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**Artigo**

# Validity Evidence of an Instrument for Mindfulness Assessment (MA) Based on its Internal Structure and External Criterion

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**Abstract:** Operationalizing the concept of *mindfulness* has been a challenge for researches. In this article, we present and discuss the procedures for the assessment of the internal structure and validity of the criteria for Mindfulness Assessment (MAP), as well as the results obtained. The collection of factors was done by exploratory factor analysis (EFA), and item- selection by item response theory (IRT). This study counted with 788 Brazilians, with ages ranging from 17 to 65 years ($M$ = 26.11; $SD$ = 9.59); 79% of which were women. Four factors were extracted: *Mindfulness* ($\alpha$ = 0.88), *Attention* ($\alpha$ = 0.84), *Acceptance* ($\alpha$ = 0.74) and *Novelty seeking* ($\alpha$ = 0.62). 47 items were retained in the MAP. We also compared the scores between non-meditator ($n$ = 653) and meditator ($n$ = 112) respondents. Analyses by IRT showed the items to be adequately adjusted. Significant differences between scores of meditators and non-meditator respondents were revealed. These findings suggest that the MAP is a valid and reliable instrument, regarding its internal structure and criterion-related evidence, which suggests its appropriateness in the study of adults.

**Keywords**: Psychological Tests, Mindfulness, Positive Psychology.

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## Evidências de Validade de uma Medida de Atenção Plena (MAP)

**Resumo:** A operacionalização da atenção plena (*Mindfulness*) tem sido um desafio para os pesquisadores. Neste artigo, serão apresentados e discutidos os procedimentos e resultados para verificação da estrutura interna e validade de critério da medida de atenção plena (MAP). Participaram desse estudo 788 brasileiros, com idades entre 17 e 65 anos ($M$ = 26,11; $DP$ = 9,59), sendo que 79% eram mulheres. A extração dos fatores se deu pela análise fatorial exploratória e a seleção dos itens incluiu métodos da teoria de resposta ao item (TRI). Foram extraídos quatro fatores: *mindfulness* ($\alpha$ = 0,88), atenção ($\alpha$ = 0,84), aceitação ($\alpha$ = 0,74) e produção de novidades ($\alpha$ = 0,62), tendo sido mantidos 47 itens. As análises pela TRI indicaram bons índices de ajuste dos itens. Ademais, foram encontradas diferenças nos escores de respondentes meditadores e não meditadores. Conclui-se que a MAP possui evidências de validade baseada em sua estrutura interna e de critério, o que sugere a sua adequação para a mensuração do construto em adultos.

**Palavras-chave:** Testes Psicológicos, Atenção Plena, Psicologia Positiva.

## Evidencias de Validez de la Medida de Atención Plena (MAP)

**Resumen:** La operacionalización del concepto de la atención plena (Mindfulness) ha sido un desafío para los investigadores. En este artículo, serán presentados y discutidos los procedimientos para verificar la estructura interna y la validez de criterio de una medida de la atención plena (MAP). Participaron 788 brasileños, de entre 17 y 65 años ($M$ = 26,11, $SD$ = 9,59); siendo la mayoría mujeres (79%). La extracción de los factores fue hecha a través de un análisis factorial exploratorio, y la selección de los ítems incluye métodos de la teoría de respuesta al ítem (IRT). Se extrajeron cuatro factores: atención plena ($\alpha$ = 0,88), atención ($\alpha$ = 0,84), aceptación ($\alpha$ = 0,74) y producción de lo nuevo ($\alpha$ = 0,62) y se mantuvieron 47 ítems. Los análisis realizados por el TRI indican buenos índices de ajuste de los elementos. Por otra parte, no se encontraron diferencias en las puntuaciones de los respondientes meditadores y no meditadores. Se concluye que la MAP tiene evidencia de validez en función de su estructura interna, lo que sugiere su validez para la medición de la atención plena en adultos.

**Palabras clave:** Pruebas Psicológicas, Atención Plena, Psicología Positive.

## Introduction

The concept of *mindfulness* is associated by origin to Eastern philosophy, and different perspectives for its comprehension and operationalization are currently being pursued (Chiesa, & Malinowski, 2011; Hart, Ivtzan, & Hart, 2013; Siegling & Petrides, 2014). However, these differences affect the internal structure of the instruments drawn for assessing this construct.

Brown & Ryan (2003) understand mindfulness as an attribute of the consciousness, involving: awareness and attention. *Awareness* refers to the monitoring of internal experiences (sensations, feelings) and of surroundings; *attention* is the process of focusing, promoting an increase in responsiveness to specific stimuli (Brown, & Ryan, 2003). Brown and Ryan emphasize that, although these two features are characteristic in the functioning of consciousness, mindfulness refers to an increase both in attention and in awareness of current experience. Kabat-Zinn (2003), however, views mindfulness as a feature of consciousness brought up by intentionally, although not judgmentally, paying attention to present experiences (thoughts, feelings, and sensations). According to the author, this state may be obtained with frequent *mindfulness meditation practice*.

