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ORIGINAL PAPER

The Relationship between Trait Mindfulness and Emotional Reactivity Following Mood Manipulation

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Abstract

Objectives Trait mindfulness can be used to refer to one's predisposition toward present-moment attention and awareness in everyday life. Increases in trait mindfulness are thought to result from states of heightened mindfulness achieved during practice over time. A significant amount of research has examined the effects of mindfulness practice on psychological well-being, including improved emotion regulation. However, it is not well understood whether this improved emotion regulation is associated with an increase or decrease in emotional reactivity when facing a negatively valenced stressor.

Methods We conducted two studies ($N = 88$; $N = 95$, and $N = 65$) to assess the relationship between trait mindfulness (assessed using the Five Facet Mindfulness Questionnaire) and emotional reactivity to an induced stressor in the laboratory.

Results In study 1, individuals with higher levels of Acting with Awareness exhibited less negatively valenced emotional reactivity in response to the induced stressor. In study 2, individuals with higher levels of overall trait mindfulness represented by acting with awareness, non-reactivity, and non-judgment exhibited less negatively valenced emotional reactivity in response to the induced stressor.

Conclusions Results from both studies suggest that certain qualities of mindfulness may provide individuals with the ability to notice and engage with stress-induced emotions in an adaptive way, resulting in reduced negatively valenced emotions.

Keywords Trait mindfulness · Psychological well-being · Negatively valenced emotions

Mindfulness refers to the quality of actively and non-judgmentally centering one's attention on present-moment physical and mental states with an orientation toward curiosity and acceptance of objects, thoughts, and sensations in awareness (Kabat-Zinn 1994). Mindfulness meditation practices have been increasingly utilized in interventions aimed at improving affective and cognitive well-being by eliciting the quality of mindfulness in both healthy and clinical populations (see Goldberg et al. 2018). The term "mindfulness" includes many similar, but distinct, constructs such as awareness, concentration, and observation. The use of the term "mindfulness" has varied considerably in literature but is consistently measured as a multifaceted construct that can be conceptualized as a state achieved during mindfulness meditation. It has also been conceptualized as a trait that refers to one's predisposition to be mindful even in the absence of practicing mindfulness meditation (Baer et al. 2006) and individuals may vary naturally in this trait. However, benefits to psychological health are thought to result from increased trait mindfulness due to mindfulness meditation practice (Kiken et al. 2015).

To measure trait mindfulness in the laboratory, the most commonly used instrument is the Five Facet Mindfulness Questionnaire (FFMQ; Baer et al. 2006). The FFMQ assesses levels of trait mindfulness across 5 unidimensional constructs: Observing, Describing, Acting with Awareness, Non-judging of inner experience, and Non-reactivity. The Observing facet of the FFMQ refers to the ability to notice or attend to internal and external experiences. The Describing facet refers to the

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ability to label internal experiences with words. Acting with Awareness refers to the ability to attend to one's activities in the present moment. Non-reactivity refers to the tendency to allow feelings and thoughts to come and go without getting carried away by them. Lastly, Non-judging refers to the act of taking a non-evaluative stance toward thoughts and feelings.

The FFMQ displays internal consistency and between-factor correlations in meditating samples. Previous research has predominately been conducted under the assumption that overall mindfulness is characterized by multifaceted, interacting factors commonly modeled as a combination of the five distinct aspects of mindfulness measured in the FFMQ. However, many studies suggest that not all of the individual FFMQ facets represent the same underlying construct in non-meditators and meditators (Baer et al. 2008). The Observing facet has often exhibited inverse relationships with the other four facets (most frequently the Non-judging facet; Baer et al. 2006) and predicts more intense self-reported affect in non-meditating samples (e.g., Leigh and Neighbors 2009). For these reasons, the Observing facet is often omitted when estimating overall trait mindfulness because it does not contribute to an overall mindfulness construct (Baer et al. 2008). The Describing facet has also exhibited inconsistent relationships with other facets and psychological symptoms (e.g., de Bruin et al. 2012). This finding, however, is not as common as those in the Observing facet. In the present studies, we assessed relationships between individual FFMQ mindfulness facets and an overall mindfulness trait.

Theoretical models have been proposed to explain the beneficial effects of mindfulness on health (e.g., see Farb et al. 2012; Teper et al. 2013). One such model is the mindfulness stress-buffering model (Creswell and Lindsay 2014). This model asserts that mindfulness acts as a buffer that reduces stress intensity and, in addition, reduces reactive responses to stress. In this model, mindfulness practice might lessen the negative impact of stressors by promoting an enhanced, non-judgmental, and curious awareness in the present moment. This mindful awareness results in less focus and over-involvement in the past or future, changing the way an individual relates to their own internal experiences, leading to a direct reduction in the intensity of emotional responses to stress (see Roemer et al. 2015). Research by Britton et al. (2012) supports this theory of reduced emotional reactivity in response to social stress after undergoing 8 weeks of Mindfulness-Based Cognitive Therapy, suggesting mindfulness training is associated with reduced emotional reactivity in response to a negatively valenced stressor. However, other studies suggest the opposite effect. For example, Beshai et al. (2018) examined the relationship between emotional flexibility and trait mindfulness and found that trait mindfulness was positively associated with mood drops after a negative mood induction procedure (MIP), suggesting higher levels of trait mindfulness are associated with increased emotional reactivity following exposure to negative stimuli. The discrepancy between these findings highlights the need for further investigation into the relationship between mindfulness and emotional reactivity in response to a negatively valenced stressor.

Two separate studies were conducted to test the relationship between trait mindfulness and negatively valenced emotional reactivity to a negative mood induction paradigm. Self-report measures were administered in order to achieve two goals: (1) to evaluate the effectiveness of the MIP and (2) to assess whether trait mindfulness mediates one's susceptibility to negatively valenced emotional reactivity as a result of the MIP. To examine emotional reactivity, mood assessments were administered to assess happiness-related, sadness-related, and anxiety-related mood shifts in response to a negative and positive MIP. The primary focus of the studies presented here was negatively valenced emotional reactivity (sadness- and anxiety-related emotional reactivity) following the negative MIP. Multiple self-report personality measures were collected: The Five Facet Mindfulness Questionnaire (FFMQ; Baer et al. 2006), Beck's Depression Inventory-II (BDI; Beck et al. 1996), and Rumination Response Scale (RRS; Treynor et al. 2003). We hypothesized that, in a general, college-age population, lower levels of self-reported trait mindfulness (excluding the Observing facet) would exhibit more self-reported negatively valenced emotional reactivity in response to a negative MIP than individuals with higher levels of self-reported trait mindfulness. Previous inconsistencies between FFMQ facets left us uncertain about which facets best index an overall mindfulness construct. Thus, we used confirmatory factor analysis to examine relationships between the facets and an overall mindfulness trait.

