The relationship between anxiety and mindfulness: The role of mindfulness facets, implicit anxiety, and the problem of measuring anxiety by self-report

Mihael Černetič

Faculty of Psychotherapy Science of Sigmund Freud University Ljubljana
DOBA Faculty of Applied Business and Social Studies Maribor

Although mindfulness interventions are increasingly used for coping with excessive anxiety, the relationship between mindfulness and anxiety is not yet clear. The study focused on this relationship. On a sample drawn from the general population, three mindfulness questionnaires were utilized. Anxiety was assessed by means of two self-report instruments as well as by two implicit anxiety measures. The latter were included because of the possibility that mindfulness might correlate with measurement error in measuring anxiety by self-report, which would cause biased results. A robust, moderate to high negative association was established between mindfulness and anxiety. Mindfulness facets related to acceptance contributed strongly to this relationship, while the role of awareness-related facets of mindfulness appeared to be less clear, seemingly contradictory and possibly two-fold. The study also suggested that level of mindfulness might indeed represent a confounding variable in self-report assessment of anxiety and probably of other constructs as well.

Keywords: anxiety, mindfulness, acceptance, implicit measures, assessment

Mindfulness and anxiety

In the last two decades, there has been a surge of interest in mindfulness and in the relation between mindfulness and anxiety in the field of psychology and related disciplines (e.g., Možina, 2010). According to one of the available definitions of the concept, mindfulness can be defined as a nonjudgmental, accepting awareness of one’s own experience in the present moment (Černetič, 2011). Such awareness can include internal experiences (thoughts, feelings, and physical sensations) and/or external stimuli (e.g., sounds, colours, odours, other people), of which a person becomes aware in an accepting manner, without trying to avoid or suppress them.

Corresponding author: miha.cernetic@sfu-ljubljana.si

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Mindfulness-based interventions have been shown to reduce anxiety in non-clinical (e.g., Shapiro, Schwartz, & Bonner, 1998) as well as in clinical samples (e.g., Vøllestad, Sivertsen, & Nielsen, 2011). A meta-analytic study by Hofmann, Sawyer, Witt, and Oh (2010) demonstrated that mindfulness-based approaches are effective in reducing anxiety symptoms, with effect sizes being robust and maintained over follow-up.

In order to differentiate the effect of mindfulness from other active constituents (specific as well as non-specific) of mindfulness-based interventions, research of underlying constructs is called for. Several studies have established inverse relationship between the constructs of mindfulness and anxiety: In different samples, Brown and Ryan (2003) found a negative correlation between four anxiety scales and mindfulness as measured by the Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003). The study conducted by Roemer et al. (2009) revealed a negative correlation between MAAS and anxious arousal. The construct of mindfulness, as measured by the short version of Freiburg Mindfulness Inventory (FMI-14), correlated negatively with trait anxiety (Kohls, Sauer, & Walach, 2009). Using both MAAS and FMI-14, Walsh, Balint, Smolira, Kamstrup Fredericksen, and Madsen (2009) established an inverse relationship between mindfulness and trait anxiety. In their view, anxiety and mindfulness are antagonistic. Moreover, several other studies have found the inverse relationship between mindfulness and neuroticism (e.g., Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006; Brown & Ryan, 2003; Fetterman, Robinson, Ode, & Gordon, 2010).

### Relations between anxiety and facets of mindfulness

While the inverse relationship between the constructs of mindfulness and anxiety is now well established by the research, there is far less knowledge about how facets of mindfulness are related to anxiety and its dimensions. In the study by Cardaciotto, Herbert, Forman, Moitra, and Farrow (2008), which investigated a two-factor model of mindfulness (comprising awareness and acceptance facets), only the acceptance facet was associated with less anxiety, and only the acceptance facet was a significant predictor of less mental illness severity. Similarly, Tran, Glück and Nader (2013) found that just one factor (orientation to experience) of a two-factor conceptualization of mindfulness (Bishop et al., 2004) was associated with less anxiety symptoms while the other factor (self-regulated attention) was not associated with anxiety symptoms.