Langer (2014), for the understanding of *mindfulness*, proposes two other states: *mindful* and *mindless*. The state of being mindful is represented by the "activated", i.e. intentional, form of attention and awareness, as opposed to their automatic functioning. In this state, one is highly attentive to one's own experiences, to what one does and to what is happening in one's surroundings, being thus able to alternatively reconstruct it. The state of being mindless, on the other hand, would be equivalent to automatic functioning, based on a predetermined cognitive schema (Brown, Ryan, & Creswell, 2007). For these authors, when one is mindless, novelties produce neither interest nor new perspectives, and a certain dependency is established with categories built in the past, with rules or routine, which signal an automatic mode of functioning (Langer, 2014; Langer, & Moldoveanu, 2000).

The operationalization of the concept of *mindfulness* has been a challenge to researchers, given the diversity of variables involved in its delimitation and comprehension (Chiesa, 2013; Hart et al., 2013; Langer, 2014; Siegling, & Petrides, 2014), which reflects in the features to which is given prominence in measurement instruments. At least eight different mindfulness instruments were published. In Brazil, studies have adapted four of these measures (Barros, Kozasa, Souza, & Ronzani, 2014, 2015; Hirayama, 2014; Silveira, Castro, & Gomes, 2012). For the purposes of this article, the mapping and the dimensioning of these measurements, as well as their interrelations, are of central importance.

In 2003, Brown and Ryan published the *Mindfulness Attention Awareness Scale* (MAAS), and reported the uni-factor structure in two samples from adults,

from which they obtained an index of internal awareness, evaluated by Cronbach's alpha, and considered adequate (α = 0.74 e 0.82). In 2004, Baer, Smith and Allen built the *Kentucky Inventory of Mindfulness Skills* (KIMS), which has four factors: *observing* (α = 0.91), *describing* (α = 0.84), *acting with awareness* (α = 0.83), *accepting without judgment* (α = 0.87). Walach, Buchheld, Buttenmüller, Kleinknecht and Schimidt (2006) developed the *Freiburg Mindfulness Inventory* (FMI), which has two versions, one with 30 items (α = 0.86) and the other with 14 (α = 0.85), both with uni-factor structure. A Brazilian study adapted FMI with Brazilian samples (Hirayama, 2014); this study pointed to a four-factor structure as the most appropriate; these factors are: *opening* (α = 0.76), *self-awareness* (α = 0.69), *attention to the present moment* (α = 0.57) and *acceptance* (α = 0.66). In the study with Brazilian samples, the four-component version, extracted by the author, showed a difference between meditator and non-meditator respondents (Hirayama, 2014).

Feldman, Hayes and Kumar (2007) revised the *Cognitive Affective Mindfulness Scale* (CAMS-R), built in 2005 (unpublished), which also has a uni-factor structure associated to four first-order factors (*attention*, *present-focus*, *awareness* and *acceptance*). The unifactorial scale presented good internal consistency (α = 0.77). The *Toronto Mindfulness Scale* (TMS), in its turn, was elaborated by Lau et al. (2006). It has two factors, *curiosity* and *decentering*. Its internal consistency was measured by the Composite Reliability Index (CRI) (0.93 and 0.91), analogous to Cronbach's alpha, whereas its precision was estimated by the average variance extracted index (AVE) (0.89 and 0.59). The authors reported that meditators with more than a year of experience presented higher TMS scores than those who were less experienced.

In a work that sought to integrate the previous measures on mindfulness, Baer, Smith, Hopkins, Krietemeyer and Toney (2006) have grouped all the items from five measures (MAAS, FMI, KIMS, CAMS and *Mindfulness Questionnaire*), with a view to build a measurement that would enable the assessment of the various aspects taken into account in the different theoretical models. Exploratory and confirmatory factor analysis identified five dimensions: *observing experiences*, *describing experiences*, *acting with awareness*, *not judging experiences* and *not reacting to experiences*. The instrument was named *Five Facet Mindfulness Questionnaire* (FFMQ). Later, Baer et al. (2008) tested FFMQ's criterial validity, by comparing the scores of mediators, non-meditators and the general population, using ANOVA. Significant differences were reported, in which meditators scored higher than the other groups in all factors.

FFMQ was object of a validity evidence study with Brazilian samples (*N* = 395) (Barros et al., 2014). After conducting exploratory factor analysis, the authors concluded the extraction of seven factors to be most appropriate; these factors were: *non-judgment* (α = 0.78), *act with awareness (autopilot)* (α = 0.79), *observe* (α = 0.76), *describe (positive)* (α = 0.76), *describe (negative)* (α = 0.75), *non-reaction* (α = 0.68) and *act distractedly* (α = 0.63). In relation to the original version, in the Brazilian version, two factors separate positive and negative dimensions: *describe* and *act with awareness*. All the components of the adapted version have shown to be sensitive to individual differences between meditator and non-meditator respondents, the former scoring higher in all factors.

Cardaciotto, Herbert, Forman, Moitra and Farrow (2008) proposed the *Philadelphia Mindfulness Scale* (PHLMS), which has two factors: *awareness* (α = 0.81) and *acceptance* (α = 0.85). PHLMS was the object of a Brazilian adaptation study, by Silveira, Castro & Gomes (2012), which confirmed the bi-factor solution as the most appropriate (α = 0.85 and α = 0.81 for *awareness* e *acceptance*, respectively).

