task they were submitting evidence for (e.g., time-based or nontime-based). Depending on their answer, they were then asked whether they completed their task, to submit photo evidence of their task, and what kind of reminder they used for their task (e.g., calendar, alarm, reminder, notes, or none). Next, participants would be asked if they were ready to submit evidence for their meditation (or vocabulary). If so, they would be asked to submit photo evidence and indicate how long they spent on their respective app. Additionally, participants were asked to complete the completion form even if they did not complete any of their tasks and indicate why they did not complete their tasks (e.g., reprioritize, forgot, unmotivated, or other). Data on reminder use and why they did not complete their tasks was not analyzed in the present study.

Mindfulness Training

Participants in the mindfulness condition were asked to complete one app-based mindfulness meditation per day for five days. The UCLA Mindful app was used to induce a state of mindfulness and serve as the mindfulness training in this study. As a requirement, all participants had to have access to a device in which they could download and use the UCLA Mindful app. This app is free to download and available on both the App Store and Google Play. UCLA Mindful is an app designed and provided by Diana Winston, the Director of Mindfulness Education at the University of California – Los Angeles. UCLA Mindful was selected for its meditations focused on attention and the mind, not simply stress reduction and well-being. Furthermore, the app provided eight free guided meditations ranging in time from 3 minutes to 19 minutes. Students were required to complete the "Breath, Sound, Body Meditation – 12 minutes" once per day for five days. However, students were allowed to complete more than the one required meditation per day. Students had access to all eight meditations and were required to indicate how many minutes they spent meditating each day. Moreover, participants were required to submit photo evidence of their completed meditation via the completion form.

Vocabulary Control

In order to create similar groups, this study employed an active control group where participants completed one app-based vocabulary builder level per day. The control group used the Vocabulary Builder app which is designed to assist with vocabulary for the Graduate Record Examination (GRE) and other standardized exams. Vocabulary Builder was free and provided the user with multiple difficulty levels to study words. For this study, participants in the control group were asked to complete one level of the "Basic Words" section per day for five days. Each level progressively increases in the number of words to study, beginning with 10 and reaching 49 on day five. As in the experimental group, participants had to indicate how many minutes were spent on the app each day. Again, participants were required to submit photo evidence of their completed vocabulary screen each day.

Post-study Survey

The post-study survey asked participants to recall their prospective memory tasks. The participants were asked to recall their tasks in order to get another measure of whether they completely forgot their tasks (retrospective memory failure) or to see if they could recall their task but forgot to execute their task (prospective memory failure). Moreover, the participants were asked to report why they did not complete a task if they failed to complete some of them. They were able to respond by saying they reprioritized another task, forgot their task, or were not motivated to complete their task. This was asked for both the time-based and nontime-based tasks, separately. Then, participants were asked to report what condition they were in (e.g., meditation or vocabulary). They were asked how often they practiced vocabulary or mindfulness prior to the study (e.g., never, 3-4 times a year, 3-4 times a month, 3-4 times a week, or every day). They were finally asked to report what sort of benefits they felt like they gained from participating in the study and whether they generally enjoyed the app-based tasks. At this point, the only data from the post-study survey used for this study was the prior practice data.

Procedure

Students interested in participating in this study were asked to select a time slot to schedule a Zoom meeting with a researcher. Once a time slot was selected, which had to be done at least 24 hours in advance, a researcher would send them a scripted email from the protocol asking the student to complete the informed consent and initial survey. This email also included the link to the Zoom meeting with the researcher and a document with the requirements for their academic task. During the Zoom meeting, the researcher introduced themselves and asked the participant for verbal confirmation of the completion of the informed consent. If the participant did not turn on their webcam, they were asked if they had a functional webcam. If they were unable to use a webcam, the participant was thanked for their time and the study was ended. If they had a functional webcam and confirmed that they completed the informed consent, they were then asked if they were a full-time student. If not, they were thanked for their time and the study was ended. If the participant confirmed to being a full-time student, the researcher proceeded with the protocol. After this initial interaction, the researcher went on to inform the participant of the requirements for their academic tasks.

