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Further Psychometric Validation of the Mindful Attention Awareness Scale (MAAS)

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Abstract Mindfulness is an increasingly prominent construct in health research but its study has been impeded by a lack of well-validated measures. The Mindful Attention and Awareness Scale (MAAS; Brown and Ryan, *Journal of Personality and Social Psychology*, 84:822–848, 2003) is a promising measure and the goal of the present study was to further validate the MAAS in a large university sample (n= 711). Confirmatory factor analysis supported the unidimensional factor structure of the MAAS in the overall sample. No gender differences in MAAS performance were evident, but the factor structure was not confirmed in the subsample of men, apparently due to power limitations. No categorical differences were evident based on experience with meditation, and MAAS performance was not significantly associated with experience with meditation. These findings are interpreted as broadly supporting the MAAS as a valid measure of mindfulness, but suggesting that novice-level experience with meditation should not be presumed to be associated with greater mindfulness.

Keywords Mindfulness · Meditation · Psychometric validation · Factor analysis

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The concept of mindfulness is a central aspect of ancient Buddhist philosophy (Das 1997; Suzuki 1964), but has recently become an increasingly prominent construct in clinical psychology. Although there are a number of conceptualizations of mindfulness (for a review, see Zvolensky et al. 2005), it can broadly be described as objective experiential awareness and is believed to be a psychological property that can be cultivated or depleted (Brown and Ryan 2003; Kabat-Zinn 1990; Teasdale et al. 1994), the latter sometimes being described as a state of "mindlessness." From both Buddhist and psychological standpoints, the development of greater mindfulness has been proposed to promote psychological health and well-being (Das 1997; Kabat-Zinn 1990; Suzuki 1964).

Based on this premise, mindfulness has recently been incorporated into a number of psychological treatments, which have been associated with significant improvements in functioning in many clinical populations, including individuals suffering from depression and other mood disorders (Robins 2002; Teasdale et al. 1994, 2000), addictive disorders (Marlatt 2002; Witkiewitz et al. 2005), chronic pain (Kabat-Zinn et al. 1987), cardiopulmonary disease (Solberg et al. 1995), and various other medical conditions (e.g., Logsdon-Conradsen 2002; Mills and Allen 2000).

Although the results from these interventions are encouraging, many of the aforementioned studies have been criticized on methodological grounds (e.g., Bishop 2002; Relman and Angell 2002; Relman et al. 2001; Roemer and Orsillo 2002). Many mindfulness-based treatment studies have serious methodological problems that undermine their clinical utility and the potential dissemination of the findings (Bishop 2002). Moreover, although the effectiveness of mindfulness-based treatments is often examined, no studies have isolated and evaluated the mindfulness component of a treatment intervention

(Dimidjian and Linehan 2003). Thus, there is a need for rigorous experimental and treatment outcome research in determining the role of mindfulness in positive clinical outcomes (Bishop 2002; Roemer and Orsillo 2002).

However, such research is impeded by a lack of well-validated measures of mindfulness. To address this issue, Brown and Ryan (2003) developed the Mindful Attention Awareness Scale (MAAS), which is a promising self-report measure of mindfulness. The MAAS purports to measure a conceptualization of mindfulness as "the presence or absence of attention to, and awareness of, what is occurring in the present moment" (Brown and Ryan 2003, p. 824). In its initial validation, the MAAS was examined in series of studies that indicated strong psychometric properties, including both convergent and divergent validity with other measures of psychological well-being. Additionally, it was shown to differentiate between the general public and experienced Zen Buddhist practitioners, a group presumed to have substantial capacity for mindfulness. Finally, Brown and Ryan demonstrated that scores on the MAAS improved over time during an 8-week standardized mindfulness-based stress reduction program, which had been previously shown to be effective in reducing psychological distress in chronic pain (Kabat-Zinn et al. 1987), anxiety (Kabat-Zinn et al. 1992; Miller et al. 1995) and other chronic medical conditions (e.g., Logsdon-Conradsen 2002; Mills and Allen 2000). Importantly, Brown and Ryan found that changes on the MAAS were related to changes in self-reported well-being.

The potential utility of the MAAS has also been supported by a recent examination of its capacity to incrementally predict depressive and anxious symptomatology (Zvolensky et al. 2006). In that study, mindfulness, as measured by the MAAS, exhibited incremental validity in predicting anhedonic depressive symptoms, further bolstering the notion that it may play a significant role in psychological and physical health. Interestingly, mindfulness did not incrementally predict anxious arousal, suggesting that the role of mindfulness may be specific to certain psychological phenomena. However, Zvolensky et al. (2006) note that given the sparse empirical literature actually examining mindfulness, these findings should be considered cautiously and as but among the first steps toward understanding the relationship between mindfulness and psychological disorders.