As the different mindfulness measures presented demonstrate, the dimensions of the construct are varied. There are studies revealing uni-factor (Brown, & Ryan, 2003; Lau et al., 2006; Walach et al., 2006), bi-factor (Cardaciotto et al., 2008; Lau et al., 2006) and four-factor (Baer et al., 2004; Feldman et al., 2007; Walach et al., 2006) solutions. There is still a five-factor version (Baer et al., 2006). This points to divergences as to the construct's dimensions.

In the same direction, despite there being four instruments adapted with Brazilian samples, there are two issues in relation to these measures in need of more detailed studies. First, it is worth pointing to the comprehensiveness of these scales in relation to the construct: they evaluate only specific components of the phenomenon (Walach et al., 2006), there being no measure that groups, for example, the *Attention* factor with *Awareness*, *Acceptance* and *Mindful behavior* factors (Bergomi, Tschacher, & Kupper, 2012; Silveira et al., 2012). The most comprehensive of all measures groups almost all components (Baer et al., 2006),

while segregating *Attention*. Another approach, which does evaluate *Attention* (Brown, & Ryan, 2003), does not include *Awareness* and *Acceptance* (Feldman et al., 2007). Likewise, none of the eight instruments here analyzed include the components proposed by Langer, for diverse reasons that are not always clear. Siegling e Petrides (2014), for example, report that the *Big Five personality traits*, when associated to mindfulness measures based on Langer's theory, have not had the same correlation pattern verified with other instruments, based on authors such as Kabat-Zinn (2003), and Brown and Ryan (2003), indicating differences between the evaluated aspect in the indicated mindfulness measures.

The second issue is related to the capacity of these instruments to work effectively for different levels of mindfulness. The currently existing scales present psychometric properties based on Classical Test Theory (CTT), besides some studies undertaking analyses by Item Response Theory (IRT) (Sauer, Walach, Offenbacher, Lynch, & Kohls, 2011); information such as the item's level of difficulty in relation to the level of a latent trait in the sample (*theta*) are not focused on these studies, which suggests gaps in mindfulness instrumentation.

Considering the different perspectives for the understanding of mindfulness, and the diverse measures and factor structures proposed for the construct's operationalization, we propose, for the development of the instrument advanced by this research, that mindfulness be a state that involves attention and awareness (Brown, & Ryan, 2003), in which one is intentionally and non-judgmentally open to perceive one's own experiences (Kabat-Zinn, 2003), besides producing novelty in one's surroundings, thus becoming more sensitive and at the same time more aware of different perspectives (Langer, 2014).

The present study intends to: (a) verify the internal structure of Mindfulness Assessment (MAP); (b) analyze its psychometric properties by means of IRT; (c) report a study on the validity of the criterion, which sought to compare meditator and non-meditator results.

# Method

## Participants

788 Brazilians participated in this study, with ages ranging from 17 to 65 ($M = 26.1$; $SD = 9.59$); most participants were single (79.70%); 16.5% were married. The sample was composed mostly of women (79.23%). Most participants (86.00%) declared to reside in the Santa Catarina state, the others in São Paulo (6.00%), Rio Grande do Sul (5.30%), Paraná (1) and four in Minas Gerais (0.40%); all these states belong to the sou thern and south-eastern regions of Brazil. Most participants were in their first undergraduate course (78.00%); 8.16% already had a university degree, and 5.22% had concluded their specializations. High school level participants and participants with a Master's degree and/or a PhD feature in equal proportions (2.17% for each group). The size of the sample followed the recommendation of the ratio item/subject for the development of factor analyses, in the ratio of five participants by item (Hair, Anderson, Tatham, & Black, 2005).

Regarding the experience of the sample group with meditation, most ($n = 468$) have shown no indication of previous contact. One hundred and seventeen respondents have shown to have taken part in one meditation class or practice, whereas 63 informed to have at least one month of experience with meditation. Six respondents indicated to have between two to six month's experience. Fifty participants informed to have one to three years of experience with meditation, 23 reported to have three to five years of experience, 17 reported 5 to 10 years, and 22 reported more than 10 years. In this research, those respondents who indicated to have more than a year of experience with some form of meditation were considered meditators, as in Barros et al. (2014) and Lau et al. (2006).

## Instruments

**Mindfulness Assessment (MAP):** It is a scale composed by 145 items, elaborated to evaluate behavior, beliefs and mindfulness features. MAP components were proposed by comparison with the factors operationalized by the eight aforementioned international mindfulness measures; the following components were raised and organized: (a) *present-moment awareness and orientation*: regarding the monitoring of experiences, which may also happen in a non-elaborated way (insight, realizing); (b) *attention and its regulation*: regarding the voluntary use of attention skills, and its regulation thereby; (c) *acceptance and non-reaction*: allowing experiences to flow, while refraining from evaluatively labeling them, (d) *observation*: the ability to intentionally perceive experien-

ces as affecting other experiences and behavior; and (e) *description*: the ability to verbally reproduce experience in a mindful state. For the writing of the MAP items, besides the five proposed dimensions, mindful and mindless states (Langer, 2014) were considered; they were related to both positive and negative sentences. The respondent had to read the statements and judge how much he or she identified with each, using a five-point scale, in which 1 represents "I do not relate to this at all", and 5 "I entirely relate to this". If the respondent does not understand an item or feels he or she cannot answer it, he or she must leave it unanswered.