Participants were instructed to list their 10 personal, academic tasks that met the requirements of the experiment. The researcher shared their screen and listed the tasks on a spreadsheet. After task selection was complete, participants were asked to recall all 10 of their tasks. Participants were asked to recall their tasks to the researcher to ensure there was not an issue with encoding the tasks in memory. Afterwards, the researcher asked the participant if they felt confident in their ability to provide picture evidence for each one of their tasks.

Participants were then instructed on how to download and use the required applications for this study. They were informed that they had to complete at least one meditation/vocabulary level per day for five days. Finally, participants were given the link to the online completion form to submit pictures or screenshots of the completion of their academic tasks and app tasks (meditations/vocabulary) completion. For instance, taking a picture of a book page when their goal was to read and taking a screenshot of their completed meditation screen were acceptable responses. They were instructed to submit the form twice per day for five days, submitting evidence for each of two tasks every day and evidence for their app task on one of those two forms. All evidence was collected on Qualtrics. All methods and procedures were well-suited for any COVID-19 restrictions, so there was not any in-person contact during the experiment. Upon completion of the five days, participants received the post-study survey and debriefing information.

CHAPTER III

RESULTS

Inter-rater Reliability

A team of researchers consisting of five students coded for successful submissions of academic task completion evidence. Evaluation criteria consisted of examining the time, date, and picture proof evidence. The data was split between four members of the research team, with each individual serving as coder one. The fifth member served as coder two for all of the data. Inter-rater reliability was calculated as the percent agreement in each condition (i.e., time-based meditation, nontime-based meditation, time-based vocabulary, and nontime-based vocabulary) as well as a total percent agreement (average across conditions). Initial percent agreement between coders was 90% for the nontime-based meditation condition, 85% for the time-based meditation condition, 94% for the nontime-based vocabulary condition, and 82% for the time-based vocabulary condition. Total initial percent agreement between coders was 87.75%. I served as the third coder across conditions in order to establish 100% agreement.

Condition Completion

First, I analyzed to determine if there was a difference in the percentage of completed meditations compared to the percentage of completed vocabulary levels. There was no significant difference for condition completion rates between mindfulness and vocabulary, $t(50) = -.60$, $p = .28$, with the vocabulary group ($M = 80.0$, $SD = 25.45$) only slightly completing more of their tasks than the mindfulness group (*M* = 75.33, *SD* = 29.01). However, when checking to see if time spent on mindfulness meditations differed from time spent on vocabulary, I did find there was a significant difference in the amount of time spent in each condition $t(50) = 3.11$, $p < .001$, where those in the meditation condition (*M* = 12.31, *SD* = .91) spent more time in meditation than the control did on their vocabulary levels (*M* = 9.06, *SD* = 5.56). This appeared to be mainly due to individuals completing their earlier, easier vocabulary levels at a quicker pace. Overall average time spent on the vocabulary and the meditations was about 10.87 minutes (*SD* = 4.06).

I examined whether there was a difference in the amount of time participants meditated versus the amount of time participants practiced vocabulary prior to this experiment. There was not a significant difference between prior meditation experience and prior vocabulary experience, $t(33) = -.69$, $p = .84$, with approximately half of the mindfulness group (50%) saying they had never meditated before and more than a third of the vocabulary group saying they had never practiced vocabulary (38.5%).

Prospective Memory Performance

Prospective memory performance was operationalized as the percentage of academic tasks submitted at the appropriate, aforementioned day and/or time. Picture evidence provided by the participant and coded as correct by the research team was considered as a prospective memory task completion, with a total of five possible for time-based tasks and five for the nontime-based tasks. Performance was analyzed using a 2 (Condition: mindfulness/vocabulary) x 2 (Task type: time-based/nontime-based) repeated-measures, mixed-factor ANOVA. Mindfulness meditation (experimental condition) and vocabulary (active control) served as the between-participants conditions and prospective memory task type (time-based vs nontime-based) served as the within-participants condition.