Study 1

Method

Participants

In study 1, eighty-eight participants (ages 18–54; mean age = 22.70; *SD* = 6.23; 57 female) completed this study in its entirety. All study procedures were approved by the University of Texas at Dallas Institutional Review Board, and informed consent was obtained from each participant prior to beginning the study. Participants were recruited from psychology classes on campus and were given course-credit for their participation.

Procedure

Due to the nature of the study, suicidal ideation scores were acquired from each participant prior to beginning the study

procedures. Suicidal ideation was assessed via Item 9 on Beck's Depression Inventory. If a value of anything other than 0 was given ("I don't have any thoughts of killing myself"), the participant was excluded from the study. With this criterion, 19 participants were excluded from the study, resulting in a total of 88 participants.

Informed written consent was obtained from all participants, followed by demographics. The demographics sheet contained the question assessing suicidal ideation and did not contain any mention of previous or current meditation experience to avoid influencing responses on the self-report mindfulness measures that followed. Participants were then administered the FFMQ, BDI, and RRS. Following completion of the self-report questionnaires, participants were asked to complete a baseline mood assessment (EVEA; Sanz 2001), where they were asked to rate statements regarding their current mood. Immediately after completing the EVEA, participants were administered a negative MIP (Robinson et al. 2012). Following the negative MIP, participants were again administered the EVEA and asked to rate the items based on how they felt at the time. A positive MIP (Robinson et al. 2012) was then administered to negate the effects of the negative MIP, followed by a final EVEA. All participants were given a debrief assessing how well she or he understood the study procedures. All participants were given information regarding the student counseling center and how to obtain free counseling from the center, as well as contact information for the National Suicide Prevention Lifeline and the National Hopeline Network.

Mood Inductions Participants completed a negative and a positive MIP. For the negative MIP, participants were asked to listen to two pieces of classical music (Barber 1939, Adagio for Strings, op. 11; Albinoni 1981, Adagio in G Minor for organ and strings) for 15 seconds each. Participants were then asked to choose the music piece they believed was more "somber," or "dark." Care was taken to ensure the words "negative," "sad," or "depressing" were not used at all in this protocol to minimize the influence of demand characteristics. After the participant chose the music piece they believed was more somber sounding, a series of 58 statements (Velten Jr 1968) were displayed on the computer using E-Prime presentation software (E-Prime version 2.0.10 on 15 inch Dell monitor) while participants listened to the chosen music piece on a continuous loop using over-the-ear headphones. For each statement, participants were told to think back to a time in their life when they felt that statement was true for them. The statements progressed from neutral ("Today is neither better nor worse than any other day") to more depressing ("I want to go to sleep and never wake up"). Statements were presented in black type on a dark gray background. Participants completed the negative MIP at their own pace, approximately 10 minutes for most participants.

The positive MIP was administered to negate the effects of the negative MIP. The positive MIP was identical to the negative MIP; however, the pieces of music (Beethoven 1805, Piano Concerto No. 4, Op. 58 in G Major: III. Rondo, Vivace; Mozart 1787, Serenade No. 13 KV 525 G Major: I. Serenade. Allegro) were livelier than those in the negative MIP and participants were asked to choose the music piece they believed to be more "upbeat." Care was taken to ensure the words "positive" or "happy" were not used at all during the protocol. After the music piece was chosen, participants read a series of 58 statements (Velten Jr 1968) which progressed from neutral ("Today is neither better nor worse than any other day") to more progressively more positive ("Wow! I feel great!") and were asked to think about a time in their life when the statement was true for them. The statements were presented in yellow type on a bright blue background. As was the case with the negative MIP, the positive MIP was self-paced and took approximately 10 minutes for most participants to complete.

For ethical reasons, the order in which the negative and positive MIPs were administered was not counterbalanced so as to ensure all participants received the positive MIP last in the experimental protocol.

Measures

Mindfulness was assessed using the Five Facet Mindfulness Questionnaire (FFMQ), which contains 39 items assessing five distinct facets that reflect a general propensity to be mindful in everyday life (Observing, Describing, Acting with Awareness, Non-judging, and Non-reactivity). Each item was answered on a 5-point Likert scale, with scores ranging from 1 (*never or very rarely true*) to 5 (*very often or always true*).

Depression was assessed using Beck's Depression Inventory-II (BDI), which contains 21 items assessing depressive symptomology. The BDI is a commonly used self-report measure of depressive symptoms.

Rumination was assessed using Rumination Response Scale (RRS), which contains 22 items assessing trait rumination. Each item was answered on a scale from 1 (*almost never*) to 4 (*almost always*).

Mood was assessed before the negative MIP, after the negative MIP, and after the positive MIP using the Scale for Mood Assessment (EVEA; Sanz 2001). The EVEA contains 16 items assessing four distinct moods: anxiety, anger-hostility (data not presented in this paper), sadness-depression, and happiness. Each item was answered on a scale from 1 (*not at all*) to 10 (*very much*), and participants were instructed to circle the number that "best indicates how you feel right now." Each mood was measured by four different items using different adjectives to define a subscale (i.e., "I feel nervous," "I feel tense," "I feel anxious," and "I feel restless").

Data Analyses

SPSS Statistics 23 was used for all analyses. First, descriptive statistics were calculated for all measures. Pearson correlation coefficients were calculated to examine the relationships between the FFMQ facets, overall mindfulness score, BDI, RRS, and mood changes resulting from the MIPs (positive and negative inductions). Internal consistency for all measures was calculated.

In order to create an overall mindfulness score, a confirmatory factor analysis was performed to test the relationship between the measured variables and their latent constructs. A five-factor model was tested, which included all 5 FFMQ facets, a four-factor model included all FFMQ facets except for the Observing facet, and a three-factor model included the Awareness, Non-judging, and Non-reactivity facets. The confirmatory factor index (CFI) compares the existing model fit to a null, or independent, model that assumes the indicator variables in the model are uncorrelated. CFI values range from 0 to 1 with values of 0.90 and above considered to be a good model fit. The Tucker Lewis Index (TLI; also referred to as the non-normed fit index) is another common incremental fit index that ranges from 0 to 1 with values of 0.95 and above considered to be a good model fit. The standardized root mean square residual (SRMR) and root mean square error of approximation (RMSEA) are both absolute fit indices ranging from 0 to 1 with smaller values indicating better model fit.

A Wilcoxon signed-rank test was performed to determine the effectiveness of both the negative and positive MIPs. Anxiety, happiness, and sadness were assessed using the EVEA, and absolute change in mood before and after both the negative and positive MIP was assessed such that larger absolute change would reflect higher emotional reactivity. Correlations were performed to assess whether trait mindfulness (overall mindfulness and the individual facets) was associated with emotional reactivity.

