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ORIGINAL PAPER

Mechanisms of Mindfulness: A Longitudinal Study of a Mindfulness-Based Stress Reduction Program

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Abstract

Objectives This study sought to identify the temporal order in which mindfulness facets develop during Mindfulness-Based Stress Reduction (MBSR) and the effect of early changes on later changes in these facets and their relation to changes in depression, anxiety, and stress.

Methods This longitudinal study of 147 adults participating in a MBSR program examined relationships between components of mindfulness, self-compassion and measures of depression, anxiety, and stress. Self-report measures were administered pre-course, mid-course, end-of-course, and 3-months post-course.

Results Initial improvements in decentering, non-reactivity, and self-compassion were observed early in the MBSR course (p-values < 0.05), followed by later changes in observing, acting with awareness, and nonjudging. Bivariate latent growth curve modelling suggested changes in the mindfulness components of decentering and nonreactivity coincided with decreases in anxiety and stress (p-values < 0.05). However, in a path analysis, changes in self-compassion appeared to uniquely contribute to changes in depression and anxiety, over and above the effects of other mindfulness components (p-values < 0.05). These changes in self-compassion were associated with simultaneous and precursory change in non-reactivity and non-judgment.

Conclusions These findings elucidate the possible temporal order of change in mindfulness facets through MBSR. Self-compassion may be a prominent mechanism of change in the MBSR program, along with non-reactivity and decentering. However, additional longitudinal research is needed with alternate model specifications to confirm the proximal role of self-compassion in longitudinal symptom change. Results are tempered by a relatively short period of longitudinal observation with a possible nonresponse bias.

Preregistration Because the trial was conceived prior to 2009, pre-registration was not possible. However, the trial was registered on anzctr.org.au after data collection and analysis. [Title: "Mechanisms of mindfulness: A longitudinal observational study of the effects of mindfulness-based stress reduction (MBSR) on depression, anxiety, and stress among participants in a MBSR program", Identifier: ACTRN12623000485639].

Keywords Mindfulness-Based Stress Reduction · Longitudinal · Structural equation modelling · Depression · Anxiety · Self-compassion

In recent years, mindfulness-based interventions (MBIs) have become an increasingly popular and studied method of improving well-being (Baminiwatta & Solangaarachchi, 2021; Goldberg et al., 2022). Mindfulness-Based Stress Reduction (MBSR) is arguably the most widely known MBI, designed to provide the benefits of Buddhist meditation

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practice in a secular context and to assist participants in integrating mindfulness into their daily lives (Kabat-Zinn, 1990). A growing body of controlled research has indicated that MBSR may lead to reductions in psychological symptoms, including depression, generalized anxiety, and stress (Goldberg et al., 2022; Gu et al., 2015). Such improvements in well-being have been observed for adults in the general community, most psychiatric populations, as well as for individuals experiencing a variety of chronic medical conditions (Alsubaie et al., 2017; Galante et al., 2021; Goldberg et al., 2018; Khoury et al., 2015). However, these benefits are not experienced among all participants, effect sizes vary considerably across studies, and some null findings have been reported for adequately powered trials of MBSR and similar MBIs (Kaplan et al., 2022; Kraines et al., 2022). It is also unclear whether MBSR supports improvements in well-being equivalent to—or beyond—active control interventions (Goldberg et al., 2022; Hoge et al., 2021). In light of these considerations, it is essential to determine the "active ingredients" of MBSR which most contribute to its efficacy (Goldberg, 2022; Stein & Witkiewitz, 2020). What are the necessary features of mindfulness that ought to be cultivated over the course of MBSR in order to effect changes in well-being? Relatedly, is there an ideal temporal sequence in which these features develop?

Seasoned MBSR instructors and practitioners may readily offer answers to these questions, informed by their personal and pedagogical experiences, which may not always correspond with the contemporary scientific-academic understanding (Alvear et al., 2022). Many contemplative traditions offer their own (perhaps complementary) descriptions of mindfulness development. For instance, the Stages of Insight from Theravada Buddhism illustrate a predictable sequence of progression through meditation practice that is often, anecdotally, recognizable over the course of MBSR (Grabovac, 2015). Modern theories of mindfulness development typically outline series of discrete skills that grow interdependently. The Monitor and Acceptance Theory (MAT; Lindsay & Creswell, 2017) is one such example. MAT suggests that attention monitoring skills are foundational to mindfulness while acceptance skills often arise later in training, serving an emotion regulatory role that directly improves affective experience and reduces stress. Others have described similar mechanisms of action in MBIs that emerge semi-sequentially, including attention regulation, body awareness, emotion regulation, and, ultimately, changes in one's perspective of the self (Hölzel et al., 2011).

Whether claims of mindfulness development come from contemplative traditions, modern theories, or the MBSR curriculum itself, it is often unclear how these proposed changes in mindfulness map onto established operationalizations of the construct. The mismatch between theory and measurement is further compounded when examining concepts from the various contemplative traditions (Galante et al., 2023). Only recently have formal models been introduced for translating these traditions' (often ancient and more subjective) claims into a form that is actually amenable to scientific investigation (Wright et al., 2023). Given these challenges, it may be most valuable for studies to use multiple, complementary measures of mindfulness and approach MBSR-related changes from a theoretically agnostic perspective using longitudinal designs (Galante et al., 2023). Such an agnostic approach better prevents biases in prediction and interpretation that may otherwise occur when adhering to any specific ontological view (Galante et al., 2023). Longitudinal studies thus far have yielded mixed and often contradictory findings on which facets of mindfulness and/or which mindfulness-adjacent skills change in response to MBSR (Alsubaie et al., 2017; Giannandrea et al., 2019; Goldberg et al., 2016; Gu et al., 2015). Even so, multiple systematic reviews point to evidence suggesting changes in individual mindfulness facets following MBSR may mediate observed reductions in psychological symptoms (Maddock & Blair, 2021; Prieto-Fidalgo et al., 2022; Quaglia et al., 2016). However, the precise configuration of these changes and the necessity of any particular facet are still unclear. One reason for this lack of clarity is that the abovementioned mediation studies used simpler models in which facets were examined individually. A more nuanced understanding of possible mechanisms, along with potential sequences of change, may come from examining these facets altogether within more complex and inclusive models (Galante et al., 2023). Extant empirical findings provide some guidance as to how such models might be built and which intervention components may be expected to have the most direct impact on well-being. We review this evidence below for several individual facets and mindfulness-adjacent skills, as they are defined by the commonly used scales of the Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006), the Toronto Mindfulness Scale-Trait Version (TMS-T; Davis et al., 2009), and the Self-Compassion Scale (SCS; Neff, 2003). We focus on the FFMQ because it is one of the most comprehensive measures of trait mindfulness, assessing five distinct facets of the mindfulness construct. Evidence for the construct representativeness of the FFMQ is apparent in its development, having been derived from a pool of 112 items from five pre-existing and well-validated mindfulness measures (Baer et al., 2006): the Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003), the Kentucky Inventory of Mindfulness Skills (KIMS; Baer et al., 2004), the Freiburg Mindfulness Inventory (FMI; Buchheld et al., 2001), the Cognitive and Affective Mindfulness Scale (CAMS; Feldman et al., 2007; Hayes & Feldman, 2004), and the Mindfulness Questionnaire (MQ; Chadwick et al., 2005). The structure of the FFMQ was further validated with a confirmatory factor analysis using a sample that comprised

over 50% experienced meditators as well as a student sample (Davis & Cairns, 2008). We also focus on the TMS-T given its complementarity with the FFMQ—given the low to moderate correlations between the TMS-T Curiosity subscale and other mindfulness questionnaires, the TMS-T may measure a unique characteristic of the mindfulness construct uncaptured by other scales (Davis et al., 2009). The TMS-T also uniquely captures decentering, a mindfulness skill that has increasingly been shown to be highly relevant to MBI outcomes and is not otherwise fully assessed by the FFMQ (Davis et al., 2009; Hoge et al., 2015; Moore et al., 2022; Pearson et al., 2015). There is evidence suggesting that state mindfulness meaningfully changes over the course of MBSR, and that these state changes drive observed changes in trait mindfulness that are also seen following the course (Kiken et al., 2015). However, we are also interested in the durability of changes and the consistency with which skills are implemented. Such durable changes are best captured using measures of dispositional mindfulness, such as the FFMQ and TMS-T. Finally, we focus on the SCS given its psychometric quality and self-compassion's putative and robust relationship with well-being outcomes (reviewed below).

The mindfulness facet of observing refers to attending to or noticing external stimuli that are experienced via the senses such as sights, sounds, and smells, as well as internal experiences such as emotions and thoughts (Baer et al., 2008). Previous findings have suggested that observing may be one of the first facets to change over the course of MBSR (Labelle et al., 2015). However, as indicated in a meta-analysis, changes in observing may only be weakly related to positive changes in mental health outcomes following mindfulness training (Quaglia et al., 2016). This was also reflected in a recent critical review of MAT's "monitoring" skill, in which observing showed inconsistent associations with indices of psychological distress across several studies (Simione & Saldarini, 2023). This could be attributed to the poor construct validity of the FFMQ's Observing subscale, which may not adequately account for emotional awareness, per exploratory factor analyses with observing-related items from other mindfulness scales (Rudkin et al., 2018). The role of observing may then be a necessary precursor to other mindfulness facets and skills in MBSR (e.g., nonreactivity and acceptance, as per MAT), but not a sufficient or direct influence on well-being and symptom reduction.

Describing is the process of using words to label internal experiences (Baer et al., 2008). The cross-sectional relationship of describing with anxiety, depression, and stress has been mixed; some studies have indicated that describing negatively predicts each of these outcomes, while others have found there is little to no relationship (e.g., Barcaccia et al., 2019; Burzler et al., 2019; Sweeney et al., 2021). Furthermore, a meta-analysis indicated that, across studies, describing may only show slight improvements following MBIs (Quaglia et al., 2016). Even so, describing (along with nonreactivity) may be integral to effective emotion regulation by supporting the strategies of reappraisal and acceptance (Iani et al., 2019). In light of these findings, describing could be similar to the observing facet, in that it is merely an antecedent to other skills but may not directly impact intervention outcomes.

Acting with awareness involves bringing attention to the activities that one is engaged in (Baer et al., 2008). Cross-sectionally, acting with awareness has been shown to be a consistent predictor of lower depression and anxiety and greater well-being (Barcaccia et al., 2019; Sweeney et al., 2021). Some cross-sectional findings have also suggested acting with awareness accounts for the greatest variance in self-report measures of psychological distress among adults, controlling for prior meditation experience (Roemer et al., 2021). Network analyses have also suggested that acting with awareness may be a vital bridge between the other mindfulness facets and decreased maladaptive outcomes, such as anxiety and stress (Medvedev et al., 2021a). However, the cross-sectional data from these investigations offer construct clarification more than an approximation of temporal interactions, which is best examined longitudinally. In one longitudinal study, acting with awareness was the only mindfulness facet to predict later depression (specifically the symptom of anhedonia) over a 1-month period (Raphiphatthana et al., 2016). The ability to act with awareness might then be more *proximally* important to changes in mental health outcomes following MBSR (compared to observing and describing).

Nonreactivity refers to the ability to be aware of thoughts and feelings without being swept along by them (Baer et al., 2008). Network analyses by Medvedev et al. (2021a) suggest that the mindfulness facets measured by the FFMQ are associated with lower depression, anxiety, and stress primarily via nonreactivity (and acting with awareness). In other words, nonreactivity (and acting with awareness) is a bridge between the other mindfulness skills and reductions in negative outcomes, having the most direct associations with both protective and maladjustment factors. Some have also provided evidence that baseline nonreactivity predicts the degree to which clinical symptoms improve due to MBSR. A recent series of meta-analytic structural equation models using data from 34 studies demonstrated that greater initial nonreactivity augmented the observed decreases in depression and anxiety attributable to MBI, many of which were MBSR studies (Prieto-Fidalgo et al., 2022). Nonreactivity, like acting with awareness, therefore may have a more proximal relation to mental health outcomes compared to other mindfulness facets and is evidently important to MBSR outcomes. However, these studies did not examine changes in nonreactivity over the course of MBSR, so they do not

provide full insight into nonreactivity as a possible active mechanism of the intervention. One study did indicate that increases in nonreactivity mediated the impact of MBSR on reductions in worry, such that those with generalized anxiety disorder who underwent MBSR (vs. a control intervention) reported decreased worry, which was partially explained by improvements in nonreactivity (Hoge et al., 2015). Thus, changes in nonreactivity could mediate the effects of the intervention on clinical outcomes, but it is unclear whether the effects of improvements in other mindfulness skills on clinical outcomes could also be mediated by nonreactivity.

Nonjudging involves responding to thoughts and emotions in a non-evaluative way (Baer et al., 2008). Nonjudging has been identified as a strong predictor of depression longitudinally over 2 years, even beyond the influence of other mindfulness facets and rumination (Petrocchi & Ottaviani, 2016). Moreover, changes in nonjudging early in the course of MBSR may predict later changes in the mindfulness facet of nonreactivity (Labelle et al., 2015). The importance of nonjudging has also been highlighted in numerous dismantling studies. Dismantling studies systematically remove various components of a treatment to determine whether they are necessary. Across these studies, nonjudgment/acceptance appears to be an active component of MBSR that supports improvements in daily positive affect over the course of treatment (Stein & Witkiewitz, 2020). The existing evidence-base for MAT also supports the prominence of nonjudging in improving well-being across interventions, although the necessity of the observing skill to its development is still unclear (Simione & Saldarini, 2023). Even so, nonjudging appears to exert positive effects on mental health and may build on other mindfulness skills. As such, it may have similar positioning and importance as nonreactivity and acting with awareness in driving changes in MBSR.