In a study by Cash and Whittingham (2010) which utilized five-facet operationalization of mindfulness (Baer et al., 2006), only nonjudging, but not the other four mindfulness facets (observing, describing, acting with awareness of present moment experience, and nonreactivity) predicted lower levels of anxiety. In contrast, Soysa and Wilcomb (2013) found that anxiety was inversely predicted by two mindfulness facets (nonjudging and nonreactivity) of the five-facet mindfulness model. Two another studies (Östafin, Brooks, & Laitem, 2014) showed an inverse relation between anxiety and two (in this case nonjudging and acting with awareness) out of five mindfulness facets. This relation was partially mediated by affective reactivity assessed with direct (self-report) and indirect (lexical decision task) measures.
Desrosiers, Klemanski, and Nolen-Hoeksema (2013) investigated associations between five-facet operationalization of mindfulness and two dimensions of anxiety symptoms (i.e., anxious arousal and general distress anxiety). They found nonreactivity was inversely associated with general distress anxiety symptoms, describing was inversely associated with anxious arousal, while acting with awareness and nonjudging facets were not associated with any dimensions of anxiety, and observing was even positively associated with anxious arousal. Desrosiers, Vine, Curtiss, and Klemanski (2014) have noted that although mindfulness-based interventions emphasize the importance of observing present moment experience, observing has often been positively (instead of inversely) related to anxiety symptoms. In their study, nonreactivity moderated the indirect effect of observing on symptoms of anxiety through worry and rumination. Authors have concluded that the relationship between observing and symptoms of anxiety depends on the capacity to observe nonreactively, which may influence symptoms directly and indirectly through cognitive emotion regulation strategies.

Based on this literature review, it can be concluded that the relations between anxiety and different facets of mindfulness are still not clear and therefore further research is needed.

The role of mindfulness in measuring anxiety by self-report

In previous studies in the field, to my knowledge, anxiety was measured using self-report techniques only. Although the use of self-report questionnaires is a common method in psychological research, it could pose a pitfall when used in the field of mindfulness. The level of mindfulness (more specifically, mindfulness facets related to self-awareness) might inversely correlate with measurement error in the use of self-report measures. Since the more mindful individuals are considered to be more aware of their thoughts, emotions, bodily sensations, and behavior, it is likely that the proportion of their relevant material (e.g., experiences of anxiety) they report in a questionnaire (e.g., in a scale measuring anxiety) is higher than with the less mindful individuals. In consequence, absolute value of correlation between mindfulness and self-reported anxiety would be lower than the real absolute correlation between these two constructs. For that reason, also the measurement methods that do not rely on introspection should be included in studies investigating associations of mindfulness with other constructs.

There are several methods which can be used to measure anxiety without collecting self-report data. These methods range from traditional physiological approaches (e.g., galvanic skin response) to newer and more cognitive approaches (e.g., dot-probe task for implicit measuring of anxiety; Egloff, Wilhelm, Neubauer, Mauss, & Gross, 2002).

Typically, implicit measures and explicit (i.e., self-report) measures are unrelated or only weakly associated (Egloff et al., 2002), depending on the construct investigated (Egloff & Schmukle, 2002). In a study where the implicit association test was used to measure implicit anxiety, the latter did not correlate with self-reported anxiety (Egloff & Schmukle, 2002). Similarly, another implicit anxiety measure (attention allocation toward threat) was unrelated to an explicit anxiety measure (anxiety questionnaire) in a study by Egloff et al. (2002). However, attention
allocation toward threat was a better predictor of cardiovascular reactivity during a speech stressor task than anxiety questionnaire, suggesting possible relevance of including implicit anxiety measures in study design in anxiety research.

**Study aims and design**

The aim of this study was to investigate the relationship between the constructs of mindfulness and anxiety. It was intended to utilize several measures of both constructs to minimize measurement error and to cover different aspects of mindfulness and anxiety. In addition to investigating the overall association between the constructs, the study intended to further examine this relationship by clarifying the roles of individual mindfulness facets and by investigating how implicit anxiety was related to mindfulness. Implicit anxiety measures were included also in order to investigate the aforementioned possible bias due to the alleged correlation between mindfulness and measurement error of self-report questionnaires: If controlling for awareness produces change in the relation between mindfulness and explicit anxiety, it means that there might be some awareness-related interference in the way that the strength of association between mindfulness and self-reported anxiety is determined. Similarly, if we can show that in high mindful subjects, compared to low mindful subjects, there is stronger relation between implicit and explicit anxiety, it might mean that self-report measurement is more valid in individuals which are more mindful.