Results

Means, medians, standard deviations, Cronbach's alpha for the mindfulness facets, RRS, and BDI are listed in Table 1. Zero-order correlations between the FFMQ facets, overall mindfulness score, BDI, RRS, and absolute change in emotional reactivity are listed in Table 2. The Observing facet was inversely related to the Non-judging facet ($r = -0.27$, $p = 0.01$), a common finding in past literature examining non-meditators (i.e., general population) using the FFMQ (Baer et al. 2006).

In order to create a composite score of the individual mindfulness facets to represent an overall mindfulness construct, a confirmatory factor analysis was performed to test the relationship between the measured variables and their latent constructs. Three models were assessed using confirmatory factor analysis: A five-factor model utilized all 5 FFMQ facets, a four-factor model utilized all FFMQ facets except for the Observing facet, and a three-factor model utilized the Awareness, Non-judging, and Non-reactivity facets. Model fit indices for the five-factor, four-factor, and three-factor model are listed in Table 3. Overall, the three-factor model was the only model that provided an acceptable fit for the observed data, with an adequate to good CFI, chi-square statistic, TLI, and SRMR. Therefore, our overall mindfulness construct score was a composite of the Acting with Awareness, Non-judging, and Non-reactivity facets.

To determine effectiveness of the negative MIP, a Wilcoxon signed-rank test was performed. A non-parametric test was used because, as a Likert-type scale, the difference between positions on the scale is not sufficiently defined to be considered uniformly incremental (Jamieson 2004). As expected, there was an increase in sadness/depression ratings and anxiety ratings after the negative MIP compared with before ($Z = -6.104$, $p < 0.001$, $r = 0.654$ and $Z = -4.134$, $p < 0.001$, $r = 0.443$, respectively). Additionally, there was a decrease in happiness ratings after the negative MIP compared with before ($Z = -5.784$, $p < 0.001$, $r = 0.620$). Cronbach's alphas were assessed for internal consistency for each of the distinct mood subscales (anxiety, happiness, and sadness) in the mood assessments (EVEA 1, 2, and 3), and all Cronbach's alphas were above 0.80 (see Table 4). Absolute change in mood before and after both the negative and positive MIP was assessed such that larger absolute change would reflect higher emotional reactivity (i.e., less emotional stability). Higher levels of the Acting with Awareness facet were associated with less anxiety-related emotional reactivity ($r = -$

Table 1 Study 1 personality assessments with median, mean, standard deviation, and Cronbach's alpha

	Observe	Describe	Aware	Non-judge	Non-react	BDI	RRS
Median	27	28	27	27	22	7	41
Mean (SD)	26.15 (5.55)	27.72 (6.28)	25.81 (5.57)	26.44 (6.21)	22.08 (4.26)	8.49 (5.85)	43.25 (13.99)
Cronbach's α	0.75	0.90	0.85	0.87	0.76	0.81	0.93

Table 2 Study 1 correlation matrix between FFMQ facets, overall mindfulness score, RRS, and absolute change in mood

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Observe	1															
2. Describe	0.12	1														
3. Aware	− 0.14	0.38**	1													
4. Non-judging	−0.27*	0.23*	0.28**	1												
5. Non-react	0.11	0.36**	0.39**	0.26*	1											
6. FFMQ total	− 0.17	0.43**	0.76**	0.75**	0.68**	1										
7. RRS	0.08	− 0.13	−0.40**	−0.44**	− 0.26*	−0.51**	1									
8. Change sadness	0.03	0.01	− 0.10	− 0.12	− 0.01	− 0.112	0.27*	1								
9. Change happiness	0.07	0.36**	0.10	− 0.02	0.15	0.09	0.19	0.25*	1							
10. Change anxiety	0.07	− 0.07	− 0.25*	0.02	− 0.08	− 0.14	0.16	0.14	− 0.18	1						
11. Sadness rebound	0.01	0.11	0.08	0.06	0.17	0.13	− 0.04	0.12	0.06	0.01	1					
12. Happiness rebound	0.19	− 0.13	0.02	− 0.13	0.11	− 0.02	0.15	0.27*	0.17	0.21*	0.12	1				
13. Anxiety rebound	0.02	0.02	− 12	− 0.05	0.03	− 0.07	0.35**	0.36**	0.07	0.20	0.17	0.15	1			
14. Sadness overall	0.01	0.11	0.06	0.03	0.16	0.10	0.02	0.32**	0.11	0.03	0.98**	0.17	0.23*	1		
15. Happiness overall	0.18	0.07	0.06	− 0.12	0.16	0.03	0.20	0.33**	0.61**	0.09	0.12	0.89**	0.16	0.19	1	
16. Anxiety overall	0.06	− 0.04	− 0.24*	− 0.01	− 0.03	− 0.13	0.33**	0.32**	− 0.07	0.79**	0.11	0.24*	0.77*	0.17	0.16	1

Absolute change in mood after negative induction ("change sadness," "change happiness," and "change anxiety"), absolute change in mood after positive induction ("sadness rebound," "happiness rebound," and "anxiety rebound"), and absolute change in mood across the entire study procedure ("sadness overall," "happiness overall," and "anxiety overall")

*$p < 0.05$, two-tailed

**$p < 0.01$, two -tailed

0.252, $p = 0.018$) after the negative MIP. There were no significant associations between negatively valenced emotional reactivity in response to the negative MIP and overall trait mindfulness.

Discussion

In study 1, we observed a significant relationship between Acting with Awareness and anxiety-related emotional reactivity, such that higher levels of Acting with Awareness were associated with less anxiety-related emotional reactivity following the negative MIP. No such relationships between other mindfulness facets, overall trait mindfulness, and negatively valenced emotional reactivity were observed. The qualities of awareness and attention to the present moment are thought to be more central to the foundation of mindfulness than other mindful attributes (see also Brown and Ryan 2003). Thus, this quality may be uniquely associated with reductions in negatively valenced emotional reactivity by virtue of placing more awareness on one's emotions and reactions when faced with a negative stressor. Thus, acting with awareness might provide individuals with the ability to notice and openly engage with emotions that arise when exposed to environmental stress, resulting in reduced negatively valenced emotional reactivity.

Confirmatory factor analysis revealed that exclusion of the Describing and Observing facets in the overall mindfulness construct provided a better model fit for this sample of college students. This result suggests that these facets function differently in general non-meditating populations. Indeed, the Observing facet often exhibits positive associations with negative psychological symptoms (e.g., depression, rumination, anxiety, stress; Baer et al. 2006; Brown et al. 2015) and is inversely related to the other mindfulness facets (e.g., Baer et al. 2006; Baer et al. 2008; Siegling and Petrides 2016). For this reason, the Observing facet is often excluded when assessing overall mindfulness in non-meditating samples (Baer et al. 2006).