Decentering has been defined as the "capacity to take a present-focused, non-judgmental stance in regard to thoughts and feelings and to accept them" (Fresco et al., 2007b, p. 448). There is relatively strong support across studies for decentering's relationship with beneficial psychological outcomes (Hoge et al., 2015; Pearson et al., 2015). There has also been some evidence that decentering mediates the positive effects of MBSR on anxiety symptoms in those with generalized anxiety disorder (Hoge et al., 2015). Decentering has also been identified as a possible "common factor" of treatment across MBIs, along with other mechanisms like acceptance/nonjudging, based on a comprehensive review of intervention studies (Goldberg, 2022). These findings suggest that the development of decentering during MBSR may be of utmost consequence in enacting positive changes in well-being; however, like the other proposed facets of mindfulness, its reliance on the earlier development of other skills is unknown.

Curiosity is an individual's desire to learn more about their experiences (Lau et al., 2006). Some have suggested the cultivation of curiosity is the starting point for the development of mindfulness more broadly (Bishop et al., 2004). Indeed, curiosity is a theme introduced early in MBSR classes (Santorelli et al., 2017). When one takes a stance of non-analytical interest toward their experiences (e.g., sensations and mind-wandering), this ostensibly allows for greater awareness, detachment from, and acceptance of said experiences, allowing for reduced judgment and reactivity to unpleasant thoughts and feelings. As such, it may be that curiosity is an antecedent to the growth of later, more impactful mindfulness skills in MBSR, although this has yet to be shown empirically. Evidence directly linking curiosity with positive psychological and well-being outcomes is also lacking, as are investigations of curiosity within the MBSR program (Alsubaie et al., 2017).

Self-compassion is defined as an attitude of care and kindness toward oneself in response to difficult situations, failure, or perceived inadequacy (Neff et al., 2007). While the primary focus of MBSR is the development of mindfulness skills (such as those listed above), implicit within all MBSR programs is the invitation to respond to one's own pain and suffering with gentleness and compassion (Santorelli et al., 2017; T. Goddard, personal communication, April 26, 2023). Rather than an explicit instruction, this is invited through the way MBSR practices are led, via the self-inquiry process, how the MBSR group is structured and managed, and how conversations unfold in the group as participants grapple with difficulties in their lives. Most MBSR programs also include Loving-Kindness Meditation (LKM), a traditional Buddhist practice that aims to deliberately cultivate feelings of caring and warmth toward oneself and others (Salzberg, 1995). Evidence for the importance of self-compassion is found in numerous cross-sectional and longitudinal studies, in which self-compassion showed consistent negative associations with many forms of psychopathology, such as depression, anxiety, self-injury, and suicidality (Lou et al., 2022; Marsh et al., 2018; Per et al., 2022). As demonstrated across controlled trials and meta-analyses, MBSR also appears to consistently enhance self-compassion which, in turn, predicts improvements in psychological symptoms and well-being (Evans et al., 2018; Golden et al., 2021; Roca et al., 2021).

A distinction should first be made between LKM and self-compassion. Loving-kindness is a meditation practice taught with the intention to encourage compassion for oneself and others. However, loving-kindness is not synonymous with self- or other-compassion, and there are no extant, validated measures of loving-kindness as its own skill or trait (e.g., assessing the frequency or ease of LKM practice). Moreover, self- and other-compassion are not exclusively taught in LKM (e.g., see Compassionate Mind Training; Matos

et al., 2021), nor does LKM guarantee improvements in self- or other-compassion (Reilly & Stuyvenberg, 2023). Additionally, self-compassion and other-compassion, while often strongly related, are also distinct constructs that have shown differential associations with psychological well-being (Lopez et al., 2018; Sahdra et al., 2023). We focus on self-compassion given its putative and robust relationship with well-being outcomes. Additionally, in LKM or Metta meditation, self-compassion is cultivated before cultivating and extending compassion to others. Even so, it is still an open question as to whether self-compassion is, in fact, an indispensable element of MBSR and whether separate training in self-compassion (e.g., via LKM) is needed. However, studies have begun to address this issue by employing standalone self-compassion interventions and/or dismantling or component designs. A recent meta-analysis of seven interventional studies found that standalone LKM reliably increases self-reported self-compassion, citing a moderate overall effect size (Reilly & Stuyvenberg, 2023). A larger meta-analysis of multiple self-compassion interventions (including LKM) found small to medium effects on depression, anxiety, and stress across 56 trials, but with high risk of publication bias (Han & Kim, 2023). While the studies included in these meta-analyses broadly support the use of adjunctive self-compassion training, they rarely investigated moderators of these effects. One meta-analysis specifically looking at the effects of LKM on anxiety did investigate the possible moderating role of mindfulness—there appeared to be an incremental benefit of combining LKM with mindfulness meditation, with such trials evidencing (on average) larger effect sizes (Zheng et al., 2023). This suggests that self-compassion could interact meaningfully with subcomponents of mindfulness to effect changes in MBSR, but the nature of this interaction and the most relevant subcomponents are still unknown. Taken together, the existing literature argues that self-compassion is a prominent mechanism of action in MBSR that could independently lead to mental health changes, with some preliminary indications that it may build on other mindfulness skills.

Of the many mindfulness-related processes in MBSR, it is still not clear which of these have the greatest effect in lessening psychological suffering following the intervention. To address this question comprehensively, all these processes should be examined together, regardless of whether we choose to label them as components of mindfulness or as adjacent and/or interdependent skills. This study aimed to identify MBSR-related changes in depression, anxiety, and stress (hereafter collectively referred to as outcome variables) and the mindfulness components of curiosity, observing, describing, decentering, nonjudging, nonreactivity, acting with awareness, and self-compassion (hereafter referred to as process variables). This aim was pursued by following the guidelines by Pilla et al. (2020) for reporting on MBI studies (when possible). Process and outcome variables were measured at various stages throughout a typical MBSR course. We hypothesized the following, based upon the literature reviewed above: (1) the components of curiosity, observing, and describing will develop antecedent to the development of decentering, nonjudging, nonreactivity, and acting with awareness; (2) these early changes in curiosity, observing, and describing will predict later changes in decentering, nonjudging, nonreactivity, and acting with awareness; (3) later changes in decentering, nonjudging, nonreactivity, and acting with awareness will in turn predict later changes in self-compassion; and (4) self-compassion will be associated with increased well-being over and above changes in other process variables.

Method

Participants

Prior to enrolment in the MBSR course, instructors conducted a 15-min phone meeting with potential students to ask about their intentions and hopes for the MBSR course and to screen for suitability. Broadly, exclusion criteria for the course were substance use, personality traits, and/or untreated trauma that would make it exceedingly difficult to practice or participate effectively in a group. However, these exclusion criteria did not operate as a strict guideline, as the decision to enrol in the course was often made mutually within the conversation between the teacher and the prospective student. This procedure for determining MBSR course enrolment was separate from (and unrelated to) formal study enrolment.

Adults enrolled in 28 MBSR courses conducted by Openground Training and Consultation in Sydney, Melbourne, and Brisbane, Australia, were invited to participate via an email sent by the general Openground email address. Invitations were sent after individuals enrolled in the MBSR course but before attending the first class. Participants were made aware that participation was voluntary and the teacher of their MBSR group would not know whether they had decided to participate. Out of the 504 people enrolled in the courses, 226 respondents provided their informed consent and participated in the study. Of these participants, $n = 79$ were excluded from final analyses as they had greater than 1 year of prior meditation experience, resulting in a final sample size of 147. This criterion was applied because our study was concerned with mechanisms of change in MBSR and we wanted to select for those who would show the most pronounced change in response to the intervention. Those who are meditation-naïve or have more limited meditation experience are likely to show the most dramatic improvements in well-being outcomes during the nascent stages of

practice (Bowles et al., 2022). However, while we considered prior meditation experience a potential confounder to the investigation of intervention mechanisms, recent evidence also suggests that novice and experienced meditators may benefit similarly from MBSR (Ito et al., 2022). As such, we did not confine our sample to individuals who were entirely meditation-naïve.

No data were available on those who chose not to participate. The number of participants in each of the 28 MBSR groups ranged from 8 to 23. Demographic information about the sample is shown in Table 1. Of the included participants, just over half ($n = 102$, 69.4%) indicated that they had no meditation experience prior to starting the course. Those with prior experience (all ≤ 1 year), reported meditating a median of 1 ($IQR = 0–3$) days in the week prior to starting the course, with an average time of 14.4 ($SD = 14.6$) minutes spent meditating on those day(s).

Procedure

Course teachers had all participated in an MBSR course as a participant and completed MBSR instructor training at the practicum level following the training curriculum from the Center for Mindfulness (CFM) at UMass Memorial Health in Worcester, MA. All teachers also participated in regular supervision with the Director of Training of Openground, who in turn engaged in regular supervision with the CFM. In addition, all teachers had attended a pre-requisite meditation retreat and maintained a personal mindfulness meditation practice. Teachers participated in regular supervision with the Director of Openground to ensure that classes were taught in accordance with the CFM MBSR program. Of note, LKM was also taught during the full day of practice that was scheduled between the fifth and sixth classes.

Questionnaires were completed at four time points: (1) before commencing the course; (2) mid-course, following attendance in Week 4; (3) end-of-course, following attendance in Week 8; and (4) 3 months after course completion. Out of the 147 respondents at Time 1, 103 returned the questionnaires at Time 2, 76 responded at Time 3, and 67 responded at Time 4. At Time 3, participants were asked how many classes they attended during the previous 4 weeks. Of the 76 respondents at Time 3, 60.5% ($n = 46$) had attended six or more of the eight classes, while 39.5% ($n = 30$) had attended five classes or less. The incentive offered for completing questionnaires at all four rounds of the study in the first term of classes was a free post-course workshop. In subsequent terms, the incentive offered was entry to a prize draw for a meditation stool valued at AU$90.

Table 1 Sample demographics and baseline characteristics

Characteristic	%
Gender*	
Female	74.1
Male	25.9
Education	
High school	8.2
Associates/trade school/TAFE	10.9
Undergraduate degree/Bachelor's	37.4
Graduate/postgraduate degree	43.5
Previous meditation experience	
None	69.4
Mindfulness	8.8
Buddhist (unspecified)	3.4
Buddhist (Zen)	0.7
Yoga	4.1
Other or unknown	13.6

$n = 147$. Mean age (SD) = 40.80 (9.80)

*Unfortunately, when these data were collected, the research team did not have hypotheses concerning race or ethnicity, and regrettably omitted questions regarding these important demographic variables. Gender data were also limited such that other identities (e.g., transgender, non-binary) were not assessed

Measures

The participants provided demographic information and details about any previous meditation practice at Time 1. Unfortunately, when these data were collected, the research team did not have hypotheses concerning race or ethnicity, and regrettably omitted questions regarding these important demographic variables. Gender data were also limited such that other identities (e.g., transgender, non-binary) were not assessed. Participants also completed questions about class attendance, length of daily practice, number of days of meditation practice, and perceived support from the group. Four questions adapted from the Credibility/Expectancy Questionnaire (Devilly & Borkovec, 2000) were also given to assess expectations about the MBSR program at each time point. While these questions were considered as possible contributors to program effectiveness, their examination is beyond the scope of this paper. The following measures were of greater relevance to our hypotheses, all of which were completed by participants at all four time points.

The Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006) is a 39-item self-report measure of trait mindfulness that participants completed at all four time points. It consists of five subscales: Nonreactivity, Observing, Acting with Awareness, Describing, and Nonjudging. Items are rated on a 5-point scale from 1 (*rarely or very rarely true*) to 5 (*very often or always true*). The FFMQ shows internal consistency (coefficient alpha) for the subscales ranging from 0.75 to 0.91 (Baer et al., 2006). In the current study, Cronbach's alpha at Time 1 was 0.85 for FFMQ Observing, 0.92 for Describing, 0.90 for Acting with Awareness, 0.93

for Nonjudging, and 0.90 for Nonreactivity. McDonald's omega at Time 1 was 0.84 for FFMQ Observing, 0.93 for Describing, 0.90 for Acting with Awareness, 0.94 for Nonjudging, and 0.87 for Nonreactivity.

The Toronto Mindfulness Scale-Trait version (TMS-T; Davis et al., 2009) is a 13-item self-report measure of mindfulness that participants completed at all four time points. It consists of two factors: Curiosity and Decentering. The Curiosity factor measures the extent of wanting to enquire about one's experiences. The Decentering factor measures an ability to not personally identify with, or become overly absorbed in, thoughts or feelings. Items are rated on a 5-point scale from 0 (*not at all*) to 4 (*very much*). The TMS-T has been found to have internal consistency (coefficient alpha) of 0.91 for Curiosity and 0.85 for Decentering (Davis et al., 2009). In the current study, Cronbach's alpha at Time 1 was 0.89 for TMS-T Curiosity and 0.83 for TMS-T Decentering. McDonald's omega at Time 1 was 0.90 for TMS-T Curiosity and 0.80 for TMS-T Decentering.