Because the five-factor model of mindfulness (Baer et al., 2006) gave inconsistent results in previous studies which investigated the association between mindfulness and anxiety, the four-factor model (Baer, Smith, & Allen, 2004) was chosen for this study, in addition to a two-factor model (Cardaciottlo et al., 2008). Comparing to the five-factor model of mindfulness, the four-factor model includes the facet *accepting without judgment* instead of the facets *nonjudging* and *nonreactivity*.

**Method**

**Subjects**

A total of 115 Slovenian subjects (86 % female), chosen by convenience sampling method, participated in the study. The majority were undergraduate psychology students. Median age was 20 years (2 subjects did not state their age). Due to an unexpected technical difficulty, only 78 subjects completed all 7 measures used in the study. The technical difficulty was related to photocopying study materials and it probably could not have any systematic influence on the study results. The study was approved by the local ethics committee, and informed consent was obtained from all participants prior to their inclusion in this research.

**Measures and procedure**

Psychometric properties and additional details of Slovenian versions of self-report measures are shown in Table 1 in the Results section.

**Measures of mindfulness.** Three self-report measures of mindfulness were used:

- *the Mindful Attention Awareness Scale* (MAAS; Brown & Ryan, 2003) which is a widely used unidimensional measure of mindfulness;
the Philadelphia Mindfulness Scale (PHLMS; Cardacioto et al., 2008) which measures mindfulness according to a two-factor model and is consisted of two subscales: awareness and acceptance;

the Kentucky Inventory of Mindfulness Skills (KIMS; Baer et al., 2004) which measures four mindfulness skills: observing, describing, acting with awareness, and acceptance without judgment.

The author of the study adapted all three measures of mindfulness to Slovenian language by employing the standard procedure of psychological tests adaptation which included independent back-translation.

**Self-report measures of anxiety.** The Slovenian version of the State-Trait Anxiety Inventory (STA; Lamovec, 1988), trait subscale, was used. STA is the most common questionnaire for measuring anxiety. The other self-report measure of trait anxiety was Anxiety Scale (AS), comprising the same 10 adjectives as the Implicit Association Test for Anxiety (Egloff & Schmukle, 2002) which was also used in this study. The participants rated each adjective according to the following instruction: “On a scale of 0 (not at all) to 5 (very much), please rate how much the following characteristics apply to you”.

**Implicit measures of anxiety.** Two implicit measures of anxiety were used. Modified dot-probe task (Egloff et al., 2002) assesses selective focusing of attention on threat stimuli. A greater bias towards threat indicates higher trait anxiety. Egloff et al. (2002) found that this measure predicted physiological reactivity in a stressful situation even better than a self-report measure of anxiety. The implicit measure included presentation of 20 word pairs consisted of one threat word and one neutral word. In each pair, words were matched for their length and frequency of occurrence in Slovenian language. The frequency was determined by using FidaPLUS, large reference corpus of modern day Slovenian (see Arhar, 2007). After presentation of a word pair, a small circle appeared on computer screen randomly in one of the two word locations. Participants had to indicate the circle location. For individuals with greater attentional bias towards threat, higher reaction time latency was expected in the two conditions when location of threat word and location of the circle were not matched. On the basis of reaction time latencies, index of implicit anxiety was computed for each participant.

The second implicit measure was the Implicit Association Test (IAT) for anxiety (Egloff & Schmukle, 2002), which allows for reliable measuring of trait anxiety. Egloff and Schmukle (2002) reported that test-retest reliability of this measure was .57 and internal consistency (Cronbach’s alpha) was .77 (at test) and .80 (at retest). In comparison with questionnaire measures of anxiety and social desirability, the IAT for anxiety better predicted criterion variables (e.g., behavioral indicators of anxiety in a stressful situation). Participants taking the IAT for anxiety are required to sort words into categories. Two categorization processes are taking place simultaneously: one set of words is being sorted into categories Me and Others, whilst words in the other set are being sorted into categories Anxiety and Calmness. Both categorization processes are operated with the same pair of keyboard buttons, so that in one part of the test the categories Me and Anxiety are combined, whilst in the other part of the test the categories Me and Calmness are assigned to the same button. From reaction time latencies of all the four possible conditions (Me/Calmness, Me/Anxiety, Others/Calmness, Others/Anxiety), the indicator of implicit self-concept can be computed (Egloff & Schmukle, 2002).

