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ORIGINAL PAPER

Becoming Mindful of Measurement: an Experimental-Experiential Analogue Study of State Mindfulness Measures

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Abstract

Objectives Preliminary research and anecdotal accounts suggest individuals often hold preconceived notions, misconceptions, and misinformation about the theory and practice of mindfulness and mindfulness meditation. Still, no experimental research examines how these ideas about mindfulness and mindfulness meditation influence responses to state mindfulness instruments designed to measure related outcomes.

Methods The current study implemented an experimental-experiential design to examine how the presentation of mindfulness via mindfulness theory-consistent(TC) and theory-inconsistent(TI) treatment rationales and subsequent mindfulness meditation practices (consistent with respective rationales) affected participants' ($n = 114$) state mindfulness scores and perceptions of mindfulness. Self-reported trait mindfulness (Mindful Attention Awareness Scale, MAAS), state mindfulness (Toronto Mindfulness Scale, TMS; State Mindfulness Scale, SMS), and qualitative measurements (participant open entry) were utilized.

Results Despite vastly different presentations of mindfulness being utilized by participants (successful experimental manipulation; significant between-group differences in number of qualitative mindfulness misconceptions coded [TI > TC]), there were no significant differences between the two experimental groups on state mindfulness measures directly following TC and TI rationales and practices. No significant differences were observed between the TC and TI conditions for usability or perceived accuracy of the rationales and practices, and self-reported previous mindfulness experience did not predict one's likelihood of providing qualitative misconceptions.

Conclusions When taught TI mindfulness meditation material, participants were more likely to respond with TI information even though state mindfulness measures after practice did not differ from the TC condition. Results and limitations are discussed, along with suggestions for future research directions and practice implications.

Keywords Mindfulness · Meditation · Misconceptions · State mindfulness

Western thought in psychology offers several definitions of mindfulness. An operational definition offered by Bishop et al. (2004) stated mindfulness is the self-regulation of attention to one's immediate experiences while adopting an attitude of curiosity, openness, and acceptance. Kabat-Zinn(1994) defined mindfulness as "the awareness that emerges through paying attention on purpose, in the present moment, and non-judgmentally to the unfolding of experience, moment to moment." Researchers have identified three axioms of mindfulness from the definition offered by Kabat-Zinn(1994): (1) intention, (2) attention, and (3) attitude. These researchers suggested all three axioms, interwoven with one another, are necessary to mindfulness practices, and they stated these processes can occur at the same time (Shapiro et al. 2006). Mindfulness has been studied as both a dispositional/trait(e.g., Brown and Ryan 2003), as well as a state quality (e.g., Lau et al. 2006; Tanay and Bernstein 2013), and is used in research as both a predictor and an outcome.

With regard to treatment, several models incorporate mindfulness, using both meditation and broader tools. Kabat-Zinn(1982, 1990) stated that his program, Mindfulness-Based Stress Reduction (MBSR), can serve as an exposure

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technique in the therapeutic setting. Exposure to one's experiences, with the absence of judgment and "catastrophic consequences," allows for a decrease in emotional reactivity (i.e., desensitization). Therapeutically, seeing thoughts as simply thoughts as opposed to reality is a cognitive change that is also central to Mindfulness-Based Cognitive Therapy (i.e., MBCT; Teasdale et al. 1995). Mindfulness may also be used as a form of self-management(Baer 2003). The relevance of self-management as a mechanism of mindfulness can be seen in treatment for attention deficits, emotion regulation, and related activities, all increased through facilitating awareness (Barkley 1997; Nigg and Casey 2005; Seidman 2006; Wilens et al. 2002; Zylowska et al. 2008).

Given there are a variety of theories and interpretations surrounding mindfulness, misconceptions, misunderstandings, and even misuse can occur merely by participants'/ practitioners' expectations and demands of their mindfulness practice. For example, mindfulness can be commonly understood by people as being merely for relaxation (Lester et al. 2018). However, a meditation used in psychotherapy used for relaxation may actually heighten one's overall arousal, causing unintended effects of the practice which may be counter indicated. In another case, an individual who only views meditation as a spiritual and/or religious practice may have less desire or willingness to partake in such treatment components of therapy when they do not identify themselves as spiritual or religious. With these considerations, assessment and measurement of mindfulness needs to be specific and sensitive enough to identify functional outcomes (e.g., anxiety reduction, exposure and response prevention, emotional labeling, decatastrophizing) and differences related to one's mindfulness practice.