When comparing to see if there was a significant difference between prospective memory task type, the results showed that time-based performance was significantly different from nontime-based performance, $F(1,50) = 16.74$, $p < .001$, $\eta_p^2 = .25$. In support of hypothesis two, average time-based performance ($M = 42.94$, $SE = 5.11$, 95% CI [32.68, 53.20]) was significantly worse than average nontime-based performance ($M = 62.55$, $SE = 4.37$, 95% CI [53.77, 71.33]). Contrary to hypothesis one, there was not a significant difference between conditions on performance across tasks, $F(1,50) = .05$, $p = .82$, $\eta_p^2 = .001$. Although the mindfulness condition's performance was marginally better ($M = 53.67$, $SE = 5.34$, 95% CI [42.94, 64.40]), mindfulness performance was statistically equivalent to performance in the vocabulary condition across tasks ($M = 51.82$, $SE = 6.24$, 95% CI [39.29, 64.35]). These data suggest a lack of main effect between conditions. In opposition to hypothesis three, there was no significant interaction between task type and conditions, $F(1,50) = 1.12$, $p = .30$, $\eta_p^2 = .02$. In efforts to be transparent and thorough, simple effects were reported as well. Time-based performance was significantly worse within the mindfulness condition, $F(1,50) = 15.66$, $p < .001$, $\eta_p^2 = .24$ but only marginally significant within the vocabulary condition $F(1,50) = 4.00$, $p = .05$, $\eta_p^2 = .07$. Moreover, time-based performance was marginally better in the vocabulary condition ($M = 44.55$, $SE = 7.76$, 95% CI [28.95, 60.14]) compared to the mindfulness condition ($M = 41.33$, $SE = 6.65$, 95% CI [1.40, 2.73]), while nontime-based performance was slightly better in the mindfulness condition ($M = 66.00$, $SE = 5.69$, 95% CI [54.58, 77.42]) compared to the vocabulary condition ($M = 59.09$, $SE = 6.64$, 95% CI [45.75, 72.43]).