Whereas the Observing facet exhibits consistent findings in non-meditating samples, the Describing facet has not yielded such consistent results. In one study, the Describing facet was the only FFMQ facet that exhibited a significant positive correlation with the Observing facet in a sample of non-meditators (de Bruin et al. 2012). Additionally, Describing and Observing were the only two facets without significant negative correlations with self-focus, as measured by the RRS in a non-meditating sample. The Describing facet was, in fact, the only facet that was not predictive of depressive symptoms in this study (de Bruin et al. 2012). Another study investigated individual differences in FFMQ facets in a non-meditating, college-age sample with a subset of the sample exhibiting clinically significant borderline personality disorder features (Peters et al. 2013). Peters et al. (2013) found that the Describing and Observing facets were the only facets that

Table 3 Study 1 CFA model fit indices for five-factor, four-factor, and three-factor model

	Chi-square (χ^2)	CFI	TLI	RMSEA	SRMR
Five-factor model	1080.36, $p < 0.001$	0.738	0.721	0.079	0.110
Four-factor model	673.99, $p < 0.001$	0.797	0.781	0.080	0.093
Three-factor model	360.37, $p < 0.001$	0.825	0.805	0.081	0.087

were not predictive of affective instability, negative relationships, identity disturbances, self-harming tendencies, anger-related rumination, and the tendency to give in to strong impulses in the presence of negative emotions.

Our results are consistent with studies showing a discrepancy between the Observing and Describing facet and other facets. They are inconsistent with studies in which the Describing facet loads significantly onto the overall mindfulness construct (e.g., Baer et al. 2006; Baer et al. 2008). On one hand, it is possible that the individuals in our sample lack the ability to mindfully observe and describe emotions; these facets might represent constructs that are not as advantageous when modulating emotion. On the other hand, this result might represent some idiosyncratic property of our sample, heretofore undetected by our measurements. We therefore sought to replicate our study 1 results in a follow-up study using a different sample but similar study procedures.

Another issue we sought to address in the second study was the stability of the trait mindfulness construct. Personality traits are generally described as consistent and stable qualities that do not change from time to time. Trait mindfulness, however, has been described as an intrinsic quality that can change with time and experience (e.g., Nyklíček et al. 2013; Shapiro et al. 2011). To our knowledge, no other studies have assessed the test-retest reliability of the FFMQ in order to determine the consistency of trait mindfulness in the absence of training. Thus, to assess the consistency of trait mindfulness, that is to determine if the FFMQ measures a stable trait in a general college-age sample, we tested the reliability of the FFMQ during two sessions separated by approximately 8 weeks.

Table 4 Study 1 Cronbach's alphas for mood assessments of self-reported sadness, anxiety, and happiness

Cronbach's α			
	Sadness	Anxiety	Happiness
EVEA 1	0.834	0.834	0.891
EVEA 2	0.935	0.863	0.902
EVEA 3	0.893	0.856	0.953

Baseline mood assessment (EVEA 1), after negative induction mood assessment (EVEA 2), and after positive induction mood assessment (EVEA 3)

Study 2

In study 2, participants underwent the same study procedures described for study 1 during two sessions separated by approximately 8 weeks. Similar to study 1, we examined the relationship between trait mindfulness and negatively valenced emotional reactivity to the negative MIP at both session one and session two in study 2. We expected to find a significant relationship between trait mindfulness and negatively valenced emotional reactivity following the negative MIP, such that lower levels of trait mindfulness would be associated with more negatively valenced emotional reactivity. We further examined if the overall trait mindfulness construct used in study 1 (excluding the Observing and Describing facets) was applicable to the general college-age sample in study 2. We hypothesized that the Describing and Observing facet would reflect different constructs than have been described previously in meditating samples and would not provide a good model fit for an overall mindfulness construct, consistent with study 1 findings. Additionally, the test-retest reliability of the trait mindfulness measure used in study 1 was assessed. Participants completed the FFMQ and underwent the negative MIP at session one and 8 weeks later at session two to determine if the trait mindfulness measure was consistent.

Method

Participants

Ninety-five undergraduates (ages 18–54; mean age = 22.25; *SD* = 6.04; 80 female) completed the first session, and of those, 65 undergraduates (ages 18–54; mean age = 22.58; *SD* = 6.49; 58 female) returned to complete the second session in its entirety, resulting in a total of 65 participants in the final analyses. All study procedures were approved by the University of Texas at Dallas Institutional Review Board, and informed consent was obtained from each participant prior to beginning the study. Participants were recruited from psychology classes on campus and were given course-credit for their participation.

Procedures

This was a two-part study with two sessions separated by 8 weeks. The two sessions were identical to one another and

followed the same procedures as study 1. The only procedural change from study 1 to study 2 was the criterion for excluding potentially suicidal individuals. Item 9 on Beck's Depression Inventory was acquired in order to screen for potentially suicidal individuals; however, as opposed to excluding participants that only endorsed thinking about suicide ("I have thoughts of killing myself, but I would not carry them out") as was the case in study 1, only participants that indicated suicidal intent were excluded from study 2 (endorsing "I would like to kill myself" or "I would kill myself if I had the chance"). Using this updated exclusion criterion, no participants endorsed suicidal intent, and none were excluded. Identical to study 1, after informed consent was given, participants were administered the FFMQ, BDI, and RRS, and the baseline mood assessment (EVEA). Immediately after completing the EVEA, participants completed the negative MIP, followed by the EVEA, positive MIP, and the final EVEA. Following completion of the final EVEA, two debriefs were given as described for study 1.

Mood Inductions Identical to study 1, participants were administered a negative and a positive MIP. All study procedures regarding the negative and positive MIPs were identical to study 1.

Measures

The same measures used in study 1 were used for both sessions in study 2 (BDI, FFMQ, RRS, and EVEA).

Data Analyses

SPSS Statistics 23 was used for all analyses. Similar analyses performed in study 1 were performed in study 2. For both sessions, descriptive statistics and internal consistency were calculated for all measures. Pearson correlation coefficients were calculated to examine the relationships between the FFMQ facets, overall mindfulness score, BDI, RRS, and mood changes resulting from the MIPs (positive and negative inductions) for both session one and session two. Intraclass correlation coefficient (ICC) estimates and their 95% confidence intervals were calculated based on an absolute agreement, 2-way mixed-effects model to assess test-retest reliability of the mindfulness facets from session one to session two (see Koo and Li 2016).