MAP items were submitted to analysis by specialists, and presented moderate concordance among them ($k = 0.5059$, IC = 75%). In this study (Pires, 2016), it was observed low concordance among specialists for the factors *Observe* and *Awareness*, as it was hypothesized the items pertaining to each may refer to different sides of a single factor. This hypothesis was tested in this study by factor analysis.

**Socio-demographic Questionnaire:** It was made of questions for socio-demographic variable control, such as sex, age, level of education, etc.

**Meditation Experience Questionnaire:** comprising questions elaborated to investigate respondent's previous experience with meditation practices.

## Ethical Concerns

This research was approved by the Ethics Committee for Research on Human Beings (CAAE: 43086815.4.0000.0121). Informed consent was obtained from all individual participants included in the study.

## Data Collection Procedures

After approval by the Ethics Committee, the heads of the Psychology, Naturology and Medicine courses in different regions of Santa Catarina were contacted. Data collection was also required in a Naturology course based in São Paulo city. By this means, 558 participants were found, which answered the questionnaires in printed format, in groups of approximately 30 students. Average duration of questionnaire sessions was 45 minutes, as it happened during a regular class. During collection, the researcher briefly presented the research, informed of possible risks, and engaged participants in the activity. Three of the participants were blind; the researcher read the instructions for them. Another share of the respondents ($n = 230$) received the data collection instruments by a link in the *Survey Monkey* platform, and were invited to take part from the networks of the research team. Also, in electronic format, invitations were sent to several meditation and Buddhist centers all over the country.

## Data Analysis Procedures

Data were analyzed with the help of the statistic software *Stata 12*® (StataCorp, 2011) and *Winsteps*® (Linacre, 2014). At first, the base was examined, with the intention of exploiting omitted data, verifying spelling mistakes, and identifying atypical observations as outliners (Hair et al., 2005). Kaiser-Mayer-Olkin Test (KMO) was used to verify sample adequacy, whereas Bartlett's sphericity test was used to verify whether the latent structure was adequate to factor analysis. The minimum value of 0.80 was expected for KMO; significance levels less than 0.5 were expected for the Barlett's Test (Valentini, & Laros, 2012).

The 145 items were subjected to exploratory factor analysis, with Kaiser Normalization for the verification of the set of items' dimensionality (Pasquali, 2010). The identification of the number of factors to be extracted was done by multiple methods: (a) conduction of parallel analysis, with the verification of the number of empirical factors with *Eigenvalues* higher than those obtained in simulated random data sets (Horn, 1965), and (b) coherence and interpretability of factors with the theoretical model proposed by MAP. Precision was estimated for the extracted dimensions by CTT with Cronbach's alpha. Results equal to or higher than 0.70 were considered adequate for this indicator of internal consistency (Valentini, & Laros, 2012).

Among the present study's hypotheses, there were three possible factor solutions: (a) the five most frequent components (as shall be later explained); (b) a five-factor version of the structure, grouping components *Observe* and *Awareness*; or (c) a two-factor structure, corresponding to mindful and mindless states. Additionally, it was expected that meditators presented higher MAP scores than people with no previous meditation experience.

The selection of items was based in four criteria: (a) minimum factor loading of 0.30 for a single factor. (b) Verification of the adjustment to the partial credit Rasch model based on infit and outfit indexes. Infit refers to unexpected answers for people who have a *theta* level

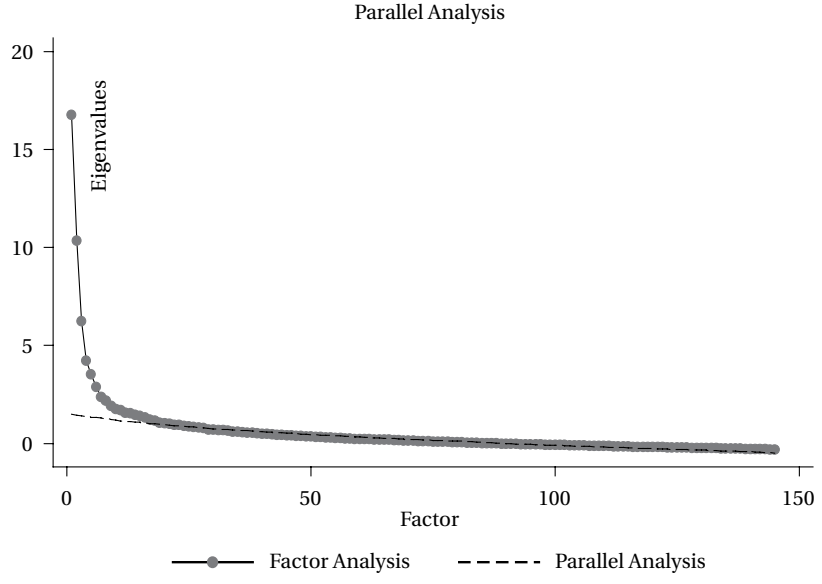
comparable to the item's difficulty; outfit refers to unexpected answers for people who have a *theta* level divergent from the item's difficulty. For both, values not higher than 1.50 are desirable (Linacre, 2014). (c) Item--*theta* correlation, regarding the association between the item and the latent variable measured by the instrument, with values higher than 0.35 being expected. (d) Verification of the item's level of difficulty in relation to the sample's *theta*, by analysis of the map of items.