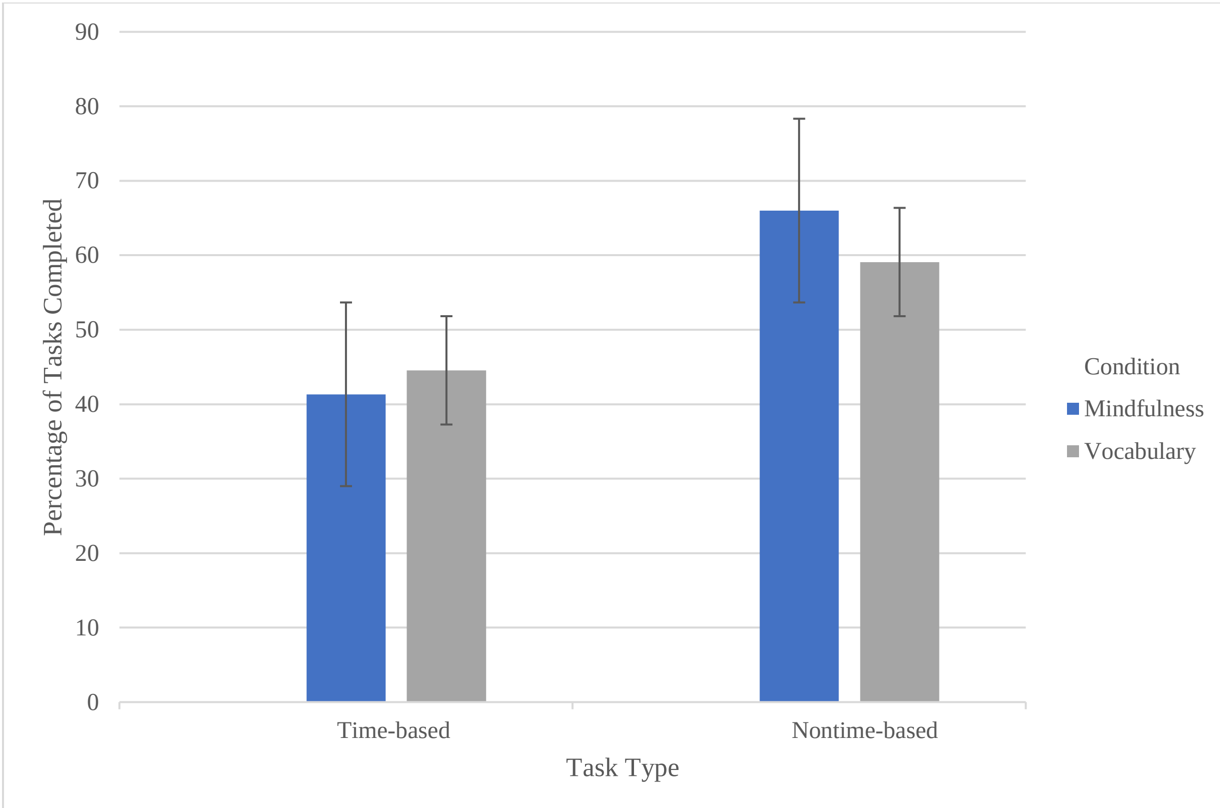

Figure 1

Percentage of correct task submissions by task type between conditions

Trait Mindfulness

To evaluate hypothesis four, the relationship between trait mindfulness and prospective memory performance was assessed by conducting three multiple regression analyses using time-based performance, nontime-based performance, and total prospective memory performance as outcomes and the FFMQ scores: Observing, Describing, Acting with Awareness, Nonjudging, and Nonreactivity as continuous predictors.

The regression models for time-based performance, $F(5,51) = 1.38$, $p = .25$, and nontime-based performance, $F(5,51) = 1.08$, $p = .38$ were not significant. However, there was a significant correlation between Nonreactivity and performance on the nontime-based tasks, r = .29, $p < .05$. Nonreactivity explained 8% of the variance in nontime-based performance. Similarly, the model for total prospective memory performance was not significant $F(5,51) = 1.17$, $p = .34$. Nevertheless, there was still a significant correlation between Nonreactivity and total prospective memory performance, $r = .26$, $p < .05$. Nonreactivity explained 7% of the variance in total prospective memory performance.

Table 1

Correlations between trait mindfulness and prospective memory performance

	Mean	SD	1	2	3	4	5	6	7	8
1. Observing	3.09	0.85	(.69)							
2. Describing	3.39	0.98	0.21	(.86)						
3. Awareness	3.05	1.07	-0.22	0.42**	(.91)					
4. Nonjudging	3.12	1.24	-0.06	0.28*	0.47**	(.90)				
5. Nonreactivity	3.04	0.88	0.29*	0.51**	0.37**	0.18	(.84)			
6. Time-based	42.69	36.09	0.04	-0.10	0.19	0.13	0.15	--		
7. Nontime-based	63.08	31.03	0.14	0.15	0.19	0.09	0.29*	0.49**	--	
8. Total PM	49.42	28.52	0.18	0.04	0.22	0.13	0.26*	0.70**	0.70**	--

Note. $N = 52$, *$p < .05$, **$p < .001$

CHAPTER IV

DISCUSSION

The goal of this study was to explore the relationship between mindfulness and prospective memory. With power limitations in mind, mindfulness meditation training was not found to produce changes in prospective memory performance. In this study, students who were in the app-based mindfulness meditation condition did not statistically outperform those who were in the app-based vocabulary control condition. The lack of significant difference between groups was found when measuring average performance across both time-based and nontime-based academic tasks. In light of the results, the current evidence is in opposition to the main hypotheses in this study. Initially, I hypothesized that students in the meditation group would outperform the vocabulary control group in prospective memory performance; however, only a small, non-significant difference was found in performance across tasks between the mindfulness group and the vocabulary group.

