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Reappraisal and savoring as mediators of the effect of informal mindfulness practice on well-being

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I hereby declare that this Master's thesis is my original work
and it has been written by me in its entirety.
I have duly acknowledged all the sources of information
which have been used in this thesis.

This Master's thesis has also not been submitted for any degree
in any university previously.

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Tan Yan Qiang

25 June 2019

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Tan Yan Qiang

Abstract

Although extensive research has been conducted on the effects of mindfulness-based interventions (MBIs), the processes through which MBIs affects well-being are still unclear. Furthermore, most of the current mindfulness research has focused on formal mindfulness practice. I aim to contribute to the field by studying the effects of informal mindfulness practice delivered through a mobile application in a two-week experience sampling study. Well-being was examined at three levels: immediately after completing an informal mindfulness exercise, at the end-of-the-day, and retrospective assessments of the two-week intervention period. I examined two possible mediators of the effect of the MBI on well-being: reappraisal and savoring. I also tested optimism as a moderator that may explain why people may benefit in varying degrees from mindfulness practice. The MBI did not have an effect on immediate and retrospective well-being but did affect end-of-day well-being. The MBI had no effect on end-of-day and retrospective reappraisal and savoring. Optimism did not moderate the relationship between MBI and

emotion regulation. Exploratory analyses showed that the MBI only increased state mindfulness for those with prior meditation experience, and that state mindfulness had effects on immediate and end-of-day well-being. At the retrospective level, reappraisal and savoring were found to mediate the relationship between the state mindfulness and mood, meaning, and stress.

Table of Contents

List of Tables

List of Figures

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Extensive research on the benefits of mindfulness has been conducted, and some of these studies include the effect of mindfulness practice on gratitude (Rothaupt & Morgan, 2007), decreased rumination (Chambers, Lo, & Allen, 2008), increased memory (Jha, Stanley, Kiyonaga, Wong, & Gelfand, 2010), increased focus (Moore & Malinowski, 2009), as well as greater emotional stability (Ortner, Kilner, & Zelazo, 2007). In addition to the above effects, several studies have shown that mindfulness-based interventions (MBIs) increase well-being (Brown & Ryan, 2003; Carmody & Baer, 2008; Hollis-Walker & Colosimo, 2011; Kong, Wang, & Zhao, 2014; Rasmussen & Pidgeon, 2011). Although the effects of MBIs on well-being have been documented in numerous studies, there is still a lack of understanding on the exact processes through which mindfulness improves well-being. This research aims to contribute to the existing literature on mindfulness by proposing mechanisms through which MBIs—in particular, informal mindfulness practices—impact well-being as well as a potential moderator of these processes.

Mindfulness

Linehan (1993) defined mindfulness as comprising of two sets of skills, namely "what" skills, which consist of observing, describing, and participating, and "how" skills, which are being nonjudgmental, one-mindful, and effective. Similarly, Segal, Williams, and Teasdale (2002) define mindfulness as the observation of present-moment experience with acceptance, nonjudgment, and also nonreactivity towards such experience. Brown and Ryan (2003) focus on the idea of observing as they defined mindfulness as paying attention to, and being aware of what is occuring in the

present. Although many definitions of mindfulness exist, I adopt the operational definition of mindfulness as the quality of awareness or consciousness that arises through purposefully attending to the experience of the present moment in an accepting and non-judgmental way (Kabat-Zinn, 1994).

Several measures of mindfulness have been created in the past two decades, and each scale measures different aspects of mindfulness as highlighted by the definitions provided above. One example is the Freiburg Mindfulness Inventory (FMI), which aims to measure the nonjudgmental observation of the present moment in participants, and openness to negative experiences (Buchheld, Grossman, & Walach, 2001). Some items include "I see my mistakes and difficulties without judging them" and "I watch my feelings without getting lost in them". Other scales measure other aspects of mindfulness, such as the Mindful Attention Awareness Scale (MAAS), which measures the tendency to pay attention to and be aware of present-moment experiences (Brown & Ryan, 2003).

In this project, I use the Five Facet Mindfulness Questionnaire (FFMQ; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006) which was derived through a factor analysis of responses obtained from participants who completed a battery of mindfulness questionnaires comprising of the FMI, MAAS, Kentucky Inventory of Mindfuless Skills (Baer, Smith, & Allen, 2004), Cognitive and Affective Mindfulness Scale (Feldman, Hayes, Kumar, & Greeson, 2004), and the Mindfulness Questionnaire (Chadwick, Hember, Mead, Lilley, & Dagnan, 2005). An exploratory factor analysis revealed five distinct factors: describing, nonjudging of inner experience, nonreactivity to

inner experience, observing, and acting with awareness. Describing refers to the ability to identify and articulate one's experiences. Nonjudging of inner experience refers to taking a nonevaluative stance toward one's cognitions and emotions. To be nonjudging is to avoid having self-critical or judging attitudes about our internal thoughts and emotions. Nonreactivity to inner experience is the tendency to allow thoughts and feelings to come and go, without getting carried away by them or caught up in them. Observing includes noticing or attending to internal and external stimuli, such as sensations, emotions, cognitions, smells, sounds, and sights. Acting with awareness includes attending to the activities of the moment and can be contrasted with automatic pilot, or behaving mechanically, without awareness of one's actions. Although both observing and acting with awareness emphasize attention, observing can include passive observation and a broadening of one's awareness to notice perceptions and sensations. On the other hand, acting with awareness involves focused attention on what one is doing, thus implying that attention is directed at one's experience in a particular activity.

It is possible that different mindfulness exercises vary in how they affect different components of mindfulness. For example, breathing exercises might affect the acting with awareness component, as it trains one to focus attention on the sensation of breathing, without being distracted by other sensations, thoughts, or feelings. A mindful eating exercise might affect both the acting with awareness component as well as the observation component, as the practitioner has to observe the details of the food, before mindfully eating and observing the taste, texture, and smell of the food. Lastly, a gratitude exercise or a loving-kindness exercise might involve nonjudging of one's own

attitudes or beliefs towards other people, thus influencing the nonjudging component of mindfulness. By strengthening these components of mindfulness, practitioners might experience greater well-being. To date it is not clear whether certain components of mindfulness are more closely associated with well-being than other components. As a first step, however, it seems important to understand whether an MBI enhances all components or only a few. For this reason, the components of mindfulness identified in the FFMQ will be assessed in this study.

Effects of Mindfulness Practice on Well-Being

Several studies have found correlations between mindfulness and different aspects of well-being. For example, trait mindfulness was found to be related to higher levels of life satisfaction (Brown & Ryan, 2003; Kong, Wang, & Zhao, 2014), optimism (Brown & Ryan, 2003), self-esteem (Brown & Ryan, 2003; Rasmussen & Pidgeon, 2011), perceived stress (Carmody & Baer, 2008), self-compassion (Hollis-Walker & Colosimo, 2011), and a composite of psychological well-being consisting of self-acceptance, positive relations with others, autonomy, environmental mastery, purpose in life, and personal growth (Carmody & Baer, 2008; Hollis-Walker & Colosimo, 2011).

In randomized controlled trials, MBIs have been shown to affect various aspects of well-being, such as reducing stress (Astin, 1997; Baer, 2003; Bränström, Kvillemo, Brandberg, & Moskowitz, 2010; Chiesa & Serretti, 2009; Grossman, Niemann, Schmidt, & Walach, 2004; Oman, Shapiro, Thoresen, Plante, & Flinders, 2008; Weinstein, Brown, & Ryan, 2009), reducing symptoms of depression (Anderson, Lau, Segal, & Bishop,

2007; Grossman, et al., 2010; Koszycki, Benger, Shlik, & Bradwejn, 2007; Radford, Crane, Eames, Gold, & Owens, 2012; Weinstein, Brown, & Ryan, 2009), reducing anxiety (Anderson, et al., 2007; Radford, Crane, Eames, Gold, & Owens, 2012; Shapiro, Schwartz, & Bonner, 1998), increasing life satisfaction (Weinstein, et al., 2009), and decreasing rumination (Anderson, et al., 2007; Jain, et al., 2007; Radford, et al., 2012).

However, nearly all studies to date focus on formal mindfulness practice, which involve exercises such as body scan meditation, sitting meditation, and walking meditation. In formal practice, participants are guided in both the nature and content of the practice (e.g. about attention, attitude, and posture) for a specific period of time (Hawley, et al., 2014). Formal mindfulness practice can consist of brief sessions of daily meditation practice, or as part of an intensive retreat where participants practice formal sitting and walking meditation for up to eight hours per session, with each retreat lasting weeks, months, or longer (Shapiro & Carlson, 2009, pp. 12-13).

In contrast, informal practices require participants to bring a mindful awareness to their daily routine experiences, such as by purposefully having an open, discerning, and accepting attention to whatever task one is engaged in. Informal practice is less structured than formal practice, and do not have a set length of time (Hawley, et al., 2014). Some examples of informal practice might include reading, eating, or paying attention to one's surroundings. Essentially, "the purpose of the informal practice is to generalize to everyday life what is learned during the formal practice" (Shapiro & Carlson, 2009, p. 13).

One important reason for studying informal mindfulness practices is that they may be done in a wider range of settings and so there is a potential for the effects to carry over and transfer into everyday life. Furthermore, formal practices like sitting meditation and body scan meditation often require set locations for practitioners to carry out their meditation, and sufficient time to complete the meditation session. Lastly, formal training (e.g., MBSR courses) require a fixed schedule that may require participants to accommodate their schedule to the period of training. Thus, given the hectic schedule of many people in the present day, formal mindfulness practice might seem too difficult or require too many lifestyle changes to accommodate. Instead, these people might consider picking up informal mindfulness practices which may be more convenient, requiring shorter durations and not needing a fixed location to be carried out in.

Many studies have concluded that MBIs can significantly reduce stress (Astin, 1997; Baer, 2003; Bränström, Kvillemo, Brandberg, & Moskowitz, 2010; Chiesa & Serretti, 2009; Grossman, Niemann, Schmidt, & Walach, 2004; Oman, Shapiro, Thoresen, Plante, & Flinders, 2008; Weinstein, Brown, & Ryan, 2009), symptoms of depression (Anderson, Lau, Segal, & Bishop, 2007; Grossman, et al., 2010; Koszycki, Benger, Shlik, & Bradwejn, 2007; Weinstein, Brown, & Ryan, 2009), and anxiety (Anderson, et al., 2007; Shapiro, Schwartz, & Bonner, 1998). Although past studies on MBIs have focused on formal practice, I expect informal practice to have similar effects on well-being as both practices are intended to improve mindfulness more generally, which is associated with well-being (Brown & Ryan, 2003; Carmody & Baer, 2008).

H1: Mindfulness will increase well-being.

Although many studies have found effects of MBIs on well-being, not all studies have observed improvements in well-being. Some reasons for this include problems defining mindfulness, and the lack of rigor in current mindfulness research (Davidson & Dahl, 2018; Goldberg, et al., 2017; Goldberg, et al., 2018; Van Dam, et al., 2018). I propose that one way to better understand the effect of MBIs on well-being is to determine how MBIs affect different components of mindfulness, and to identify mediators and moderators of the relationship between MBIs and well-being. The study described in this paper utilizes an experience sampling method to study the short-term effects of brief mindfulness exercises, delivered through a mobile application.

Mediators of Mindfulness

At present, several studies have examined proposed mediators of the effect of mindfulness on well-being (Gu, Strauss, Bond, & Cavanagh, 2015). For example, MBIs such as MBCT theoretically aim to reduce recurrence of depression by increasing awareness of and disengagement from repetitive negative cognitions about depressive symptoms (Segal, Williams, & Teasdale, 2002). Consistent with this, change in cognitive distortions were found to mediate the effects of mindfulness meditation on anxiety, negative affect, and hope (Sears & Kraus, 2009). In other words, after going through the meditation intervention, decrease in cognitive distortions predicted decreased negative affect and anxiety, and increased hope. However, there needs to be more research on the mediators of MBIs and mindfulness in general (Shapiro

& Carlson, 2009). One explanation for why some studies have found no significant change in MBI participants might be that the key mechanisms needed to enhance well-being were not engaged in these studies, thus no effect of mindfulness was detected. This paper specifically examines whether positive reappraisal, and savoring mediate the relationship between mindfulness and well-being.