*Theta* represents the latent variable, in this case, mindfulness, which affects respondent performance in the test (Valentini, & Laros, 2012), in terms of statement endorsement. It was expected that the scale would have items that may cover the highest possible zone of the respondent's *theta* spectrum, keeping items that evaluate different levels of the latent variable being measured (typically, with values between -3 and +3). Besides, disorders were investigated in categories of answers, this being an indicator of the adequacy of the points of the scale for the assessment of the prominence of the trait expressed in the item.

After the items were analyzed by CTT, 75 remained for IRT analysis. The first factor grouped exceeding items, which superimposedly evaluated the same *theta* zone. Comparing the values in the item--*theta* correlation of these items, 28 were eliminated, and only 47 went to the final MAP version. With this version, mindfulness results were also compared, calculated by TCT procedure in z-score, between meditator and non-meditator respondents. In order to do this, the amount of time practicing meditation was used as dependent variable; the factors extracted were submitted to logistic regression, with a view to better understanding MAP sensibility to capture differences in terms of meditation experience. For this analysis, the most adequate cutting point, in reason of the specificity and sensibility of the measure, was verified (Schisternman, Faraggi, Reiser, & Trevisan, 2001) and established as 0.15.

## Results

In relation to the initial viability verifications for the use of factor analysis on the data obtained, KMO was 0.88 and Bartett's Test presented significance levels of less than 0.001, whose values corroborate the adequacy of the sample's factoriality. The 145 items were first subjected to exploratory factor analysis, with no limitation on the number of factors to be extracted. Parallel analysis suggested the presence of 22 factors, the *Eigenvalues* of which were higher than those obtained from simulated data. The first six factors presented *Eigenvalues* different from those of the simulation, and, from the seventh factor on, the differences gradually approached zero, indicating that they should be ignored, as presented in Figure 1.




*Source:* Elaborated by the authors.

*Figure 1*
Parallel Analysis Scree Plot.

We opted to extract solutions with 3, 4, 5, 6 and 7 factors, using oblique rotation (oblimin and promax). The contents of the item groups generated from these extractions were analyzed, as well as their factor loadings, and the four-factor solution, with oblimin rotation, was shown to be the most appropriate, since groups were in accordance with the mindfulness elements proposed in this study. With a view to a simple structure, only those items that presented factor loadings higher than 0.38 in a single factor were maintained, which led to the maintenance of 47 items in the final version.

The first factor grouped exclusively items built for the evaluation of the positive pole of the construct ($n$ = 24), and integrated different aspects of mindfulness: consciousness, insight, awareness, curiosity, attention, observation, self-regulation and description. Considering the diversity of converging elements in the factor, *Mindfulness* was the most appropriate label for its identification, and the Cronbach's alpha estimated for this factor was 0.88. Mindfulness indicates how aware, open, curious and sensitive one is in relation to one's own experiences, activities and surroundings. This component is also related to the intentional monitoring of experiences, involving attitudes such as observing and describing, also in a non-elaborate manner, as when one finds oneself thinking of something.

The second group revealed 14 items, which evaluate the negative pole of mindfulness, which describe aspects such as lack of attention, and lack of attention regulation. Taking the item's negative aspect into consideration, and the fact that they were originally elaborated to evaluate the *Attention* factor and its regulation, it was possible to maintain the original label, *Attention*, as this factor's label. The factors estimated precision, according to Cronbach's alpha, was 0.84. *Attention* refers to the voluntary use of different attention skills (concentrating, alternating and dividing), whether for attaining higher awareness or for self-regulation.

The third factor involved five negative items which evaluate lack of experience acceptance, and was labeled *Acceptance*, since these items had been originally proposed as such. Internal consistency was estimated as adequate when $\alpha$ = 0.78. *Acceptance* is the domain that indicates how much a person accepts her own experiences, and leaves them be as they are, without wishing to avoid or alter them.

Four negative items were grouped in the fourth factor, which denote the attitude of living in the automatic state of functioning. As this factor is composed by items possessing negative contents and factor loading (item 161, "I usually do not perceive details in my surroundings"), it was labeled *Novelty seeking*. Internal consistency was set at 0.62. This factor is related to the intentional promotion of awareness by the exploitation and discovery of new elements in the environment and context. This attitude amplifies context sensibility, and contributes to prevent aimless wandering or being guided by automatic functioning.

The four factors, as a group, were labeled, *General Mindfulness* or *General Factor*. This factor is composed by 47 items, having presented and average a mean of 3.13 ($SD$ = 0.45), the precision of which was estimated in $\alpha$ = 0.85. The correlation between the extracted factors is in Table 1.

All these factors present significant correlations among themselves, with magnitudes varying form very low, as obtained between *Acceptance* (F3) and *Novelty seeking* (F4), moderate, as between *Attention* (F2), *Acceptance* (F3) and *Novelty seeking* (F4) and the total MAP score (GF). *Acceptance* (F3) and *Mindfulness* (F1) presented low and negative correlation, albeit meaningful. Psychometric properties of items and factors may be seen in Table 2. Below, the maps of the items of the extracted factors (Figures 2, 3, 4, 5).