Borrowing constructs from clinical and experimental psychology (e.g., treatment expectancies, demand characteristics) can help conceptualize individual differences in mindfulness measurement more broadly. Expectancies in psychotherapy pertain to the duration of treatment, the therapeutic process, and the outcome of therapy. These expectations can be seen in both clients and therapists, and they can impact the outcome of treatment (Joyce and Piper 1998). Simply put, providing a context which ensures reasonable expectancies for treatment/ practice will help with the discrepancy between client expectations and the actual treatment.

Research on meditation shows similar outcomes with regard to treatment expectations and demand characteristics. Delmonte (1981) assessed participants' perceived-selves and expectations of transcendental meditation before having talks on meditation for recruitment. Findings indicated expectations and perceived-self were related to one's decisions to and frequency of practicing meditation. Specifically, those who took up the meditation practice were mostly older in age, had a more negative perceived-self, and had higher expectations of meditation. However, younger individuals demonstrated higher suggestibility, noted by increasing scores of expectations after the meditation talks. Closely aligned with this is the idea that "the perceived efficacy of an intervention is related to outcome" (Bandura et al. 1977; Delmonte 1981); these results demonstrated the importance an individual's previous learning history plays in the uptake and expectations of their meditative practice.

Demand characteristics are the expectations the researcher/ clinician places on the individual participating/practicing that effect how one behaves in a situation. Simply changing the order of elements in a treatment rationale (i.e., an explanation of *what* the treatment is and *how* it works) can influence the behavior of people. Kanter et al. (2004) found that a change in the cognitive therapy treatment rationale for affective responses (ABC to ACB) influenced reporting. Specifically, participants who received the ABC rationale (A representing a recent event, B representing automatic thoughts about event, and C representing affective response) reported more automatic thoughts first, while the ACB rationale reported more affective responses (i.e., feelings) first. The rationales were also more influential for images with high arousal, and less influential for subjects with previous experience of therapy. They suggested that psychotherapeutic rationales can be influentially powerful for clients who begin therapy with distressing events and a focus on negative affect.

Kanter et al.'s (2002) findings also suggested almost one fourth of the participants changed their responses to presented images after being informed by study consistent responses. This finding indicated therapeutic demand characteristics have greater effects when the information is presented as truth and without reasonable alternatives (Kanter et al. 2002). Also, this study demonstrated that learning histories are fluid and changeable—even in an experimental setting.

Although the research body is limited, mindfulness researchers have begun to explore the role that expectations play in mindfulness-based interventions (e.g., Farb 2012), as well as individuals' reasons for practicing mindfulness (Pepping et al. 2016). Research has suggested that one's expectations of mindfulness practices contribute to mindfulness outcomes (Farb 2012). Individuals practice mindfulness for emotion regulation, to alleviate emotional distress, and to increase well-being(Pepping et al. 2016), and these expectations and reasons for practice can affect expectations, and ultimately measurement outcomes of interventions.

There are many methods of assessing mindfulness outcomes. As the research on the therapeutic effects continues to increase, research has begun to focus on components of treatment and mechanisms of change (Baer 2011; Baer et al. 2009). Still, measuring mindfulness can be challenging because no clear markers in overt behaviors exist (Baer 2011), and related behaviors, like attention and relaxation, are not necessary or sufficient indicators of mindfulness alone.

One way to measure mindfulness is to assess brain structure and activity (e.g., FMRI, MRI, EEG). Several studies have used imaging techniques to gain more insight into brain structure, function, and connectivity of meditators (e.g., Leung et al. 2013; Vestergaard-Poulsen et al. 2009; see Cahn and Polich 2006 for review). Meditators show increased gray matter (e.g., Hölzel et al. 2011) and differences in functionality of brain areas (e.g., Lazar et al. 2005) as compared to non-meditators. Although these measurements provide insight about brain structure and function, these findings do not prove to be adequate measures of mindfulness at the individual level. It is not clear how such patterns relate to overall propensity to be mindful in daily life (Baer 2011).