I also hypothesized that time-based task performance would be significantly worse than nontime-based task performance; in this case, my hypothesis was supported. I found that students were significantly worse at completing time-based tasks as opposed to nontime-based tasks. This result remained true even when comparing between conditions. Additionally, I hypothesized that time-based performance would be better in the mindfulness condition compared to the vocabulary condition. I based this prediction on the theoretical assumption that mindfulness would support attention and therefore relieve some of the attentional difficulties of time-based tasks. On the contrary, trends in the data showed that time-based task performance was slightly better in the vocabulary condition, whereas nontime-based performance was better in the mindfulness condition.

Finally, I hypothesized that trait mindfulness scores would significantly predict prospective memory performance. In partial support of this hypothesis, Nonreactivity was correlated with nontime-based performance and total prospective memory performance. Although the global models did not show a significant predictive effect, trait mindfulness scores were found to be significantly correlated to prospective memory performance.

Although under a different experimental design, the main results of the present study were in line with one of the only studies to explore the relationship between mindfulness and prospective memory. Girardeau et al. (2020) found that individuals who underwent a single 15-minute mindfulness induction did not outperform the control group who underwent a single 15-minute mind wandering induction. However, in Girardeau et al. (2020), the participants completed their tasks in a lab environment in a virtual reality setting. On the other hand, researchers Wang et al. (2012) found that individuals who participated in eight weeks of mindfulness training had faster reaction times on a computerized prospective memory task compared to a waitlist control group. Although Wang et al. (2012) did find a significant difference in reaction times between conditions, they did not find that the mindfulness condition had better performance on the prospective memory task. Therefore, the current study's main results support the previous literature in that there does not appear to be a prospective memory performance benefit produced by undergoing mindfulness training, despite the theoretical connection of attention between the two constructs. Although this study was able to discover a small difference in performance, mindfulness training has yet to produce a statistically significant difference in prospective memory performance on a computerized task, in virtual reality, and in the natural setting–even with various quantities of mindfulness meditation sessions.

Although the research on mindfulness and prospective memory is sparse, studies have shown that mindfulness possesses a strong relationship with several cognitive faculties. For instance, Jha et al. (2007) reported that individuals who completed an 8-week mindfulness training increased in orienting (i.e., ability to maintain, limit, and direct focus) when compared to a control group. A finding such as this, and various other studies that show a relevant importance of mindfulness on attention (Ainsworth et al., 2013; Gallant, 2016; Moore & Malinowski, 2009), lead to theoretical support for the idea that mindfulness should have aided in the attentional abilities of the participants when having to balance between multiple tasks and maintain their attention towards their duties.

A potential reason as to why mindfulness may have only lead to a small difference in performance compared to a control group on prospective memory tasks completion is that the beneficial effects of mindfulness could be suited to other tasks instead of academic tasks. In other words, it is possible that academic task completion is less likely to be affected by mindfulness, whereas remembering to complete a task such as a self-care goal may reap the benefits. Therefore, this study only focused on prospective memory tasks that were academic in nature; however, it is possible that other task types such as self-care goals, may be more liable to receive prospective memory benefits from mindfulness training.

It is also unclear as to whether or not the meditation dose (i.e., number of meditation sessions) was too low in this study. Research has shown that a singular mindfulness session has not been enough to produce an effect on cognition (Bing-Canar et al., 2016; Johnson et al., 2015). While studies have found an effect on cognition after five days of mindfulness training (Droit-Volet et al., 2015; Tang et al., 2015), it is still unclear as to what the proper dosage may be for mindfulness meditation training to start yielding an effect. Likewise, it is not well known how an individual who has not practiced meditation (i.e., mediation naïve) compares to individuals who have months or more of meditation experience. Meditation naïve individuals may be unable to reap benefits for the first few weeks of practice. For instance, Jha et al. (2007) found that meditation naïve individuals were unable to reap an attentional benefit in alerting; however, when assessing mindfulness experience, the researchers were able to find a significant correlation. In this case, an 8-week mindfulness training program did not benefit alerting scores in meditation naïve individuals, yet meditation experience was related to the alerting scores. Similar to the dosage issue, it is unclear whether the mindfulness training delivery method is relevant enough to change the effects. For example, common mindfulness-based stress reduction programs take up to 8-weeks and typically involve in-person classes that take two hours or more. Mindfulness-based stress reduction programs, particularly in the clinical realm, have shown strong evidence in favor of its beneficial effects (Grossman et al., 2004). In comparison, app-based mindfulness training has sparsely been studied within the academic literature–in spite of its exponential mainstream popularization (Marshall et al., 2020).