Positive Reappraisal as a Mediator

Positive reappraisal is defined as the attempt to see the good aspects of negative situations, and to look on the positive side of things in general (Helgeson, Reynolds, & Tomich, 2006). For example, some people who go through traumatic events such as serving in war, or surviving a heart attack, or cancer, are able to identify positive ways their lives have changed as a result of these events. Based on a meta-analysis conducted by Helgeson, Reynolds, and Tomich (2006), positive reappraisal was found to be related to more positive well-being, and less depression, but also more intrusive-avoidant thoughts about the stressor. However, Helgeson et al. also found that positive reappraisal was unrelated to global distress (i.e., negative affect, overall mood), subjective physical health (i.e., physical functioning, participants' rating of physical health), anxiety, and quality of life (i.e., measures that included aspects of both physical and mental health). In addition, Aldao and Nolen-Hoeksema (2010) found that positive reappraisal was negatively correlated with rumination, symptoms of depression, anxiety, and symptoms of eating disorders. Cross-sectional studies have also shown that positive reappraisal statistically mediated the relationship between mindfulness and various outcomes, such as alcohol and drug cravings (Garland, Roberts-Lewis,

Kelley, Tronnier, & Hanley, 2014), depression (Desrosiers, Vine, Klemanski, & Nolen-Hoeksema, 2013), burnout (Gerzina & Porfeli, 2012), and stress (Garland, Gaylord, & Fredrickson, 2011).

I hypothesize that mindfulness may increase the mindful practitioner's tendency to carry out positive reappraisal, and that positive reappraisal is one mediator of the relationship between mindfulness and well-being. Citing the Mindful Coping Model (Garland, Gaylord, & Fredrickson, 2011), Hanley and Garland (2014) propose that mindfulness facilitates decentering, which helps disrupt negative automatic thought processes, and broaden attention to increase the information available to the individual. This expanded data set increases psychological flexibility and the likelihood of carrying out positive reappraisal. Across five separate studies, Hanley and Garland (2014) found that mindfulness (measured with the FFMQ) and positive reappraisal were significantly positively correlated.

Furthermore, several quasi- and true experimental studies suggest that training in mindfulness may increase positive reappraisal (Bormann & Carrico, 2009; Huston, Garland, & Farb, 2011; Rayan & Ahmad, 2016). As further evidence suggesting that positive reappraisal mediates the relationship between mindfulness and well-being, Garland, Gaylord, and Fredrickson (2011) found that positive reappraisal was a signficant mediator of the relationship between mindfulness (measured with the FFMQ) and perceived stress for participants who went through a Mindfulness-Based Stress and Pain Management course. By bringing mindfulness into the context of daily experience, informal practice should similarly facilitate positive appraisal. For example, it could be that greater attention and awareness of people and

contexts makes it easier for practitioners to consider alternative explanations for negative events that are less threatening or stressful.

H2: The effect of mindfulness on well-being will be mediated by positive reappraisal.

Savoring as a Mediator

Savoring is defined as being able to actively regulate positive feelings by attending to and appreciating enjoyable life events (Bryant, 1989). Savoring has three temporal components: anticipating future positive events, reminiscing about past positive events, and enjoying or savoring events in the present (Bryant, 2003). Bryant and Veroff (2007) proposed that savoring can increase happiness by altering the emotional impact of events through behavioral or cognitive responses. For instance, Jose, Lim, and Bryant (2012) found that momentary savoring was a statistically significant mediator of the relationship between positive daily events and happy mood. In addition, it was found that individuals who tend to savor positive events were happier than individuals who did not savor positive events (Jose, Lim, & Bryant, 2012).

I propose that mindfulness training may increase the tendency for individuals to savor positive events, which in turn leads to an increase in well-being. In other words, savoring mediates the relationship between mindfulness practice and well-being. Although there has been little to no research examining the relationship between mindfulness and savoring, the two concepts are related as mindfulness involves being aware of present moment experiences, while savoring involves attention to the positive aspects of these experiences (Beaumont, 2011; Bryant & Veroff, 2007). Since savoring the

present moment (momentary savoring) requires one to be attentive to one's experience, logically, mindfulness can be considered a pre-requisite for momentary savoring to occur. Similarly, if a person is distracted, they are unlikely to be able to savor their present moment experience, because they are not paying attention to what is occuring. As evidence of the link between mindfulness and savoring, Beaumont (2011) found that savoring beliefs were positively correlated with mindfulness scores.

One key difference between savoring and mindfulness is that awareness of the present moment (i.e., being mindful) does not necessarily entail enjoyment or savoring. In contrast, savoring involves regulating and extending the positive aspects of present moment experiences (Beaumont, 2011). For example, one mindfulness exercise consists of eating a raisin. This exercise involves careful observation of a raisin, such as through the various senses of sight, taste, and smell. Although participants are aware of the sensations of the raisin in their mouth, this awareness may not enhance enjoyment for those who do not like raisins. Instead, mindfully eating the raisin might make such individuals more aware of their dislike of raisins rather than help them savor the experience.

Similar to the raisin exercise, informal practices may encourage attention to certain kinds of "consumption activities" often with instructions to slow down the experience to allow practitioners to notice how they are experiencing these activities or objects. This can include eating, drinking, even wearing certain clothes. However, *unlike* the raisin exercise, people often select consumption activities based on their own preferences or past enjoyment. Given that, it is more plausible that increased mindfulness will

enhance the enjoyment of these experiences (savoring), which in turn may increase well-being.

H3: The effect of mindfulness on well-being will be mediated by savoring.

Optimism as a Moderator

In addition to the mediators discussed above, it is possible that the effects of MBIs may also depend on individual characteristics and personality traits. These individual differences may moderate the effectiveness of MBIs. For example, compared with individuals who are low on neuroticism, Nyklíček and Irrmischer (2017) found that those high on neuroticism experienced a smaller decrease in anxiety after going through an MBSR course, but a larger decrease at a follow up period three months after the course.

Revisiting the definition of mindfulness, it is the quality of awareness or consciousness that arises through purposefully attending to the experience of the present moment in an accepting and non-judgmental way (Kabat-Zinn, 1994). From this definition, it is clear that mindfulness or a mindful state is not inherently positive or negative. Thus, it is possible that mindfulness may not always foster positive reappraisal or savoring, since it is a neutral state of mind. However, individuals may differ in their tendency to focus on positive stimuli or information. This may explain why two different people in the same situation might react differently, although both of them may have practiced mindfulness. As an analogy, the tendency to focus on positive information might be likened to riding a bicycle. When two different people are brought to

a bicycle (i.e. the neutral state of mindfulness), they may or may not ride it to the same location (i.e., engage in reappraisal or savoring). Where they go may depend on their inclination to see and do certain things (e.g., tendency to focus on positive stimuli or information). Thus, an individual difference that explains why people differ in their tendency to focus on positive information might clarify the relationship of mindfulness with positive reappraisal and savoring. One such individual difference could be optimism.

Optimism is a personality trait that is typified by an expectancy of positive outcomes in general (Carver, Scheier, & Segerstrom, 2010). As theorized previously, optimism is a predisposition or tendency to focus on positive information in the environment. In a cross-sectional study, optimism was found to be significantly positively correlated with attention to positive information, and significantly negatively correlated to attention to negative information (Noguchi, Gohm, & Dalsky, 2006). Experimental studies have also shown that optimistic individuals are more likely to focus on positive information than negative information than pessismistic individuals. Isaacowitz (2005) tracked the eye movements of college students and found that optimists chose to avoid negative images, while pessimists fixated more on negative images. Using the emotional Stroop task, Segerstrom (2001) found that optimism was associated with a bias for positive stimuli compared to negative stimuli. Yeung, Ho, and Mak (2015) found that hope (a construct closely related to optimism) was significantly positively correlated with both cognitive reappraisal and attention to positive information, but not significantly related to attention to negative information. In a longitudinal diary study, Snyder et al. (1996) found that participants who reported higher

daily hope (related to optimism) also reported more positive reappraisals of daily events than participants with lower levels of daily hope. Based on the evidence, it seems likely that optimism is related to a focus on positive aspects of a situation. This may facilitate the processes of savoring which requires the individual to attend to the positive aspects of one's experiences (Isaacowitz, 2005; Noguchi, Gohm, & Dalsky, 2006; Segerstrom, 2001).

The tendency of optimists to focus on positive information may even apply during negative experiences (Tennen & Affleck, 1999). Research suggests that optimism is related to benefit finding (Davis, Nolen-Hoeksema, & Larson, 1998; Rini, et al., 2004), which refers to a tendency to find positive consequences arising from a stressful event (Slattery, McMahon, & Gallagher, 2017). Research has shown that a positive relationship exists between optimism and benefit finding (Affleck, Tennen, & Rowe, 1991; Gardner, et al., 2017; Rini, et al., 2004). For example, Rini et al. (2004) found that dispositional optimism was the best predictor of benefit finding in mothers of children going through stem cell transplantation. In addition, several studies have examined the relationship between optimism and positive reappraisal (Bryant & Cvengros, 2004; Carver, et al., 1993; Fontaine, Manstead, & Wagner, 1993; Helgeson, Reynolds, & Tomich, 2006). In a study of early stage breast cancer patients, Carver et al. (1993) reported that dispositional optimism significantly correlated with positive reframing, $r(59) = .41$, $p < .01$. From a separate cross-sectional study, Fontaine, Manstead, and Wagner (1993) found that optimism was positively correlated with positive reinterpretation (sample item: *I look for something good in what is happening*), $r(420) = .17$, $p < .01$. Optimism was also positively correlated

with positive reappraisal in a meta-analysis conducted by Helgeson, Reynolds, and Tomich (2006). Across eleven studies, optimism was related to benefit finding with an effect size of $r = .27$, $p < .001$, 95% CI [0.24, 0.31]. Thus, research seems to suggest that optimistic people tend to focus on positive information and carry out positive reappraisal.

The above research seems to suggest only a main effect of optimism on savoring and reappraisal. That is, if optimistic people already tend to savor and reappraise their experiences, what role can mindfulness play in these processes? First, it is important to note that the reported relationships of optimism with savoring and reappraisal seem to be of a small to medium effect size. This in turn implies that optimistic people are more likely to savor and positively reappraise a situation, but this may not occur all the time. Other factors may influence these tendencies. Mindfulness may be one such factor. Greater awareness (mindfulness) combined with greater attention to positive information (optimism) may enhance the ability to savor positive experiences and reappraise negative experiences. However, a potential issue is that optimistic people may already be highly mindful. Contrary to this, past research has found that optimism correlates modestly (r between 0.2 to 0.4) with the FFMQ subscales (Malinowski & Lim, 2015) and the MAAS (Brown & Ryan, 2003; Smith, et al., 2011). These correlation coefficients suggest that although they are related, mindfulness and optimism are distinct constructs, and that optimistic people may vary in how mindful they are. Mindfulness varies not only as a trait but also as a state (Brown & Ryan, 2003). Therefore, like a plant that needs the right conditions to sprout, conditions have to be right for optimistic people to carry out reappraisal. Mindfulness may help to

create the conditions required for savoring and reappraisal to occur—and optimistic people may be better prepared to take advantage of such conditions.

To sum up the argument for optimism as a moderator, this paper proposes that individuals who are more optimistic may benefit more from mindfulness practice compared to individuals who are less optimistic. Theoretically speaking, mindfulness practice is a way to help increase a practitioner's focus and awareness of their environment. If optimistic people practice mindfulness, they might become more aware of the positive aspects in the situations they are in due to their tendency to focus on positive information. Thus, this may increase their well-being, as being aware of more positive information facilitates the processes of positive reappraisal and savoring.