In order to examine if the three-factor model used in study 1, representing an overall mindfulness construct, was applicable to the sample used in study 2, a confirmatory factor analysis was performed using a five-factor model, a four-factor model, and a three-factor model, similar to study 1. Absolute change in mood before and after both the negative and positive MIP was assessed such that larger absolute change would reflect higher emotional reactivity. A Wilcoxon signed-rank test was performed to determine the effectiveness of both the negative and positive MIP. ICC estimates were calculated based on an absolute agreement, 2-way mixed-effects model to assess test-retest reliability of each of the subscales in the mood assessments (EVEA 1, 2, and 3; Koo and Li 2016). Finally, correlation analyses were conducted to examine whether overall trait mindfulness was associated with emotional reactivity.

Results

Means, medians, standard deviations, Cronbach's alpha, and zero-order correlations between the personality assessments for the first session are listed in Table 5 and the second session in Table 6. Zero-order correlations between the FFMQ facets, overall mindfulness score, BDI, RRS, and absolute change in emotional reactivity are listed in Table 7 for session one and Table 8 for session two. The only significant difference between participants that did not attend the second session and those that did was found in the Observing facet ($t(94) = -1.98$, $p = 0.05$). For both session one and session two, the Non-reactivity mindfulness facet displayed weak internal consistency ($\alpha = 0.68$ and 0.74, respectively), and the Observing facet displayed weak internal consistency at session one ($\alpha = 0.70$). Between-factor correlations for the mindfulness facets during session one and session two were consistent with study 1 findings. Intraclass correlation coefficient (ICC) estimates and their 95% confidence intervals were calculated based on an absolute agreement, 2-way mixed-effects model to assess test-retest reliability of the mindfulness facets from session one to session two. The ICC estimates for the mindfulness facets were good-to-excellent for the FFMQ mindfulness facets (all above 0.77).

Table 5 Study 2, session one, means, medians, standard deviations, and Cronbach's alpha for personality assessments

	Observe	Describe	Aware	Non-judge	Non-react	BDI	RRS
Median	26	28	26	28	22	7	46
Mean (SD)	25.63 (5.64)	27.65 (6.70)	26.21 (6.51)	26.73 (7.93)	21.76 (4.42)	9.31 (8.25)	46.87 (14.85)
Cronbach's α	0.70	0.90	0.89	0.91	0.68	0.91	0.88

Table 6 Study 2, session one correlation matrix between FFMQ facets, overall mindfulness score, RRS, and absolute change in mood

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Observe	1															
2. Describe	0.01	1														
3. Aware	0.03	0.43**	1		.											
4. Non-judging	−0.13	0.23*	0.49**	1												
5. Non-react	0.71	0.14	0.32**	0.41**	1											
6. FFMQ total	−0.01	0.35**	0.79**	0.87**	0.65**	1										
7. RRS	0.17	−0.26*	−0.52**	−0.62**	−0.46**	−0.70**	1									
8. Change sadness	0.12	− 0.05	−0.30**	−0.21**	− 0.15	−0.29**	0.31**	1								
9. Change happiness	0.01	0.11	− 0.09	− 0.01	− 0.01	− 0.05	0.09	0.54**	1							
10. Change anxiety	0.10	− 0.04	−0.31**	−0.28**	− 0.18	−0.34**	0.26*	0.69**	0.39**	1						
11. Sadness rebound	0.17	− 0.01	−0.27**	−0.28**	−0.21*	−0.33**	0.32**	0.81**	0.57**	0.58**	1					
12. Happiness rebound	−0.02	− 0.09	− 0.08	− 0.03	− 0.03	− 0.06	0.01	0.45**	0.63**	0.27**	0.60**	1				
13. Anxiety rebound	0.002	− 0.03	−0.21*	−0.32**	− 0.12	−0.30**	0.29**	0.59**	0.35**	0.63**	0.53**	0.32**	1			
14. Sadness overall	−0.08	−0.29**	−0.26**	− 0.19	−0.32**	0.33**	0.95**	0.59**	0.66**	0.96**	0.56**	0.59**		1		
15. Happiness overall	− 0.01	− 0.004	− 0.09	− 0.03	− 0.02	− 0.06	0.05	0.54**	0.88**	0.35**	0.65**	0.93**	0.37**	0.63**	1	
16. Anxiety overall	0.06	− 0.04	−0.31**	−0.34**	− 0.18	−0.37**	0.31**	0.71**	0.41**	0.92**	0.62**	0.33**	0.89**	0.70**	0.40**	1

Absolute change in mood after negative induction ("change sadness," "change happiness," and "change anxiety"), absolute change in mood after positive induction ("sadness rebound," "happiness rebound," and "anxiety rebound"), and absolute change in mood across the entire study procedure ("sadness overall," "happiness overall," and "anxiety overall")

*$p < 0.05$, two-tailed

**$p < 0.01$, two -tailed

Table 7 Study 2, session two, means, medians, standard deviations, and Cronbach's alpha for personality assessments

	Observe	Describe	Aware	Non-judge	Non-react	BDI	RRS
Median	26	27	28	28.5	22	6	44
Mean (SD)	25.78 (6.47)	26.55 (7.15)	27.92 (6.83)	28 (7.84)	22.34 (4.61)	8.09 (7.87)	45.71 (15.41)
Cronbach's α	0.81	0.94	0.92	0.91	0.74	0.91	0.95

To examine if the three-factor model utilized in study 1 representing an overall mindfulness construct was applicable to the sample used in study 2, a confirmatory factor analysis was conducted using a five-, four-, and three-factor model. Model fit indices for the five-factor, four-factor, and three-factor models for sessions one and two are listed in Table 9. Similar to study 1, the three-factor model provided the best fit for the observed data at both sessions one and two, with an adequate CFI, chi-square statistic, TLI, SRMR, and RMSEA. Also consistent with study 1, the most acceptable model to represent an overall mindfulness construct included only the Acting with Awareness, Non-judging, and Non-reactivity facets from the FFMQ.

For the first session, significant associations were found with sadness-related emotional reactivity and the Acting with Awareness and Non-Judging facets such that higher levels of Acting with Awareness and Non-judging were related to less sadness-related emotional reactivity after the negative MIP ($r = -0.30$, $p = 0.003$ and $r = -0.21$, $p = 0.04$, respectively). Similarly, higher levels of Acting with Awareness and Non-judging were associated with less anxiety-related emotional reactivity after the negative MIP ($r = -0.31$, $p = 0.002$ and $r = -0.28$, $p = 0.006$, respectively). Higher overall mindfulness was associated with less sadness and anxiety-related emotional reactivity after the negative MIP ($r = -0.29$, $p = 0.005$ and $r = -0.34$, $p < 0.001$, respectively).