The Self-Compassion Scale (SCS; Neff, 2003) is a 26-item self-report measure of the extent to which an individual is compassionate toward themselves, which participants completed at all four time points. It consists of six factors that measure three main components of self-compassion: self-kindness versus self-judgment; an experience of common humanity versus isolation; and mindfulness versus over-identification (Neff, 2003). For brevity and parsimony, the Self-Compassion Total Score was used rather than the six factor scores. Reported internal consistency (coefficient alpha) for the total SCS was 0.92 (Neff, 2003). In the current study, Cronbach's alpha at Time 1 for the total SCS was also 0.92. McDonald's omega was 0.90.

The Depression Anxiety Stress Scales – Short form (DASS-21; Lovibond & Lovibond, 1995) is a 21-item self-report measure of depression, anxiety, and stress that participants completed at all four time points. In an Australian non-clinical sample, Cronbach's alpha was 0.90 for the Depression scale, 0.79 for the Anxiety scale, and 0.89 for the Stress scale (Crawford et al., 2011). In the current study, Cronbach's alpha at Time 1 was 0.91 for the Stress scale, 0.93 for the Depression scale, and 0.89 for the Anxiety scale. McDonald's omega at Time 1 was 0.91 for the Stress scale, 0.94 for the Depression scale, and 0.90 for the Anxiety scale.

Data Analyses

To first examine which process and outcome variables changed over the MBSR course and the 3-month follow-up, individual linear mixed effects models were run with each process and outcome variable specified as the dependent variable and with time specified as both a fixed and random effect. Because 10 models were run, a Bonferroni correction ($\alpha/10$ tests) was applied for a significance cut-off of $p < 0.005$ for each model's fixed effect of time. For models with a significant ($p < 0.005$) fixed effect of time, Bonferroni post hoc comparisons were made between each time point, applying the Bonferroni correction again ($\alpha/6$ comparisons) for a significance cut-off of $p < 0.008$. Figures 1 and 2 show changes in mean z-scores for the process and outcome variables respectively. To then examine which process variables changed together with which outcome variables, bivariate linear growth curve modelling was used (Fig. 3), pairing two variables together and freely estimating the covariances between their intercept and slope factors (with a significant covariance between slope factors indicating that the variables changed together over time).

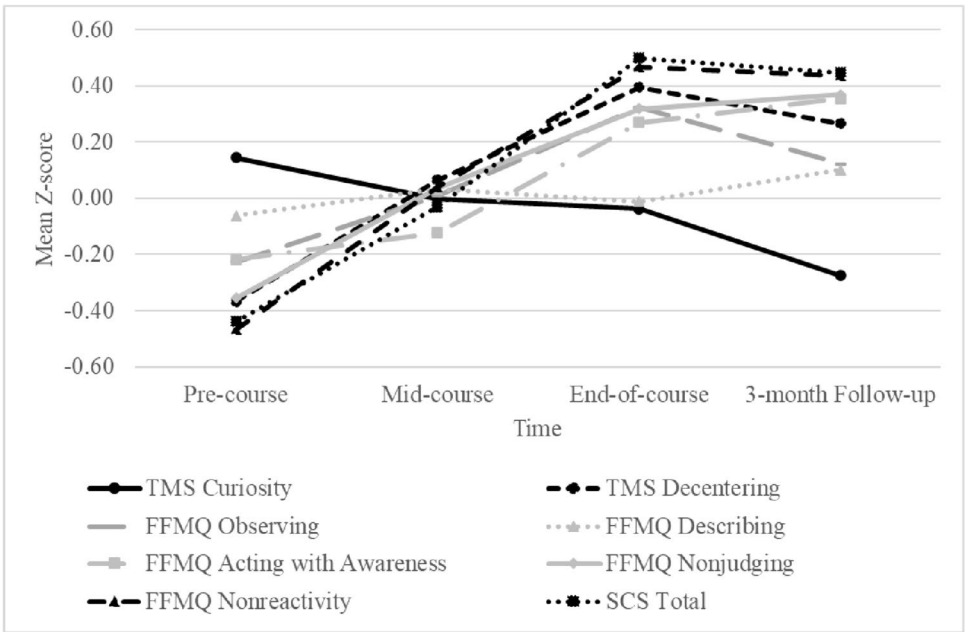

Fig. 1 Changes in mean *z*-scores for process variables over time. Z-scores based on grand *M* and *SD* pooled across time points

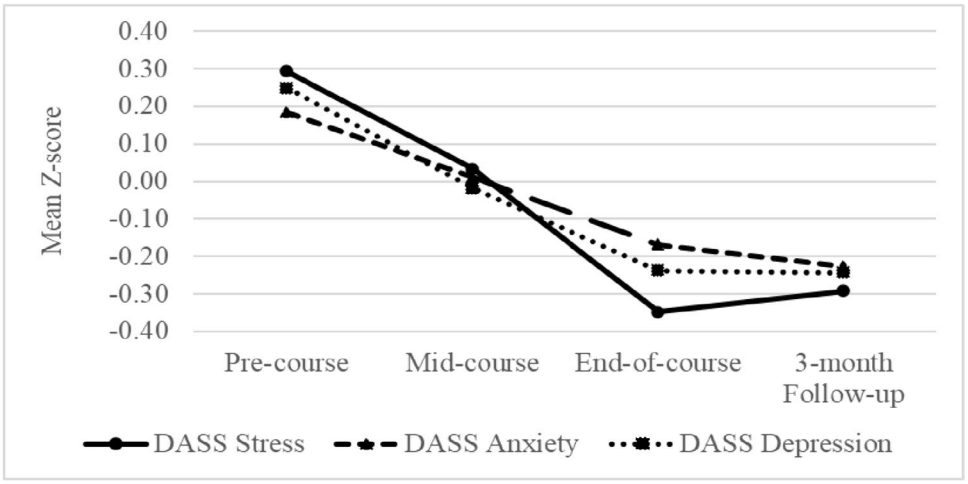

Fig. 2 Changes in mean *z*-scores for outcome variables over time. Z-scores based on grand *M* and *SD* pooled across time points

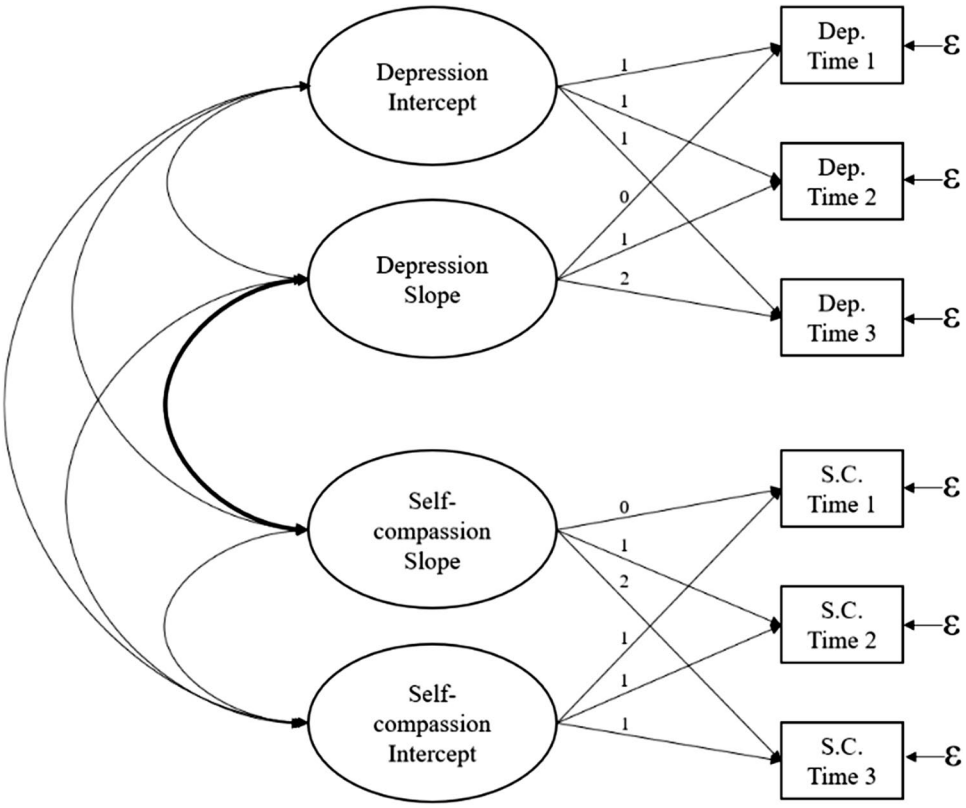

Fig. 3 Example diagram of bivariate latent growth curve model. Model was repeated for each process variable paired with each outcome variable. S.C., self-compassion; Dep., depression

Finally, to test the hypotheses regarding individual aspects of mindfulness being possible precursors to others, we conducted a path analysis using raw difference scores between each time point. We chose Time 1 to Time 3 difference scores for the outcome variables to represent cumulative change over the entirety of the course. We chose Time 2 to 3 difference scores in self-compassion as a direct effect predicting the Time 1–3 outcome differences because we believed changes in self-compassion during the latter half of the course would be *most impactful* to the overall cumulative changes that were observed in depression, anxiety, and stress resulting from the MBSR course. Because of limitations imposed by our sample size, our path analysis model was built solely to explore our hypotheses, rather than to comprehensively explore every possible course-related change predicting every other possible course-related change. Our path analysis model was specified as follows: the exogenous variables were changes from Time 1 to 2 in TMS-T Curiosity, FFMQ Observing, and FFMQ Describing. Each of these exogenous variables were specified to predict changes from Time 2 to 3 in TMS-T Decentering, FFMQ Acting with Awareness, FFMQ Nonjudging, and FFMQ Nonreactivity.

These Time 2–3 changes were then set as direct regression predictors of change in SCS Total from Time 2 to 3. Overall changes in the outcome variables from Time 1 to 3 were then regressed on Time 2–3 change in self-compassion. The specification of this path analysis is illustrated in Fig. 4. Statistical significance of covariances and direct effects was determined using a $p < 0.05$ cut-off. We determined statistical significance of indirect effects using 95% bootstrapped confidence intervals (derived from 1000 bootstrapped samples) that do not contain zero. Additionally, given its association with data missingness, age was included as a control variable in our analysis—for simplicity's sake, the effects of age are omitted from Fig. 4. To account for possible clustering, an alternate version of the path analysis was also run which included class/instructor as a control variable as well—as this was a model we did not specify a priori, these results are reported in the Supplementary Material. Alternate versions of this path analysis were also run to account for the two subfactors of the SCS—compassionate self-responding (CS) and uncompassionate self-responding (UCS). In these alternate models, the CS and UCS were used in place of the SCS Total Score. Additionally, to account for potential construct overlap of the SCS with the FFMQ and TMS-T, we also re-ran the path analysis using the SCS, excluding the mindfulness subscale items. Finally, given the potential advantages of using residualized change scores over raw difference scores (e.g., increased power and reliability; Castro-Schilo & Grimm, 2018), we also ran our path analysis model using residualized change scores. These alternate models are represented in Figures S1-S5 in the Supplementary Material.

Results

Analysis of Missing Data

Details of the missing data in this study are shown in Table S1. Because linear mixed effects models, growth curve models, and path analyses use full information maximum-likelihood (FIML) estimation, they require any missing data to be at least *missing at random* (MAR)—this means that missingness must be predicted by a separate variable and not the outcome/missing variable itself. When missing data on an outcome is likely attributable to the (unobserved)

Fig. 4 Full path analysis. Values shown are standardized coefficients. Δ indicates raw change score. * $p < 0.05$, ** $p < 0.01$. χ^2 (24) = 31.49, $p = 0.14$; *RMSEA* = 0.057 (90% *CI* 0.000, 0.106); standardized root mean square residual = 0.059; Comparative Fit Index = 0.944; Tucker-Lewis Index = 0.878

scores on the outcome itself, then it is missing not at random (MNAR). In order to examine the missing data mechanism, analyses were conducted to examine whether missing data/nonresponse was associated with any participant characteristics (i.e., MAR) or scores on outcome measures at other time points (i.e., MNAR; Little & Rubin, 1989). Independent samples *t*-tests were conducted to examine whether participants who had missing data differed in their scores on the FFMQ, TMS-T, and DASS at Time 1. These *t*-tests evidenced no significant differences between those with missing data and complete cases (all *p*-values > 0.05), indicating the data were likely not MNAR. However, missingness was related to age, $t(108.99) = 1.99$, $p = 0.049$, $d = 0.34$, as those with missing data ($M = 39.55$, $SD = 9.50$) were significantly younger than those with no missing data ($M = 42.89$, $SD = 10.01$), suggesting that the data were indeed MAR. Given that FIML estimation manages MAR data fairly well (Schafer & Graham, 2002), we proceeded with the planned analyses of the observed data.

Change in Process and Outcome Variables Over Time

Means and standard deviations for all variables at each time point are shown in Table 2. Individual mixed model analyses with time as the fixed and random effects found that all variables showed significant changes over time (*p*-values < 0.005) with the exception of FFMQ Describing ($p = 0.724$) and FFMQ Observing ($p = 0.040$). Age was not a significant covariate in any of these models ($p > 0.05$).