Regarding IRT analyses, the *Mindfulness* factor presented adequate infit ($M$ = 1.01; $SD$ = 0.16) and outfit ($M$ = 1.03; $SD$ = 0.16) values, and the item-*theta* correlations varied between 0.43 and 0.67, indicating adequate adjustment to the model. Regarding the items' level of difficulty (Figure 2), they cover most of the *theta* spectrum of the sample. No disorders were

*Table 1*
Correlation between z-scores referring to the extracted factors.

| | F2 | F3 | F4 | GF |
|---|---|---|---|---|
| F1 | 0.08** | -0.25* | 0.26* | 0.37* |
| F2 | | 0.32* | 0.27* | 0.71* |
| F3 | | | 0.07*** | 0.54* |
| F4 | | | | 0.69* |

GF = General factor.

*$p$ < 0.01; **$p$ < 0.02; ***$p$ < 0.05.

Source: Elaborated by the authors.

*Table 2*
MAP psychometric properties.

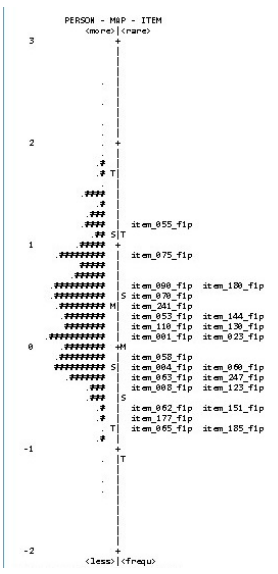
| | | Mindfulness | Attention | Acceptance | Novelty seeking |
|---|---|---|---|---|---|
| Factor loading | Mean | 0.50 | 0.53 | 0.51 | 0.48 |
| | SD | 0.07 | 0.09 | 0.06 | 0.07 |
| | Maximum | 0.67 | 0.68 | 0.59 | 0.53 |
| | Minimum | 0.39 | 0.42 | 0.45 | 0.38 |
| Infit | Mean | 1.01 | 1.03 | 1.00 | 0.90 |
| | SD | 0.16 | 0.21 | 0.21 | 0.07 |
| | Maximum | 1.28 | 1.44 | 1.27 | 0.98 |
| Outfit | Mean | 1.04 | 1.04 | 1.01 | 0.89 |
| | SD | 0.17 | 0.21 | 0.18 | 0,08 |
| | Maximum | 1.29 | 1.37 | 1.23 | 0.95 |
| IRT b | Mean | -0.05 | 0.00 | 0.00 | -0.05 |
| | SD | 0.53 | 0.54 | 0.11 | 0.12 |
| | Minimum | -0.85 | -0.90 | -0.11 | -0.14 |
| | Maximum | 1.21 | 0.94 | 0.14 | 0.13 |
| item-*theta* relation | Mean | 0.52 | 0.56 | 0.69 | 0.67 |
| | SD | 0.06 | 0.07 | 0.02 | 0.03 |
| | Minimum | 0.43 | 0.47 | 0.66 | 0.63 |
| | Maximum | 0.67 | 0.67 | 0.72 | 0.69 |
| Eigenvalue | | 6.62 | 4.72 | 2.50 | 1.49 |
| Explicit variation (%) | | 36.91 | 26.33 | 13.98 | 8.35 |
| Cronbach's alpha | | 0.88 | 0.84 | 0.78 | 0.62 |
| *M* | | 3.46 | 3.16 | 3.77 | 2.12 |
| *SD* | | 0.64 | 0.73 | 0.83 | 0.88 |

Source: Elaborated by the authors.

observed in the answer categories of the factor. Item 58 ("Every now and then, I find myself attentive to sensations in my body") presented higher loading, whereas 55 ("When I drink water, I imagine the path in makes inside my body") was shown to be the most difficult, and 185 ("I am attentive to emotions (such as jealousy, courage, nostalgia) when I notice them coming") was the easiest.

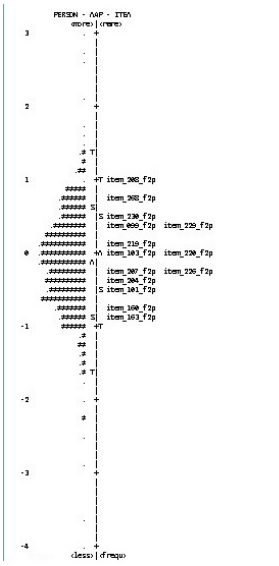
Similarly, items in the *Attention* factor also presented good adjustment levels to the model, *infit* ($M$ = 1.03; $SD$ = 0.20), *outfit* ($M$ = 1.04; $SD$ = 0.20), and the level of difficulty of these items (Figure 3) covers most of the sample's *theta*. Item 226 ("I think of several different things at the same time, and therefore I have difficulty concentrating in a single task") has the strongest factor loading, whereas 208 ("In this exact moment, my attention wanders more than focuses on this test") was shown to be the most difficult, and item 163 ("Sometimes, I have to read something more than once in order to understand it, as I easily lose focus") the easiest.