For both implicit measures, the PsychoPy software (Peirce, 2007) was utilized to present stimuli and capture responses. PsychoPy is open-source software for psychological research which allows for time accuracy in order of a millisecond.

**Statistical analyses**

**Data preparation.** Outliers in implicit anxiety measures’ data were identified and excluded. In IAT data, outliers were identified according to the algorithm by Greenwald,
Nosek and Banaji (2003). In dot-probe task data, results of trials that were more than 3 standard deviations away from the mean were regarded as outliers.

**Data analysis.** As the main approach of statistical analysis, canonical correlation analysis (CCA; see, e.g., Hair, Anderson, Tatham, & Black, 1998; Sherry & Henson, 2005) was chosen. Although viewed by many researchers as an inferior method for analysis of multivariate data because of its relatively few restrictions on the types of data on which it operates, Hair et al. (1998) reasoned that CCA was the most appropriate and powerful multivariate technique in situations with multiple dependent and independent variables. Two validation methods recommended by Hair et al. (1998) were applied on the results: (a) modification of CCA models by exclusion of some variables, followed by comparison of such modified models with the original model; (b) analysis of models on different subsamples.

In addition to CCA, two other approaches were utilized to investigate the role of mindfulness in measuring anxiety by self-report: (a) computing partial bivariate correlations between mindfulness and anxiety scales, and thus controlling the effect of mindfulness facets related to self-awareness; (b) comparing the amount of coherence (i.e., simple bivariate correlation) between implicit and explicit anxiety in low mindful and high mindful participants.

**Results**

**Psychometric properties of measures**

As shown in Table 1, all scales and subscales of self-report measures used in the study had sufficient reliability. Inter-item correlations were also in appropriate range, with the exception of Anxiety Scale items 2 (peaceful – reverse scored) and 6 (timid) which were too highly correlated in unexpected direction, probably because in Slovenian language these two adjectives share a common semantic relation to being inhibited.

Table 1

<table>
<thead>
<tr>
<th>Scale or subscale</th>
<th>( M )</th>
<th>( SD )</th>
<th>( \alpha )</th>
<th>( n )</th>
<th>Inter-item correlations</th>
<th>( M )</th>
<th>min</th>
<th>max</th>
<th>( N )</th>
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<tr>
<td>AS</td>
<td>18.69</td>
<td>6.62</td>
<td>.80</td>
<td>10</td>
<td>.29</td>
<td>-.29</td>
<td>.80</td>
<td>115</td>
<td></td>
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<tr>
<td>STAI</td>
<td>38.14</td>
<td>9.20</td>
<td>.90</td>
<td>20</td>
<td>.30</td>
<td>.01</td>
<td>.69</td>
<td>115</td>
<td></td>
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<tr>
<td>MAAS</td>
<td>60.73</td>
<td>9.25</td>
<td>.78</td>
<td>15</td>
<td>.19</td>
<td>-.13</td>
<td>.55</td>
<td>115</td>
<td></td>
</tr>
<tr>
<td>PHLMS</td>
<td>68.38</td>
<td>11.11</td>
<td>.80</td>
<td>20</td>
<td>.17</td>
<td>-.27</td>
<td>.69</td>
<td>115</td>
<td></td>
</tr>
<tr>
<td>PHLMS(_{AW})</td>
<td>36.52</td>
<td>5.18</td>
<td>.75</td>
<td>10</td>
<td>.23</td>
<td>.02</td>
<td>.53</td>
<td>115</td>
<td></td>
</tr>
<tr>
<td>PHLMS(_{AC})</td>
<td>31.86</td>
<td>7.09</td>
<td>.86</td>
<td>10</td>
<td>.39</td>
<td>.14</td>
<td>.69</td>
<td>115</td>
<td></td>
</tr>
<tr>
<td>KIMS</td>
<td>129.79</td>
<td>16.76</td>
<td>.89</td>
<td>39</td>
<td>.17</td>
<td>-.27</td>
<td>.74</td>
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<tr>
<td>KIMS(_{D})</td>
<td>38.37</td>
<td>7.40</td>
<td>.83</td>
<td>12</td>
<td>.28</td>
<td>.00</td>
<td>.62</td>
<td>94</td>
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<tr>
<td>KIMS(_{O})</td>
<td>28.08</td>
<td>5.24</td>
<td>.87</td>
<td>8</td>
<td>.46</td>
<td>.36</td>
<td>.61</td>
<td>94</td>
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<tr>
<td>KIMS(_{AWA})</td>
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<td>5.90</td>
<td>.81</td>
<td>10</td>
<td>.30</td>
<td>-.04</td>
<td>.74</td>
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</tr>
<tr>
<td>KIMS(_{AWJ})</td>
<td>31.81</td>
<td>6.52</td>
<td>.87</td>
<td>9</td>
<td>.43</td>
<td>.19</td>
<td>.71</td>
<td>94</td>
<td></td>
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</tbody>
</table>