To examine which process and outcome variables changed together, we ran linear growth curve models pairing each process variable with each outcome variable. While the intercept and slope factors for these models were allowed to freely covary, of particular interest was the covariance between the two slope factors. Models with an *RMSEA* > 0.8 were considered poor fit, and thus the significance of any covariances between slopes was not evaluated. Results of these growth curve models (Table 3) indicated that changes in DASS Depression were significantly associated with changes in Self-compassion ($p = 0.006$) while changes in DASS Anxiety and DASS Stress were both significantly associated with changes in Decentering, Nonreactivity, and Self-compassion (*p*-values < 0.05). Despite showing no significant overall change, the slope factor for Describing significantly covaried with DASS Anxiety ($p = 0.016$).

For the first hypothesis, we anticipated that the components of curiosity, observing, and describing would develop antecedent to the development of decentering, nonjudging, nonreactivity, and acting with awareness. Contrary to expectations, the Bonferroni post hoc comparisons revealed that Observing only showed significant improvements in the latter half (i.e., from Time 2 to 3) of the MBSR course ($p < 0.001$) while Curiosity and Describing did not significantly change over the MBSR course (*p*-values > 0.008). Also unexpectedly, Decentering, Nonreactivity, and Self-compassion showed significant increases both in the first and second halves of the course (all *p*-values < 0.008). All process and outcome variables which changed significantly over the MBSR course maintained these changes at the 3-month follow-up time point (i.e., *p*-values < 0.05 for comparison of Time 4 to Time 1 *and* no significant changes from Time 3 to Time 4).

Table 2 Linear mixed models showing change in process and outcome variables over time

Variable	Time 1 *M* (*SD*)	Time 2 *M* (*SD*)	Time 3 *M* (*SD*)	Time 4 *M* (*SD*)	F^a	*p*
Process variable						
TMS-T Curiosity	17.48 (5.64)	16.72 (5.06)	16.53 (4.28)	15.28 (5.21)	2.80	0.040
FFMQ Observe	25.17 (5.63)	26.48 (5.26)	28.23 (5.2)*†	27.12 (5.73)*	5.57	**< 0.001**
FFMQ Describe	27.02 (7.21)	27.68 (6.78)	27.37 (7.09)	28.16 (6.9)	0.44	0.724
TMS-T Decenter	12.37 (5.28)	14.77 (5.11)*	16.58 (5.06)*†	15.87 (5.71)*	13.48	**< 0.001**
FFMQ Acting with Awareness	21.45 (6.28)	22.04 (5.85)	24.47 (6.04)*†	25.00 (5.71)*	7.70	**< 0.001**
FFMQ Nonjudge	22.15 (7.43)	25.14 (7.04)	27.3 (6.98)* †	27.69 (7.8)*	12.61	**< 0.001**
FFMQ Nonreactivity	16.69 (4.65)	19.13 (4.24)*	21.19 (4.25)*†	21.04 (4.5)*	23.51	**< 0.001**
SCS Total	15.87 (3.15)	17.41 (3.32)*	19.39 (3.76)*†	19.2 (3.92)*	23.72	**< 0.001**
Outcome variable						
DASS Stress	23.87 (11.97)	20.67 (12.2)*	15.97 (10.67)*†	16.66 (12.65)*	9.53	**< 0.001**
DASS Anxiety	14.24 (10.75)	12.35 (10.97)*	10.41 (10.49)*	9.78 (10.72)*	3.49	**0.002**
DASS Depression	18.91 (12.17)	15.62 (11.67)	12.9 (11.53)*†	12.84 (13.28)*	5.81	**< 0.001**

TMS-T, Toronto Mindfulness Scale, Trait Version; *FFMQ*, Five Facet Mindfulness Questionnaire; *SCS*, Self-compassion Scale; *DASS*, Depression Anxiety Stress Scale. [a]Test for overall mixed model of time predicting the process or outcome variable with $df = 3$, $df_e = 373$. **Bold** indicates $p < 0.005$ for test of overall mixed model; *$p < 0.008$ Bonferroni comparison of respective time point vs. Time 1. †$p < 0.008$ Bonferroni comparison of respective time point vs. time point immediately prior to it

Table 3 Bivariate latent growth curve models

Variable	DASS Depression							
	χ^2 (*df*)	*p*	*RMSEA* (90% CI)	*SRMR*	*CFI*	*TLI*	Slopes Cov (*SE*)	p_{cov}
TMS-T Curiosity	8.324 (7)	0.305	0.036 (0.000, 0.112)	0.032	0.996	0.992	−0.497 (0.918)	0.588
FFMQ Describing	5.195 (7)	0.636	0.000 (0.000, 0.085)	0.018	1.000	1.008	−1.357 (0.886)	0.126
FFMQ Observing	7.656 (7)	0.364	0.026 (0.000, 0.108)	0.027	0.998	0.997	−1.550 (0.877)	0.077
TMS-T Decentering	10.146 (7)	0.180	0.055 (0.000, 0.124)	0.029	0.991	0.981	−1.538 (0.900)	0.087
FFMQ Acting with Awareness	26.864 (7)	< 0.001	0.141 (0.087, 0.200)	0.034	0.957	0.907	−0.162 (0.914)	0.859
FFMQ Nonjudging	14.874 (7)	0.038	0.089 (0.020, 0.152)	0.020	0.982	0.962	−1.523 (1.217)	0.211
FFMQ Nonreactivity	**15.145 (7)**	**0.034**	**0.091 (0.023, 0.154)**	**0.024**	**0.981**	**0.959**	**−1.626 (0.804)**	**0.043**
Self-Compassion	**14.12(7)**	**0.165**	**0.083 (0.005, 0.146)**	**0.028**	**0.986**	**0.970**	**−1.294 (0.804)**	**0.006**
Variable	DASS Anxiety							
	χ^2(*df*)	*p*	*RMSEA* (90% CI)	*SRMR*	*CFI*	*TLI*	Slopes Cov (*SE*)	p_{cov}
TMS-T Curiosity	7.142 (7)	0.414	0.012 (0.000, 0.103)	0.024	1.000	0.999	−0.714 (0.796)	0.370
FFMQ Describing	**11.185 (7)**	**0.131**	**0.065 (0.000, 0.133)**	**0.027**	**0.992**	**0.982**	**−1.846 (0.764)**	**0.016**
FFMQ Observing	4.652 (7)	0.702	0.000 (0.000, 0.078)	0.027	1.000	1.012	0.137 (0.752)	0.856
TMS-T Decentering	**5.686 (7)**	**0.577**	**0.000 (0.000, 0.089)**	**0.017**	**1.000**	**1.008**	**−2.436 (0.842)**	**0.004**
FFMQ Acting with Awareness	13.976 (7)	0.052	0.084 (0.000, 0.148)	0.033	0.985	0.968	−1.277 (0.779)	0.101
FFMQ Nonjudging	10.314 (7)	0.171	0.058 (0.000, 0.127)	0.020	0.993	0.985	−2.004 (1.086)	0.065
FFMQ Nonreactivity	**6.120 (7)**	**0.526**	**0.000 (0.000, 0.095)**	**0.016**	**1.000**	**1.004**	**−1.537 (0.716)**	**0.032**
Self-Compassion	**5.105 (7)**	**0.647**	**0.000 (0.000, 0.083)**	**0.018**	**1.000**	**1.008**	**−1.647 (0.498)**	**0.001**
Variable	DASS Stress							
	χ^2 (*df*)	*p*	*RMSEA* (90% CI)	*SRMR*	*CFI*	*TLI*	Slopes Cov (*SE*)	p_{cov}
TMS-T Curiosity	8.050 (7)	0.328	0.032 (0.000, 0.110)	0.034	0.997	0.993	0.475 (1.034)	0.646
FFMQ Describing	10.106 (7)	0.183	0.056 (0.000, 0.126)	0.034	0.993	0.985	−1.572 (1.029)	0.126
FFMQ Observing	4.676 (7)	0.699	0.000 (0.000, 0.078)	0.019	1.000	1.013	−1.426 (1.009)	0.158
TMS-T Decentering	**6.621 (7)**	**0.469**	**0.000 (0.000, 0.098)**	**0.017**	**1.000**	**1.003**	**−2.236 (1.094)**	**0.041**
FFMQ Acting with Awareness	23.847 (7)	0.001	0.130 (0.075, 0.189)	0.035	0.960	0.914	−2.421 (1.124)	0.031
FFMQ Nonjudging	12.126 (7)	0.096	0.072 (0.000, 0.138)	0.023	0.988	0.973	−2.313 (1.406)	0.100
FFMQ Nonreactivity	**7.222 (7)**	**0.406**	**0.015 (0.000, 0.105)**	**0.026**	**0.999**	**0.999**	**−3.697 (0.993)**	**< 0.001**
Self-Compassion	**13.683 (7)**	**0.057**	**0.081 (0.000, 0.144)**	**0.032**	**0.986**	**0.970**	**−2.395 (0.717)**	**0.001**

TMS-T, Toronto Mindfulness Scale, Trait Version; *FFMQ*, Five Facet Mindfulness Questionnaire; *DASS*, Depression Anxiety Stress Scale; *RMSEA*, root mean square error of approximation; *SRMR*, standardized root mean squared residual; *CFI*, Comparative Fit Index; *TLI*, Tucker-Lewis index; *Slopes Cov*, covariance between the latent slope factors of respective process and outcome variable. **Bold** indicates $p < 0.05$

Evaluation of Precursory Change

Results of the path analyses are shown in Fig. 4. For the second hypothesis, we predicted early changes (i.e., from Time 1 to 2) in curiosity, observing, and describing would predict later changes (i.e., from Time 2 to 3) in decentering, nonjudging, nonreactivity, and acting with awareness. The model showed that only early increases in Describing predicted later increases in Acting with Awareness ($\beta = 0.21$, $SE = 0.10$, $p = 0.039$). For the third hypothesis, we expected that later changes (i.e., from Time 2 to 3) in Decentering, Nonjudging, Nonreactivity, and Acting with Awareness would predict later changes in self-compassion. Only later changes in Nonjudgment ($\beta = 0.10$, $SE = 0.05$, $p = 0.040$) and Nonreactivity ($\beta = 0.37$, $SE = 0.08$, $p < 0.001$) predicted later changes in Self-compassion. Finally, we hypothesized that changes in self-compassion would be associated with decreased depression, anxiety, and stress over and above changes in other process variables. The direct effects of Time 2–3 change in Self-compassion on overall changes in Depression ($\beta = -0.75$, $SE = 0.38$, $p = 0.049$) and Anxiety ($\beta = -0.86$, $SE = 0.31$, $p = 0.005$) were significant. Time 2–3 change in Self-compassion did not predict overall change in stress ($\beta = -0.28$, $SE = 0.44$, $p = 0.52$). Each of the total indirect effects (Table S2) of the other process variables via Self-compassion were not significant (i.e., each of the bootstrapped 95% confidence intervals contained zero); one exception was the indirect effect of Nonreactivity on DASS Anxiety via Self-compassion, which was significant (i.e., bootstrapped confidence interval did not contain zero). Age was not a significant covariate in any of our models ($p > 0.05$).

Exploratory Alternate Path Analyses

Our alternate path analyses (Supplementary Material) demonstrated various degrees of fit, but with nearly identical patterns of effects. Several alternate models demonstrated comparable or better fit than our primary model, including the models using the CS [χ^2 (24) = 26. 48, $p = 0.33$; *RMSEA* = 0.033 (90% *CI* 0.000, 0.091)] and UCS [χ^2 (24) = 29.34, $p = 0.21$; *RMSEA* = 0.048 (90% *CI* 0.000, 0.100)] and the model that used residualized change instead of difference scores [χ^2 (24) = 31.12, $p = 0.15$; *RMSEA* = 0.055 (90% *CI* 0.000, 0.105)]. These three models yielded similar results to the primary model, but with several notable differences. For the model using residualized change scores, the effect of Time 1–2 Describing on Time 2–3 Acting with Awareness was no longer significant ($p > 0.05$). For the models using the CS and residualized change scores, changes in Time 2–3 Non-judging no longer predicted changes in Time 2–3 Self-compassion (p values > 0.05). For the models using the CS, UCS, and residualized change scores, the direct effect of Time 2–3 Self-compassion on course-related changes in Depression also fell to non-significance (p-values > 0.05). Otherwise, the direct effects for these three models were generally comparable to our primary path analysis model.

Discussion

This study aimed to develop a model of changes in mindfulness components and psychological distress over the course of MBSR. Specifically, we sought to identify the temporal order in which mindfulness facets develop during MBSR and the effect of early changes on later changes in these facets. We also examined whether changes in self-compassion had a unique effect on depression, anxiety, and stress in the MBSR program.

We first hypothesized that curiosity, observing, and describing would develop antecedent to the other mindfulness facets. Our results did not support this prediction, as none of these three facets showed significant change in the first 4 weeks of MBSR. In fact, of these facets, only observing showed any significant increases over the entirety of the course. As curiosity, observing, and describing did not significantly increase in the first half of the course, our second hypothesis that they would each predict subsequent improvements in the other facets was also not supported—for this reason, the significant effect of Time 1–2 change in describing on Time 2–3 change in acting with awareness should be viewed sceptically. Curiosity, observing, and describing were hypothesized to be precursors to the other facets because we viewed them as lower-order mindfulness skills and previous findings were mixed regarding their *direct* effects on well-being and symptom outcomes. In light of our null findings, we posit a number of reasons for the lack of early (and total) change on these facets.