The *Acceptance* factor, in its turn, presented good infit ($M$ = 1.00; $SD$ = 0.19) and outfit ($M$ = 1.01; $SD$ = 0.16) levels. The map of items (Figure 4) indicates that the levels of difficulty of the items evaluate *theta* levels close to zero. Item 35 ("I usually criticize some of my behaviors") presented the highest factor loading. Factor *Novelty seeking* presented good levels



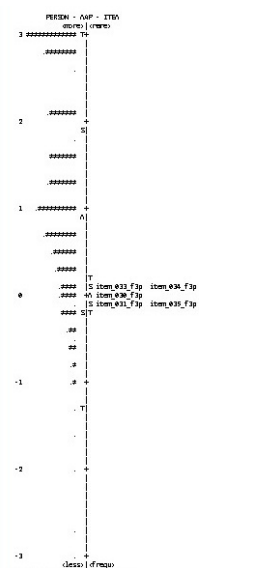
*Source:* Elaborated by the authors.

*Figure 2*
Mindfulness.



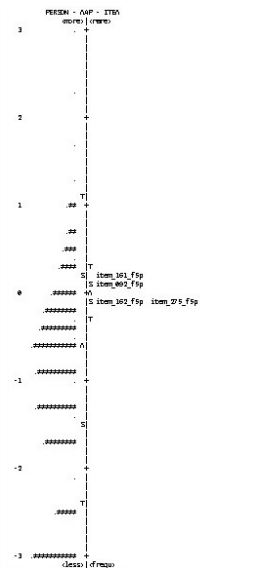
*Source:* Elaborated by the authors.

*Figure 3*
Attention.



*Source:* Elaborated by the authors.

*Figure 4*
Acceptance.



*Source:* Elaborated by the authors.

*Figure 5*
Novelty seeking.

*Table 3*
Logistic regression based on meditation experience.

| Independent variables | *B* | *EP* | Z | *P* | 95% IC | |
|---|---|---|---|---|---|---|
| Mindfulness | 1.512 | 0.20 | 7.26 | 0.00 | 1.103 | 1.920 |
| Attention | 0.964 | 0.15 | 0.58 | 0.56 | -0.229 | 0.422 |
| Acceptance | 0.250 | 0.13 | 1.93 | 0.05 | -0.003 | 0.525 |
| Novelty seeking | - 0.071 | 0.14 | -0.50 | 0.61 | -0.353 | 0.209 |
| Constant | - 7,871 | 0.92 | -8.53 | 0.00 | -9.679 | -6.062 |

$p < 0.001$.

$Chi^2(4) = 68.79$.

Source: Elaborated by the authors.

of adjustment, infit ($M$ = 1.00; $SD$ = 0.19) and outfit ($M$ = 1.01; $SD$ = 0.16), and the analysis of the map of items (Figure 5) indicates that the level of difficulty of the items was also concentrated around zero. Item 161 ("I usually do not perceive details in my surroundings") presented the strongest loading. There was no disorder in the answer categories for these two factors. Considering that items were not removed by IRT, 47 items remained in the instrument.

As was said earlier, researches conducted with mindfulness measures developed from different theoretical backgrounds indicated that such instruments were capable of detecting statistically significant differences between people with and without meditation experience (Baer et al., 2006; Barros et al., 2014; Lau et al., 2006). To test whether MAP can replicate such results, a logistic regression was undertaken, which took MAP factors as independent variables, and the meditator/non-meditator indication as dependent variable. The results of this analysis are reproduced in Table 3.

Results obtained by logistic regression point that factors *Mindfulness* and *Acceptance* predict experience with meditation practices. It should be noted

that the regression model generated adequately classified 69.02% of the respondents, and presented sensibility of 71.43%, and specificity of 68.61%.

## Discussion

The process for the construction of MAP intended to integrate different mindfulness elements in an originally Brazilian measure. This study sought evidence for the validity of MAP by the verification of its internal structure and the evaluation of its predictive capacity for external criteria (American Educational Research Association, American Psychological Association, National, Council on Measurement in Education, 1999). Furthermore, its psychometric properties were assessed by TCC and IRT.

In relation to the final MAP version, after the selection of the most suitable elements from different psychometric tests, it was shown that the quantity of items maintained in the scale, 47, follows the tendency of other studies intent on the construction of mindfulness instruments. Brown and Ryan (2003), for example, originally elaborated 184 items, out of which 160 were eliminated as a result of exploratory factor analysis, leaving 24 items in the final MAAS version. Baer et al. (2004) elaborated 77 items, only 39 of which were incorporated into KIMS after analysis by specialists and exploratory factor analysis. Feldman et al. (2007) analyzed 47 items; factor analysis excluded 27 of them. Baer et al. (2006) began with 112 items; exploratory and confirmatory factor analyses caused only 39 to remain. Cardaciotto et al. (2008) initially produced 105 items to be integrated into PHLMS; only 20 were left after validity studies based on internal structure.

Factor analysis revealed four of the factors expected in the review of literature on the construct. Generally speaking, an agglomeration of positive items into a single factor was observed, which factor evaluates more general and "adaptive" aspects of mindfulness; it is associated to the other three negative components, which evaluate different aspects and levels of the construct. This composition indicates that, in a way, it was possible to maintain the mindful and mindless poles described by Langer (2014). In the Brazilian FFMQ adaptation study, Barros et al. (2014) obtained similar results. During factor analysis, two of the original factors separated their positive and negative aspects, thus creating two new (negative) factors in the adapted version. Considering the results by Barros et al. (2014) and those of the present research, it is hypothesized that, in the Brazilian population, the construct is expressed with the segregation of the negative contents, a feature to be investigated by future research.