*Note. \( \alpha \) = Cronbach’s alpha coefficient; \( n \) = number of items; \( N \) = number of participants; AS = Anxiety Scale; STAI = State–Trait Anxiety Inventory (Trait subscale); MAAS = Mindful Attention Awareness Scale; PHLMS = Philadelphia Mindfulness Scale; PHLMS\(_{AW}\) = Philadelphia Mindfulness Scale (Awareness subscale); PHLMS\(_{AC}\) = Philadelphia Mindfulness Scale (Acceptance subscale); KIMS = Kentucky Inventory of Mindfulness Skills; KIMS\(_{O}\) = Kentucky Inventory of Mindfulness Skills (Observing subscale); KIMS\(_{D}\) = Kentucky Inventory of Mindfulness Skills (Describing subscale); KIMS\(_{AWA}\) = Kentucky Inventory of Mindfulness Skills (Acting with awareness subscale); KIMS\(_{AWJ}\) = Kentucky Inventory of Mindfulness Skills (Acceptance without judgment subscale).*
The relationship between mindfulness and anxiety constructs

Figure 1 shows the relationship between canonical variates (i.e., latent variables) representing the constructs of mindfulness and anxiety as computed with CCA. Also shown are canonical loadings, known also as canonical structural correlations (i.e., correlations between observed variables and their respective linear composite). Only the first canonical function reached statistical significance, Wilks’s $\lambda = .477$, $F(12, 188.14) = 5.062$, $p < .000$. Canonical variates shared 47% of variance in this canonical function. Mindfulness canonical variate explained 71% of variance of the mindfulness group of observed variables and 21% of variance of the anxiety group of observed variables. Anxiety canonical variate explained 44% of variance of the anxiety group of observed variables and 33% of variance of the mindfulness group of observed variables.

![Diagram of Figure 1](image)

*Figure 1.* Canonical correlation analysis of the relationship between the mindfulness and anxiety constructs. Canonical correlation between latent variables is represented by a curve, whilst canonical structural correlations are shown with straight lines. MAAS = Mindful Attention Awareness Scale; PHLMS = Philadelphia Mindfulness Scale; KIMS = Kentucky Inventory of Mindfulness Skills; IIA = Index of Implicit Anxiety (selective attention to threat); D = Implicit Association Test for Anxiety; AS = Anxiety Scale; STAI = State–Trait Anxiety Inventory (Trait subscale).

The results of CCA of the relationship between anxiety and the two-factor model of mindfulness (Cardaciotto et al., 2008) are shown in Figure 2. Again, only the first canonical function reached statistical significance, Wilks’s $\lambda = .603$, $F(8, 180) = 6.484$, $p < .000$. The two canonical variates shared 38% of variance. Mindfulness canonical variate explained 55% of variance of the mindfulness group of observed variables and 17% of variance of the anxiety group of observed variables. Anxiety canonical variate explained 43% of variance of the anxiety group of observed variables and 21% of variance of the mindfulness group of observed variables.
Figure 2. Canonical correlation analysis of the relationship between anxiety and mindfulness, with the latter being represented by a two-factor model. Canonical correlation between the latent variables is shown with a curve, whilst canonical structural correlations are represented by straight lines. PHLMS\textsubscript{AW} = Philadelphia Mindfulness Scale (Awareness subscale); PHLMS\textsubscript{AC} = Philadelphia Mindfulness Scale (Acceptance subscale); IIA = Index of Implicit Anxiety (selective attention to threat); D = Implicit Association Test for Anxiety; AS = Anxiety Scale; STAI = State–Trait Anxiety Inventory (Trait subscale).