I hypothesize that the effects of mindfulness on savoring and reappraisal will be moderated by optimism, such that optimistic people who go through mindfulness training will savor or reappraise more than optimistic people who do not go through mindfulness training. Pessimistic people may also become more aware of the present moment after mindfulness training, but this may not lead to a large increase in tendency to reappraise or savor. This may be due to their tendency to focus on negative information or a reduced tendency to focus on positive information (Noguchi, Gohm, & Dalsky, 2006).

> H4: The effect of mindfulness on reappraisal and savoring will be moderated by optimism.

Hypotheses

Hypothesis 1: Mindfulness will increase well-being.

Hypothesis 2: The effect of mindfulness on well-being will be mediated by positive reappraisal.

Hypothesis 3: The effect of mindfulness on well-being will be mediated by savoring.

Hypothesis 4: The effect of mindfulness on reappraisal and savoring will be moderated by optimism

Method

This experiment made use of experience sampling and involved a treatment and an active control group. The treatment group listened to guided tracks from a mindfulness application (MindFi) on their phones, while the active control group listened to relaxing music for an equivalent duration. Before the start of the intervention, all participants completed a series of baseline measures described in detail below. Participants completed a survey before and after listening to each track. At the end of each day, participants completed another set of measures. The intervention lasted two weeks (14 days), after which participants returned to the lab and completed a final survey.

Participants

Participants for this study were undergraduate SMU students recruited from the SMU subject pool. They were given a mix of research credit and cash as compensation for their participation. Only participants using iPhones took part in the study as the application is only available on the iOS platform. A total of 187 participants took part in the study and completed the Phase 1 survey. Twenty-eight participants dropped out , leaving 159 participants who

completed the study. I carried out an independent samples t-test and found that there were no significant differences in meaning, optimism, stress, affect balance, and life satisfaction between participants who completed the study and those who dropped out. Surprisingly, participants who dropped out had significantly higher levels of mindfulness (M = 123.50, SD = 17.68) than participants who completed the study (M = 116.09, SD = 15.75), $t(185) = -2.253$, $p = .025$. I carried out a chi-square test of independence to compare the frequency of dropouts between those in the control and MBI groups. There was no significant relation between dropout frequency and treatment group, $\chi^2 (1, N = 184) = .616$, $p = .433$.

There were 130 (81.8%) female participants and 29 (18.2%) male participants. Participants had a mean age of 21.62, with a standard deviation of 1.908. One hundred thirty-seven participants (86.1%) were of Chinese ethnicity, 4 (2.5%) were Indian, 2 (1.3%) were Malay, and other ethnicities reported were Filipino, Javanese, Korean, and Vietnamese. Most participants were from the school of social sciences (67 participants; 42.1%). Forty-two participants (26.4%) were from the school of business, 18 (11.3%) from the school of accountancy, 15 (9.4%) from the school of information systems, 9 (5.7%) from the school of economics, and 8 (5.0%) from the school of law. The majority of participants were in their first year (67 participants; 42.1%), with 34 (21.4%) in year two, 33 (20.8%) in year three, and 25 (15.7%) in year four and above.

Sixty-one participants (38.4%) reported prior experience with meditation, of which 19 attended a formal session led by an instructor. Some examples given by participants include breathing meditation, guided practice

via mobile applications and online sources, and yoga. Only 6 participants (3.8%) indicated that they currently still meditate. As described later, these participants were excluded from all analyses.

Baseline Survey

Trait Mindfulness. The Five-Factor Mindfulness Questionnaire (FFMQ; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006) measures five components of mindfulness: describing, nonjudging of inner experience, nonreactivity to inner experience, observing, and acting with awareness. The full scale consists of 39 items and is rated on a five-point scale (1 = *never or very rarely true*, 5 = *very often or always true*). A higher score indicates higher ability for the respective component.

Optimism. The Life Orientation Test Revised (LOT-R; Scheier, Carver, & Bridges, 1994) consists of ten items and is rated on a five-point scale (0 = *strongly disagree*, 4 = *strongly agree*). Three of the items are reverse scored and can be used as a separate measure of pessimism, three items measure optimism, and the remaining four items are fillers. The LOT-R measures optimism, and higher scores indicate higher levels of optimism.

Meaning in Life Questionnaire (Past 2-weeks). The Meaning in Life Questionnaire (MLQ; Steger, Frazier, Oishi, & Kaler, 2006) consists of ten items and is rated on a seven-point scale (1 = *absolutely untrue*, 7 = *absolutely true*). The MLQ contains two separate five-item subscales: Presence of meaning and Search for meaning. High scores indicate higher presence of meaning in life or searching for meaning in life, respectively. In this study, only the Presence of meaning subscale is used. The instructions for the MLQ

and all other well-being scales were modified to reference the past two weeks (see Procedure for more details).

Perceived Stress Scale 4 (Past 2-weeks). The Perceived Stress Scale 4 (PSS-4; Cohen & Williamson, 1988) consists of four items and is rated on a five-point scale (0 = *never*, 4 = *very often*). Higher scores indicate more perceived stress.

Scale of Positive and Negative Experiences (Past 2-weeks). The Scale of Positive and Negative Experiences (SPANE; Diener, et al., 2009) was used to measure feelings and emotions experienced over the past two weeks. The SPANE consists of twelve items and is rated on a five-point scale (1 = *very rarely or never*, 5 = *very often or always*). The SPANE produces a score for both positive feelings and negative feelings. An affect balance (AB) score was calculated for each participant by subtracting the mean score of negative affect items from the mean score of positive affect items (higher scores indicate that positive affect was experienced more often than negative affect).

Satisfaction with Life Scale (Past 2-weeks). The Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985) consists of five items and is rated on a seven-point scale (1 = *strongly disagree*, 7 = *strongly agree*). The SWLS measures global life satisfaction, and higher scores indicate higher life satisfaction.

Daily Exercise Assessment

Exercise Pretest. Before listening to the audio clips, participants rated how much they were currently experiencing several positive emotions (*Happy, Positive, Excited, Relaxed*) and negative emotions (*Sad, Negative, Nervous,*

Bored, Stressed). Both high arousal and low arousal states were assessed. All items were rated on a five-point scale (1 = *not at all*, 5 = *a great deal*).

Exercise Posttest. After listening to the audio clips, participants again rated their affect and stress using the same items in the pretest. In addition, participants completed an abbreviated FFMQ consisting of four questions that measured four of the five FFMQ components, namely Nonreactivity, Observing, Acting with awareness, and Nonjudging. The Describing component was not assessed because few MindFi tracks emphasize this aspect of mindfulness. Lastly, participants rated how difficult they found the exercise, and how distracted they were during the exercise. All the items are rated on a five-point scale (1 = *not at all*, 5 = *a great deal*).

End-Of-Day Survey

At the end of every day, participants completed an End-Of-Day survey consisting of six separate measures.

Daily Meaning. The scale measures daily meaning in life (Steger, Kashdan, & Oishi, 2008), and originally consists of two items rated on a five-point scale (1 = *not at all*, 5 = *very much so*). However, only the item "Today, how meaningful did your life feel?" was used to reduce participant burden.

Daily Satisfaction. Daily life satisfaction (Steger, Kashdan, & Oishi, 2008) was measured with one item rated on a five-point scale (1 = *not at all*, 5 = *very much so*). The item is "Today how satisfied were you with your life?"

Affect. Participants rated (1 = *not at all*, 5 = *a great deal*) how much they experienced several positive (Happy, Positive, Excited, Relaxed) and

negative (Sad, Negative, Nervous, Bored, Stressed) emotions during the past day.

Reappraisal. Participants were first asked to recall one negative event. This item is a free response question and is meant to aid participants' recall of negative events that occurred on that day. Participants were asked two questions on how much they reappraised the negative situation. Specifically, they are asked to rate (1 = *not at all*, 5 = *a great deal*) the extent to which they: 1) Thought about the event in a way that helped them stay calm, and 2) Looked for something positive in the experience.

Savoring. Participants were first asked to recall one positive event. Participants were then asked two questions on how much they savored the positive situation. Specifically, they are asked to rate (1 = *not at all*, 5 = *a great deal*) the extent to which they: 1) Tried to intensify the moment by focusing on it, and 2) Thought only about the present—got absorbed in the moment.

Procedure

In Phase 1, participants were recruited through the SMU Subject Pool, and given a choice of compensation via research credit or cash. Participants were randomly assigned to either the treatment or control condition. Participants attended a briefing on the experiment that explained the general procedures involved. Participants installed and tested the mobile application used for the study, MindFi. MindFi is a mindfulness application with audio clips containing guided instructions on informal mindfulness practice. After the briefing, participants completed the Baseline Survey which included

several measures (MLQ, PSS-4, SPANE, SWLS) designed to assess their well-being over the past two weeks. This allowed for a comparison with the post-intervention measures (which referenced the past two weeks of the intervention in Phase 2).

In Phase 2, participants were instructed to listen to the audio clips before 2pm to ensure sufficient time in the day to practice the skills learnt during the clips. Each day, participants listened to one clip via the MindFi application. Before listening to the clips, both MBI and control group participants completed the Exercise Pretest survey questions through an online Qualtrics survey link. Next, participants in the MBI group listened to guided mindfulness tracks on MindFi. Examples of these tracks include mindfully writing with a pen, or carefully observing food while eating. Participants in the active control condition listened to music tracks on MindFi that were of similar duration. After listening to the clips, both MBI and control group participants completed the Exercise Posttest. Later that day (from 10pm), participants completed the End-Of-Day survey. Participants completed the End-Of-Day survey before 2am each night. Phase 2 lasted for fourteen days.

In Phase 3, participants completed a set of post-intervention measures including the FFMQ and the well-being measures previously assessed in the Baseline Survey. Participants were debriefed on the experiment and given their respective compensation.

Results

Data Screening

Responses from Phase 1 (11 cases) and Phase 3 (2 cases) that were not associated with a valid userID were screened out. Sixty-one participants reported prior meditation experience, and those who were currently still meditating were excluded (6 cases). Qualtrics saves the start and end dates of all survey submissions in the data set; this information was also used to screen the data. For example, in Phase 2, participants were instructed to complete the posttest survey between 0600 and 1400 each day, to allow sufficient time for practice between the posttest survey and the end-of-day survey. Pretest and posttest responses submitted outside of this window were excluded. In addition, duplicate pretest and posttest responses (i.e., more than one response from the same participant on the same day) were excluded. For the posttest, responses that were submitted one day after the survey was started were excluded (e.g., started on Monday but only submitted on Tuesday). In addition, the duration between the end of the pretest survey and the start of the posttest survey was calculated for each participant. This value was compared against the duration of the audio clip and was meant to gauge whether participants were actually listening to the clip. We established an upper limit of 5 minutes (300 seconds) *after* the end of a clip as the maximum duration for the pre-to-post clip time. Participants whose pre-to-post clip time either exceeded this maximum duration (176 cases), or fell below the clip duration i.e., did not listen to the entire clip (64 cases), were excluded. Cases where participants were missing pretest data, but had posttest data (9 cases), and vice versa (289 cases), were excluded. Lastly, participants were sent an end-of-day

survey only if they completed a posttest survey on that day. Participants were instructed to complete the end-of-day survey from 2200 to 0300, and responses submitted outside of this window were screened out (3 cases). Duplicate end-of-day responses were also screened out (122 cases). In the end-of-day survey, participants were asked to report one negative event, and one positive event as part of the reappraisal and savoring questions respectively. When participants did not report a relevant event (e.g., "Nothing good/bad happened today"), their responses regarding reappraisal or savoring were excluded from analysis. Across the sample, participants completed 8.44 out of 14 possible days in Phase 2. This average value closely corresponds to the minimum number of 7 days required for participants to participate in the Phase 3 survey. There was no significant difference in the average number of days completed for participants in the MBI group (M = 8.76, SD = 2.82), and participants in the control group (M = 8.11, SD = 2.39); $t(151) = -1.535$, $p = .127$. MBI and control group participants also did not differ on any of the Phase 1 variables measured (i.e., trait mindfulness, life satisfaction, affect balance, perceived stress, meaning in life, and optimism; all p's > .05, Table 1).