The purpose of the current study was to further validate the MAAS as a measure for assessing mindfulness in two ways. The first goal was to use confirmatory factor analysis to validate unidimensional factor structure of the MAAS, both in a large mixed sample and separately by gender. Given that the MAAS is conceptually based in self-regulation theory (Brown and Ryan 2003) and self-regulation varies by gender in some domains (e.g., Nolen-Hoeksema and Corte 2004), the study sought to examine potential gender differences in mindfulness, a possibility heretofore unaddressed in the existing empirical literature. Based on its promise in empirical research to date, the MAAS was predicted to exhibit robust psychometric properties across these analyses. Second, meditation has been repeatedly proposed to generate greater mindfulness (Das 1997; Suzuki 1964), therefore, the study sought to examine the relationship between the MAAS and self-reported experience with meditation, predicting that individuals with experience with meditation would perform higher on the MAAS, and degree of meditation experience would be positively associated with performance on the MAAS. The study used a large, university-based sample to partially overlap with Brown and Ryan's (2003) initial development study, but also to diverge from that study in examining mindfulness and self-reported meditation in a non-selected sample, more representative of the general population than advanced Zen practitioners. In addition, this sample was selected to further validate the MAAS in a sample similar to those commonly used to characterize the relationship between mindfulness and mental or physical health (e.g., Astin 1997; Leigh et al. 2005; Zvolensky et al. 2006).

Materials and Methods

Participants

Participants were 727 students recruited at the State University of New York at Binghamton. Of these individuals, 16 did not provide complete MAAS data and were excluded from subsequent analyses. Of those who provided complete data, the sample was 63% (n=448) Caucasian; 23% (n=164) Asian/Asian American; 3% (n=23) African American; 4% (n=29) Latino/Latina; <1% (n=3) American Indian; 2% (n=16) Biracial; <1% (n=5) Pacific Islander; 2% (n=13) "Other;" and 2% (n=11) declined to answer. Participants were primarily college freshman and sophomores aged 18–19 years. Women comprised 53% (n=377) of the sample, men comprised 33% (n=233) of the sample, and 14% (n=101) did not provide their gender.

Measures

Participants completed the MAAS and a brief questionnaire assessing experience with meditation. The MAAS uses 15 items that a participant rates on a scale from one ("almost always") to six ("almost never"). Scoring involves calculating mean performance across the 15 items, with higher scores indicating greater mindfulness. The meditation-related questionnaire assessed whether participants had any experience with meditation using a categorical response format (i.e., yes/no). In addition, if the answer was yes, participants were asked to elaborate by indicating how many years they engaged in these activities, starting with

1 year or less. The type of meditation practiced was assessed using an open-ended format.

Procedure

All procedures were approved by the Binghamton University Human Subjects Research Review Committee (Institutional Review Board). All measures were administered in mass administrations over two semesters. All participants provided informed consent and received one research credit for participation.

Data Analysis

Performance on the MAAS was initially examined for normality and outliers. Multivariate outliers were examined by regressing all items onto a dummy variable and generating the mahalanobis distance (critical χ^2 (df>100)= 149.45; p<0.001). Internal reliability was examined using Cronbach's alpha. Confirmatory factor analysis (CFA) was used to examine the factor structure of the MAAS and model fit was assessed using three indices: the root mean square residual (RMR; Marsh and Hocevar 1985), the comparative fit index (CFI; Bentler 1990), and the root mean square error of approximation (RMSEA; Browne and Cudeck 1993). Criteria for adequate model fit were as follows: RMR≤0.10 (Marsh and Hocevar 1985); CFI≥0.90 (Bentler 1990); and RMSEA≤0.08 (Browne and Cudeck 1993). Ninety percent confidence intervals (CI) were also calculated for the RMSEA.To assess the relationship between the MAAS and self-reported meditation, participants were dichotomized based on meditation experience and compared using a one-way analysis of variance (ANOVA). Continuous analyses were conducted using Pearson's product-moment (r) correlation. Participants with no experience with meditation were assigned a zero value, but nonetheless included in the continuous analysis, and a continuous analysis exclusively among meditators was also conducted. Responses to open-ended questions about the types of meditative experiences were qualitatively examined for common responses. Comparisons by gender used the same approach as the dichotomous meditation analyses and CFAs by gender used the same approach as the overall CFA.