For each of these mindfulness components, our linear approach to modelling change may have hidden a true process of nonlinear change. This would be consistent with some recent suggestions that the benefits of mindfulness practice may accumulate in nonlinear and/or curvilinear ways (Bowles et al., 2022; Galante et al., 2023). For curiosity specifically, it may be that it simply is not a central element of the mindfulness construct and therefore not essential for change (Siegling & Petrides, 2016). It should also be noted that we used the trait version of the TMS, and it may still be possible that *state* curiosity is an important component of mindfulness development in MBSR. For example, state curiosity could be vital in periods of formal practice (e.g., being curious about one's experience during meditation itself) but not necessarily in daily life. Future research might explore this possibility, given our findings and the discrepancies in the literature regarding trait curiosity. Recent employments of generalizability theory have affirmed these scales' valid capturing of trait (vs. state) qualities, meaning important state changes were likely neglected in our measurement (Medvedev et al., 2017a, 2021a; Truong et al., 2020). Alternatively, novel experience sampling approaches that are confined to periods of formal mindfulness practice may better capture important state changes that occur over the course of training (Kümmerle et al., 2023). As Kiken et al. (2015) demonstrated, state mindfulness is an important predictor of trait-level changes associated with MBSR participation. Future research may seek to determine whether such distinctions between trait and state are specifically meaningful for curiosity in MBSR. We encourage researchers to explore the state-trait dichotomy using methods such as experience sampling alongside repeated administration of trait measures.

The lack of change in describing may have similar explanations. Like curiosity, describing has also shown evidence of weak factor loadings with mindfulness overall (Siegling & Petrides, 2016). As defined by the FFMQ, describing is the ability to put thoughts and emotions into words. While emotion- and thought-labelling can be elements of mindfulness practice, MBSR does not particularly focus on fostering accurate or detailed description of these experiences (as is conveyed by some of the FFMQ Describing items). Furthermore, increases in describing in response to MBSR have been reported by some studies, but not others (Giannandrea et al., 2019; Ortet et al., 2020; Winnebeck et al., 2017). According to one meta-analysis, describing showed weak effect sizes across 88 RCTs of MBIs (Quaglia et al., 2016). More research is clearly needed to determine whether describing is responsive to MBSR and whether it is actually necessary for the development of mindfulness more generally.

While observing did show increases by the end of the MBSR course, it did not significantly increase in the first 4 weeks. Observing also did not predict subsequent changes in the other facets, calling into question its role as a foundational skill. This is consistent with the mixed findings to-date on observing's contribution to the development of acceptance skills in MBIs, with relevance to the empirical support of Monitor and Acceptance Theory (Simione & Saldarini, 2023). These findings might be explained by the possibility that the *quality* of observing could differ between meditators and non-meditators, in that observing becomes more objective and obtains a more balanced focus on positive and negative stimuli with increased mindfulness practice. This appears to be supported by factor analytic findings that show observing's association with the other mindfulness facets grows stronger post-MBIs (Gu et al., 2016). Thus, observing may become more consistent with other mindfulness facets as meditation experience increases, an interpretation which aligns with the delayed changes in observing found in our sample of mostly non-meditators.

There were also early improvements in decentering, nonreactivity, and self-compassion during the first 4 weeks of the program. Although these early improvements were not hypothesized, they are also not unprecedented. Significant mid-course increases in self-compassion have been shown in previous research (Bergen-Cico & Cheon, 2014), while one other study has found that nonreactivity can improve in MBSR as early as 2 weeks into the program (Baer et al., 2012). This is perhaps unsurprising, as such themes are not exclusively taught in later weeks of the course. Although responsivity vs. reactivity (formally taught in Week 4 and Week 5) and self/other compassion (formally offered in Week 6) are not the explicit focus of early classes, it is important to acknowledge the implicit ways in which both are communicated and experienced by participants even from the first pre-course interview. At the outset and throughout the program, participants are invited to approach and explore all aspects of their experience, including pleasant and unpleasant body sensations, emotions, thoughts and impulses, and circumstances. They are also invited to do this exploration with kindness, curiosity, and care. The teacher responding with steady curiosity and kindness to participants' reactive experiences (e.g., irritability, shame, boredom, negativity, and intellectualizing) is perhaps more effecting than formal psychoeducation about self-compassion or reactivity. It could be argued that decentering is also implicitly woven into the entirety of MBSR, as much of the program is focused on disidentification with thoughts and emotions, even early on.

Our hypothesis that later changes in decentering, nonjudging, nonreactivity, and acting with awareness would predict later changes in self-compassion was partially supported. Only changes in non-judging and non-reactivity evidenced significant direct effects on changes in self-compassion. This is consistent with previous cross-sectional findings showing that these two facets moderately correlate with self-compassion and with one longitudinal study suggesting mindfulness development precedes and instigates self-compassion development in MBSR, which in turn mediates the effects of mindfulness on symptomatology (Bergen-Cico & Cheon, 2014; Golden et al., 2021; Sweeney et al., 2021). In interpreting this finding, the conceptual overlap of non-reactivity and nonjudging with self-compassion should be noted. The SCS includes both a mindfulness subscale and (in direct contrast to the FFMQ's nonjudging) a self-judgment subscale (Neff, 2003). As such, it is unclear the degree to which the significant effect of nonjudging and nonreactivity on self-compassion reflects these constructs' conceptual/psychometric overlap. Whether mindfulness should be parsed out as one of six subscales on the SCS is a matter of open debate—it is likely that the SCS summarizes a complex series of processes that constitute "self-compassion," and the utility of these subscales likely depends on numerous factors, such as individual differences in context and the timeframe of measurement (Ferrari et al., 2022). Additionally, as there was only one mid-course time point in our study, we had to represent the mindfulness facets' prediction of self-compassion as regressions of contemporaneous change scores; while temporal precedence was implied with these effects, it was not shown directly. Thus, these effects could reflect simultaneous change, lagged prediction, or both. Future studies with additional measurement time points may clarify these relationships further.

As expected, self-compassion scores had a significant effect on anxiety and depression scores. The total indirect effects of the mindfulness facets were nearly all nonsignificant, possibly indicating the primacy of self-compassion over and above other mechanisms in predicting changes in anxiety and depression. The one exception was the indirect effect of changes in non-reactivity on changes in anxiety (via self-compassion). Without a direct effect specified a priori, we cannot make definitive statements about this relationship, but it is noteworthy in light of some previous findings. Non-reactivity has shown significant cross-sectional relationships with anxiety previously, with some evidence of partial mediation through decentering (Barcaccia et al., 2019; Brown et al., 2015). Others found, in a network analysis, that non-reactivity did not have a direct edge shared with anxiety, but it did with other negative outcomes like stress and a pre-specified collection of maladaptive nodes (Medvedev et al., 2021b). More longitudinal investigations are needed to determine whether the non-reactivity-anxiety link holds throughout MBSR and if it is truly mediated by other variables such as self-compassion.

The unique effects observed for changes in self-compassion on two of the outcome variables perhaps speaks to the

importance of self-compassion as a mechanism of action, but also to the benefit of loving-kindness as a module of training. This result as it relates to depression is also intuitive, given that individuals suffering from depression often experience negative self-talk, which is likely to be lessened with an increased capacity for self-compassion. This result also builds on preliminary findings showing self-compassion to be a mediator of well-being changes in MBSR (Gu et al., 2015). However, as with the other mindfulness facets, self-compassion may share conceptual overlap with depression; the proposed bifactor model of the SCS includes "self-criticism" as one of two major components of the self-compassion construct (Neff, 2016). While self-criticism is not directly represented in the DASS-21, it is often considered a core symptom of depression (Beck et al., 1996; Høstmælingen et al., 2021). Therefore, it is possible that this effect reflects the SCS's partial capturing of depression in its measurement. This is in light of recent discussions in the field about the usage of a "total score" on the SCS, which again, may be an oversimplification of a dynamic interplay between subprocesses such as self-kindness, self-judgment/criticism, and feelings of common humanity (Ferrari et al., 2022; Muris & Otgaar, 2022). Because of the questionable utility of the SCS Total Score, future work may benefit by exploring these changes in depression and anxiety alongside the individual subscales of the SCS. There is psychometric evidence to support two distinct factors within the SCS—the CS and UCS—representing protective and vulnerability metrics, respectively; moreover, these factors may not lie at opposite ends of a shared continuum, with some orthogonality present (Muris & Otgaar, 2022). Thus, it is perhaps unsurprising that our supplementary analyses yielded slightly different results using either of these factors in place of the SCS Total Score. In fact, there was somewhat better fit of the alternative CS-only and UCS-only models, with changes on these subfactors predicting overall changes in anxiety, but not depression. This finding suggests the possibility that MBSR works to improve the protective features of self-compassion and reduce uncompassionate characteristics, with particular relevance to reductions in anxiety. This also underscores the possibility that the effect of changes in self-compassion on changes in depression in our primary model was merely an artifact of using the SCS Total Score. The path from non-judging to self-compassion also appeared to be unique to the UCS-only model, and not the CS-only model. This may represent the UCS factor's capturing of self-judgment (Muris & Otgaar, 2022) and its potentially being the conceptual inverse of the FFMQ's non-judgment. Given the slight difference in results between the CS-only and UCS-only models, these findings further support future investigations examining these subfactors apart from (or in place of) the SCS Total score. These distinctions notwithstanding, across both the bivariate latent growth curve models and the path analyses, increases in self-compassion appear to play an operative role in the efficacy of MBSR. This interpretation is qualified by the fact that we did not include direct effects of each mindfulness facet on the outcome variables, so full and partial mediation could not conclusively be identified. It is also important to acknowledge the drawbacks of an exclusive focus on *self*-compassion in our study (and in the field at large). Further work may clarify whether these paths are unique to self-compassion, or if other-compassion and/or compassion more broadly have similar effects. The specific role of LKM in these changes is also not entirely clear, as validated measures of LKM practice are currently not available.

These considerations notwithstanding the significant increases in self-compassion observed early in the MBSR course, along with self-compassion's direct association with changes in depression and anxiety, suggest there may be added benefit to making self-compassion a more explicit course theme in early sessions. This could imply that it would be useful to introduce LKM and compassion-based meditations earlier in the course to encourage early gains and treatment buy-in. Such a restructuring of the course sequence is further supported by the demonstrated efficacy of standalone LKM and self-compassion interventions (Reilly & Stuyvenberg, 2023). The prediction of nonreactivity and non-judging further supports the notion that these skills be emphasized and taught in-tandem with self-compassion, potentially earlier in the course. Our results also suggest that curiosity and describing may also not necessarily be preliminary skills that are prerequisites for later, more impactful skills. However, more research is needed to determine whether such components of mindfulness should be de-emphasized due to being less directly relevant to clinical change.

Limitations and Future Directions

Although the absence of a control group could be considered a limitation of this study, we did not set out to conduct a study of treatment efficacy, as there is already a growing body of evidence that supports the efficacy of the MBSR program compared with control conditions. However, the inclusion of a control group would have bolstered possible claims of causal inference. Within a control group, we would have expected minimal change in mindfulness components over time, and this may have provided a starker contrast to reveal mechanisms of change. In lieu of a control group, we planned to statistically control for treatment expectancy, number of classes attended, amount of home practice, and perceived levels of group support. Unfortunately, due to a large amount of missing data and power constraints, this form of additional statistical control was not feasible.

Missing data, largely by attrition, was the primary limitation of this study. Our attrition rate was slightly higher than most trials of MBSR over similar time spans (Nam & Toneatto, 2016). There were several reasons for the higher

attrition rate in our study. For one, this was an observational study of a community sample, rather than a randomized clinical trial with a clinical population (such as those examined in Nam & Toneatto, 2016). Moreover, unlike most clinical trials, enrolment in our study was not a condition of participation in the MBSR course itself. Compensation for completion of the study was also relatively low compared to most formal clinical trials, so participants may not have been as motivated to respond to all surveys. An important consideration is that those who did not respond to the later survey time points may have also dropped out of the course, potentially for experiencing a lack of benefit, introducing a possible confound to our findings. Despite this level of missing data, the study was still powered enough to adequately perform our planned analyses on data within the 8-week course period. Additionally, as demonstrated by the missing data analyses and MAR characteristics of the data, our results likely would not have differed substantially had attrition and nonresponse rates been lower. However, the sample size did preclude us from pursuing there could still have been many unmeasured variables that may have predicted the missing data. For instance, as mentioned above, perhaps attritors/non-responders did not experience much change or benefit from the course, resulting in their choice not to complete follow-up measures. While age emerged as the only predictor of missing data, age alone could be a proxy for many other impactful variables that would complicate the data's MAR designation. Thus, all conclusions drawn herein should be qualified by a strong possibility of response bias. It is possible that those younger in age were less likely to respond to surveys due to decreased course attendance and/or having more time constraints due to outside obligations (employment, family etc.). However, this explanation is limited, as employment and marital/partnership status were unrelated to age and missing data. To our knowledge, no studies have identified age as a significant predictor of compliance or attrition in MBSR studies. Future work may wish to explore this possible association between age, MBSR course participation, and study compliance.