Table 1

Results of t-tests for Phase 1 and 3 variables by Treatment Group

Outcome	Group				
	MBI		Control		
	M	SD	M	SD	t
1. Trait Mindfulness	114.177	14.981	117.257	16.414	1.213
2. Optimism	17.418	4.607	17.662	4.298	.339
3. P1 AB	3.304	6.722	2.473	6.891	-.755
4. P1 PA	20.595	3.636	19.770	4.390	-1.269
5. P1 NA	17.291	4.444	17.297	4.003	.009
6. P1 Satisfaction	22.722	5.764	20.946	6.709	-1.759
7. P1 Meaning	23.861	5.972	22.311	6.447	-1.544
8. P1 Stress	12.127	2.691	12.284	2.940	-.345
9. P3 AB	5.405	7.358	3.108	7.254	-1.943
10. P3 PA	20.620	4.192	19.338	4.421	-1.842
11. P3 NA	15.215	4.463	16.230	4.507	1.398
12. P3 Satisfaction	15.861	5.563	17.716	6.680	1.872
13. P3 Meaning	25.544	5.020	24.000	5.134	-1.881
14. P3 Stress	11.317	2.340	11.730	2.512	1.054

Note. Composite scores were created by summing responses to all items in the respective scale. The following are the possible score ranges: Trait mindfulness (39 – 195), Optimism (0 – 24), AB = Affect balance (-30 – 30), PA = Positive affect (6-30), NA = Negative affect (6-30) Satisfaction (5 – 35), Meaning (5 – 35), Stress (0 – 16).

Manipulation Check

Multilevel analysis was used to predict mindfulness from MBI treatment group (1 = MBI, 0 = control) as a manipulation check to determine if the MBI group reported higher levels of state mindfulness after each exercise. Multilevel analysis is appropriate due to the nested nature of the data (participants provided data on multiple days). After controlling for Phase 1 trait mindfulness, the MBI still significantly predicted posttest FFMQ scores, $b = 1.07$, $t(150) = 2.546$, $p = .012$. On average, MBI participants (M =

12.194) reported higher levels of state mindfulness after listening to the exercises than control participants (M = 11.270), $t(151) = -2.116$, $p = .036$, d = 0.34. End of day mindfulness was slightly higher for MBI participants (M = 11.685) than control participants (M = 11.028), although this difference was not significant $t(151) = -1.409$, $p = .161$, $d = 0.23$. Using OLS regression, the MBI significantly predicted Phase 3 trait mindfulness after controlling for trait mindfulness, $b = 5.66$, $t(149) = 3.209$, $p = .002$. However, a t-test conducted on the difference in Phase 3 mindfulness between the MBI (M = 119.59) and control group (M = 116.55) was not significant, $t(151) = -1.217$, $p = .225$. Though the t-test suggests no group difference in overall trait mindfulness in Phase 3, the regression analysis suggests that MBI participants experienced greater increases in trait mindfulness from their baseline, compared with controls.

Effect of Mindfulness on Immediate Well-Being

Table 2 shows the correlations among all measures at the immediate and end-of-day levels. Prior to correlating these variables, all scores were centered on participant means to remove between-person variation. Both pretest and posttest affect balance (AB) were associated with posttest mindfulness—though the relation was stronger with posttest AB.

Table 2

Bivariate Correlations of Immediate and End-of-Day Variables

Variable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1. Pretest AB	-													
2. Pretest PA	.863*	-												
3. Pretest NA	-.803*	-.391*	-											
4. Posttest AB	.730*	.656*	-.555*	-										
5. Posttest PA	.626*	.709*	-.304*	.865*	-									
6. Posttest NA	-.561*	-.315*	.651*	-.761*	-.322*	-								
7. Posttest Mindfl.	.131*	.142*	-.071*	.268*	.274*	-.149*	-							
8. EOD Reappraisal	.060*	.072*	-.026	.050	.076*	.003	.065*	-						
9. EOD Savoring	.109*	.117*	-.063*	.080*	.078*	-.051	.043	.204*	-					
10. EOD AB	.384*	.310*	-.337*	.352*	.279*	-.303*	.113*	.238*	.274*	-				
11. EOD PA	.344*	.334*	-.235*	.316*	.300*	-.208*	.107*	.239*	.312*	.862*	-			

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
12. EOD NA	-.292*	-.168*	.335*	-.266*	-.152*	.306*	-.079*	-.154*	-.129*	-.800*	-.385*	-		
13. EOD Satisfaction	.208*	.189*	-.158*	.199*	.188*	-.132*	.077*	.194*	.304*	.543*	.586*	-.295*	-	
14. EOD Meaning	.206*	.190*	-.152*	.210*	.199*	-.138*	.080*	.166*	.291*	.453*	.511*	-.218*	.718*	-
Mean	.185	2.33	2.15	.516	2.503	1.987	11.696	5.113	6.790	.387	2.657	2.271	3.130	3.102
SD	.754	.609	.636	.766	.641	.589	2.749	1.403	1.658	.869	.650	.594	.712	.722

Note. The following are the possible score ranges: AB = Affect balance (-4 – 4), PA = Positive affect (4-25), NA = Negative affect (5-30), Posttest Mindfulness (4 – 20), Reappraisal (2 – 10), Savoring (2 – 10), Satisfaction (1 – 5), Meaning (1 – 5). EOD = End of day.

* $p < .05$.

The effect of mindfulness on well-being will be separated into the Immediate, End-of-day, and Retrospective levels. Only H1 can be tested at the Immediate level, as H2 – H4 rely on End-of-day data. H1 predicts that mindfulness would increase well-being. Multilevel analysis was used to predict posttest affect balance (AB) scores from the treatment group, controlling for pretest AB scores.

Pretest AB significantly predicted posttest AB scores, $b = .67$, $t(128) = 25.562$, $p < .001$. However, there was no effect of the MBI on posttest AB, $b = .21$, $t(152) = 1.701$, $p = .091$. I also explored the possible interaction between the MBI and pretest affect balance by including the interaction term in a second model. The interaction between the MBI and pretest AB was significant, $b = -.13$, $t(126) = -2.514$, $p = .013$. A simple slopes analysis was carried out on the effect of the MBI at ±1SD and ±2SD on pretest AB (refer to Figure 1). When people began the session in a largely positive mood (pretest AB = +1 or +2 SDs above the mean), the MBI had no effect on posttest AB: $b_{(+1SD)} = .072$, $t(155) = .534$, $p = .594$; and $b_{(+2SD)} = -.057$, $t(152) = -.353$, $p = .725$. Instead, the MBI improved mood particularly for people who began the session in a largely negative mood (pretest AB = -1 or -2 SD's below the mean), $b_{(-1SD)} = .33$, $t(156) = 2.497$, $p = .014$; and $b_{(-2SD)} = .46$, $t(157) = 2.899$, $p = .004$.

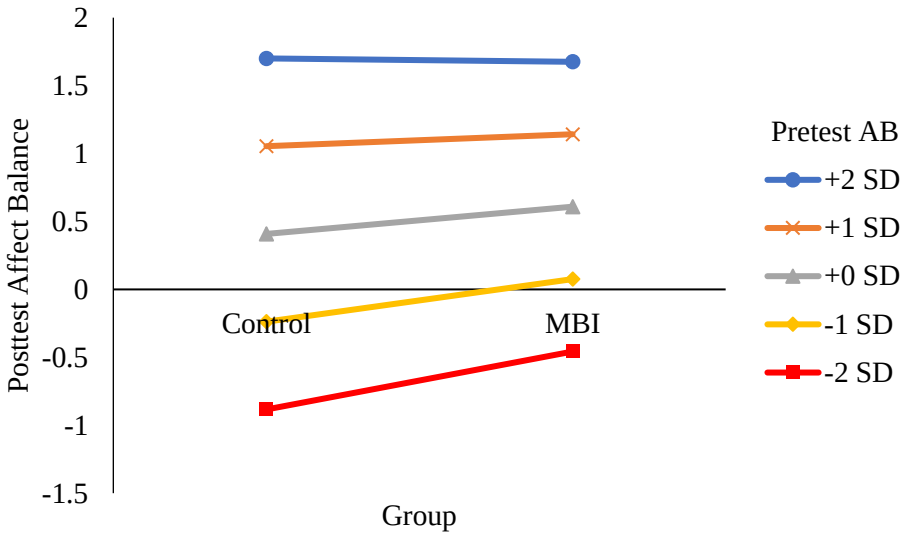

Figure 1. Posttest AB by Group and Pretest AB. Simple slopes analysis of the effect of treatment group on posttest AB at ±2SD levels of pretest AB. Only the -1SD and -2SD slopes were significant, $b_{(-1SD)}$ = .3295, $t(156)$ = 2.497, p = .014; and $b_{(-2SD)}$ = .4584, $t(157)$ = 2.899, p = .004.

The analyses were repeated for posttest positive affect (PA) and posttest negative affect (NA). The MBI did not predict posttest PA, b = .19, $t(151)$ = 1.808, p = .073, but the interaction between pretest PA and the MBI was significant, b = -.12, $t(115)$ = -2.407, p = .018. Simples slopes analysis revealed the same pattern of results as affect balance, namely that the effect of the MBI was significant for participants with lower pretest PA, $b_{(-1SD)}$ = .31, $t(145)$ = 2.551, p = .012; and $b_{(-2SD)}$ = .44, $t(134)$ = 2.785, p = .006, but not for participants with average or high levels of pretest PA, $b_{(+0SD)}$ = .19, $t(151)$ = 1.808, p = .073; $b_{(+1SD)}$ = .06, $t(146)$ = .570, p = .570; and $b_{(+2SD)}$ = -.06, $t(137)$ = -.466, p = .642. The MBI did not predict posttest NA, b = -.01, $t(151)$ = -.129, p = .897, and the interaction between pretest NA and the MBI was not significant, b = -.05, $t(142)$ = -.938, p = .350. These results suggest that the improvement in AB is due to an increase in PA rather than a decrease in NA—but only for those who were low in pretest PA.

Effect of Mindfulness on End-of-day Well-Being

At the End-of-day level, the effect of mindfulness on well-being was analyzed by examining affect balance, satisfaction, and meaning experienced during the past day. To test H1, I used multilevel analysis to predict end-of-day well-being (AB, life satisfaction, and meaning) from MBI, controlling for pretest AB scores. The interaction between the MBI and pretest AB was also included to test the moderating effect of pretest AB. The results for all models are presented in Table 3. The MBI had an effect on end-of-day life satisfaction and meaning, but not on AB, PA, and NA. There was no interaction between the MBI and pretest AB on end-of-day well-being.

Table 3

Effect of Mindfulness on End-of-day Well-Being

Model	*b*	*SE*	*p*
EOD Affect Balance			
Pretest AB	.45	.06	<.001
MBI	.11	.14	.421
MBI * PretestAB	-.06	.08	.455
EOD Positive Affect			
Pretest PA	.40	.06	< .001
MBI	.06	.11	.592
MBI * PretestPA	-.05	.08	.499
EOD Negative Affect			
Pretest NA	.42	.06	< .001
MBI	-.05	.10	.580
MBI * PretestNA	-.04	.08	.643
EOD SWLS			
Pretest AB	.22	.04	< .001
MBI	.26	.11	.022
MBI * PretestAB	-.05	.05	.344

EOD Meaning			
Pretest AB	.21	.04	< .001
MBI	.25	.12	.030
MBI * PretestAB	-.05	.05	.302

Note. AB = Affect Balance, PA = Positive Affect, NA = Negative Affect, SWLS = Satisfaction with Life Scale, EOD = End of day.