In Figure 3 results of CCA of the relationship between anxiety and the four-factor model of mindfulness (Baer et al., 2004) are shown. Once more, only the first canonical function reached statistical significance, Wilks’s $\lambda = .362$, $F(16, 214.49) = 5.294$, $p < .000$. Canonical variates shared 60% of variance. Mindfulness canonical variate explained 39% of variance of the mindfulness group of observed variables and 27% of variance of the anxiety group of observed variables. Anxiety canonical variate explained 45% of variance of the anxiety group of observed variables and 23% of variance of the mindfulness group of observed variables.

Figure 3. Canonical correlation analysis of the relationship between anxiety and mindfulness, with the latter being represented by a four-factor model. Canonical correlation between the latent variables is shown with a curve, whilst canonical structural correlations are represented by straight lines. KIMS\textsubscript{O} = Kentucky Inventory of Mindfulness Skills (Observing subscale); KIMS\textsubscript{D} = Kentucky Inventory of Mindfulness Skills (Describing subscale); KIMS\textsubscript{AWA} = Kentucky Inventory of Mindfulness Skills (Acting with awareness subscale); KIMS\textsubscript{AJW} = Kentucky Inventory of Mindfulness Skills (Acceptance without judgment subscale); IIA = Index of Implicit Anxiety (selective attention to threat); D = Implicit Association Test for Anxiety; AS = Anxiety Scale; STAI = State–Trait Anxiety Inventory (Trait subscale).
The results shown in Figures 1, 2 and 3 were validated using two validation methods recommended by Hair et al. (1998): Modified versions of the CCA models were computed, so that each time one or two observed variables were taken out of the model. CCA models were also computed on subsamples which were obtained by random halving of the whole sample. In all these cases, canonical correlations between latent variables, as well as canonical structural correlations, did not differ substantially from the results obtained on unmodified models.

The role of mindfulness in measuring anxiety by self-report

To investigate whether mindfulness was related to the accuracy of measuring anxiety by self-report, I computed partial bivariate correlations between mindfulness and anxiety scales in order to control the effect of self-awareness encompassed by relevant mindfulness facets. Controlling for the effect of PHLMS Awareness subscale did not change the correlations, whereas controlling for the effect of KIMS Observing subscale increased the correlations between KIMS and STAI (from $r = -.62$ to $r = -.72$; for both coefficients $p < .00$, for the difference between coefficients $p = .04$) and between KIMS and AS (from $r = -.53$ to $r = -.62$; for both coefficients $p < .00$, for the difference between coefficients $p = .10$).

In addition, the correlation between implicit anxiety (measured by the IAT) and explicit anxiety (measured by the AS questionnaire) was analyzed in regard to different levels of mindfulness. Comparisons between these two measures were possible because the same set of verbal stimuli was used in both measures. With low-mindful participants (MAAS score more than a standard deviation below mean), the correlation between the IAT and the AS was $r = .05$ ($p = .82$; $N = 19$). With high-mindful participants (MAAS score more than a standard deviation above mean), the correlation between implicit and explicit anxiety was $r = .14$ ($p = .52$; $N = 22$). One-way testing for statistical significance of the difference between the correlation coefficients using Fisher $r$-to-$z$ transformation yielded $p = .40$.

The role of implicit anxiety measures

There was a low positive bivariate correlation between the two implicit measures of anxiety ($r = .20$, $p = .05$; training trials of the dot-probe task were not included in calculation).

Canonical loadings of both implicit anxiety measures were very low in all CCA models analyzed, and they were not stabilized across the modified versions of the models. Similar results showed up in a CCA model where implicit anxiety measures alone were correlated with mindfulness measures.

In one of the models, though, the second canonical function came very close to the threshold of statistical significance ($p = .07$). In this second canonical function, the correlation between canonical variates (i.e., canonical correlation) was $-.27$. The mindfulness canonical variate was saturated mostly with the
MAAS observed variable (canonical structural correlation was .73), while the anxiety canonical variate was saturated mostly with the implicit anxiety measure IAT (canonical structural correlation was .80). A very similar pattern (including p values that were close to an acceptable level of statistical significance) was evident in several other models. However, neither of these results reached the statistical significance threshold of .05 which would allow interpretation.