Results

Performance on the MAAS was normally distributed, skewness=−0.13 (SE=0.09), kurtosis=0.07 (SE=0.18), with no evidence of univariate or multivariate outliers. Cronbach's α indicated good internal reliability, α=0.89. Mean performance was at 60% of scale maximum (M= 4.00, SD =0.85). Confirmatory factor analysis revealed that the single factor structure provided an adequate fit to the data: RMR=0.082; CFI=0.914; RMSEA=0.071 (CI= 0.065–0.079). All items exhibited significant factor loadings, as indicated in Table 1.

In terms of gender differences, no significant difference was evident between women (M=4.01, SD=0.81) and men (M=4.01, SD=0.86), F (1, 609)=0.01, p>0.90. Internal reliability was high for the subsamples of women (α=0.89) and men (α=0.87). Confirmatory factor analysis supported the unidimensional factor structure for women (RMR= 0.085; CFI=0.921; RMSEA=0.070 [CI=0.060–0.080]),

Table 1 Standardized factor loadings for the single factor solution of the mindfulness awareness and attention scale identified using confirmatory factor analysis for the total sample, women, and men; ***p<0.001

Item	Overall Sample	Women	Men
1. I could be experiencing some emotion and not be conscious of it until some time later.	0.43***	0.43***	0.44***
2. I break or spill things because of carelessness, not paying attention, or thinking of something else.	0.44***	0.40***	0.45***
3. I find it difficult to stay focused on what's happening in the present.	0.62***	0.62***	0.63***
4. I tend to walk quickly to where I'm going without paying attention along the way.	0.52***	0.58***	0.45***
5. I tend not to notice feelings of physical tension or discomfort until they really grab my attention.	0.51***	0.55***	0.43***
6. I forget a person's name almost as soon as I've been told it for the first time.	0.41***	0.47***	0.31***
7. It seems I'm "running on automatic" without much awareness of what I'm doing.	0.74***	0.74***	0.70***
8. I rush through activities without being really attentive to them.	0.76***	0.80***	0.68***
9. I get so focused on the goal I want to achieve that I lost touch with what I am doing right now to get there.	0.71***	0.74***	0.67***
10. I do jobs or tasks automatically, without being aware of what I'm doing.	0.74***	0.74***	0.77***
11. I find myself listening to someone with one ear, doing something else at the same time.	0.56***	0.58***	0.48***
12. I drive places on "automatic pilot" and then wonder why I went there.	0.62***	0.59***	0.62***
13. I find myself preoccupied with the future or the past.	0.54***	0.56***	0.50***
14. I find myself doing things without paying attention.	0.78***	0.76***	0.78***
15. I snack without being aware that I'm eating.	0.52***	0.51***	0.52***

but not men (RMR=0.111; CFI=0.856; RMSEA=0.089 [CI=0.076–0.101]). However, in both cases, all items nonetheless significantly loaded on the overall factor (*p*s< 0.001), provided in Table 1. To explore whether an alternative factor structure was evident in men, an exploratory factor analysis using a principal axis (common) factors extraction and direct oblimin rotation was conducted. Examination of the eigenvalues revealed a single factor structure. An initial factor had an eigenvalue of 5.33 accounting for 33.55% of the variance, and all subsequent factors had eignenvalues less than 0.60, accounting for less than 4% of the variance. In addition, all item loadings (range: 0.31–0.79) on the identified factor met the commonly used convention of 0.30 (Tabachnick and Fidell 2001), suggesting a unidimensional factor structure.

Ten percent (n=69) of the sample reported any experience with meditation. No significant differences were identified between participants with meditation experience and those without, F (1, 707)=0.05, p>0.80. The mean on the MAAS for participants with experience (M=4.03, SE= 0.10) was approximately the same as the mean for those without (M=4.00, SE=0.03). With regard to the degree of experience with meditation, experience ranged from 1 year or less to 10 years, with the modal response being one year or less (65%; n=45). Based on substantial positive skewness, experience with meditation was logarithmically transformed, adding a constant of one to all values (to permit transformation of zero experience using a logarithm), which substantially improved the distribution. Experience with meditation and performance on the MAAS were not significantly associated (r=0.04, p>0.30), as was the case also within the subsample of individuals who reported experience with meditation (r=0.11, p>0.35).