I predicted that the effect of mindfulness on well-being will be mediated by the extent to which participants positively reappraised negative events (H2) and savored positive events (H3). To test the mediation models proposed in H2 and H3, I first had to establish Path A: the effect of the MBI on the mediators (reappraisal and savoring). The MBI did not have a significant effect on either end-of-day reappraisal, or savoring, b_{REP} = -.04, t = -.180, p = .858; b_{SAV} = .01, t = .041, p = .967. Since the MBI did not predict end-of-day reappraisal, and savoring, Path A was not supported. Thus, the mediation models were not tested.

Lastly, I predicted that the effect of mindfulness on reappraisal and savoring will be moderated by optimism (H4). I tested H4 by predicting end-of-day reappraisal, and savoring from the MBI, optimism, and the interaction between the MBI and optimism, controlling for pretest AB. The results are presented in Table F. There was no main effect of the MBI, or optimism. Moreover, contrary to H4, there was no moderating effect of optimism on the relationship between MBI and reappraisal/savoring.

Table 4

Effect of Optimism on End-of-day Reappraisal and Savoring

Model	*b*	*SE*	*p*
EOD Reappraisal			
Pretest AB	.11	.06	.075
MBI	-.06	.23	.806
Optimism	-.06	.04	.108
Optimism * MBI	-.02	.05	.679
EOD Savoring			

Pretest AB	.21	.06	.001
MBI	.001	.27	.997
Optimism	-.03	.04	.502
Optimism * MBI	-.01	.06	.864

Note. AB = Affect Balance, EOD = End of day, P1 = Phase 1.

Effect of Mindfulness on Retrospective Well-Being

Table 5 shows the correlations among all variables measured at Phase 1 and 3. The correlations are at the between-person level.

Table 5

Bivariate Correlations of Phase 1 and 3 Well-being Variables

Variable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1. Trait Mindfulness	-													
2. Optimism	-.333*	-												
3. P1 AB	.432*	-.623*	-											
4. P1 PA	.316*	-.588*	.814*	-										
5. P1 NA	-.393*	.442*	-.833*	-.357*	-									
6. P1 Satisfaction	.288*	-.482*	.581*	.590*	-.372*	-								
7. P1 Meaning	.356*	-.483*	.521*	.585*	-.281*	.636*	-							
8. P1 Stress	-.484*	.577*	-.742*	-.618*	.605*	-.543*	-.497*	-						
9. P3 AB	.316*	-.508*	.684*	.585*	-.543*	.512*	.432*	-.588*	-					
10. P3 PA	.121	-.399*	.479*	.508*	-.287*	.382*	.333*	-.418*	.828*	-				
11. P3 NA	-.402*	.448*	-.659*	-.469*	.614*	-.471*	-.387*	.560*	-.841*	-.393*	-			
12. P3 Satisfaction	-.226*	.415*	-.367*	-.414*	.195*	-.623*	-.448*	.469*	-.570*	-.495*	.457*	-		

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
13. P3 Meaning	.216*	-.317*	.417*	.476*	-.217*	.528*	.678*	-.373*	.501*	.509*	-.331*	-.461*	-	
14. P3 Stress	-.273*	.361*	-.426*	-.362*	.340*	-.255*	-.248*	.551*	-.617*	-.504*	.526*	.431*	-.322*	-
Mean	115.667	17.536	2.902	20.196	17.294	21.863	23.111	12.203	4.294	20.000	15.706	16.758	24.797	11.516
SD	15.715	4.447	6.795	4.026	4.222	6.282	6.234	2.806	7.374	4.338	4.498	6.178	5.118	2.425

Note. P1 = Phase 1, P3 = Phase 3, AB = Affect Balance, PA = Positive Affect, NA = Negative Affect.

* $p < .05$.

In this study, retrospective well-being refers specifically to participants' assessment of their well-being over the past two weeks. At Phase 1, this refers to the past two weeks *before* the study; at Phase 3, the reference period was the two weeks during the study (i.e., Phase 2). To test H1 (that mindfulness would increase well-being), OLS regression was used to predict Phase 3 retrospective well-being from the MBI, Phase 1 well-being, and their interaction. The well-being variables analyzed were affect balance, life satisfaction, perceived stress, and meaning in life. All measures of well-being at Phase 3 were predicted by their levels at Phase 1. There was no main effect of the MBI, and no moderating effect of Phase 1 well-being on the relationship between MBI and Phase 3 well-being. However, the MBI had a marginally significant effect on Phase 3 AB.

Table 6

Effect of Mindfulness on Retrospective Well-being

Model	*b*	*SE*	*p*
P3 AB			
P1 AB	.74	.09	< .001
MBI	1.69	.87	.054
MBI * P1 AB	-.01	.13	.938
P3 PA			
P1 PA	.43	.10	.000
MBI	.83	.61	.173
MBI * P1 PA	.25	.15	.105
P3 NA			
P1 NA	.72	.10	.000
MBI	-1.01	.57	.079
MBI * P1 NA	-.11	.14	.409
P3 Life Satisfaction			
P1 SWLS	-.51	.08	< .001
MBI	-.78	.79	.326

MBI * P1 SWLS	-.22	.13	.086
P3 PSS			
P1 PSS	.49	.08	< .001
MBI	-.34	.33	.306
MBI * P1 PSS	-.03	.12	.816
P3 Meaning			
P1 Meaning	.53	.07	< .001
MBI	.69	.62	.264
MBI * P1 Meaning	.05	.10	.626

Note. AB = Affect Balance, PA = Positive Affect, NA = Negative Affect, SWLS = Satisfaction with Life Scale, PSS = Perceived Stress Scale, P1 = Phase 1, P3 = Phase 3.

To test H2 and H3 at the retrospective level (that reappraisal and savoring would mediate the effects of the MBI on well-being), I examined whether the MBI had an effect on average reappraisal/savoring reported across Phase 2. The MBI did not have a significant effect on either average reappraisal, b_{REP} = -.06, t = -.255, p = .799; or average savoring, b_{SAV} = .002, t = .008, p = .993. As the MBI did not have a significant effect on average reappraisal/savoring, Path A was not established. Thus, the mediation models were not tested.

Lastly, I predicted that optimism would moderate the effect of mindfulness on reappraisal and savoring in H4. I tested H4 at the retrospective level by predicting average reappraisal and savoring from the MBI, optimism, and their interaction. The results are presented in Table 7. There was no main effect of the MBI or optimism, and no moderating effect of optimism on the relationship between MBI and average reappraisal/savoring. Thus H4 was not supported.

Table 7

Effect of Mindfulness and Optimism on Average Reappraisal and Savoring

Model	*b*	*SE*	*p*
Average Reappraisal			
MBI	-.08	.23	.737

Optimism	-.06	.04	.104
Optimism * MBI	-.02	.05	.672
Average Savoring			
MBI	-.01	.27	.984
Optimism	-.03	.05	.474
Optimism * MBI	-.01	.06	.908

Exploratory Analyses: Effect of Previous Experience

After the screening procedures described in the first section of the results, a total of 159 participants remained. Out of these participants, 61 had prior experience with meditation. Of the 61 participants with prior experience, 6 were currently meditating. Of the remaining 55 participants, their last experience with meditation was 8.71 months ago on average. Eighteen of these participants reported that their prior experience involved formal meditation. After excluding the 6 participants still currently meditating, approximately 36% of the sample had prior experience with meditation. Thus, I carried out exploratory analyses to examine the effects of previous experience on the effect of the MBI.

I tested the moderating effect of prior experience on posttest mindfulness. There was no main effect of prior experience on posttest mindfulness, b = -.34, t = -.574, p = .567. However, there was a significant interaction between MBI and prior experience on posttest mindfulness, b = 2.06, t = 2.383, p = .018. A simple slopes analysis (Figure 2) revealed an MBI effect only among participants with prior experience, b = 2.47, $t(149)$ = 3.554, p = .001. For participants with no prior experience, the MBI had no effect on posttest mindfulness, b = .41, $t(148)$ = .797, p = .427.

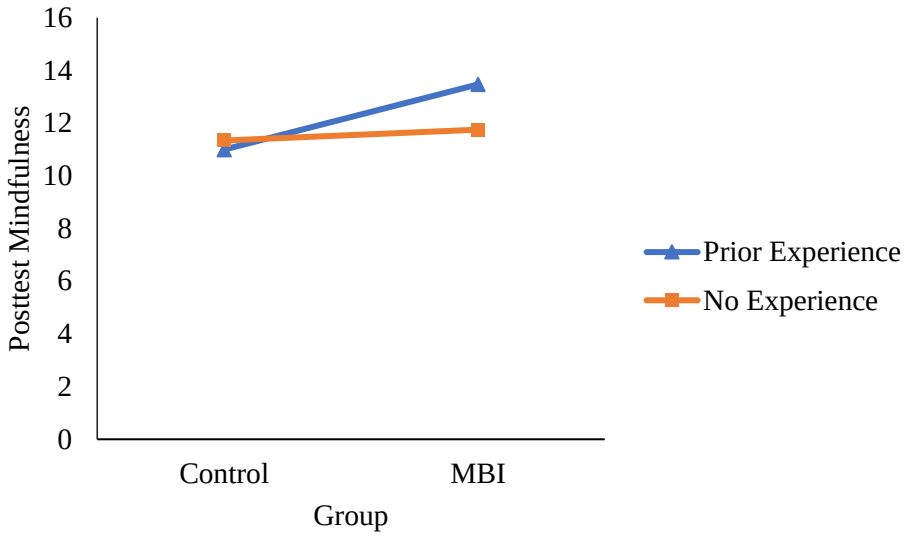

Figure 2. Posttest Mindfulness by Group and Prior Experience. Simple slopes analysis of the effect of treatment group on posttest mindfulness at 2 levels of prior experience. Only the prior experience slope was significant, $b = 2.47$, $t(149) = 3.554$, $p = .001$.

In addition, I tested the moderating effect of prior experience on the relationship between the MBI and well-being, reappraisal, and savoring at both the end-of-day and retrospective levels. Most of the interaction terms were not significant for the models tested[1].

Exploratory Analyses: Effect of Posttest Mindfulness on Immediate Well-Being

Since the MBI significantly predicted posttest mindfulness for those with previous experience, additional analyses were conducted using posttest mindfulness as a predictor of well-being. Prior to the following analyses, I tested whether previous experience moderated the effect of posttest mindfulness on well-being and emotion regulation. However, there were no moderating effects, so I ran simpler models focused on the effect of posttest mindfulness.

At the immediate level, multilevel analysis was used to predict posttest AB scores from posttest mindfulness, controlling for the MBI, trait mindfulness, and pretest AB. I controlled for trait mindfulness to determine whether posttest mindfulness had an effect above and beyond that of trait mindfulness. Posttest mindfulness predicted higher levels of

[1] The MBI*experience interaction term was significant when predicting end-of-day reappraisal, $b = -.96$, $p = .045$. A simple slopes analysis revealed that for participants with **no** prior experience, the MBI increased end-of-day reappraisal, $b = 1.62$, $p = .048$. For participants **with** prior experience, the MBI did not significantly increase end-of-day reappraisal, $b = .66$, $p = .086$.

posttest AB, b = .05, t = 5.711, p < .001, even after controlling for trait mindfulness and pretest AB. The interaction between pretest AB and posttest mindfulness was not significant, b = -.004, t = -.575, p = .565.

Posttest mindfulness predicted posttest PA, b = .04, t = 6.636, p < .001. The interaction between pretest PA and posttest mindfulness was not significant, b = -.005, t = -.622, p = .534. Posttest mindfulness predicted posttest NA, b = -.01, t = -2.753, p = .007. The interaction between pretest NA and posttest mindfulness was not significant, b = .004, t = .457, p = .648.

Exploratory Analyses: Effect of Posttest Mindfulness on End-of-day Well-Being

To test H1, I used multilevel analysis to predict end-of-day well-being from posttest mindfulness, controlling for pretest AB scores, MBI, and trait mindfulness. The results for all models are presented in Table 8. Posttest mindfulness was associated with higher levels of AB and PA, but not NA, satisfaction, and meaning at the end of the day.