Discussion

The results of the study showed the existence of a considerable negative association between mindfulness and anxiety constructs, which was evident from moderate to high correlation between the latent variables (i.e., canonical variates) in computed CCA models. The two psychological constructs investigated thus share almost half of their variance.

Taking into account the results of validation procedures recommended by Hair et al. (1998), findings about the relationship between anxiety and mindfulness can be considered stable, since very similar patterns of results occurred in various CCA models, as well as in the testing of models on random subsamples, and thus proving the findings to be robust and reliable.

The inverse relationship between mindfulness and anxiety found in this study is consistent with the findings provided by other research on this topic (e.g., Walsh et al., 2009). It can be concluded that mindfulness – the construct which is increasingly generating interest and attention among professionals and researchers alike – is indeed significantly associated with anxiety, a construct of key importance in the field of psychology, psychiatry and related disciplines. The impact of mindfulness interventions on anxiety might therefore be specific, and not only a consequence of non-specific factors (e.g., positive expectations, therapeutic alliance, psychoeducation). This conclusion supports the importance of research into the use of mindfulness approach for coping with anxiety. Had mindfulness interventions demonstrated only non-specific effects on anxiety, developing (and using) this kind of interventions would probably be rather pointless. However, the fact that anxiety and mindfulness are related per se (i.e., as psychological constructs) means that mindfulness might well be an active constituent in mindfulness interventions.

How could negative correlation between mindfulness and anxiety be explained? First, the awareness facet of mindfulness might attenuate anxiety by lowering the automaticity and impulsivity of an individual’s reacting to the environment, particularly to threat stimuli. Second, a decentred perspective (e.g., Teasdale, Segal, & Williams, 1995), which is typical of mindful awareness, could facilitate a more objective viewpoint of an individual towards their inner experience, in accordance with the phrasing that “thoughts are not facts”. Third, the acceptance facet of mindfulness (i.e., an individual’s allowing of their own thoughts, feelings, and sensations) might lower anxiety by means of reducing the need for thought suppression and experiential avoidance (both of which have been shown to be related to higher anxiety: e.g., Feldner, Zvolensky,
Eifert, & Spira, 2003; Muris, Merckelbach, & Horselenberg, 1996), by creating possibilities for internal self-exposure of an individual to feared stimuli, and by a potential reduction of anxiety sensitivity.

The present study also shed some light on the roles which different mindfulness facets have in the mindfulness-anxiety relationship. Both multidimensional mindfulness questionnaires used in the study (PHLMS and KIMS) showed notably stronger association with anxiety for mindfulness facets related to acceptance (PHLMS Acceptance, KIMS Awareness without judgment) comparing to awareness-related facets (PHLMS Awareness, KIMS Observing, KIMS Describing). In other words, the results showed that the acceptance group of manifest variables made greater contribution to the relationship between anxiety and mindfulness compared to the awareness group of manifest variables. This finding was also supported by both methods used for validation of the CCA results, which means that the dominance of the acceptance factor in the relationship between mindfulness and anxiety showed to be highly robust.

How could this finding (i.e., the relatively low contribution of the awareness component of mindfulness to the relationship between mindfulness and anxiety) be explained, when it is widely believed that the construct of mindfulness is primarily characterized by awareness? The process of awareness might exhibit a dual influence: on the one hand, being aware of one’s own experience might be related to lower anxiety, but on the other, awareness might also be related to higher anxiety if not moderated by acceptance-related processes such as nonreactivity and nonjudging. This reasoning is in accordance with the findings of Desrosiers et al. (2014) that nonreactivity moderates the indirect effect of observing on symptoms of anxiety through worry and rumination. Baer et al. (2008) noted that with certain individuals, observing inner experience could also include judging it, whilst some other people (e.g., experienced meditators) might be used to observe their own experience in a nonreactive and nonjudging manner. Several authors (e.g., Bishop et al., 2004; Wells, 2006) even claimed that self-awareness alone, without acceptance-related processes, could be related to psychopathology. Thus, when combined in a whole sample of research participants in this study, potential anxiety-attenuating as well as anxiety-increasing impact of the awareness component of mindfulness could have rendered a relatively low overall correlation between anxiety and awareness-related mindfulness facets.