To determine effectiveness of the negative MIP at the first session, a Wilcoxon signed-rank test was performed. Consistent with study 1 findings, there was a significant increase in sadness/depression and anxiety after the negative MIP compared with before ($Z = -5.764$, $p < 0.001$, $r = 0.588$ and $Z = -2.387$, $p = 0.017$, $r = 0.244$, respectively). Similar results were found for the second session for sadness and happiness changes after the negative MIP ($Z = -5.047$, $p < 0.001$, $r = 0.515$ and $Z = -5.970$, $p < 0.001$, $r = 0.610$, respectively); however, there was no significant change in anxiety after the negative MIP. Cronbach's alphas for each of the subscales in the mood assessments (EVEA 1, 2, and 3) at both sessions one and two were all above 0.80 (see Table 10). ICC estimates were calculated based on an absolute agreement, 2-way mixed-effects model to assess test-retest reliability of each of the subscales in the mood assessments (EVEA 1, 2, and 3) and were all above 0.68, indicating moderate consistency.

For the second session, higher levels of Non-reactivity were associated with less sadness-related emotional reactivity after the negative MIP ($r = -0.32$, $p = 0.01$). Additionally, higher levels of Acting with Awareness were associated with less anxiety-related emotional reactivity after the negative MIP ($r = -0.31$, $p = 0.02$). Higher overall mindfulness was associated with less sadness-related and anxiety-related emotional reactivity after the negative MIP ($r = -0.27$, $p = 0.03$ and $r = -0.28$, $p = 0.03$, respectively).

Discussion

Our first hypothesis was that individuals with lower trait mindfulness would exhibit more negatively valenced emotional reactivity in response to the negative MIP. Results from both session one and session two support this hypothesis. In session one, lower levels of Acting with Awareness and Non-judging were associated with more sadness- and anxiety-related emotional reactivity after the negative MIP. Additionally, lower levels of overall trait mindfulness were related to more sadness- and anxiety-related emotional reactivity. In session two, lower levels of Non-reactivity and overall trait mindfulness were associated with more sadness-related emotional reactivity. Additionally, lower levels of Acting with Awareness and overall trait mindfulness were associated with more anxiety-related emotional reactivity. Our second hypothesis was that, consistent with results from study 1, the Describing and Observing facets would reflect different constructs in a general college-age sample and that a model excluding these facets would provide the best model fit for an overall mindfulness construct. Results from study 2 supported this hypothesis; the three-factor model that included only Acting with Awareness, Non-judgment, and Non-reactivity facets provided the best model fit to represent an overall mindfulness construct. Finally, we assessed the test-retest reliability of the trait mindfulness measure and found the trait mindfulness measure and responsiveness to the MIP to be consistent across the two sessions.

General Discussion

The aims of study 1 were to examine the relationship between trait mindfulness and emotional reactivity to the MIP. The

Table 8 Study 2, session two correlation matrix between FFMQ facets, overall mindfulness score, RRS, and absolute change in mood

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Observe	1															
2. Describe	−0.03	1														
3. Aware	−0.12	0.49**	1		.											
4. Non-judging	−0.18	0.34**	0.52**	1												
5. Non-react	0.51	0.18	0.23	0.19	1											
6. FFMQ total	−0.10	0.47**	82**	0.84**	0.52**	1										
7. RRS	0.20	−0.26*	−0.47**	−0.63**	− 0.31*	−0.67**	1									
8. Change sadness	0.14	− 0.11	− 0.21	− 0.13	− 0.32*	− 0.27*	0.12	1								
9. Change happiness	0.04	− 0.05	− 0.19	− 0.08	− 0.29*	− 0.23	0.07	0.62**	1							
10. Change anxiety	−0.04	− 0.08	− 0.31*	− 0.12	− 0.22	− 0.28*	0.17	0.15	0.30*	1						
11. Sadness rebound	0.11	− 0.22	−0.36**	− 0.17	−0.42**	−0.39**	0.27*	0.87**	0.67**	0.23	1					
12. Happiness rebound	0.003	− 0.05	− 0.10	− 0.02	− 0.22	− 0.13	−0.04	0.60**	0.69**	0.18	0.66**	1				
13. Anxiety rebound	0.04	0.11	− 0.11	− 0.07	− 0.21	− 0.16	0.06	0.39**	0.39**	0.55**	0.41**	0.30**	1			
14. Sadness overall	0.14	− 0.17	− 0.30*	− 0.14	−0.37**	−0.34**	0.19	0.97**	0.67**	0.20	0.97**	0.65**	0.41**	1		
15. Happiness overall	0.02	− 0.05	− 0.15	− 0.05	− 0.27*	− 0.18	0.004	0.67**	0.90**	0.25*	0.72**	0.94**	0.37**	0.72**	1	
16. Anxiety overall	.001	.02	−.24	−.11	−.24	−.25	.13	.30*	.39**	.90**	.35**	.27*	.86**	.34**	.35**	1

Absolute change in mood after negative induction ("change sadness," "change happiness," and "change anxiety"), absolute change in mood after positive induction ("sadness rebound," "happiness rebound," and "anxiety rebound"), and absolute change in mood across the entire study procedure ("sadness overall," "happiness overall," and "anxiety overall")

*$p < 0.05$, two-tailed

**$p < 0.01$, two -tailed

Table 9 Study 2, session one and two CFA model fit indices for five-factor, four-factor, and three-factor model

	Chi-square (χ^2)	CFI	TLI	RMSEA	SRMR
Session one					
Five-factor model	1094.25, $p < 0.001$	0.77	0.75	0.079	0.103
Four-factor model	681.38, $p < 0.001$	0.834	0.821	0.078	0.097
Three-factor model	358.74, $p < 0.001$	0.866	0.851	0.078	0.085
Session two					
Five-factor model	1289.17, $p < 0.001$	0.669	0.648	0.117	0.108
Four-factor model	757.60, $p < 0.001$	0.766	0.746	0.111	0.095
Three-factor model	391.656, $p < 0.001$	0.808	0.786	0.107	0.099

aims of study 2 were to further investigate our study 1 finding that individuals with lower trait mindfulness exhibit increased negatively valenced emotional reactivity following mood induction. We also sought to examine if the three-factor model excluding the Observing and Describing facets would provide the best model fit to represent an overall mindfulness construct. In study 2, the test-retest reliability of the trait mindfulness measure (FFMQ) was assessed to determine the stability of trait mindfulness in a general college-age sample. Findings from study 2 provided support for the notion that trait mindfulness is a stable, consistent trait, at least over the 8-week interval between assessments in this study and in the absence of training or practice. Study 2 results replicated those from study 1 regarding the inconsistency of using FFMQ facets to reflect an overall mindfulness construct in general college-age samples; both the Describing and Observing facets might represent different constructs in general college-age samples than have been previously found in meditating samples. By excluding those two facets when using a general college-age sample, a better model fit for an overall mindfulness construct was obtained. Our results suggest that the Acting with Awareness, Non-reactivity, and Non-judgment facets provide the best reflection of overall trait mindfulness in general college-age samples. Our findings from study 1 suggest that lower trait mindfulness, specifically, the quality of acting with awareness, is associated with increased negatively valenced emotional reactivity. Findings from study 2 further support the hypothesis that lower overall trait mindfulness is associated with increased negatively valenced emotional reactivity. Taken together, these findings support theories of mindfulness suggesting that high overall trait mindfulness acts as a protective buffer against the impact of stressors by altering the way an individual evaluates and copes with a stressor, thus reducing the negative effect of the stressors resulting in reduced emotional reactivity.