Some studies measure mindfulness by proxy with cognitive and other ability tests. Multiple studies (e.g., Black et al. 2011; Valentine and Sweet 1999; van Leeuwen et al. 2012) examining constructs such as attention, working memory, and processing speed have led to mixed results. Baer (2011) concluded the mixed findings are likely because measuring mindfulness is not the same as measuring cognitive tasks. Researchers have suggested computer and laboratory-based tasks may prove to be useful for measuring one's ability to be mindful (Baer et al. 2013; Bishop et al. 2004).

Similar to other psychological constructs, mindfulness has commonly been assessed with self-report questionnaires (Sauer et al. 2012). Self-report methods of assessing mindfulness are popular in part because they are convenient to administer and are reliable and valid if they are developed in a way that truly reflects the theory/construct of mindfulness. Most of these mindfulness questionnaires are developed from Western definitions of mindfulness and aimed at assessing mindfulness in everyday life (Baer et al. 2009). These questionnaires typically treat mindfulness as a dispositional (trait-like) variable which is consistent over time and across situations. Conversely, it is assumed changes in mindfulness skills can be assessed by these measures to demonstrate the change in mindfulness with interventions and practice (Baer 2011); this raises a dilemma for clinical researchers given the limited number of state mindfulness measures (i.e., Toronto Mindfulness Scale; Lau et al. 2006; State Mindfulness Scale; Tanay and Bernstein 2013).

There are several unique challenges inherent to measuring mindfulness. In addition to typical self-report issues, individuals may not be accustomed to noticing thoughts and feelings, or other aspects of mindfulness practice, and thus may inaccurately report (i.e., response shifts; Sauer et al. 2012)—especially in the early stages of assessment (Baer 2011). Also, mindfulness is a challenging concept to define—and even harder to operationalize (Grossman 2008). Further, mindfulness is broadly associated with context-dependent semantics (Grossman 2008) and conceptual pluralism, meaning that there are vacillations between different traditions (Theravada and Tibetan Buddhism), which have been used to define it (Sauer et al. 2012).

Mindfulness is extensively studied and spans a multitude of clinical and academic arenas. Although healthy dissents and dialog appear in the scientific literature, conceptualizations and understandings of mindfulness can be widely varied, and in some cases starkly inconsistent with one another. Researchers must ask if these differing presentations and interpretations of mindfulness affect one's practice and subsequent measurement of such phenomena. Although there is a general awareness of these conceptions and some budding research (i.e., Hitchcock et al. 2016; Lester et al. 2018), no formal research has been done to examine the effect these conceptions have on state mindfulness measurement in an experimental context. The current study seeks to understand how the presentation of mindfulness material might affect how people respond to state mindfulness measures.

The aim of this study was to understand the relationship between mindfulness conceptions, treatment expectations, and demand characteristics (i.e., presentation of mindfulness material via treatment rationales) and subsequent state mindfulness measurement. The hypothesis was that participants taught *theory-consistent* (i.e., TC) information about mindfulness meditation would have higher scores on state mindfulness measures compared to those taught *theory-inconsistent*(TI) mindfulness meditation information.

Methods

Participants

Participants were adult undergraduates at a public university in the south-central region of the USA. They were recruited from the online research system for human subjects (*Sona System*) after the study received university IRB approval. For this study, 114 participants were recruited satisfying the 30 participants per condition for medium to large effects to be detected. The average participant age was 20.71 ($SD = 3.75$; *range* = 18–40). Participants were diverse, with White/European American being the most commonly endorsed (35.5% White/European American, 22.7% Hispanic/Latino, 21.8% Black/African American, 10.9% Asian/Pacific Islander, 5.5% biracial, 2.7% other, and .9% Middle Eastern/Arab). The sample was mostly female (64.5% female, 34.9% male, and .9% transgender). A third of the sample was freshmen, and a majority (approximately 62%) identified as Christian. Demographic data is presented in Table 1.