When considering the effects of mindfulness on prospective remembering, it was hypothesized that mindfulness would contribute most to the most attentionally demanding tasks, time-based tasks. It is largely common within prospective memory paradigms that time-based performance is worse than nontime-based performance, since time-based tasks are presumed to require more attention (Einstein et al., 1995; Khan et al., 2008; Kliegel et al., 2008; McDaniel & Einstein, 2007). Therefore, since mindfulness was expected to produce an effect by means of attention, I expected for time-based performance to be greater in the mindfulness condition compared to the vocabulary control condition. This was not the finding illustrated in my results. Time-based task performance was found to be significantly worse than nontime-based performance across both conditions. Although mindfulness training did not influence attention in a way that could produce a significant difference in time-based performance–or nontime-based performance for that matter–this finding is also parallel to the results in previous literature, where mindfulness was not found to produce a significant change in the performance of time-based or nontime-based tasks (Girardeau et al., 2020).

It is possible that the mindfulness condition did not outperform the control group in time-based or nontime-based performance due to the nature of mindfulness training. As stated above, mindfulness clearly possess qualities which make it relevant to attention, but mindfulness, at its core, is a present-moment state of being (Kabat-Zinn, 1994). Thus, perhaps it is not unusual that a present-moment awareness training fails to demonstrate a significant difference in prospective memory performance. Although mindfulness research has demonstrated an increase in time sensitivity (Droit-Volet et al., 2015), perhaps being present can also yields a state of being much like a flow state, in which individuals lose track of time in the moment. However, since the results did not reflect a worsened performance in the meditation group, it appears as though being present does not hinder performance of prospective memory tasks either. Specifically, this is interesting in the time-based tasks, which may have not been completed on time due to being caught in the present moment, but the time-based tasks could have still been completed later in the day. As for nontime-based performance, the results demonstrated a small difference in favor of the meditation condition, which may imply that being caught in the moment is not affecting the tasks without a time constraint.

Additionally, it was important that time-based tasks were found to be more difficult than nontime-based tasks. Specifically, being able to demonstrate the effects of greater difficulty for time-based tasks shows an empirical distinction in the task types. Moreover, this finding lends itself to the validity of the prospective memory paradigm used in this study. In other words, the prospective memory paradigm, although novel and naturalistic, was able to reproduce a relevant distinction between task types that increases the internal validity of the design.

In the present study, trait mindfulness was also not predictive of any variation of prospective memory performance (e.g., time-based, nontime-based, and total). This finding is contrary to the study conducted by Girardeau et al. (2020), where the researchers find that the Describing trait in the FFMQ was predictive of time-based performance. This study failed to replicate this finding; however, it is important to note that there were differences in experimental design and prospective memory tasks between the two studies. Moreover, research looking at conflict monitoring has shown that even when placed under 8-weeks of mindfulness training, meditation naïve individuals are not able to reap enough benefit to outperform individuals with prior mindfulness experience (Jha et al., 2007). This example is of particular importance since conflict monitoring is relevant to the prioritization and completion of tasks.

Despite the regression model being non-significant and the FFMQ factors being unable to predict performance, there were a few significant correlations between performance and FFMQ traits. There was a persistent and significant correlation between the Nonreactivity FFMQ score and nontime-based performance as well as total prospective memory performance. Although the Nonreactivity trait is more consistent with limiting reaction to emotions (Baer et al., 2004), this inhibitory behavior may be closely related to cognitive inhibition. Since cognitive inhibition has been found to be correlated with prospective memory (Bisiacchi et al., 2009; Schnitzspahn et al., 2013), the relationship between Nonreactivity and prospective memory performance may be due to a similar inhibitory behavior. These findings do not suggest a causal, predictive relationship between prospective memory performance and trait mindfulness; however, the significant correlations found in this study point towards a potential relationship between aspects of trait mindfulness and successful completion of academic prospective memory tasks. With the accruement of more participants, it is also likely that more aspects of trait mindfulness, such as acting with awareness, may become a significant correlation.