In particular, the high degree of missing data at the 3-month follow-up precludes any strong conclusions about mindfulness mechanisms and the long-term outcomes of MBSR. Constricting our analyses mostly to the timeframe of the MBSR course itself may be obscuring the way in which these mechanisms actually change and influence one another over longer periods. This is especially critical given recent evidence highlighting the importance of meditation length and "dose response" in bolstering the benefits of mindfulness practice (Bowles et al., 2022; Strohmaier et al., 2021). Follow-up and booster sessions for MBIs have also shown promise in sustaining changes in decentering as well as remission of depression, anxiety, and stress following the initial intervention period (Radosavljevic & Farb, 2023; Williams et al., 2022). In this way, it is possible that the sequence of changes that we observed in our study was related merely to the sequence in which course material was presented. This would be in contrast to our theoretical vision of initial skill development naturalistically presaging the development of later skills. It should be noted that the curriculum sequence did not obviously map onto the sequence in which the various mindfulness facets developed in our study. Nevertheless, without additional follow-up data, we cannot definitively state that the order of skill consolidation was entirely independent of the curriculum order. This is also in keeping with an emerging need for more long-term follow-up research on MBIs, with data collection extending beyond the intervention period (Lee et al., 2021).

One possible limitation of our study was misspecification of our path analysis. A misspecification could explain why we did not observe an indirect effect of decentering, despite a wealth of previous literature suggesting decentering's importance to MBI outcomes and well-being (Hoge et al., 2015; Moore et al., 2022; Pearson et al., 2015). An alternative model specification might have included change in decentering at the same level as self-compassion, such that its *direct* effects on the outcomes could be calculated. Future studies of mechanisms might explore this possibility, given the emerging value of decentering in contemporary mindfulness research and its significant associations with change in stress and anxiety in our latent growth models. We also only used one measure of decentering (i.e., the TMS-T) in our study. Alternative measures, such as the Experiences Questionnaire (Fresco et al., 2007a), may have yielded different results and could explain the discrepancy between our findings and others' regarding decentering.

An additional limitation is that this study was not preregistered. This study was conceived and data were collected prior to the advent of preregistration and its becoming the standard for the field. While the study was post-registered, we recognize that this is not a satisfactory substitute. Preregistration is vital for the comparison of hypotheses and data analytic strategies to a predefined plan, and a lack of preregistration hinders the assessment of reporting bias and scientific fidelity.

A further critique could be made that the measures used in our study do not to entirely encompass the nebulous construct of "mindfulness," nor the most vital mechanisms of change. Any individual self-report measure of mindfulness is inherently limited and other drivers of mindfulness development would likely be better captured using behavioural or neurocognitive approaches (Baer, 2019; Lutz et al., 2015). Even the usage of alternative self-report measures (e.g., self-reported trait emotion regulation) may have been more explanatory. For instance, a structural equation modelling study of meditators and non-meditators revealed five core mindfulness factors that were each best represented by

subscales from *different* measures of mindfulness and emotion regulation—notably, the FFMQ facets uniquely loaded onto these five factors, but did not demonstrate the highest loadings on any one factor (Bednar et al., 2020). As has also been posited by Medvedev et al. (2022), scores on Likert-style measures should be converted to an interval scale prior to running analyses in order to meet the assumptions of parametric statistics, as has been previously proposed for the FFMQ using Rasch analysis (Medvedev et al., 2017b). Future work may seek to pursue these alternate analyses and compare results with traditional approaches. Finally, a limitation to our analytic approach is that there may be within-person effects that our path analysis model did not capture, as it was primarily suited for capturing between-person effects. As our research question was concerned with individual growth over time, future studies may improve upon our approach by explicitly using models that elucidate both between- and within-person effects (Curran & Bauer, 2011). Moreover, a critique could be made of our reliance on difference scores for the main path analysis model. In planning our analyses, we considered the possibility of Lord's paradox, which suggests potential type 1 error when using residualized change scores if there are potential baseline differences (e.g., in Time 1 scores) as a function of the predictor (Castro-Schilo & Grimm, 2018). However, residualized change scores offer more power due to smaller standard errors and are therefore more likely to detect an effect. So it is unsurprising that we discovered slightly different results using both methods, and we encourage future researchers to consider the limitations of each in interpreting results from path analyses or structural equation models.

Our study is also part of a long history in mindfulness research of nomothetic approaches using quantitative, Likert-style measures. Such approaches offer limited insights into the practicalities of how mindfulness skills are applied on a moment-to-moment basis in individual's daily lives. Over the course of MBSR, an individual might report that they have grown more curious about their experiences and are better able to describe those experiences with words; however, measures like the FFMQ and TMS-T do not elucidate *how* those skills are being employed, nor do they identify the relevant stimuli/situations. A better understanding of the sequence of changes in MBSR could be gleaned through adjunctive qualitative information. For instance, participants could have reported on their subjective experience of the course and personal skill development via free-response diary entries throughout the study. Such a daily diary approach could, for example, reveal particular instances in which an individual is intentionally nonjudgmental and self-compassionate in response to anxiety or sad mood following a unique stressor. This is consistent with recent movements in the field more broadly to collect more ideographic data regarding the mechanisms of mindfulness (Frank & Marken, 2022). This trend is driven by a growing acknowledgement that important elements of the change process are likely being lost by rigidly adhering to conventional operationalizations (or even by abstracting mindfulness more generally) to serve easier academic investigation. Even so, efforts to ideographically understand a participant's experience of mindfulness, particularly using multimodal qualitative approaches, remain rare and are sorely needed (Frank & Marken, 2022).

Participants in the current study were not screened for any specific disorders, but were experiencing moderate levels of depression, anxiety, and stress at the start of the study. Future longitudinal studies with participants who experience specific types of distress such as anxiety disorders or major depression may be warranted to examine which mindfulness processes have the greatest effect on changes in symptoms. However, the benefits of mindfulness-based therapies may not be specific to certain diagnoses, but rather may be relevant to processes underlying multiple disorders (Goldberg et al., 2022). Per our bivariate latent growth curve models showing that decentering, non-reactivity, and self-compassion each are associated with reductions in psychological distress, future studies could examine the effects of emphasizing these processes in training to determine whether this leads to greater symptom improvement and, if so, for whom. This is in line with an increasing need in MBI research to examine individual differences and tailor interventions to account for said differences (Karl & Fischer, 2022; Zhu et al., 2020). In turn, future work may place greater emphasis on demographic moderators of these mechanisms and replication in non-Western populations (Baminiwatta & Solangaarachchi, 2021). We also acknowledge the deeply unfortunate omission of detailed race/ethnicity and gender data. At the time of data collection, lacking hypotheses regarding these demographics, the clear importance of having this information was not apparent, and this is an oversight that many might consider unthinkable in our current clinical research landscape. This falls significantly below current reporting standards and severely limits study generalizability, and we further recognize the importance of these variables as potential moderators. For instance, race and ethnicity, as well as sexual and gender minority status, have all been shown to differentially predict MBI outcomes (Sun et al., 2021, 2022). One other important demographic moderator may be participants' spiritual and/or religious background (particularly degree of secularity), which could potentially influence course engagement and the extent to which change is observed (Palitsky & Kaplan, 2021). Another avenue of investigation that could be followed up is the issue of development of trait curiosity and describing in MBSR to determine whether these do change over a longer period of time. Finally, studies should focus on whether these observed changes in mindfulness facets and psychological symptoms are in fact specific to MBSR or can also be found in other interventions as well (Goldberg, 2022).

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Author Contribution Karen M. Davis: conceptualization/study design, methodology, data collection and management, original draft preparation, writing and editing, review and editing of final draft.

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Emily A. P. Haigh: review and editing of final draft.

Data Availability This study obtained ethics board approval and was closed prior to the advent of open science/public data sharing. Therefore, data are only available upon individual request to the authors, pending further IRB review and approval for such requests.

Declarations

Informed Consent All participants gave their informed consent prior to their inclusion in this study. The manuscript does not contain clinical studies or patient data.

Ethics Approval Macquarie University Human Research Ethics Committee granted approval for this study. The procedures used in this study adhere to the tenets of the Declaration of Helsinki.

Conflict of Interest The authors declare no competing interests.

Use of Artificial Intelligence No artificial intelligence tools were used for this study.

References

Alsubaie, M., Abbott, R., Dunn, B., Dickens, C., Keil, T. F., Henley, W., & Kuyken, W. (2017). Mechanisms of action in mindfulness-based cognitive therapy (MBCT) and mindfulness-based stress reduction (MBSR) in people with physical and/or psychological conditions: A systematic review. *Clinical Psychology Review, 55*, 74–91. https://doi.org/10.1016/j.cpr.2017.04.008

Alvear, D., Soler, J., & Cebolla, A. (2022). *Meditators' non-academic definition of mindfulness. Mindfulness, 13*(6), 1544–1554. https://doi.org/10.1007/s12671-022-01899-3

Baer, R. A., Carmody, J., & Hunsinger, M. (2012). Weekly change in mindfulness and perceived stress in a mindfulness-based stress reduction program. *Journal of Clinical Psychology, 68*(7), 755–765. https://doi.org/10.1002/jclp.21865

Baer, R. (2019). Assessment of mindfulness by self-report. *Current Opinion in Psychology, 28*, 42–48. https://doi.org/10.1016/j.copsyc.2018.10.015

Baer, R. A., Smith, G. T., & Allen, K. B. (2004). Assessment of mindfulness by self-report: The Kentucky Inventory of Mindfulness Skills. *Assessment, 11*(3), 191–206. https://doi.org/10.1177/1073191104268029

Baer, R. A., Smith, G. T., Hopkins, J., Krietemeyer, J., & Toney, L. (2006). Using self-report assessment methods to explore facets of mindfulness. *Assessment, 13*, 27–45. https://doi.org/10.1177/1073191105283504

Baer, R. A., Smith, G. T., Lykins, E., Button, D., Krietemeyer, J., Sauer, S., Walsh, E., Duggan, D., & Williams, J. M. G. (2008). Construct validity of the five Facet Mindfulness Questionnaire in meditating and nonmeditating samples. *Assessment, 15*(3), 329–342. https://doi.org/10.1177/1073191107313003

Baminiwatta, A., & Solangaarachchi, I. (2021). Trends and developments in mindfulness research over 55 years: A bibliometric analysis of publications indexed in web of science. *Mindfulness, 12*(9), 2099–2116. https://doi.org/10.1007/s12671-021-01681-x

Barcaccia, B., Baiocco, R., Pozza, A., Pallini, S., Mancini, F., & Salvati, M. (2019). The more you judge the worse you feel. A judgemental attitude towards one's inner experience predicts depression and anxiety. *Personality and Individual Differences, 138*, 33–39. https://doi.org/10.1016/j.paid.2018.09.012

Beck, A. T., Steer, R. A., & Brown, G. K. (1996). Beck depression inventory (BDI-II). Pearson London.

Bednar, K., Voracek, M., & Tran, U. S. (2020). Common factors underlying the five facets of mindfulness and proposed mechanisms: A psychometric study among meditators and non-meditators. *Mindfulness, 11*(12), 2804–2817. https://doi.org/10.1007/s12671-020-01492-6

Bergen-Cico, D., & Cheon, S. (2014). The mediating effects of mindfulness and self-compassion on trait anxiety. *Mindfulness, 5*(5), 505–519. https://doi.org/10.1007/s12671-013-0205-y

Bishop, S. R., Lau, M., Shapiro, S., Carlson, L., Anderson, N. D., Carmody, J., Segal, Z. V., Abbey, S., Speca, M., Velting, D., & Devins, G. (2004). Mindfulness: A proposed operational definition. *Clinical Psychology: Science & Practice, 11*, 230–241. https://doi.org/10.1093/clipsy.bph077

Bowles, N. I., Davies, J. N., & Van Dam, N. T. (2022). Dose–response relationship of reported lifetime meditation practice with mental health and wellbeing: A cross-sectional study. *Mindfulness, 13*(10), 2529–2546. https://doi.org/10.1007/s12671-022-01977-6

Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology, 84*(4), 822–848. https://doi.org/10.1037/0022-3514.84.4.822

Brown, D. B., Bravo, A. J., Roos, C. R., & Pearson, M. R. (2015). Five facets of mindfulness and psychological health:Evaluating a psychological model of the mechanisms of mindfulness. *Mindfulness, 6*(5), 1021–1032. https://doi.org/10.1007/s12671-014-0349-4

Buchheld, N., Grossman, P., & Walach, H. (2001). Measuring mindfulness in insight meditation (Vipassana) and meditation-based psychotherapy: The development of the Freiburg Mindfulness Inventory (FMI). *Journal for Meditation and Meditation Research, 1*(1), 11–34.

Burzler, M. A., Voracek, M., Hos, M., & Tran, U. S. (2019). Mechanisms of mindfulness in the general population. *Mindfulness, 10*(3), 469–480. https://doi.org/10.1007/s12671-018-0988-y

Castro-Schilo, L., & Grimm, K. J. (2018). Using residualized change versus difference scores for longitudinal research. *Journal of Social and Personal Relationships, 35*(1), 32–58. https://doi.org/10.1177/0265407517718387

Chadwick, P., Taylor, K. N., & Abba, N. (2005). Mindfulness groups for people with psychosis. *Behavioural and Cognitive Psychotherapy, 33*(3), 351–359. https://doi.org/10.1017/S1352465805002158

Crawford, J., Cayley, C., Lovibond, P. F., Wilson, P. H., & Hartley, C. (2011). Percentile norms and accompanying interval estimates from an Australian general adult population sample for self-report mood scales (BAI, BDI, CRSD, CES-D, DASS, DASS-21, STAI-X, STAI-Y, SRDS, and SRAS). *Australian Psychologist, 46*, 3–14. https://doi.org/10.1111/j.1742-9544.2010.00003.x

Curran, P. J., & Bauer, D. J. (2011). The disaggregation of within-person and between-person effects in longitudinal models of change. *Annual Review of Psychology, 62*, 583–619. https://doi.org/10.1146/annurev.psych.093008.1003

Davis, K. M., & Cairns, D. R. (2008). Measuring mindfulness: The challenge of appropriate sampling. In S. Boag (Ed.), *Personality down under: Perspectives from Australia* (pp. 51–60). Nova Science.