Discussion

This study sought to further validate the MAAS as a measure of mindfulness, with mixed support for its predictions. Consistent with the hypotheses, the single factor structure of the MAAS reported by Brown and Ryan (2003) was confirmed in the overall sample on all fit indices, with all MAAS items significantly loading on that factor. In terms of item content, items 7, 8, 10, and 14 exhibited the highest magnitude factor loadings, which reflected self-reported inattention and "running on automatic," and were consistent with the conceptual basis of the MAAS. In addition, the factor structure of the MAAS was affirmed in women according to all fit indices. Finally, it was notable that men and women did not differ in terms of mindfulness, suggesting that mindfulness as measured by the MAAS is not related to gender. These findings largely support the validity of the MAAS.

However, contrary to predictions, no significant categorical differences were evident between individuals with and without meditation experience, and no significant continuous association was evident in the overall sample or in individuals reporting experience with meditation. The absence of categorical differences or continuous associations may be better understood in the context of the previous research with the MAAS. In their original validation study, Brown and Ryan (2003) examined middle-aged Zen Buddhist practitioners who were recruited directly from a Zen monastery, finding both significant categorical and continuous relationships between the MAAS and experience with meditation. This study's sample was of young adults from a university, who could be best characterized as novice meditators. As such, it appears likely that the sample studied by Brown and Ryan were individuals who were more experienced and more committed to meditative practices, also evidenced by notably higher mean MAAS scores in that sample relative to the meditator sample in this study. Thus, these data suggest that there are no clear differences in mindfulness (as measured by the MAAS) between novice meditators and those with no experience with meditation, and also suggest caution in presuming experience with meditation is associated with greater mindfulness in a general sample. Of note, these findings may have important implications for clinical practice, where a clinician might erroneously presume that an individual with familiarity with the concept of mindfulness and some experience with meditation would be particularly adept in the practice of mindfulness. In light of this possibility, the current findings suggest that the MAAS may have clinical utility in objectively gauging an individual's level of mindfulness.

A second unanticipated finding was that the single factor structure of the MAAS was not confirmed in men, suggesting that the MAAS is less valid for use in men. However, this appears to have been a function of the sample size of the subsample of men (n=233), which had lower statistical power than the subsample of women (n= 377) and fell short of commonly used recommendations for conducting CFA (n>300; Ullman 2001). Although speculative, this explanation is supported by the uniformly significant item loadings for men, the similar magnitudes of association by item as women (Table 1), the similarly high internal reliability as women, and the follow-up exploratory factor analysis suggesting a single factor structure was indeed the best fit for the data.

Finally, it should be noted that the current study has a number of limitations. For example, the assessment of participants' meditative practices was not exhaustive and a fine-grained analysis of the various types of meditative practices could not be conducted. As such, it is possible that proficiency with mindfulness may be specific to certain

meditation variants, which may have been overlooked. In addition, the MAAS was not examined in the context of a more comprehensive battery of measures permitting more thorough construct validation, which is of high-priority given the promise of the measure. In particular, this latter domain should be the focus of future empirical research.

In spite of these limitations, these findings nonetheless largely support the psychometric validity of the MAAS in the assessment of mindfulness as a psychological construct. In addition, they underscore the need for careful assessment in studies of mindfulness, where intuitive assumptions about individual characteristics and mindfulness may not be veridical.

References

Astin, J. A. (1997). Stress reduction through mindfulness meditation: Effects on psychological symptomatology, sense of control, and spiritual experiences. *Psychotherapy and psychosomatics, 66*, 97–106.

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin, 107*, 238–246.

Bishop, S. R. (2002). What do we really know about mindfulness-based stress reduction? *Psychosomatic Medicine, 64*, 71–83.

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*, 822–848.

Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp.136–162). Newbury Park, CA: Sage.

Das, S. (1997). *Awakening the buddha within: Tibetan wisdom for the western world*. New York: Broadway.

Dimidjian, S., & Linehan, M. M. (2003). Defining an agenda for future research on the clinical application of mindfulness practice. *Clinical Psychology: Science and Practice, 10*(2), 166–171.

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

Kabat-Zinn, J., Lipworth, L., Burney, R., & Sellers, W. (1987). Four-year follow-up of a meditation-based program for the self-regulation of chronic pain: Treatment outcomes and compliance. *Clinical Journal of Pain, 2*, 159–173.

Kabat-Zinn, J., Massion, A.O., Kristeller, J., Peterson, L.G., Fletcher, K.E., Pbert, L. et al. (1992). Effectiveness of a meditation-based stress reduction program in the treatment of anxiety disorders. *American Journal of Psychiatry, 149*, 936–943.