Table 8

Effect of Posttest Mindfulness on End-of-day Well-being

Model	*b*	*SE*	*p*
EOD Affect Balance			
Trait Mindfulness	.01	.004	.006
Pretest AB	.40	.04	<.001
MBI	.15	.14	.276
Posttest Mindfulness	.03	.01	.040
EOD Positive Affect			
Trait Mindfulness	.003	.003	.361
Pretest PA	.36	.04	.000
MBI	.06	.11	.572
Posttest Mindfulness	.02	.01	.049
EOD Negative Affect			

Trait Mindfulness	-.01	.003	.004
Pretest NA	.39	.04	.000
MBI	-.08	.09	.375
Posttest Mindfulness	-.01	.01	.107
EOD Life Satisfaction			
Trait Mindfulness	.01	.004	.095
Pretest AB	.17	.03	< .001
MBI	.27	.11	.020
Posttest Mindfulness	.02	.01	.196
EOD Meaning			
Trait Mindfulness	.01	.004	.088
Pretest AB	.16	.03	< .001
MBI	.27	.12	.020
Posttest Mindfulness	.02	.01	.169

Note. AB = Affect Balance, PA = Positive Affect, NA = Negative Affect, EOD = End of day.

I predicted that the effect of mindfulness on well-being will be mediated by positive reappraisal in H2, and by savoring in H3. Before testing the mediation model, I first tested Path A, i.e., whether posttest mindfulness predicted end-of-day reappraisal and savoring. Multilevel analysis was used to predict end-of-day reappraisal and savoring from the MBI and posttest mindfulness, controlling for pretest AB and trait mindfulness. The results are presented in Table 9. There was no effect of posttest mindfulness on end-of-day reappraisal or savoring. Since Path A was not supported for either mediator, I did not proceed to test the indirect effects of posttest mindfulness on well-being.

Table 9

Effect of Posttest Mindfulness on End-of-day Reappraisal

Model	*b*	*SE*	*p*
EOD Reappraisal			
Trait Mindfulness	.02	.01	.003
Pretest AB	.10	.06	.134

MBI	-.001	.23	.995
Posttest Mindfulness	.04	.02	.075
EOD Savoring			
Trait Mindfulness	.01	.01	.096
Pretest AB	.20	.06	.001
MBI	.03	.26	.923
Posttest Mindfulness	.02	.03	.456

Note. AB = Affect Balance, EOD = End of day.

Lastly, I carried out exploratory analysis on H4, namely that the effect of posttest mindfulness on reappraisal and savoring will be moderated by optimism. The results are presented in Table 10. There was no main effect of posttest mindfulness or optimism. Furthermore, there was no moderating effect of optimism on the relationship between posttest mindfulness and end-of-day reappraisal/savoring.

Table 10

Effect of Posttest Mindfulness and Optimism on End-of-day Reappraisal/Savoring

Model	*b*	*SE*	*p*
EOD Reappraisal			
MBI	-.03	.23	.902
Pretest AB	.09	.06	.144
Optimism	-.05	.03	.052
Trait Mindfulness	.02	.01	.031
Posttest Mindfulness	.05	.02	.055
Optimism * Posttest Mindfl	-.005	.005	.328
EOD Savoring			
MBI	.02	.26	.949
Pretest AB	.20	.06	.001
Optimism	-.02	.03	.460
Trait Mindfulness	.01	.01	.188
Posttest Mindfulness	.02	.03	.437

Optimism * Posttest Mindfl.	-.003	.006	.626

Note. AB = Affect Balance, Mindfl = Mindfulness, EOD = End of day.

Exploratory Analyses: Effect of Posttest Mindfulness on Retrospective Well-Being

Phase 3 data was used for the retrospective level analysis. For these analyses, I used the average posttest mindfulness reported by participants over the two weeks of the study. I used OLS regression to test H1 by predicting retrospective well-being from the MBI, and average posttest mindfulness, controlling for Phase 1 well-being and trait mindfulness. The results for all models are presented in Table 11. Average posttest mindfulness had no effect on affect balance, PA, NA, life satisfaction, or perceived stress. However, average posttest mindfulness had a significant effect on Phase 3 meaning in life, even after controlling for Phase 1 meaning, trait mindfulness, and the MBI.

Table 11

Effect of Average Posttest Mindfulness on Retrospective Well-Being

Model	*b*	*SE*	*p*
P3 Affect Balance			
Trait Mindfulness	.01	.03	.700
P1 Affect Balance	.71	.07	< .001
MBI	1.59	.90	.078
Average Posttest Mindfl.	.17	.17	.326
P3 Positive Affect			
Trait Mindfulness	-.02	.02	.452
P1 Positive Affect	.51	.08	.000
MBI	.63	.62	.316
Average Posttest Mindfl.	.20	.12	.102
P3 Negative Affect			
Trait Mindfulness	-.06	.02	.005
P1 Negative Affect	.57	.07	.000
MBI	-1.20	.58	.039

Average Posttest Mindfl.	.01	.11	.941
P3 Life Satisfaction			
Trait Mindfulness	-.02	.03	.544
P1 Life Satisfaction	-.58	.07	< .001
MBI	-.73	.82	.373
Average Posttest Mindfl.	-.15	.15	.316
P3 Perceived Stress			
Trait Mindfulness	.001	.01	.908
P1 Perceived Stress	.47	.07	< .001
MBI	-.26	.34	.438
Average Posttest Mindfl.	-.08	.07	.243
P3 Meaning			
Trait Mindfulness	-.02	.02	.455
P1 Meaning	.54	.05	< .001
MBI	.44	.63	.487
Average Posttest Mindfl.	.24	.12	.047

Note. AB = Affect Balance, Mindfl = Mindfulness, P1 = Phase 1, P3 = Phase 3.

To test H2 and H3 at the retrospective level (that reappraisal and savoring would mediate the effects of mindfulness on well-being), I examined whether average posttest mindfulness influenced average reappraisal/savoring reported across Phase 2. I first had to establish Path A, the effect of posttest mindfulness on reappraisal/savoring. I used OLS regression to predict average reappraisal and savoring from average posttest mindfulness, controlling for MBI and trait mindfulness. Results for both models are reported in Table 12. Average posttest mindfulness significantly predicted both average reappraisal and savoring. The effects of posttest mindfulness were above and beyond trait mindfulness. As posttest mindfulness had a significant effect on average reappraisal and savoring, Path A was established for both mediators.

Table 12

Effect of Average Posttest Mindfulness on Retrospective Reappraisal/Savoring

Model	*b*	*SE*	*p*
Average Reappraisal			
Trait Mindfulness	.01	.01	.149
MBI	-.30	.20	.129
Average Posttest Mindfl.	.27	.04	< .001
Average Savoring			
Trait Mindfulness	-.01	.01	.374
MBI	-.35	.23	.122
Average Posttest Mindfl.	.36	.04	< .001

Note. Mindfl = Mindfulness.

Next, I established Path B by computing the partial correlations between Phase 3 well-being and average reappraisal and savoring, controlling for Phase 1 well-being, posttest mindfulness, MBI, trait mindfulness. Average reappraisal was significantly correlated with Phase 3 affect balance and stress, while average savoring was correlated with meaning (Table 13). Phase 3 life satisfaction did not correlate significantly with either mediator.

Table 13

Partial Correlations of Average Reappraisal, Savoring with Retrospective Well-being

Phase 3	**Reappraisal**	**Savoring**
AB	.174*	.152
PA	.240*	.304*
NA	-.106	.006
Satisfaction	-.058	-.058
Meaning	.140	.262**
Stress	-.185*	-.120

Note. Partial correlations control for Phase 1 well-being, MBI group, trait mindfulness, and posttest mindfulness. AB = Affect Balance, PA = Positive Affect, NA = Negative Affect.
* p < .05. ** p < .01.

Since Path B was established for AB, PA, stress, and meaning, I tested the indirect effect of posttest mindfulness on these well-being measures via average reappraisal/savoring. First, I tested average reappraisal as a mediator of average posttest mindfulness on Phase 3 AB and stress. The indirect effects of all models were significant. Average posttest mindfulness significantly predicted average reappraisal, b = .27, t = 7.348, p < .001, 95% CI [.20, .34], and average reappraisal predicted Phase 3 AB, b = .77, t = 2.075, p = .040, 95% CI [.04, 1.50]. The indirect effect of average posttest mindfulness on AB was significant, b = .21, SE = .09, 95% CI [.04, .41]. Average posttest mindfulness significantly predicted both average reappraisal, b = .24, t = 6.380, p < .001, 95% CI [.17, .32], and average savoring, b = .33, t = 7.754, p < .001, 95% CI [.25, .42]. Average savoring predicted Phase 3 PA, b = .66, t = 2.912, p = .004, 95% CI [.21, 1.11], but not average reappraisal, b = .43, t = 1.692, p = .0928, 95% CI [-.07, .94]. The indirect effect of average posttest mindfulness on PA via average savoring was significant, b = .22, SE = .09, 95% CI [.06, .42]. For the model predicting Phase 3 stress, average posttest mindfulness significantly predicted average reappraisal, b = .28, t = 7.472, p < .001, 95% CI [.21, .35], and average reappraisal predicted stress, b = -.32, t = -2.283, p = .024, 95% CI [-.60, -.04]. The indirect effect of average posttest mindfulness on stress was significant, b = -.09, SE = .05, 95% CI [-.19, -.003].

Next, I tested average savoring as a mediator of average posttest mindfulness on meaning. Average posttest mindfulness significantly predicted average savoring, b = .35, t = 8.079, p < .001, 95% CI [.26, .43], and average savoring predicted meaning, b = .71, t = 3.155, p = .002, 95% CI [.26, 1.15]. The indirect effect of average posttest mindfulness on meaning via average savoring was significant, b = .24, SE = .10, 95% CI [.07, .45]. In

summary, posttest mindfulness increased average reappraisal and savoring, and reappraisal and savoring increased AB, stress, and meaning.

Lastly, I predicted that optimism would moderate the effect of mindfulness on reappraisal and savoring in H4. For exploratory analysis, I specifically tested whether optimism moderated the effect of average posttest mindfulness on either average reappraisal and savoring. The results for both models are presented in Table 14. Contrary to H4, there was no moderating effect of optimism on the relationship between average posttest mindfulness and average reappraisal/savoring. The main effects of posttest mindfulness remained significant.

Table 14

Effect of Average Posttest Mindfulness and Optimism on Retrospective Reappraisal and Savoring

Model	*b*	*SE*	*p*
Average Reappraisal			
MBI	-.35	.20	.077
Optimism	-.06	.02	.007
Average Posttest Mindfl.	.28	.04	< .001
Optimism * Posttest Mindfl.	.001	.01	.888
Average Savoring			
MBI	-.32	.22	.152
Optimism	-.02	.03	.483
Average Posttest Mindfl.	.35	.04	< .001
Optimism * Posttest Mindfl.	-.003	.01	.721

Note. Mindfl = Mindfulness.

Discussion

Analyzing the immediate effects of the MBI, informal practice was found to increase state mindfulness. However, this effect held only for participants with some previous experience with meditation. Moreover, the MBI had no main effect on immediate mood.

Instead, I found a significant interaction between pretest mood and the MBI, which suggested that the MBI improves people's mood if they are in a bad mood, but does not raise mood if they are already in a good mood. This moderating effect was not moderated by previous experience (p = .554). Further analysis of posttest PA and NA revealed that the interaction between MBI and pretest affect was driven mainly by an increase in posttest PA for those with low pretest PA, rather than a reduction in NA. This can be seen as partial support for H1, that mindfulness increases well-being at the immediate level.

At the end-of-day, there were main effects of the MBI on daily satisfaction and meaning but not affect balance (AB), partially supporting H1. However, contrary to H2 and H3, the MBI had no effect on either reappraisal and savoring. One possible explanation for the lack of main effects of the MBI on reappraisal and savoring could be that participants reported a single negative and positive event, and their end-of-day reappraisal and savoring was based on their responses to these single events. This may have been an inaccurate measure of their tendency to reappraise/savor during the day, because participants may have remembered an extraordinary event that did not reflect how they generally regulated their emotion throughout the day.