Davis, K. M., Lau, M. A., & Cairns, D. R. (2009). Development and preliminary validation of a trait version of the Toronto Mindfulness Scale. *Journal of Cognitive Psychotherapy, 23*, 185–197. https://doi.org/10.1891/0889-8391.23.3.185

Devilly, G. J., & Borkovec, T. D. (2000). Psychometric properties of the credibility/expectancy questionnaire. *Journal of Behavior Therapy and Experimental Psychiatry, 31*(2), 73–86. https://doi.org/10.1016/S0005-7916(00)00012-4

Evans, S., Wyka, K., Blaha, K. T., & Allen, E. S. (2018). Self-compassion mediates improvement in well-being in a mindfulnessbased stress reduction program in a community-based sample. *Mindfulness, 9*(4), 1280–1287. https://doi.org/10.1007/s12671-017-0872-1

Feldman, G., Hayes, A., Kumar, S., Greeson, J., & Laurenceau, J. P. (2007). Mindfulness and emotion regulation: The development and initial validation of the cognitive and affective mindfulness scale-revised (CAMS-R). *Journal of Psychopathology and Behavioral Assessment, 29*, 177–190.

Ferrari, M., Ciarrochi, J., Yap, K., Sahdra, B., & Hayes, S. C. (2022). Embracing the complexity of our inner worlds: Understanding the dynamics of self-compassion and self-criticism. *Mindfulness, 13*(7), 1652–1661. https://doi.org/10.1007/s12671-022-01897-5

Frank, P., & Marken, M. (2022). Developments in qualitative mindfulness practice research: A pilot scoping review. *Mindfulness, 13*(1), 17–36. https://doi.org/10.1007/s12671-021-01748-9

Fresco, D. M., Moore, M. T., van Dulmen, M. H., Segal, Z. V., Ma, S. H., Teasdale, J. D., & Williams, J. M. (2007a). Initial psychometric properties of the experiences questionnaire: Validation of a self-report measure of decentering. *Behavior Therapy, 38*(3), 234–246. https://doi.org/10.1016/j.beth.2006.08.003

Fresco, D. M., Segal, Z. V., Buis, T., & Kennedy, S. (2007b). Relationship of posttreatment decentering and cognitive reactivity to relapse in major depression. *Journal of Consulting and Clinical Psychology, 75*, 447–455. https://doi.org/10.1037/0022-006X.75.3.447

Galante, J., Friedrich, C., Dawson, A. F., Modrego-Alarcón, M., Gebbing, P., Delgado-Suárez, I., Gupta, R., Dean, L., Dalgleish, T., White, I. R., & Jones, P. B. (2021). Mindfulness-based programmes for mental health promotion in adults in nonclinical settings: A systematic review and meta-analysis of randomised controlled trials. *PLoS Medicine, 18*(1), e1003481. https://doi.org/10.1371/journal.pmed.1003481

Galante, J., Grabovac, A., Wright, M., Ingram, D. M., Van Dam, N. T., Sanguinetti, J. L., Sparby, T., van Lutterveld, R., & Sacchet, M. D. (2023). A framework for the empirical investigation of mindfulness meditative development. *Mindfulness, 14*(5), 1054–1067. https://doi.org/10.1007/s12671-023-02113-8

Giannandrea, A., Simione, L., Pescatori, B., Ferrell, K., Olivetti Belardinelli, M., Hickman, S. D., & Raffone, A. (2019). Effects of the mindfulness-based stress reduction program on mind wandering and dispositional mindfulness facets. *Mindfulness, 10*(1), 185–195. https://doi.org/10.1007/s12671-018-1070-5

Goldberg, S. B. (2022). A common factors perspective on mindfulness-based interventions. *Nature Reviews Psychology, 1*(10), 605–619. https://doi.org/10.1038/s44159-022-00090-8

Goldberg, S. B., Wielgosz, J., Dahl, C., Schuyler, B., MacCoon, D. S., Rosenkranz, M., Lutz, A., Sebranek, C. A., & Davidson, R. J. (2016). Does the Five Facet Mindfulness Questionnaire measure what we think it does? Construct validity evidence from an active controlled randomized clinical trial. *Psychological Assessment, 28*(8), 1009–1014. https://doi.org/10.1037/pas0000233

Goldberg, S. B., Tucker, R. P., Greene, P. A., Davidson, R. J., Wampold, B. E., Kearney, D. J., & Simpson, T. L. (2018). Mindfulness-based interventions for psychiatric disorders: A systematic review and meta-analysis. *Clinical Psychology Review, 59*, 52–60. https://doi.org/10.1016/j.cpr.2017.10.011

Goldberg, S. B., Riordan, K. M., Sun, S., & Davidson, R. J. (2022). The empirical status of mindfulness-based interventions: A systematic review of 44 meta-analyses of randomized controlled trials. *Perspectives on Psychological Science, 17*(1), 108–130. https://doi.org/10.1177/1745691620968771

Golden, H. L., Vosper, J., Kingston, J., & Ellett, L. (2021). The impact of mindfulness-based programmes on self-compassion in nonclinical populations: A systematic review and meta-analysis. *Mindfulness, 12*(1), 29–52. https://doi.org/10.1007/s12671-020-01501-8

Grabovac, A. (2015). The stages of Insight: Clinical relevance for mindfulness-based interventions. *Mindfulness, 6*(3), 589–600. https://doi.org/10.1007/s12671-014-0294-2

Gu, J., Strauss, C., Bond, R., & Cavanagh, K. (2015). How do mindfulness-based cognitive therapy and mindfulness-based stress reduction improve mental health and wellbeing? A systematic review and meta-analysis of mediation studies. *Clinical Psychology Review*, *37*, 1–12. https://doi.org/10.1016/j.cpr.2015.01.006

Han, A., & Kim, T. H. (2023). Effects of self-compassion interventions on reducing depressive symptoms, anxiety, and stress: A meta-analysis. *Mindfulness, 14*(7), 1553–1581. https://doi.org/10.1007/s12671-023-02148-x

Hayes, A. M., & Feldman, G. (2004). Clarifying the construct of mindfulness in the context of emotion regulation and the process of change in therapy. *Clinical Psychology: Science and Practice, 11*(3), 255–262. https://doi.org/10.1093/clipsy.bph080

Hoge, E. A., Bui, E., Goetter, E., Robinaugh, D. J., Ojserkis, R. A., Fresco, D. M., & Simon, N. M. (2015). Change in decentering mediates improvement in anxiety in mindfulness-based stress reduction for generalized anxiety disorder. *Cognitive Therapy and Research, 39*(2), 228–235. https://doi.org/10.1007/s10608-014-9646-4

Hoge, E. A., Acabchuk, R. L., Kimmel, H., Moitra, E., Britton, W. B., Dumais, T., Ferrer, R. A., Lazar, S. W., Vago, D., Lipsky, J., Schuman-Olivier, Z., Cheaito, A., Sager, L., Peters, S., Rahrig, H., Acero, P., Scharf, J., Loucks, E. B., & Fulwiler, C. (2021). Emotion-related constructs engaged by mindfulness-based interventions: A systematic review and meta-analysis. Mindfulness, 12(5), 1041–1062. https://doi.org/10.1007/s12671-020-01561-w

Hölzel, B. K., Lazar, S. W., Gard, T., Schuman-Olivier, Z., Vago, D. R., & Ott, U. (2011). How does mindfulness meditation work? Proposing mechanisms of action from a conceptual and neural perspective. *Perspectives on Psychological Science, 6*(6), 537–559. https://doi.org/10.1177/1745691611419671

Høstmælingen, A., Ulvenes, P., Nissen-Lie, H. A., Eielsen, M., & Wampold, B. E. (2021). Do self-criticism and somatic symptoms play a key role in chronic depression? Exploring the factor structure of Beck Depression Inventory-II in a sample of chronically depressed inpatients. *Journal of Affective Disorders, 283*, 317–324. https://doi.org/10.1016/j.jad.2021.01.066

Iani, L., Lauriola, M., Chiesa, A., & Cafaro, V. (2019). Associations between mindfulness and emotion regulation: The key role of describing and nonreactivity. *Mindfulness, 10*(2), 366–375. https://doi.org/10.1007/s12671-018-0981-5

Ito, Y., Browne, C. A., & Yamamoto, K. (2022). The impacts of mindfulness-based stress reduction (MBSR) on mindfulness and well-being for regular and novice meditators. *Mindfulness, 13*(6), 1458–1468. https://doi.org/10.1007/s12671-022-01888-6

Kabat-Zinn, J. (1990). *Full catastrophe living: Using the wisdom of your body and mind to face stress, pain, and illness*. Delacorte.

Kaplan, D. M., Mehl, M. R., Pace, T. W., Negi, L. T., Ozawa-de Silva, B., Lavelle, B. D., Sivilli, T., Williams, A., Comstock, T., Price, B., Medrano, V., Robbins, M. L., Cole, S. P., Craighead, W.

E., & Raison, C. L. (2022). Implications of a null randomized controlled trial of mindfulness and compassion interventions in healthy adults. *Mindfulness, 13*(5), 1197–1213. https://doi.org/10.1007/s12671-022-01861-3

Karl, J. A., & Fischer, R. (2022). The state of dispositional mindfulness research. *Mindfulness, 13*(6), 1357–1372. https://doi.org/10.1007/s12671-022-01853-3

Khoury, B., Sharma, M., Rush, S. E., & Fournier, C. (2015). Mindfulness-based stress reduction for healthy individuals: A metaanalysis. *Journal of Psychosomatic Research, 78*(6), 519–528. https://doi.org/10.1016/j.jpsychores.2015.03.009

Kiken, L. G., Garland, E. L., Bluth, K., Palsson, O. S., & Gaylord, S. A. (2015). From a state to a trait: Trajectories of state mindfulness in meditation during intervention predict changes in trait mindfulness. *Personality and Individual Differences, 81*, 41–46. https://doi.org/10.1016/j.paid.2014.12.044

Kraines, M. A., Peterson, S. K., Tremont, G. N., Beard, C., Brewer, J. A., & Uebelacker, L. A. (2022). Mindfulness-based stress reduction and mindfulness-based cognitive therapy for Depression: A systematic review of cognitive outcomes. *Mindfulness, 13*(5), 1126–1135. https://doi.org/10.1007/s12671-022-01841-7

Kümmerle, S., Heidenreich, T., & Mueller-Engelmann, M. (2023). Beyond mindfulness assessed by questionnaires: The mindfulbreathing Exercise as an additional approach in PTSD and Depression. *Mindfulness, 14*(4), 919–932. https://doi.org/10.1007/s12671-023-02093-9

Labelle, L. E., Campbell, T. S., Faris, P., & Carlson, L. E. (2015). Mediators of mindfulness-based stress reduction (MBSR): Assessing the timing and sequence of change in cancer patients. *Journal of Clinical Psychology, 71*(1), 21–40. https://doi.org/10.1002/jclp.22117

Lau, M. A., Bishop, S. R., Segal, Z. V., Buis, T., Anderson, N. D., Carlson, L., Shapiro, S., Carmody, J., Abbey, S., & Devins, G. (2006). The Toronto mindfulness scale: Development and validation. *Journal of Clinical Psychology, 62*, 1445–1467. https://doi.org/10.1002/jclp.20326

Lee, J., Kim, K. H., Webster, C. S., & Henning, M. A. (2021). The evolution of mindfulness from 1916 to 2019. *Mindfulness, 12*(8), 1849–1859. https://doi.org/10.1007/s12671-021-01603-x

Lindsay, E. K., & Creswell, J. D. (2017). Mechanisms of mindfulness training: Monitor and acceptance theory (MAT). *Clinical Psychology Review, 51*, 48–59. https://doi.org/10.1016/j.cpr.2016.10.011

Little, R. J. A., & Rubin, D. B. (1989). The analysis of social science data with missing values. *Sociological Methods & Research*, *18*, 292–326. https://doi.org/10.1177/0049124189018002004

López, A., Sanderman, R., Ranchor, A. V., & Schroevers, M. J. (2018). Compassion for others and self-compassion: Levels, correlates, and relationship with psychological well-being. *Mindfulness, 9*(1), 325–331. https://doi.org/10.1007/s12671-017-0777-z

Lou, X., Wang, H., & Minkov, M. (2022). The correlation between self-compassion and depression revisited: A three-level metaanalysis. *Mindfulness, 13*(9), 2128–2139. https://doi.org/10.1007/s12671-022-01958-9

Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: Comparison of the depression anxiety stress scales (DASS) with the beck depression and anxiety inventories. *Behaviour Research and Therapy, 33*, 335–343. https://doi.org/10.1016/0005-7967(94)00075-U

Lutz, A., Jha, A. P., Dunne, J. D., & Saron, C. D. (2015). Investigating the phenomenological matrix of mindfulness-related practices from a neurocognitive perspective. *American Psychologist, 70*(7), 632. https://doi.org/10.1037/a0039585