Leigh, J., Bowen, S., & Marlatt, G. (2005). Spirituality, mindfulness and substance abuse. *Addictive Behaviors, 30*, 1335–1341.

Logsdon-Conradsen, S. (2002). Using mindfulness meditation to promote holistic health in individuals with HIV/AIDS. *Cognitive and Behavioral Practice, 9*, 67–72.

Marlatt, G. A. (2002). Buddhist philosophy and the treatment of addictive behavior. *Cognitive and Behavioral Practice, 9*, 44–50.

Marsh, H. W. & Hocevar, D. (1985) Application of confirmatory factor analysis to the study of self-concept: First and higher-order factor models and their invariance across groups. *Psychological Bulletin, 97*, 562–582.

Miller, J. J., Fletcher, K., & Kabat-Zinn, J. (1995). Three-year follow-up and clinical implications of a mindfulness meditation-based stress reduction intervention on the treatment of anxiety disorders. *General Hospital Psychiatry, 17*, 192–200.

Mills, N., & Allen, J. (2000). Mindfulness of movement as a coping strategy in multiple sclerosis. A pilot study. *General Hospital Psychiatry, 22*(6), 425–431.

Nolen-Hoeksema, S. & Corte, C. (2004). Gender and self-regulation. In R. F. Baumeister & K. D. Vohs (Eds.) *Handbook of self-regulation: Research, theory, and applications* (pp. 411–421). New York: Guilford.

Relman, A., & Angell, M. (2002). Resolved: There is no good published evidence that psychosocial interventions can directly affect the outcome of organic diseases, or that psychosocial factors directly cause such diseases. *Psychosomatic Medicine, 64*, 558–563.

Relman, A., Riley, D., Kabat-Zinn, J., & Hosmer, D. (2001). Parsing the data: An examination of a study on meditation and psoriasis. *Advances in Mind-body Medicine, 17*, 66–77.

Robins, C. J. (2002). Zen principles and mindfulness practice in dialectical behavior therapy. *Cognitive and Behavioral Practice, 9*, 50–57.

Roemer, L., & Orsillo, S.M. (2002). Expanding our conceptualization of and treatment for generalized anxiety disorder: Integrating mindfulness/acceptance-based approaches with existing cognitive-behavior models. *Clinical Psychology: Science and Practice, 9*, 54–68.

Solberg, E.E., Halvorsen, R., Sundgot-Borgen, J., Ingjer, F., & Holen, A. (1995). Meditation: A modulator of the immune response to physical stress? A brief report. *British Journal of Sports Medicine, 29*, 255–257.

Suzuki, D. T. (1964). *An introduction to Zen Buddhism*. New York: Grove Weidenfield.

Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics* (4th ed.). Needham Heights, MA: Allyn & Bacon.

Teasdale, J. D., Segal, Z., & Williams, J. M. G. (1994). How does cognitive therapy prevent depressive relapse and why should attentional control (mindfulness) training help? *Behavior Research and Therapy, 33*, 25–39.

Teasdale, J. D., Segal, Z. V., Williams, J. M. G., Ridgeway, V. A., Soulsby, J. M., & Lau, M. A. (2000). Prevention of relapse/recurrence in major depression by mindfulness-based cognitive therapy. *Journal of Consulting and Clinical Psychology, 68*, 615–623.

Ullman, J. B. (2001). Structural Equation Modeling. In B. G. Tabachnick & L. S. Fidell (Eds.), *Using multivariate statistics* (4th ed.) (pp. 653–771). Needham Heights, MA: Allyn & Bacon.

Witkiewitz, K., Marlatt, G. A., & Walker, D. (2005). Mindfulness-based relapse prevention for alcohol and substance use disorders. *Journal of Cognitive Psychotherapy, 19*, 211–228.

Zvolensky, M. J., Feldner, M. T., Leen-Feldner, E. W., & Yartz, A. R. (2005). Exploring basic processes underlying acceptance and mindfulness. In S. M. Orsillo & L. Roemer (Eds.), *Acceptance and mindfulness-based approaches to anxiety: Conceptualization and treatment* (pp. 325–357). New York: Springer.

Zvolensky, M. J., Solomon, S. E., McLeish, A. C., Cassidy, D., Bernstein, A., Bowman, C. J., et al. (2006). Incremental validity of mindfulness-based attention in relation to concurrent prediction of anxiety and depressive symptomatology and perceptions of health. *Cognitive and behaviour Therapy, 35*, 148–158.