Limitations and Future Directions

There are several limitations within this study. To begin, this study possessed a lack of power to find an effect between conditions. As stated in Chapter II, the sample used for this study was only 52 participants, and 98 participants were needed to have enough power to find a significant between-participants main effect. Although the *trends* in the data did not appear to begin supporting my hypothesis for better performance in the meditation group compared to the control, it is important to have enough power to be able to properly detect a difference between groups. It is possible that a surprising effect, such as better nontime-based performance in the meditation group could have been found with enough power. Additionally, given that this study was conducted as a field experiment, there are limitations that naturally accrue with this type of design. In particular, it was not possible to ensure that the participants abided by the meditation requirement of this study. Although we asked for picture proof of the completion of their meditation, it is impossible to know whether or not the participants actually sat and practiced or if they jumped to the end of the recording and then took a screenshot. Future studies can improve upon this limitation by employing a better verification system such as tracking website or app usage. For instance, mindfulness researchers have used an audio/video hosting website (https://wistia.com/) that requires participants to log on to listen to meditations, while allowing the researchers to track when the participants completed their meditations (Basso et al., 2019). Another limitation includes the lack of distinction between time-based tasks. The present study attempted to include task parameters that enhanced the naturalistic tasks design to meet the true nature of an academic task by being inclusive to early task submissions. By accepting time-based tasks submitted early and on the right day, I accommodated for those who submitted earlier than their time intention instead of punishing their early submission by coding it as a failure. However, what was not accounted for was late submissions. In this study, I did not distinguish amongst the small variations between a submission that was two minutes late vs a submission that was five hours late. Future research can consider making this distinction more nuanced to account for the submission that are only short off the mark.

Another limitation of the paradigm used in this study included being unable to account for the legitimacy of the academic tasks between and within participants. In this study, participants were allowed to come up with 10 self-concordant academic tasks. It is arguably very important to allow participants to come up with their own task both to increase the external validity of the design as well as to promote the completion of the tasks. Students should have felt inclined to complete these tasks, since they were likely tasks that they intended on doing regardless. Although I did not expect for students to come up with tasks they did not intend to complete, it is impossible to know whether these were tasks the participants were making up solely for the purpose of coming up with a task. For some students, it was easy to come up with 10 academic tasks; others struggled to reach 10 tasks. Therefore, although not expected, it is possible that some tasks were never likely to be completed.

Finally, this study employed an active control group in order to create a rigorous comparison between experimental and control group. An app-based task was randomly assigned to the active control (vocabulary levels) and the experimental group (meditations). Although this allowed for a fair and even comparison between groups, using an active control instead of a waitlist control forces there to be more difficulty in finding an effect between conditions. This is particularly important in our study, since the app-based tasks used by both conditions unavoidably served as reminders to complete their academic tasks. For instance, remembering to complete the app-based task could have reminded the student to complete their academic task, or submitting evidence of their completed app-based task could have also reminded them to submit evidence for their academic task.

Conclusion

In this study, the relationship between prospective memory and mindfulness was explored. Compared to an active control group, students who participated in app-based mindfulness meditation were only slightly better at completing academic tasks over the course of five days. However, this difference was not statistically significant. Significant differences in performance between groups were not observed across time-based or nontime-based tasks. Although this was in opposition to hypotheses one and three of this study, this result was consistent with the only two studies that have explored this relationship (Girardeau et al., 2020; Wang et al., 2012). Moreover, trait mindfulness was not found to be predictive of prospective memory performance. However, aspects of trait mindfulness were found to be correlated with performance. This result was in partial support of the fourth hypothesis in this study as well as previous literature (Girardeau et al., 2020). In support of hypothesis two, I did find that time-based tasks were significantly more difficult than nontime-based tasks across conditions. This is an important finding with implications for the academic setting, as most academic tasks are time-based by nature. Seeing as time-based tasks are more difficult, it is valuable to consider the potential benefits of nontime-based or event-based academic tasks.