Maddock, A., & Blair, C. (2021). How do mindfulness-based programmes improve anxiety, depression and psychological distress? A systematic review. *Current Psychology, 42*, 10200–10222. https://doi.org/10.1007/s12144-021-02082-y

Marsh, I. C., Chan, S. W. Y., & MacBeth, A. (2018). Self-compassion and psychological distress in adolescents: A meta-analysis. *Mindfulness, 9*(4), 1011–1027. https://doi.org/10.1007/s12671-017-0850-7

Matos, M., Duarte, C., Duarte, J., Pinto-Gouveia, J., Petrocchi, N., & Gilbert, P. (2021). Cultivating the compassionate self: An exploration of the mechanisms of change in compassionate mind training. *Mindfulness, 13*(1), 66–79. https://doi.org/10.1007/s12671-021-01717-2

Medvedev, O. N., Krägeloh, C. U., Narayanan, A., & Siegert, R. J. (2017a). Measuring mindfulness: Applying generalizability theory to distinguish between state and trait. *Mindfulness, 8*(4), 1036–1046. https://doi.org/10.1007/s12671-017-0679-0

Medvedev, O. N., Siegert, R. J., Kersten, P., & Krägeloh, C. U. (2017b). Improving the precision of the five facet mindfulness questionnaire using a rasch approach. *Mindfulness, 8*(4), 995–1008. https://doi.org/10.1007/s12671-016-0676-8

Medvedev, O. N., Cervin, M., Barcaccia, B., Siegert, R. J., Roemer, A., & Krägeloh, C. U. (2021a). Network analysis of mindfulness facets, affect, compassion, and distress. *Mindfulness, 12*(4), 911–922. https://doi.org/10.1007/s12671-020-01555-8

Medvedev, O. N., Dailianis, A. T., Hwang, Y. S., Krägeloh, C. U., & Singh, N. N. (2021b). Applying generalizability theory to the self-compassion scale to examine state and trait aspects and generalizability of assessment scores. *Mindfulness, 12*(3), 636–645. https://doi.org/10.1007/s12671-020-01522-3

Medvedev, O. N., Krägeloh, C. U., Siegert, R. J., & Singh, N. N. (2022). An introduction to assessment in mindfulness research. In O. N. Medvedev, C. U. Krägeloh, R. J. Siegert, & N. N. Singh (Eds.), *Handbook of assessment in mindfulness research* (pp. 1–11). Springer.

Moore, M. T., Lau, M. A., Haigh, E. A. P., Willett, B. R., Bosma, C. M., & Fresco, D. M. (2022). Association between decentering and reductions in relapse/recurrence in mindfulness-based cognitive therapy for depression in adults: A randomized controlled trial. *Journal of Consulting and Clinical Psychology, 90*(2), 137–147. https://doi.org/10.1037/ccp0000718

Muris, P., & Otgaar, H. (2022). Deconstructing self-compassion: How the continued use of the total score of the self-compassion scale hinders studying a protective construct within the context of psychopathology and stress. *Mindfulness, 13*(6), 1403–1409. https://doi.org/10.1007/s12671-022-01898-4

Nam, S., & Toneatto, T. (2016). The influence of attrition in evaluating the efficacy and effectiveness of mindfulness-based interventions. *International Journal of Mental Health and Addiction, 14*(6), 969–981. https://doi.org/10.1007/s11469-016-9667-1

Neff, K. D. (2003). Development and validation of a scale to measure self-compassion. *Self and Identity, 2*, 223–250. https://doi.org/10.1080/15298860309027

Neff, K. D. (2016). The Self-Compassion Scale is a valid and theoretically coherent measure of self-compassion. *Mindfulness, 7*(1), 264–274. https://doi.org/10.1007/s12671-015-0479-3

Neff, K. D., Kirkpatrick, K., & Rude, S. S. (2007). Self-compassion and its link to adaptive psychological functioning. *Journal of Research in Personality, 41*, 139–154. https://doi.org/10.1016/j.jrp.2006.08.002

Ortet, G., Pinazo, D., Walker, D., Gallego, S., Mezquita, L., & Ibáñez, M. I. (2020). Personality and nonjudging make you happier: Contribution of the five-factor model, mindfulness facets and a mindfulness intervention to subjective well-being. *PLoS ONE, 15*(2), e0228655. https://doi.org/10.1371/journal.pone.0228655

Palitsky, R., & Kaplan, D. M. (2021). The role of religion for mindfulness-based interventions: Implications for dissemination and implementation. *Mindfulness, 12*(8), 2076–2089. https://doi.org/10.1007/s12671-019-01253-0

Pearson, M. R., Brown, D. B., Bravo, A. J., & Witkiewitz, K. (2015). Staying in the moment and finding purpose: The associations of trait mindfulness, decentering, and purpose in life with depressive symptoms, anxiety symptoms, and alcoholrelated

problems. *Mindfulness, 6*(3), 645–653. https://doi.org/10.1007/s12671-014-0300-8

Per, M., Schmelefske, E., Brophy, K., Austin, S. B., & Khoury, B. (2022). Mindfulness, self-compassion, self-injury, and suicidal thoughts and behaviors: A correlational meta-analysis. *Mindfulness, 13*(4), 821–842. https://doi.org/10.1007/s12671-021-01815-1

Petrocchi, N., & Ottaviani, C. (2016). Mindfulness facets distinctively predict depressive symptoms after two years: The mediating role of rumination. *Personality and Individual Differences, 93*, 92–96. https://doi.org/10.1016/j.paid.2015.08.017

Pilla, D., & Qina'au, J., Patel, A., Meddaoui, B., Watson, N., Dugad, S., & Saskin, M. (2020). Toward a framework for reporting and differentiating key features of meditation-and mindfulness-based interventions. *Mindfulness, 11*(11), 2613–2628. https://doi.org/10.1007/s12671-020-01475-7

Prieto-Fidalgo, Á., Gómez-Odriozola, J., Royuela-Colomer, E., Orue, I., Fernández-González, L., Oñate, L., Cortazar, N., Iraurgi, I., & Calvete, E. (2022). Predictive associations of dispositional mindfulness facets with anxiety and depression: A meta-analytic structural equation modeling approach. *Mindfulness, 13*(1), 37–53. https://doi.org/10.1007/s12671-021-01756-9

Quaglia, J. T., Braun, S. E., Freeman, S. P., McDaniel, M. A., & Brown, K. W. (2016). Meta-analytic evidence for effects of mindfulness training on dimensions of self-reported dispositional mindfulness. *Psychological Assessment, 28*(7), 803–818. https://doi.org/10.1037/pas0000268

Radosavljevic, J., & Farb, N. A. (2023). Walking the talk: A randomized trial exploring the role of mindfulness booster sessions on skill acquisition following workshop attendance. *Mindfulness, 14*(4), 891–907. https://doi.org/10.1007/s12671-023-02091-x

Raphiphatthana, B., Jose, P. E., & Kielpikowski, M. (2016). How do the facets of mindfulness predict the constructs of depression and anxiety as seen through the lens of the tripartite theory? *Personality and Individual Differences, 93*, 104–111. https://doi.org/10.1016/j.paid.2015.08.005

Reilly, E. B., & Stuyvenberg, C. L. (2023). A meta-analysis of loving-kindness meditations on self-compassion. *Mindfulness, 14*(10), 2299–2310. https://doi.org/10.1007/s12671-022-01972-x

Roca, P., Vazquez, C., Diez, G., Brito-Pons, G., & McNally, R. J. (2021). Not all types of meditation are the same: Mediators of change in mindfulness and compassion meditation interventions. *Journal of Affective Disorders, 283*, 354–362. https://doi.org/10.1016/j.jad.2021.01.070

Roemer, A., Sutton, A., Grimm, C., & Medvedev, O. N. (2021). Differential contribution of the five facets of mindfulness to well-being and psychological distress. *Mindfulness, 12*(3), 693–700. https://doi.org/10.1007/s12671-020-01535-y

Rudkin, E., Medvedev, O. N., & Siegert, R. J. (2018). The Five-facet mindfulness questionnaire: Why the observing subscale does not predict psychological symptoms. *Mindfulness, 9*(1), 230–242. https://doi.org/10.1007/s12671-017-0766-2

Sahdra, B. K., Ciarrochi, J., Fraser, M. I., Yap, K., Haller, E., Hayes, S. C., Hofmann, S. G., & Gloster, A. T. (2023). The compassion balance: Understanding the interrelation of self- and other-compassion for optimal well-being. *Mindfulness, 14*(8), 1997–2013. https://doi.org/10.1007/s12671-023-02187-4

Salzberg, S. (1995). *Loving-kindness: The revolutionary art of happiness*. Shambhala.

Santorelli, S. F., Kabat-Zinn, J., Blacker, M., Meleo-Meyer, F., & Koerbel, L. (2017). Mindfulness-based stress reduction (MBSR) authorized curriculum guide. In *Center for mindfulness in medicine, health care, and society (CFM)*. University of Massachusetts Medical.

Schafer, J. L., & Graham, J. W. (2002). Missing data: Our view of the state of the art. *Psychological Methods, 7*(2), 147–177. https://doi.org/10.1037/1082-989X.7.2.147

Siegling, A. B., & Petrides, K. V. (2016). Zeroing in on mindfulness facets: Similarities, validity, and dimensionality across three independent measures. *PLoS ONE, 11*(4), e0153073. https://doi.org/10.1371/journal.pone.0153073

Simione, L., & Saldarini, F. (2023). A critical review of the monitor and acceptance theory of mindfulness. *Mindfulness, 14*(6), 1317–1328. https://doi.org/10.1007/s12671-023-02129-0

Stein, E., & Witkiewitz, K. (2020). Dismantling mindfulness-based programs: A systematic review to identify active components of treatment. *Mindfulness, 11*(11), 2470–2485. https://doi.org/10.1007/s12671-020-01444-0

Strohmaier, S., Jones, F. W., & Cane, J. E. (2021). Effects of length of mindfulness practice on mindfulness, depression, anxiety, and stress: A randomized controlled experiment. *Mindfulness, 12*(1), 198–214. https://doi.org/10.1007/s12671-020-01512-5

Sun, S., Nardi, W., Loucks, E. B., & Operario, D. (2021). Mindfulness-based interventions for sexual and gender minorities: A systematic review and evidence evaluation. *Mindfulness, 12*(10), 2439–2459. https://doi.org/10.1007/s12671-021-01710-9

Sun, S., Goldberg, S. B., Loucks, E. B., & Brewer, J. A. (2022). Mindfulness-based interventions among people of color: A systematic review and meta-analysis. *Psychotherapy Research, 32*(3), 277–290. https://doi.org/10.1080/10503307.2021.1937369

Sweeney, T., Morriss, R., Nixon, E., Guo, B., & Callaghan, P. (2021). Psychometric properties of the five facets mindfulness questionnaire in moderate-to-severe, persistent depression. *Mindfulness, 12*(4), 1009–1021. https://doi.org/10.1007/s12671-020-01573-6

Truong, Q. C., Krägeloh, C. U., Siegert, R. J., Landon, J., & Medvedev, O. N. (2020). Applying generalizability theory to differentiate between trait and state in the five Facet Mindfulness Questionnaire (FFMQ). *Mindfulness, 11*(4), 953–963. https://doi.org/10.1007/s12671-020-01324-7

Williams, J. M. G., Baer, R., Batchelor, M., Crane, R. S., Cullen, C., De Wilde, K., Fennell, M. J. V., Kantor, L., Kirby, J., Ma, S. H., Medlicott, E., Gerber, B., Johnson, M., Ong, E.-L, Peacock, JW., Penman, D, Phee, A., Radley, L., Watkin M., & Taylor, L. (2022). What next after MBSR/MBCT? An open trial of an 8-week follow-on program exploring mindfulness of feeling tone (vedanā). *Mindfulness, 13*(8), 1931–1944. https://doi.org/10.1007/s12671-022-01929-0

Winnebeck, E., Fissler, M., Gärtner, M., Chadwick, P., & Barnhofer, T. (2017). Brief training in mindfulness meditation reduces symptoms in patients with a chronic or recurrent lifetime history of depression: A randomized controlled study. *Behavior Research and Therapy, 99*, 124–130. https://doi.org/10.1016/j.brat.2017.10.005

Wright, M. J., Sanguinetti, J. L., Young, S., & Sacchet, M. D. (2023). Uniting contemplative theory and scientific investigation: Toward a comprehensive model of the mind. *Mindfulness, 14*(5), 1088–1101. https://doi.org/10.1007/s12671-023-02101-y

Zheng, Y., Yan, L., Chen, Y., Zhang, X., Sun, W., Lv, J., Zhou, J., Gu, X., Zhao, X., Luo, W., Chen, Y., Lang, Y., Wang, Z., Gao, C., Jiang, Y., Li, R., Deng, Y., & Zeng, X. (2023). Effects of loving-kindness and compassion meditation on anxiety: A systematic review and meta-analysis. *Mindfulness, 14*(5), 1021–1037. https://doi.org/10.1007/s12671-023-02121-8

Zhu, L., Wang, J., & Schroevers, M. J. (2020). Looking beyond the value of individual facets of mindfulness: A person-centered examination of mindfulness. *Mindfulness, 11*(10), 2349–2359. https://doi.org/10.1007/s12671-020-01452-0