At the retrospective level, there were no direct effects of the MBI on well-being over the two weeks of the intervention, and no effects on average reappraisal and savoring. Thus, H1, H2, and H3 were not supported at the retrospective level.

According to H4, optimism would moderate the effect of the MBI on reappraisal and savoring. However, no support for this hypothesis was found at either the end-of-day or retrospective levels. One possibility is that optimistic people are already carrying out positive reappraisal and savoring to a high degree, and that the intervention was not able to increase it significantly. I carried out a correlational analysis on optimism, trait mindfulness, average reappraisal, and average savoring to see if there was a strong, positive relationship among

these variables. Optimism was positively correlated with trait mindfulness $r(153) = -.333$, $p < .001$—which is a moderate, not strong relationship. This negative association between mindfulness and optimism became weaker when Phase 3 FFMQ scores were used, r(153) = -.223, p = .006. This negative relationship between optimism and mindfulness was also unexpected, as past research has found moderate positive correlations (r between 0.2 to 0.4) between the FFMQ subscales (Malinowski & Lim, 2015) and the MAAS with optimism (Brown & Ryan, 2003; Smith, et al., 2011). Surprisingly, trait optimism was negatively associated with average reappraisal, $r(152) = -.232$, p = .004. Optimism was not related to average savoring, $r(152) = -.098$, p = .229). The small negative correlation between optimism with average reappraisal was unexpected, as past research has shown that optimism was positively related to positive reappraisal (Bryant & Cvengros, 2004; Carver, et al., 1993; Fontaine, Manstead, & Wagner, 1993; Helgeson, Reynolds, & Tomich, 2006). Similarly, I expected optimism to correlate positively with savoring, as optimism was positively associated with attention to positive information (Isaacowitz, 2005; Noguchi, Gohm, & Dalsky, 2006; Segerstrom, 2001). However, simply focusing on positive information may only be one condition for savoring to occur. Other individual or situational factors may influence whether savoring takes place. For example, it could be that people do not savor certain types of positive experiences, for example finishing a task at work or school. People may not want to prolong thoughts about completing such activities, but rather wish to move on to something else. In contrast, an enjoyable activity such as eating, or watching a performance may be something that people choose to prolong, and they may do so by savoring the moment. Thus, the type of event reported by participants might strongly influence their savoring scores, consequently affecting the present analysis.

Additional exploratory analyses using posttest mindfulness as a predictor were carried out. Posttest mindfulness predicted posttest AB at both the immediate and end-of-day levels.

However, at the end-of-day, posttest mindfulness did not predict reappraisal and savoring, and optimism did not interact with posttest mindfulness to predict reappraisal or savoring. At the retrospective level, average posttest mindfulness was associated with greater retrospective meaning in life, and higher levels of average reappraisal and savoring. This was above and beyond the effect of trait mindfulness. Furthermore, average reappraisal mediated the effects of average posttest mindfulness on AB and stress, and average savoring mediated the effects of average posttest mindfulness on meaning. These results suggest that mindfulness increases one's *average* tendency to reappraise situations, which then increase AB and reduces stress. Likewise, mindfulness may also increase one's *average* capacity to savor, thus leading to increased meaning in life.

Overall, the effects of posttest mindfulness suggest that the effects of the MBI may depend not only on previous experience but also on whether the MBI increased state mindfulness. Below, I elaborate on the implications of these two key factors.

Moderating Effects of Previous Experience

Based on the exploratory analysis, the MBI only seemed to have an effect on posttest mindfulness for people with previous experience. A possible explanation is that those without previous experience may differ in their understanding of mindfulness. This might affect how they respond to the posttest FFMQ items—resulting in less reliable scores. To examine this possibility, I computed the reliability of posttest FFMQ scores for participants with previous experience and those without previous experience. The Cronbach's alpha for posttest FFMQ was .664 for participants with previous experience, and .737 for those without previous experience. Given that the reliabilities for both groups seem similar, it is likely that all participants interpreted the FFMQ in a similar manner.

The moderating effect of previous experience may suggest that informal mindfulness practice may benefit those with previous experience as their background in meditation may

enable them to have a better understanding of the exercises used in the present study. It is important to note that participants were not given any background information on meditation and mindfulness. They were only instructed to listened to one track per day. The tracks I chose did not necessarily explain or introduce key meditation concepts to participants (e.g., non-judging, acceptance, etc.). Perhaps if participants are given more background information and previous exposure, they may practice the exercises more diligently and the MBI may then be more effective in boosting posttest mindfulness, well-being, and emotion regulation.

Possible Importance of State Mindfulness on Emotion Regulation

The MBI did not affect reappraisal and savoring at the end-of-day or retrospective levels. However, *posttest mindfulness* did have an effect on these emotion regulation strategies at the retrospective level. This suggests that in addition to previous experience, it is also important for the intervention to actually impact state mindfulness in order to influence emotion regulation. However, this effect did not occur at the end of the day—it only held for average savoring and reappraisal across the two-week intervention period, which in turn were associated with more positive affective balance, less stress, and higher levels of meaning at the retrospective level. Thus, a longer period of practice may be needed before the effects of mindfulness on emotion regulation and well-being can be observed. It is important to note that the effects of Phase 1 well-being were controlled for in the mediation models, so the results suggest that average levels of posttest mindfulness indirectly predict ***changes*** in well-being by increasing reappraisal and savoring.

Links between Mindfulness and Meaning

Although research on the Mindfulness to Meaning theory found that reappraisal predicted higher meaning in life (Garland, et al., 2017), reappraisal had no effect on meaning

in the present study. Instead, savoring was found to predict meaning—and only at the retrospective level. Although reappraisal allows individuals to change their perspective of a negative situation, a reduction of negative emotions may not be sufficient for meaning to increase. On the other hand, savoring may increase positive emotions that individuals experience, which may have stronger effects on meaning. Past research has shown that positive affect (PA) is a stronger predictor of meaning in life compared to goal appraisals, and that average daily PA rather than average daily meaning predicted meaning in life over a five-day period (King, Hicks, Krull, & Del Gaiso, 2006). Other studies have also found that meaning was associated with PA (Hicks, Trent, Davis, & King, 2012; Tov & Lee, 2016).

Limitations

One limitation of the present study was that there was no pretest measure for state mindfulness. This would have allowed for a clearer interpretation of whether the manipulation had the intended effect of increasing mindfulness from pretest to posttest. However, including a pretest measure of mindfulness could increase demand characteristics, and lead to inflated effects of the MBI on posttest mindfulness. In addition, the present study consisted entirely of undergraduate students from SMU. This may restrict generalizability to other samples, for example individuals from different age groups, or from different cultures and SES brackets.

Because the MBI itself did not affect reappraisal and savoring, the mediation hypotheses (H2 and H3) were not supported for either the end-of-day or retrospective well-being. One explanation could be that the strength of the MBI used (one track per day) was not enough to more consistently increase reappraisal and savoring. In a similar vein, the duration of the MBI (two weeks) may not have been enough to observe large differences between the treatment and control groups. In other words, the effects of mindfulness practice may require

more intensive practice, rather than a few minutes a day, over a longer duration. Building on this, it would be helpful to conduct another study that extends the duration of the MBI to eight weeks, similar in duration to formal MBSR programs. This would allow for more straightforward comparisons between informal and formal mindfulness practice. Furthermore, increasing the intensity of the MBI, for example by instructing participants to listen to more than one track a day, may also increase the effects on well-being.

None of the mindfulness audio clips included in this research study involved a focus on positive information. One example of mindfulness with a focus on positive emotions is loving-kindness meditation (LKM). LKM involves directing one's attention to other people and to cultivate warm and tender feelings (Fredrickson, Cohn, Coffey, Pek, & Finkel, 2008). Such an intervention has been shown to increase positive emotions, which then influence purpose in life and other personal resources, which in turn increase life satisfaction. I excluded positively-valenced audio clips to better isolate the effect of mindfulness on well-being without the added effects of positively-valenced instructions. However, outside of research studies, such positively-valenced instructions may be more beneficial to a wider audience. For example, people who are low on optimism may experience greater increases in well-being after listening to guided mindfulness audio clips with elements of positive psychology. This might be studied by examining whether trait optimism moderates the effect of positively-valenced mindfulness audio clips on well-being.

Another issue was the choice of examining affect balance by subtracting the mean score from the negative affect (NA) items from the mean of the positive affect (PA) items. This method of calculating balance scores would mean that a person high on both PA and NA might be considered the same as another person low on both PA and NA, if the PA and NA scores cancel out. However, frequently experiencing high levels of both PA and NA may have negative effects on well-being. For example, research has shown that high affect

intensity is associated with more negative coping orientations in response to emotionally distressing experiences (Flett, Blankstein, & Obertynski, 1996). Furthermore, taking the difference between PA and NA scores assumes that affect is bipolar, with PA and NA representing opposite ends of a single spectrum. Theoretically speaking, the affect measure used in this study (SPANE) appears to fulfill this criterion as the PA items administered have corresponding NA items. For example, positive/negative, happy/sad, and good/bad are some of the pairs that suggest PA and NA assessed by SPANE may be bipolar in nature. For the posttest and end of day affect measures, I adapted some items from SPANE (happy/sad, positive/negative) but also included other item pairs such as relaxed/bored, and excited/nervous. I examined the correlations between posttest, end of day, and retrospective affect. Posttest PA and NA were negatively correlated ($r = -.332$, $p < .001$), as were end of day and retrospective (Phase 3) PA and NA ($r_{EOD} = -.385$, $p < .001$; $r_{P3} = -.393$, $p < .001$). The negative correlations suggest that PA and NA assessed with the SPANE and the posttest/end-of-day measures were inversely related—providing some support for using the affect balance score. However, the correlations were not strong—perhaps explaining why some effects were observed only for PA (e.g., MBI interacted with pretest PA but not pretest NA).

Future Directions

In addition to examining how mindfulness has different effects on PA and NA, it may also be fruitful to analyze possible differential effects of mindfulness on affect arousal level. For example, mindfulness practices tend to focus on achieving a calm, neutral state of observation. Thus, mindfulness may increase low arousal PA more than high arousal PA. Conversely, mindfulness practice might decrease high arousal NA more than low arousal NA. To explore these possibilities, I analyzed the effect of the MBI on individual affect items (e.g. relaxed vs excited). The MBI did not have any effects on the specific posttest affect items. However, the present study assessed PA and NA using only a few items for each

dimension—and this could make it difficult to detect change in specific types of affect. Future studies should increase the number of items to more reliably measure high and low arousal aspects of PA and NA.

Lastly, the choice of control group is a key element of the study design, and in this study I chose to employ an active control group to provide a stringent test of the effects of mindfulness on well-being. The instructions given to the control group (focus on the rhythm of the music) were meant to provide control participants with an intentional activity to perform just as MBI participants would be going through mindfulness exercises. This was meant to make the study procedures more equivalent between the two groups. However, the type of exercise given to control participants in this study did not focus on any specific dimensions, whereas the mindfulness exercises targeted different skills such as observing, nonjudging, and acting with awareness. Thus, one improvement for future studies would be to analyze the specific dimensions of mindfulness targeted by the MBI, and to provide similar types of non-mindful exercises for control group participants. Given that posttest FFMQ items represented distinct aspects of mindfulness, I conducted exploratory analyses to determine whether the MBI had effects on the separate items while controlling for trait mindfulness. The MBI significantly predicted non-reacting ($b = .28$, $t(150) = 2.515$, $p = .013$), observing ($b = .32$, $t(150) = 2.459$, $p = .015$), and non-judging ($b = .27$, $t(147) = 2.191$, $p = .030$), but not acting with awareness ($b = .21$, $t(149) = 1.828$, $p = .070$). Prior experience only had a main effect on non-reacting ($b = -.23$, $t(151) = -1.987$, $p = .049$). Overall, the MBI predicted most of the mindfulness factors, suggesting that the control intervention did not increase mindfulness. However, the MBI did not increase acting with awareness more than the control intervention. Thus, a different control group activity that does not influence this mindfulness factor might lead to a clearer interpretation of the results, i.e., if the control

intervention does not increase any of the mindfulness factors, then the difference between the MBI and control groups could be attributed to mindfulness.