Participants were randomly assigned to one of three conditions (34.5% in TC, $n = 37$; 31.8% in TI, $n = 35$; and 33.6% control, $n = 38$). Approximately half of the sample (44.5%) was unfamiliar with mindfulness, with 58% reported never practicing mindfulness, and 70% had never formally practiced

Table 1 Characteristics of sample ($N = 110$)

	Frequency	Percent
Gender		
Male	38	34.5
Female	71	64.5
Transgender	1	0.9
Ethnicity		
European American	35	35.5
Hispanic/Latino	25	22.7
African American	24	21.8
Biracial	6	5.5
Asian/Pacific Islander	12	10.9
Middle Eastern/Arab	1	.9
Other	3	3.7
Marital status		
Single	104	94.5
Cohabitating	4	3.6
Married	1	0.9
Divorced	1	0.9
College classification		
Freshman	38	34.5
Sophomore	24	21.8
Junior	25	22.7
Senior	23	20.9
Religious/spiritual identity		
Agnostic	17	15.5
Atheism	6	5.5
Buddhism	2	1.8
Christian	68	61.8
Islam	2	1.8
Judaism	2	1.8
Other	13	11.8
Primary language		
English	104	94.5
Spanish	2	1.8
Chinese	1	0.9
Other	3	2.7
Socioeconomic status (SES)		
Lower class	27	24.5
Middle class	76	69.1
Upper class	7	6.4

meditation. Still, a majority of participants (80.9%) reported being willing to practice if given the opportunity.

Procedure

Participants scheduled a time via *Sona System* to complete the intentionally vaguely-titled study, "Learning by Experience," and completed the experiment in the lab with an experimenter present. Consent forms prior to the experiment did not elaborate on the kind of activity the participant would be completing, given that approximately one third of participants would be receiving the control condition unrelated to mindfulness meditation. Participants were randomly assigned to one of three conditions (two experimental conditions and one control condition) via a random number generator. After being assigned to a condition, participants completed a self-report measure of trait mindfulness prior to being given one of the two mindfulness meditation rationales, or a control rationale (about baseball; i.e., non-meditation related rationale).

The TC rationale was based on the Western definitions and theory of mindfulness, particularly as they apply in therapeutic contexts. It included statements such as, "Simply put, mindfulness is a type of careful attention to what is happening right now," and "As you practice, the mind will likely drift off. This is absolutely natural." The TI rationale provided common misconceptions about mindfulness, such as, "You must practice in a very quiet place (possibly a temple or an empty room) without any distraction," "You must sit in a full-lotus position on the floor," and "The goal of meditation is to relax and control your mind."

After the rationales, participants in the control listened to a pre-recorded script about baseball while the other two groups spent equal amounts of time (15 min) participating in pre-recorded guided meditation practice, which was consistent with their rationale. The guided meditations were adapted from the *Mindfulness-Based Stress Reduction Workbook (*Stahl and Goldstein 2010), with the TI-guided meditation having content changed to reflect themes from a study the first author conducted on mindfulness misconceptions. These themes included: controlling thoughts, body, and environment, religiosity/spirituality, self-evaluation and judgment, and goal-oriented behavior (e.g., achieving insight, relaxation; Lester et al. 2018).

After the experiential exercise, participants completed state mindfulness measures and demographic measures. Participants in all three conditions were appropriately debriefed on the study. Specifically, those in the TI rationale condition were given a TC rationale sheet to provide them with correct information. The effort was to have enough contrast between the TC and TI rationales and practices, but not to overexaggerate these differences and decrease believability of content.