Yet another, and by previous studies unaddressed, reason for the relatively low association between awareness and anxiety might be the potentially problematic use of self-report measures of anxiety in mindfulness studies. As explicated above, if participants with higher level of self-awareness are better in perceiving their anxiety, then it would affect the correlation between mindfulness and anxiety measured by questionnaires. In this study, controlling the effect of an awareness component of mindfulness (KIMS Observing subscale) increased the correlation between mindfulness and self-reported anxiety. It means that higher level of awareness of one’s own inner experience might indeed be associated with relatively greater reporting of anxiety in questionnaires and consequently
creating a problem with validity of measuring anxiety by self-report. Although limitations of introspection generally seem not to affect the researchers’ and professionals’ use of self-report measures to much extent, these limitations are probably particularly important for mindfulness studies, where they should be given more attention.

As the correlation between implicit anxiety and self-reported anxiety is concerned, no statistically significant difference was detected in this study between high mindful and low mindful subjects. Had it been otherwise, it would represent another evidence for higher self-awareness of anxiety in high mindful participants. In fact, Brown and Ryan (2003) did report such finding: they found higher coherence between implicit and explicit affect in subjects exhibiting higher levels of mindfulness. In general, though, implicit measures are not correlated with self-report measures, as there usually exists only a weak correlation between them, at best (Egloff et al., 2002).

Implicit anxiety measures in this study were not correlated with mindfulness. Although in the second canonical function the negative association between unidimensional mindfulness questionnaire and anxious implicit self-concept showed up, closely approaching the threshold of statistical significance, it did not reach this threshold and therefore it could not be interpreted. However, characterizing the result in question as totally accidental might not be entirely appropriate either, given that the same pattern was evident in several CCA models. It can be concluded that further investigation of a hypothesized association between implicit anxiety and mindfulness is recommended.

Among the limitations of the study was that the sample was consisted mainly of psychology students. Another limitation was the fairly small sample size in some analyses involving implicit measures of anxiety. As a result, lack of statistical power represented a hindrance in making conclusions about adequacy of measuring anxiety by self-report in mindfulness studies. Since implicit measures of anxiety used in the study were time-consuming, it would be demanding to increase the sample size. One solution to this challenge might be to make use of other objective methods of anxiety measurement. Another possibility might be to include external evaluators (e.g., friends and relatives) who would assess anxiety of the subjects. Although it might be interesting to include also implicit measures of mindfulness in addition to implicit measures of anxiety, to my knowledge no such readily available assessment instrument has been developed so far.

In future research of the relationship between mindfulness and anxiety, conclusions could be improved by using structural equation modeling (SEM) instead of CCA. Further research is also needed for clarification of the nature of awareness-related mindfulness facets. This applies not only to the relationship between mindfulness and anxiety but also to the models of mindfulness in general. This study, as well as some other research (e.g., Desrosiers et al., 2014; Wells, 2006), suggested there might be two types of awareness. The first type is calm, decentered, relatively objective and impartial, fluid and smooth awareness, whilst the second type is anxious, centered, markedly subjective and sided,
fixed and perseverative awareness. The currently available questionnaires of the awareness-related facets of mindfulness, however, do not differentiate between these two types of awareness. Therefore, it is understandable that the findings resulting from the use of those questionnaires are sometimes contradictory.

**Conclusion**

The study focused on the relationship between psychological constructs of anxiety and mindfulness. The results showed the existence of a relatively strong and robust negative association between the constructs in question. Mindfulness facets related to acceptance, nonjudgment and nonreactivity clearly contributed to this association. The role of awareness-related facets of the mindfulness construct, however, was less clear, which was possibly due to the mutually opposing processes that might be involved in self-awareness. Thus the relation between anxiety and awareness-related facets of mindfulness appears to be two-fold or seemingly contradictory.

The study also suggested that level of mindfulness (more specifically, self-awareness) might be related to measurement error in self-report assessments of anxiety (and probably of other psychological constructs as well). Further research on this topic is certainly warranted, which also includes research on the role of implicit measures of anxiety, as well as of other psychological constructs, when relations of these constructs with mindfulness need to be investigated.

**References**


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