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Appendix 1 – Measures used

Phase 1 – Pre-Intervention Measures

Meaning in Life Questionnaire (MLQ; Steger et al, 2006)

- 1 (absolutely untrue) to 7 (absolutely true) [ref period = past 2 weeks]

1. I understand my life's meaning.
2. My life has a clear sense of purpose.
3. I have a good sense of what makes my life meaningful.
4. I have discovered a satisfying life purpose.
5. My life has no clear purpose.

Optimism - Life Orientation Test Revised (Scheier et al, 1994)

- Scored from 1 (I agree a lot) to 5 (I disagree a lot)

1. In uncertain times, I usually expect the best.

2. It's easy for me to relax.

3. If something can go wrong for me, it will. (R)

4. I'm always optimistic about my future.

5. I enjoy my friends a lot.

6. It's important for me to keep busy.

7. I hardly ever expect things to go my way. (R)

8. I don't get upset too easily.

9. I rarely count on good things happening to me. (R)

10. Overall, I expect more good things to happen to me than bad.

Perceived Stress Scale 4 (Cohen & Williamson, 1988)

- On a scale of 0 (never) to 4 (very often)

1. In the past 2 weeks, how often have you felt that you were unable to control the important things in your life?
2. In the past 2 weeks, how often have you felt confident about your ability to handle your personal problems?
3. In the past 2 weeks, how often have you felt that things were going your way?
4. In the past 2 weeks, how often have you felt difficulties were piling up so high that you could not overcome them?

Scale of Positive and Negative Experiences (Diener et al., 2010)

In the **past 2 weeks**, how often have you felt the following emotions?

		very rarely or never				very often or always
1.	Positive	1	2	3	4	5
2.	Sad	1	2	3	4	5
3.	Negative	1	2	3	4	5
4.	Contented	1	2	3	4	5
5.	Unpleasant	1	2	3	4	5
6.	Joyful	1	2	3	4	5
7.	Bad	1	2	3	4	5
8.	Happy	1	2	3	4	5
9.	Good	1	2	3	4	5
10.	Afraid	1	2	3	4	5
11.	Pleasant	1	2	3	4	5
12.	Angry	1	2	3	4	5

Satisfaction with Life Scale (Diener et al., 1985)

- 1 (Strongly disagree) – 7 (Strongly agree)

1. In most ways my life is close to my ideal.
2. The conditions of my life are excellent.
3. I am satisfied with my life.
4. So far I have gotten the important things I want in life.
5. If I could live my life over, I would change almost nothing.

Five Facet Mindfulness Questionnaire (Baer R. A., Smith, Hopkins, Krietemeyer, & Toney, 2006)

- rated on a 5-point scale (1 = never or very rarely true, 5 = very often or always true)

Factor 1: Nonreactivity to Inner Experience

FFMQ 1: I perceive my feelings and emotions without having to react to them.

FFMQ 2: I watch my feelings without getting lost in them.

FFMQ 3: In difficult situations, I can pause without immediately reacting.

FFMQ 4: Usually when I have distressing thoughts or images, I am able just to notice them without reacting.

FFMQ 5: Usually when I have distressing thoughts or images, I feel calm soon after.

FFMQ 6: Usually when I have distressing thoughts or images, I "step back" and am aware of the thought or image without getting taken over by it.

FFMQ 7: Usually when I have distressing thoughts or images, I just notice them and let them go.

Factor 2: Observing/noticing/attending to sensations/perceptions/thoughts/feelings

FFMQ 8: When I'm walking, I deliberately notice the sensations of my body moving.

FFMQ 9: When I take a shower or a bath, I stay alert to the sensations of water on my body.

FFMQ 10: I notice how foods and drinks affect my thoughts, bodily sensations, and emotions.

FFMQ 11: I pay attention to sensations, such as the wind in my hair or sun on my face.

FFMQ 12: I pay attention to sounds, such as clocks ticking, birds chirping, or cars passing.

FFMQ 13: I notice the smells and aromas of things.

FFMQ 14: I notice visual elements in art or nature, such as colors, shapes, textures, or patterns of light and shadow.

FFMQ 15: I pay attention to how my emotions affect my thoughts and behavior.

Factor 3: Acting with awareness/automatic pilot/concentration/nondistraction

FFMQ 16: I find it difficult to stay focused on what's happening in the present.

FFMQ 17: It seems I am "running on automatic" without much awareness of what I'm doing.

FFMQ 18: I rush through activities without being really attentive to them.

FFMQ 19: I do jobs or tasks automatically, without being aware of what I'm doing.

FFMQ 20: I find myself doing things without paying attention.

FFMQ 21: When I do things, my mind wanders off and I'm easily distracted.

FFMQ 22: I don't pay attention to what I'm doing because I'm daydreaming, worrying, or otherwise distracted

FFMQ 23: I am easily distracted.

Factor 4: Describing/labeling with words

FFMQ 24: I'm good at finding the words to describe my feelings.

FFMQ 25: I can easily put my beliefs, opinions, and expectations into words.

FFMQ 26: It's hard for me to find the words to describe what I'm thinking.

FFMQ 27: I have trouble thinking of the right words to express how I feel about things.

FFMQ 28: When I have a sensation in my body, it's hard for me to describe it because I can't find the right words.

FFMQ 29: Even when I'm feeling terribly upset, I can find a way to put it into words.

FFMQ 30: My natural tendency is to put my experiences into words.

FFMQ 31: I can usually describe how I feel at the moment in considerable detail

Factor 5: Nonjudging of experience

FFMQ 32: I criticize myself for having irrational or inappropriate emotions.

FFMQ 33: I tell myself that I shouldn't be feeling the way I'm feeling.

FFMQ 34: I believe some of my thoughts are abnormal or bad and I shouldn't think that way.

FFMQ 35: I make judgments about whether my thoughts are good or bad.

FFMQ 36: I tell myself I shouldn't be thinking the way I'm thinking.

FFMQ 37: I think some of my emotions are bad or inappropriate and I shouldn't feel them.

FFMQ 38: I disapprove of myself when I have irrational ideas.

FFMQ 39: Usually when I have distressing thoughts or images, I judge myself as good or bad, depending what the thought/image is about.

Demographics

Meditation refers to various exercises that are designed to train your attention and awareness. These exercises can involve focusing the mind on a particular object (e.g., your breath or body) or instructing the mind to notice or become more aware of any sensations or perceptions that arise in your surroundings or even within your body.

1. Have you ever had any previous experience with meditation?
    1. (If Yes) Was it a formal session led by an instructor?
    2. (If Yes) How long ago was your last formal session? Please indicate in years or months.
    3. (If Yes) What type of meditation practice have you tried? (Open-ended qn)

2. Do you currently meditate? (Y/N)

3. What faculty are you in?
    1. School of Accountancy
    2. School of Business
    3. School of Economics
    4. School of Information Systems
    5. School of Law
    6. School of Social Sciences

4. What year are you in?
    1. Year 1
    2. Year 2
    3. Year 3
    4. Year 4 or greater

5. What is your gender?
    1. Male
    2. Female

6. What is your age? (open ended)
7. What is your ethnicity? (open ended)

Phase 2 – Before and After Podcast Measures

Before Podcast Measures

Stress: [included in affect items]

Affect:

How much are you feeling the following emotions RIGHT NOW?

- 1 (not at all) to 5 (a great deal)

1. Bored
2. Happy
3. Nervous
4. Positive
5. Stressed
6. Excited
7. Relaxed
8. Sad
9. Negative

After Podcast Measures

Affect:

How much are you feeling the following emotions RIGHT NOW?

- 1 (not at all) to 5 (a great deal)

1. Bored
2. Happy
3. Nervous
4. Positive
5. Stressed
6. Excited
7. Relaxed
8. Sad
9. Negative

Abbreviated Momentary FFMQ

- 1 (not at all) to 5 (a great deal)

During the session, to what extent were you able to…

1. Notice your thoughts and feelings and let them go (Nonreact)
2. Pay attention to any sensations (sound, smell, taste, touch) you experienced (Observing)
3. Carry out the exercise with full awareness of what you were doing (Acting w Awareness)
4. Avoid making judgments about whether your thoughts were good or bad (Nonjudging)

Difficulty of the exercise

- 1 (not at all) to 5 (a great deal)

1. How difficult was it for you to do the exercise? (e.g., hard to understand instructions or carry out exercise)

Mind-Wandering and Distraction

1 [not at all (completely listening)] – 2 (some of the time) – 3 (much of the time) – 4 (all of the time)

2. Were there any external noises or distractions while listening to the track?
3. Were you thinking about something else instead of listening to the track?

Use of headphones

- 1 (yes) to 2 (no)

4. Did you listen to the track with earphones on?

Phase 2 – END-OF-DAY Measures

Daily Meaning Scale (Steger et al, 2008)

- 1 (not at all) to 5 (a great deal)

DMS 1: Today, how meaningful did your life feel?

Daily Life Satisfaction Scale (Steger et al, 2008)

- 1 (not at all) to 5 (a great deal)

DLS 1: Today how satisfied were you with your life?

Affect:

How much are you feeling the following emotions RIGHT NOW?

- 1 (not at all) to 5 (a great deal)

1. Bored
2. Happy
3. Nervous
4. Positive
5. Stressed
6. Excited
7. Relaxed
8. Sad
9. Negative

RAP 1: Please think of one negative event that you experienced today. Try to briefly describe it in the space below.

[Textbox with initial text: "One negative event I experienced today was …"]

When this event happened…how much did you do the following things (modified from Gross & John, 2003, and Garnefski, Kraaij, & Spinhoven, 2001)

1 (not at all) to 5 (a great deal)

RAP 2: Thought about the event in a way that helped you stay calm

RAP 3: Looked for something positive in the experience

SAV 1: Please think of one positive event that you experienced today. Try to briefly describe it in the space below.

[Textbox with initial text: "One positive event I experienced today was …"]

When this event happened, how much did you do the following things (modified from Bryant, 2003)

1 (not at all) to 5 (a great deal)

SAV 2: Tried to intensify your enjoyment of the experience by focusing on it.

SAV 3: Tried to appreciate the experience for as long as you could.

Manipulation Check

- 1 (not at all) to 5 (a great deal)

MC 1: How much did you try to apply today's exercise to what you did or experienced during the remainder of the day?

End-Of-Day Abbreviated FFMQ

- 1 (not at all) to 5 (a great deal)

Today, (outside of the exercise) how much were you able to…

1. Notice your thoughts and feelings and let them go (Nonreact)
2. Pay attention to any sensations (sound, smell, taste, touch) you experienced (Observing)
3. Do things with full awareness of what you were doing (Acting w Awareness)
4. Avoid making judgments about whether your thoughts were good or bad (Nonjudging)

Phase 3 – Post-Intervention Measures

Meaning in Life Questionnaire (MLQ; Steger et al, 2006)

Perceived Stress Scale 4 (Past 2 Weeks)

Satisfaction with Life Scale (Diener et al., 1985)

Scale of Positive and Negative Experiences (Diener et al., 2010) (Past 2 Weeks)

Five Facet Mindfulness Questionnaire (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006)

Appendix 2: List of tracks used in treatment condition

Category name:	**Commute**	**Meal**	**Break**	**Work**
Track names:	Mindful scrolling	Mindful of texture	Notice your mood	Deadline blues
	Journey markers	Pleasure in taste	Let go of annoyance	Clean up your desk
	People watching	Eating with non-dominant hand	Write with your pen	Dealing with difficult colleagues
		Chewing your food	Stop to walk	