Measures

Data were taken from a larger study which explored multiple qualitative and quantitative aspects of mindfulness. Although several other measurements were given, the measures listed below were primary to the current study. Participants completed the following measures in the order listed after consenting to participate:

The Mindfulness Attention Awareness Scale The Mindfulness Attention Awareness Scale (MAAS)(Brown and Ryan 2003) is a self-report measure consisting of 15-items assessing the inclination to be mindful of present experiences. The measure uses a 6-point Likert-type scale, ranging from 1 (*almost always*) to 6 (*almost never)*. Higher total scores on the MAAS indicate greater levels of dispositional mindfulness. The MAAS exhibits concurrent validity with other scales of mindfulness, openness to new experiences, and self-esteem, and divergent validity with scales of depression and anxiety (Brown and Ryan 2003). The MAAS demonstrates adequate internal consistency in both a college student sample, as well as a general adult sample ($\alpha =$ .82 to .87, respectively). The internal consistency for this sample was .89.

Toronto Mindfulness Scale The Toronto Mindfulness Scale (TMS)(Lau et al. 2006) is a 13-item measure assessing two factors of mindfulness: curiosity and decentering. Items on the TMS range from 0 (*not at all*) to 5 (*very much*) with a possible total score of 52 (higher scores indicate more state mindfulness). The measure is generally given immediately following meditation sessions in order to assess the experience. The curiosity factor of the TMS has a Cronbach's alpha of .86 and the decentering factor has an alpha of .87 in a non-clinical, middle-aged sample, with varying ranges of mindfulness experience (Lau et al. 2006). Although more research is needed, the TMS has been used previously in college samples (e.g., Weger et al. 2012). The internal consistency for this sample was .90.

State Mindfulness Scale The State Mindfulness Scale (SMS)(Tanay and Bernstein 2013) is a 21-item self-report measure containing two separate subscales: one measuring state mindfulness relating to mental processes, and the other relating to the bodily processes. The SMS utilizes a 5-point scale ranging from 0 (*not at all*) to 4 (*very* well). The SMS was created to be consistent with both traditional Buddhist tenets and scientific and scholarly understandings of mindfulness. In the validation study, both SMS subscales demonstrate strong test-retest reliability (SMS Body $\alpha = .95$ and SMS Mind $\alpha = .90$; Tanay and Bernstein 2013). The internal consistency for this sample was .94.

Demographics and Mindfulness Meditation Survey The Demographics and Mindfulness Meditation Survey (DMMS) (created by authors) assessed participant understanding of mindfulness and meditation practices through the Qualitative Meditation Survey (i.e., QMS, Lester et al. 2018), as well as vignettes to gauge attitudes and ideas towards mindfulness/meditation actions. Lastly, this survey assessed age, ethnicity, primary language, religion, educational status, gender, marital status, employment, socioeconomic status and income, previous mindfulness and meditation experience, and attitudes towards these practices.

Determinants of Meditation Practice Inquiry The Determinants of Meditation Practice Inquiry (DMPI) (Williams et al. 2011) is a 17-item self-report measure developed to assess individuals' perceived barriers to practicing meditation. The DMPI utilizes a 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The measure examines perceived barriers related to perceptions and misconceptions, pragmatic concerns, and sociocultural beliefs related to meditation. The internal consistency reported in the initial validation study is considered good ($\alpha = .87$) and the internal consistency for this sample was .86.

Manipulation Check After completing the demographic questionnaire, individuals were given a manipulation check on which they answered items relevant to their experimental condition, which included some pre-recorded rationale and exercise (further called *Experiential Exercise*; i.e., EE). First, participants were given an open-ended question about the EE they were given and asked to briefly explain how the EE suggested to participate. The second question asked whether or not they used the information they were taught and to describe how they used this information. The participants were also asked to rate on a 5-point Likert-type scale how helpful, valuable, and accurate they found their respective EE to be.

Data Analyses

All consented and randomized participants were included in data analyses. A randomization website was used to randomize all participants to their respective conditions. Data cleaning and preliminary data analyses utilized chi-square tests and *t* tests to compare participants on non-experimentally related variables (e.g., age, gender, previous mindfulness experience), as well as bivariate correlations between variables of interest. Primary analyses utilized ANOVAs/ANCOVAs, and *t* tests and were conducted using the Statistical Package for Social Sciences version 24 (SPSS 24.0) software. Qualitative coding was conducted using NVivo 10 qualitative data analyses software. Descriptive statistics for these measures are presented in Table 1 and descriptive of key variables are presented in Table 2.