Table 10 Study 2, session one and two Cronbach's alphas for mood assessments of self-reported sadness, anxiety, and happiness

Cronbach's α			
	Sadness	Anxiety	Happiness
Session 1			
EVEA 1	0.891	0.813	0.940
EVEA 2	0.902	0.880	0.952
EVEA 3	0.833	0.840	0.957
Session 2			
EVEA 1	0.920	0.884	0.959
EVEA 2	0.924	0.860	0.967
EVEA 3	0.938	0.899	0.953

Baseline mood assessment (EVEA 1), after negative induction mood assessment (EVEA 2), and after positive induction mood assessment (EVEA 3)

The results from the two studies presented here permit speculation on the mechanisms by which trait mindfulness facilitates regulation of emotional reactivity in response to external environmental influences upon mood. Other studies have found that high trait mindfulness is associated with an increased ability to release negative thoughts (e.g., Frewen et al. 2008) and more effective emotion regulation (Roemer et al. 2015). Emotion regulation refers to the processes by which emotion is modulated so as to control when emotions are experienced, what emotions are experienced, how they are experienced, and expressed (Gross 1998b). Emotion regulation can be accomplished by employing different strategies. These strategies can be broadly categorized as either "antecedent-focused" or "response-focused" (Gross 1998a). These distinctions refer to the point along the emotional response timeline that the strategy is employed (e.g., antecedent-focused strategies are employed before the emotion response has become fully activated, while response-focused strategies refer to the regulation of the emotional response once the emotion response is already underway). Although both emotion regulation strategies are effective at reducing emotional expression, antecedent-focused strategies (i.e., reappraisal) are better at reducing the experience of emotion, while response-focused strategies (i.e., suppression) induce physiological changes and do not result in reductions in the subjective experience of negative emotion (Gross 1998b).

While standard emotion regulation strategies involve reappraising events in a more positive context or by

suppressing the emotional response (Gross 2002), mindful emotion regulation is thought to arise by a different mechanism. Farb et al. (2012) explicate this theory of mindful emotion regulation as two processes that are distinct from standard antecedent- and response-focused emotion regulation strategies but fundamentally characteristic to mindfulness: (1) Paying attention to present-moment sensation and (2) not judging the experience as intrinsically good or bad. Mindfulness encourages an open attitude toward emotional experience, allowing the individual to consciously attend to the emotional experience in a less biased manner (i.e., non-judgmentally) and to view emotions as transient mental events, as opposed to reflections of reality (Hargus et al. 2010). By approaching stressors in a mindful way, the enhanced non-judgmental attention and expanded non-reactive awareness regarding a situation and one's own present-moment experience might permit an improved ability to detect if, when, and how an emotion needs to be modulated.

Approaching a stressor with an open and non-judgmental stance might alter the way an individual relates the stressor to their own internal experiences, which may impact the emotional response (Roemer et al. 2015). As such, mindfulness is closer to an antecedent-focused type of emotion regulation than a response-focused type because mindful emotion regulation involves changes to a person's relationship with their emotions rather than changes to the emotional response itself (see Teper et al. 2013). The results of the present studies suggest that high overall trait mindfulness, represented by high levels of awareness, non-reactivity, and non-judgment, provides individuals with the ability to notice and openly engage in a non-reactive and non-judgmental way with the negative emotions that arose during the mood manipulation, enabling them to de-identify with those emotions (instead of habitually responding to them) resulting in reduced emotional reactivity.

While previous research has often characterized overall mindfulness as a combination of the five distinct aspects of mindfulness measured in the FFMQ, findings from the present studies suggest that not all of the individual FFMQ facets represent the same underlying construct in non-meditators and meditators. Often, studies exclude the Observing facet when assessing overall mindfulness in non-meditators because it does not contribute to an overall mindfulness construct and often displays positive relationships with psychological symptoms in non-meditating samples. These findings suggest that the Observing facet might not adequately capture the intended quality of mindfully attending to emotional experiences for non-meditating populations (Baer et al. 2006). To investigate this claim, Rudkin et al. (2018) examined the Observing facet with other mindfulness measures and psychological symptoms. By performing an exploratory factor analysis, Rudkin et al. (2018) identified three main components underlying the Observing construct: (1) observation of physical sensations in the body, (2) perception of external stimuli, and (3) emotional awareness. Emotional awareness was the only component negatively related to psychological symptoms; however, none of the Observing facet items on the FFMQ directly assesses emotional awareness, supporting the notion that the Observing facet does not adequately capture the construct that is central to mindfulness (Rudkin et al. 2018).

Phrasing of Observing facet queries on the FFMQ might also contribute to its discrepant performance compared with other facets. Observing facet items are phrased in a way that, depending on the respondent's interpretation, might be closer to a measure of analytical self-focus, or rumination. A meditating sample might interpret the observing items in a way that appropriately measures the intended underlying construct of mindful observation (i.e., open, non-judgmental, and non-reactive observation of physical sensations and internal emotions); however, non-meditators may be less likely to interpret and associate observing with such mindful qualities of attention (Eisenlohr-Moul et al. 2012; Van Dam et al. 2018), resulting in a measure closer to self-critical, ruminative self-focus (Lilja et al. 2013). Thus, in a non-meditating sample, the Observing facet considered individually might reflect more reactive forms of observation, such as rumination and other manifestations of maladaptive self-focused attention (e.g., Eisenlohr-Moul et al. 2012). The results presented here support the exclusion of the Observing facet when constructing an overall mindfulness measure in a general college-age sample.

Our results show that excluding the Describing and Observing facets provides a better model to represent an overall mindfulness construct in a general population sample. While previous studies have generally yielded consistent findings regarding the Observing facet in non-meditators, the Describing facet has not displayed such consistency. In previous research investigating individual mindfulness facets and distress variables (e.g., depression, anxiety, stress, and distress), varying relationships between the Observing and Describing facets and distress variables have been observed between different populations (Medvedev et al. 2018). These researchers suggested that findings involving mindfulness assessments including these two facets cannot be directly generalizable across all populations.