Although null results were found in this study, these findings nourish the literature by opposing the vast majority of significant findings in favor of the publication bias. The current results provide further evidence for the lack of significant impact on prospective memory performance from mindfulness training. Specifically, the mindfulness training condition in this study did not outperform the control condition, but mindfulness training did not worsen performance either. In other words, mindfulness training, which produces a state of present-moment awareness, did not help prospective memory performance, but mindfulness did not hurt performance. This is still an important finding in that individuals are able to practice mindfulness, reap its mental health benefits (Grossman et al., 2004), and still remember to complete academic tasks at the level of those who are not practicing mindfulness. It is possible that mindfulness training is positively changing other variables, while simultaneously not harming prospective memory performance.

Finally, this study also employed a naturalistic paradigm to account for the lack thereof when exploring the relationship between mindfulness and prospective memory. Additionally, five days of app-based meditation was chosen as the mindfulness training method to account for the dosage and delivery differences in prior research. With these alterations in mind, the results of this study supplement the literature and suggest that mindfulness does not significantly effect prospective memory but that aspects of trait mindfulness may be related to prospective memory performance.

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APPENDIX A

IRB APPROVAL LETTER

THE UNIVERSITY OF TENNESSEE
CHATTANOOGA

Institutional Review Board
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TO: Christopher Nuno
Dr. Jill Shelton
IRB # 21-074

FROM: David Deardorff, Interim Director of Research Integrity
Dr. Susan Davidson, IRB Committee Chair

DATE: 10/26/2021

SUBJECT: IRB #21-074: Being Present for the Future: Exploring Mindfulness and Prospective Memory

The University of Tennessee at Chattanooga Institutional Review Board has reviewed and approved the following changes for the IRB protocol listed above:

- Investigators Morgan Robinson, Anna Pusser, and Christian Ishak will be added to the project.
- The survey form submission method, number of required meditations, exclusion criteria, and number of SONA credits will be changed.
- The informed consent form will be updated to reflect these changes.
- The participant pool will be expanded to Dalton State College.

Please keep in mind that all research must be conducted according to the proposal submitted to the UTC IRB. If changes to the approved protocol occur, a revised protocol must be reviewed and approved by the IRB before implementation. For any proposed changes in your research protocol, please submit an Application for Changes, Annual Review, or Project Termination/Completion form to the UTC IRB. Please bear in mind that significant changes could result in having to develop a new application for submission and approval. Your protocol will be automatically closed at the end of the proposed research period unless a change request application is submitted. No research may take place under a closed or expired protocol.

A goal of the IRB is to prevent negative occurrences during any research study. However, despite our best intent, unforeseen circumstances or events may arise during the research. If an unexpected situation or adverse event happens during your investigation, please notify the UTC IRB as soon as possible. Once notified, we will ask for a complete explanation of the event and your response. Other

VITA

Chris Nuño was born in Peoria, Illinois to Ignacio and Luz Maria Nuño. He is the middle of three siblings, with one younger brother, Johnathon, and one older half-sister, Michel. Chris graduated from Coahulla Creek High School, in Dalton, Georgia. After graduation, Chris attended Dalton State College where he studied Psychology. During his senior year, his interest in research piqued, and he conducted animal behavior research, which later led to the development of Dalton State College's first Psychology lab. In November of 2018, Chris attended the Psychonomic Society's annual conference. He completed his Bachelor of Science degree in Psychology in December of 2019. Afterwards, Chris went on to conduct research while earning his Master of Science in Psychological Science at the University of Tennessee at Chattanooga. During his time at the University of Tennessee at Chattanooga, Chris worked as a graduate assistant in the Department of Education, managed the Cognitive Aging, Learning, and Memory Lab, and taught an undergraduate Psychology course. Chris graduated with a Master of Science degree in Psychology in May of 2022, and he plans to continue his education by pursuing a Ph.D. in Psychology.