Table 2 Descriptive statistics for key variables ($N = 110$). Characteristics of sample ($N = 110$)

	M	*SD*	Observed range	Possible range
TMS total	36.96	10.87	13–62	13–65
SMS total	63.79	18.10	25–105	21–105
DMPI total	43.07	12.54	17–73	17–85

Results

Preliminary Analyses Before the primary analyses were run, several differences between groups were examined. Although participants were randomly assigned to groups, participants assigned to the control group ($n = 38$) demonstrated significantly more trait mindfulness (M = 4.11) prior to the experimental manipulation than those assigned to the TI rationale group ($n = 35$; $M = 3.56$; TC group $n = 37$; $M = 3.71$), $F(2,109) = 4.08$, $p = .02$.

State Mindfulness Two independent samples *t* tests were conducted to examine levels of state mindfulness after the experimental manipulation. The control condition was not included in this analysis; however, both experimental conditions significantly differed from the control condition (i.e., baseball rationale) individually ($p < .05$). The TI and TC conditions were compared, and there were not significant differences between the TC and TI conditions on the TMS ($t(70) = .01$, $p = .991$) nor SMS ($t(70) = -.68$, $p = .49$).

Exploratory Analysis for Perceptions and Practice of Mindfulness ANCOVAs (trait mindfulness covariate; Games-Howell post hoc analyses) was used to examine whether there was a significant difference between groups for whether the participants used the rationale/instructions given (i.e., "Did you use the information given to you for your meditation practice?"). The overall model was significant, $F(2, 109) = 29.81$, $p < .001$, with the significant differences existing between the control condition and the TI condition ($p < .001$), and the control condition and the TC condition ($p < .001$). This demonstrated that individuals in the control condition used their EE less than the TC and TI conditions. No significant difference existed between the TI condition and the TC condition ($p = .36$). By condition, 3 of 35 participants in the control condition, 27 of 35 participants in the TI condition, and 23 of 37 in the TC condition reported using the given information in their meditation practice.

The participants were also asked about their perception of the accuracy of the material presented (i.e., "Overall, I felt that the recording gave an accurate representation of meditation.") on a scale from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*). The overall model was significant, $F(2, 109) = 32.49$, $p < .001$), with post hoc analysis demonstrating significant differences existed between the control condition and the TI condition ($p < .001$), and the control condition and the TC condition ($p < .001$). No significant difference existed between the TI condition and the TC condition ($p = .77$). By condition, 7 of 38 participants in the control condition and 28 of 35 participants in the TI condition agreed or strongly agreed that the provided recording gave an accurate representation of meditation. For the TC condition, 25 of 37 participants agreed or strongly agreed that the recording provided a TC representation of meditation.

Related to qualitative findings, three independent raters, each of whom was an advanced graduate student in clinical psychology with extensive training in mindfulness-based therapy, created ratings based on the first question of the QMS in the DMMS (i.e., "What is meditation?"). All participants were given scores of either TC or TI by the coders. The intraclass correlation coefficient for this coding suggested very good reliability ($k = .89$).

The percentage of participants who held misconceptions about meditation was 77.3% ($n = 85$). When looking at misconceptions by condition, there was a significant difference between groups, $F(2, 109) = 8.17$, $p < .001$). Specifically, there were two statistically significant differences between groups. The control condition had significantly fewer TI answers for the first QMS question ($p = .02$) than the TI condition. There was not a significant difference between the control condition and the TC condition. Further, the TI group had significantly more mindfulness meditation misconceptions than the TC condition ($p < .001$). Overall, 34 of 35 participants in the TI condition responded with misconceptions while only 22 of 37 responded to the TC condition with misconceptions. Without any information on mindfulness provided, the control condition had 29 of 38 participants respond with misconceptions.