Discrepancies between the Observing and Describing facets and the other mindfulness facets could be accounted for in terms of the "what" versus "how" distinction described by Baer et al. (2008). This distinction suggests that it is not only what the internal experiences are that a person observes, but how the person observes and accurately describes those internal experiences. Delaying reaction to the thoughts and feelings one is observing allows the opportunity to internally engage in more accurate, non-judgmental assessment and description of the emotional experience, resulting in more behaviorally adaptive responses. Thus, while the tendency to observe and describe is generally considered beneficial, it

may actually be maladaptive for individuals that lack the ability to approach their internal experiences in a non-reactive and non-judgmental manner (Desrosiers et al. 2014). In our studies using general college-age samples, the Observing and Describing facets were the only two facets that either did not exhibit significant inverse relationships with trait rumination (study 1) or exhibited the weakest inverse relationships with trait rumination compared with the other facets (study 2, both sessions). It might be that, for non-meditators lacking the ability to mindfully observe and describe emotions, the Observing and Describing facets index qualitatively different constructs that might not be as advantageous when modulating emotion.

Limitations and Future Research

Some limitations of the studies presented here should be noted. One limitation of these studies was the use of self-report measures to examine trait mindfulness. Many past studies investigating trait mindfulness in meditators and non-meditators have used correlational research methods in the laboratory, relying mainly on the association of self-report measures without any experimental manipulation or behavioral measurement (see Hoge et al. 2019). Interpretation of results from these kinds of studies is limited owing to effects of response bias, sampling bias, the inability of respondents to accurately assess themselves, and varying interpretation of the questions asked on self-report measures (e.g., Van Dam et al. 2018). While any study using self-report measures are impacted by these limitations, the use of self-report measures to assess mindfulness may be particularly vulnerable (Van Dam et al. 2011). For instance, response bias might lead non-meditators to conflate the desire to be mindful with actually being mindful (Grossman and Van Dam 2011; Van Dam et al. 2018). Familiarity with and exposure to mindfulness terms might increase perceptions of the overall importance of mindfulness (Grossman 2008). Previous studies examining trait mindfulness in non-meditators have primarily relied on convenience sampling of college students who are not necessarily representative of the entire population, leading to results that are not generalizable across populations. General limitations of introspection might make self-reporting mindfulness more difficult in non-meditators because an individual might not understand which aspects of mental states should be considered in order to properly make a personal assessment of mindfulness (Van Dam et al. 2018). Furthermore, assessing self-reported mindfulness requires metacognition of awareness (e.g., Schooler 2002), in which the total number of attentional lapses (or mindless moments) that an individual notices and can report depends entirely on recognizing that a lapse in attention has occurred in the first place. Non-meditators might lack this metacognitive awareness, resulting in biased self-reported assessments of mindfulness.

The two studies presented in this paper are not exempt from the general limitations of using self-reported mindfulness measures. However, additional experimental control was gained by utilizing an experimental MIP, allowing laboratory observation of self-reported mood changes without the variability due to demand characteristics and memory limitations (see also, e.g., Arch and Craske 2006; Ortner et al. 2007; Westermann et al. 1996). MIPs are widely used and known to induce transient mood states in the laboratory. The Velten procedure is one of the most commonly used MIPs and is considered to be highly effective at inducing a transient depressed mood (Gerrards-Hesse et al. 1994; Westermann et al. 1996). Negative MIPs are considered to be more effective at inducing negative mood states rather than reducing positive mood states (Piñeua-Shuhaibar et al. 2011). It is possible that, for those in the present study that did not exhibit a significant change in mood after the negative MIP, the mood changes measured after the MIP were not reflective of the actual emotions that arose during the MIP. It might be that their negative mood dissipated by the time mood was assessed after the induction. However, several studies have found objective measures to be consistent with self-reported mood changes when measured immediately after completion of the MIP (e.g., Mayberg et al. 1999; McKenna and Lewis 1994). As such, self-report measures that are completed immediately after the MIP are thought to be representative of the actual mood elicited during the MIP. However, it would be useful for future research to include self-report mood measures during mood induction (as well as objective measures of arousal, such as cortisol levels, heart rate, and skin conductance) to provide further support for mood changes resulting from MIPs.

The two studies presented here featured smaller, gender-weighted (mostly females) samples compared with other studies that have employed structural equation modeling. Several model characteristics, including insufficient statistical power for structural equation modeling, affect the stability and reliability of the model fit indices and parameter estimates when performing confirmatory factor analysis (e.g., MacCallum et al. 1999; Wolf et al. 2013). Replication of our results with larger, gender-balanced samples is certainly warranted. We did not query our participants on their meditation experience. Thus, a small number of experienced meditators might have contributed variance to our measures. Most research studies assessing experienced meditators typically recruit participants from meditation programs, institutes, centers, or other meditation-related gatherings, so we are confident that our sample of college-age undergraduate students did not contain a significant number of experienced meditators. Future research should also focus on examining a broader range of negatively valenced emotional reactivity, such as guilt or shame, and specific positive mood states. In order to avoid the abovementioned limitations, future research should strive to replicate our findings by assessing mindfulness with objective measures in non-student populations.

The studies presented here assessed relationships between overall trait mindfulness and emotional reactivity in response to a laboratory-based mood induction. Additionally, we examined the individual mindfulness facets of the FFMQ to determine which facets most significantly contribute to a construct representing overall mindfulness in a general population sample. Results from both studies indicate that the Observing and Describing facets do not measure the same intended underlying construct in the general population as for meditators and, by excluding these two facets, a more suitable representation of overall mindfulness could be constructed. Our findings suggest that individuals with higher overall mindfulness represented by the Awareness, Non-judgment, and Non-reactivity facets on the FFMQ exhibit less emotional reactivity in response to negative mood manipulation. These results support theories of mindfulness suggesting that high trait mindfulness is associated with more adaptive emotion regulation in the presence of a stressor, resulting in less emotional reactivity. Additional research is needed to understand the exact mechanisms by which individuals mindfully regulate negative emotions when presented with external stressors and which core features of mindfulness (e.g., non-judgment, non-reactivity, present-moment awareness, or acceptance) might lead to reduction in emotional reactivity.

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Authors' Contributions LH designed and executed the study, performed the data analysis, and wrote the paper. NAH collaborated in the design of the study. GBM collaborated in conducting data analysis and contributed to editing of the manuscript. JG collaborated with the design and execution of the study. MPT collaborated with the design of the study. BR collaborated in the design and execution of the study, collaborated in data analysis, and oversaw and contributed to the writing and editing of the manuscript. All authors approved the final version of the manuscript for submission.

Compliance with Ethical Standards

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

Statement of Ethics All research procedures received approval by the University of Texas at Dallas Institutional Review Board.

Informed Consent Informed consent was received from all individuals who participated in this research.

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