Last, previous mindfulness experience did not significantly predict whether a participant had [a] misconception(s) about mindfulness meditation ($F = .05$, $p = .48$; coding strategy detailed above). There were no significant differences between the TC and TI conditions for perceived accuracy of their respective EE ($t(70) = .69$, $p = .49$), the value of the recording to their EE ($t(59) = .05$, $p = .98$), how helpful the recording was ($t(70) = -.96$, $p = .34$), whether or not they used the audio recording in their practice ($t(69) = -1.38$, $p = .17$), or their perceived understanding of mindfulness meditation ($t(70) = 1.22$, $p = .23$). Perceived barriers to practice, as measured by the DMPI, did not significantly differ between the TC and TI conditions ($t(70) = 1.25$, $p = .21$).

Discussion

Mindfulness is increasingly ubiquitous in popular culture (Kabat-Zinn 2014), as well as in therapeutic modalities and psychological research (see Orsillo et al. 2016). For this reason, the effort was to understand how mindfulness conceptions, treatment expectations and demand characteristics (i.e., presentation of mindfulness material via treatment rationales), and an individual's learning history affects their mindfulness understanding and practice, as well as state mindfulness measurement after practice.

The lack of significant difference between the TI condition and the TC condition on state mindfulness measures after being presented their respective EEs is puzzling. One explanation for this may be that participants with only brief training in mindfulness may depend on demand characteristics when responding to measures due to their limited ability to monitor their mental process of internal attention (Davidson and Kaszniak 2015). There was also no significant difference between the TC and TI conditions for perceived accuracy of their EEs, how valuable they found their EEs for their practice, whether or not they used their EE for their practice, or their perceived understanding of mindfulness meditation after their respective EEs. These findings are supported by the ongoing conversations by multiple researchers' concerning accurately disseminating and measuring mindfulness and mindfulness meditation accurately and appropriately (Baer et al. 2006; David 2014a, b; Gardner et al. 2014).

Although in theory the TI condition had more restricting and unattainable components (e.g., clear mind of all thoughts, levitation) in the EE, there was no significant difference between the TI and TC condition on this variable. These findings suggest that client expectancies are not predictive of a client's likelihood of engaging in mindfulness, even if the qualities are likely unattainable or limiting. It was also hypothesized that previous mindfulness experience would positively predict positive self-report variables. Mindfulness understanding significantly, negatively predicted barriers to practice on the DMPI. Therefore, assessment of perceptions of understanding mindfulness may serve as a clinical prescreening measure before engaging an individual in a mindfulness meditation exercise.

Overall, the DMPI was significantly related to previous mindfulness experiences, with previous mindfulness experience significantly relating to lower perceived barriers. In many ways, this is a positive prognosis for the use of mindfulness in a therapeutic modality. If an individual is introduced to mindfulness in a TC and thorough way, previous mindfulness experience is predictive of lower perceived barriers. Also, perceived understanding of mindfulness meditation was significantly related to previous mindfulness experiences. This finding indicates that even though there are some issues with common perceptions of mindfulness practices, when an individual has a previous experience with mindfulness meditation, they are more likely to report a better understanding of it.

No significant difference was found between the TI and TC conditions on the use of their respective EEs. In fact, the TI group reported using their EE more than the TC condition during the exercise. Some significant group differences existed for use of the EE and perception of accuracy, with the control condition reporting the least use of their EE. This finding is likely explained based purely on the nature of the control condition's EE—baseball material and not mindfulness. These findings suggest that participants were able to discriminate between mindfulness-related material (TC and TI) and unrelated material (baseball). These findings also suggest that participants of mindfulness meditation will use the material given, regardless of whether it is TC or TI.

There was also no significant difference between the TI and TC conditions for perception of accuracy of the EE. Moreover, by incidence, the perceived accuracy was higher for the TI group than the TC condition. Considering "preexisting biases" (Stanovich 2013), these results demonstrate that simply changing the elements in a rationale can influence one's behavior. These findings are consistent with Kanter et al. (2004), where their rationales were influential for clients and their perception of the therapeutic process, especially when true or credible information is presented without other competing alternatives.

After the EE, there was a statistically significant difference between conditions in the frequency of mindfulness misconceptions, with the control condition and TC condition showing significantly fewer misconceptions about mindfulness than the TI group. There was no significant difference between the control condition and the TC condition. This finding is consistent with previous research by the first two authors of this manuscript which highlights the prevalence of theory inconsistent mindfulness conceptions. These results also suggest that individuals learned misconceptions from a brief 15-min intervention. Further, previous mindfulness experience did not have a significant effect on number of misconceptions. This finding is also consistent with previous work of (Lester et al. 2018*)* which indicates that previous mindfulness practice was not correlated with fewer misconceptions.

These findings must be considered when implementing mindfulness in clinical research contexts. Specifically, it is important to consider participants' previous mindfulness experiences and ideas about mindfulness (TC and some TI) before engaging in mindfulness-based practices (Dunkley and Stanton 2013). Commonsense beliefs about scientific information can limit understanding, and "preexisting biases" about psychology are especially hard to overcome due to emotionally supported beliefs about human behavior (Lassonde et al. 2016; Stanovich 2013). Beliefs about the benefits of mindfulness tend to have this emotional component tied to mental health and well-being (Lester et al. 2018). Given that the rationales and meditations predicted significant differences in the frequency of misinformation reported—ultimately demonstrating learning of misconceptions when directly taught—it is critical to consider how mindfulness is conveyed.

Last, the hypothesis predicted there would be differences in state mindfulness measures between the group that was trained in TC mindfulness and the groups which were not (i.e., the control and TI group). The state mindfulness measures could adequately discriminate between those practices

which were mindfulness-related (regardless of TC or TI) and those which had no mindfulness-related content (baseball), but not between practices which were theory-consistent and inconsistent. These raise conceptual questions about state mindfulness scores, specifically for interventions which measure state mindfulness directly after activities which are not theory-consistent. Researchers may need to ask broader conceptual questions of whether state mindfulness measures should be able to have the specificity in measurement to identify those practices that are not only labeled as mindfulness, but specifically those practices which are consistent with the theory and research of mindfulness more broadly. Without this specificity, clinical research may confront larger methodological issues in the future research using state mindfulness measurement in research.

Limitations

EEs were time-limited and cross-sectional. It is possible that if a participant were to receive multiple exposures to the same EE (i.e., dosing effect) that responses would become more variable and would produce differences between groups on measures of mindfulness. Although not certain, the effects of mindfulness are thought to be cumulative and dose-dependent, and a one point-in-time intervention might not produce significant differences between participants at the group level. Relatedly, measurement was self-reported and unimodal, making the potential of common method biases more possible. Studies looking to examine the relationship between mindfulness presentation and state mindfulness measurement may benefit from using a multitrait-multimethod approach (Podsakoff et al. 2003)

This study was also based on a previous study examining college students' mindfulness meditation misconceptions (i.e., convenience sample). Therefore, the generalizability of such a sample to the broader public may be tenuous. Although this study had a diverse undergraduate sample and a true experimental design, this study also had mostly participants who identified as Christian. Future research may consider broadening their respective samples' demographic scope, with special considerations to understanding how these misconceptions are in other diverse samples.

This study may suggest that different conceptions of mindfulness meditation are prevalent and easily suggested—ultimately contributing to the individual's understanding of such practices. Also, this project demonstrated that these misconceptions could be taught and learned by specific rationales and exercises. Careful attention must then be paid to the incredible power that scientific information, popular media, and therapeutic interventions can have on an individuals' understanding. In the words of Paul Grossman (2008), "The qualities of careful attention, patience, openness, curiosity, and beginner's mind are often seen as central to the cultivation of mindfulness. Perhaps similar qualities can also serve us in our pursuits to bridge paradigms."

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Author Contributions EL: designed and executed the study, conducted data analyses, and wrote the manuscript. AM: supervised the project and study design, contributed to the data analytic strategy, and contributed substantially to the editing and finalization of this manuscript. Both authors approved the final version of the manuscript for submission.

Data Availability Statement All data are available upon request to the first author of this manuscript.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This study was approved by the University of North Texas Institutional Review Board.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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