The items elaborated for factors *Observe* and *Describe* are grouped with consciousness, awareness, insight, curiosity and orientation toward present moment in the first factor, following the tendency of the results obtained by specialist analysis and confirming the hypothesis that grouped *Observe* and *Awareness*. This factor was shown to be comprehensive, as it involves different aspects of mindfulness, approached by different instruments. It was verified that this factor was shown to be similar to the *opening* dimension, proposed by FMI (Hirayama, 2014; Walach et al., 2006).

Convergence of the items under the factor entitled *Mindfulness* was also reported by other mindfulness instruments (Brown, & Ryan, 2003; Walach et al., 2006), and is shown to be coherent with the study by Aguado et al. (2015), which, upon conduction of an FFMQ bi-factor analysis, concluded that the latent structure of a global factor, associated to five cognitive aspects, would be most appropriate for the instrument. This suggests that current findings follow tendencies in the international literature, besides the complexity behind the operationalization of mindfulness (Chiesa, 2013; Siegling, & Petrides, 2014).

The dropping of the factor *Observe* as one dimension of mindfulness, as in FFMQ, is, in some measure, positive, as it was questioned by some studies (Baer et al., 2006; Radon, 2014; Schmidt, & Vinet, 2015). It is worth noting that the FFMQ developers understand that this dimension functions differently for meditators and non-meditators, whose feature was corroborated by other studies (Aguado et al., 2015). In the present study, items in MAP that were shown to be more difficult, according to the map of items built for use in the IRT, are related to the observation of experiences. Such a result indicates that, for the non-meditator sample, which comprised most of the subjects, such indicators would be endorsed with more difficulty. However, differential item functioning (DIF) studies must be conducted so we may attain a better understanding of this result.

Regarding the factor *Novelty seeking*, as proposed by Langer (2014), the present research has shown that it may be associated with the remaining mindfulness domains, which are operationalized

by FFMQ and MAAS. These results challenges the impossibility attested by some authors (Hart et al., 2013; Siegling, & Petrides, 2014) of grouping these components. Thus, the integration of elements from different perspectives on mindfulness was shown to be both feasible and a differential aspect of MAP. This finding also indicates that we are far from obtaining a structure that may be deemed a "golden standard" for mindfulness assessment, and consequently the discussion about its dimensionality cannot be closed, as Hart et al. (2013) have attempted. Furthermore, regarding the low level of internal consistency estimated for this factor, it is understood that it may have been influenced by its reduced number of items (Carvalho, Nunes, Primi,& Nunes, 2012).

The other extracted factors also indicate that it is possible to integrate *Attention*, approached solely in MAAS (Brown, & Ryan, 2003) to mindfulness elements operationalized in other scales (Baer et al., 2004, 2006; Cardaciotto et al., 2008; Feldman et al., 2007; Lau et al., 2006), such as *Describe* and *Observe*. Thus, considering the various possible components for the construct, and their organization in this study, it is possible to think that factors *Attention*, *Acceptance* and *Novelty seeking* are, indeed, attributes associated to mindfulness, but not mindfulness itself. Another result reinforcing this interpretation is related to the results obtained with logistic regression, in which the factor *Mindfulness* showed to be different from the others, given that it was better at predicting the indicator "meditator/non-meditator". In this analysis, the three other components presented smaller, non-significant *betas* for two factors. Despite the discussion, future studies must assess the importance of these components for the construct.

Regarding the correlation among the extracted factors, despite its low magnitude, results were coherent with the literature. In the construction of FFMQ (Baer et al., 2006), factors presented correlations ranging from 0.15 ($p < 0.01$) (for *Act with awareness* and *Observe*) to 0.34 ($p < 0.01$) (between *Not reacting* e *Not judging*). *Not judging* and *Observe* presented a non-significant correlation of -0.07. Two years later, in a FFMQ criterial validity study (Baer et al., 2008), the correlations among factors presented higher magnitudes than those obtained by the study for the construction of the instrument. Furthermore, the FFMQ Brazilian adaptation (Barros et al., 2014) reported correlations similar to those of the original instrument and to those found in the present study. *Not reacting*, for example, had correlations ranging from -0.04 (with *Negative Describe*) to -0.07 (with *Not judging*), besides a high correlation with *Observe* (0.51). This indicates that the correlations obtained between MAP factors must be reviewed in the future, so that the relation among its components may be adequately understood. Besides, it is worthy to note that, despite the fact that it seems pertinent to expect negative correlations between the factor *Mindfulness* and the remaining MAP factors, it should not be forgotten that, for Langer (2014), mindful and mindless states are not opposed, but complementary. This justifies the association between these components. Likewise, the contribution of the mindless state for everyday life cannot not be denied.

The fact that the factor *Acceptance* has a negative association with the factor *Mindfulness* indicates that there may be mechanisms specific to human acceptance, which mobilize attention and awareness of individuals to specific points of their experiences, which supposedly demand higher acceptance on their part (such as suffering, for instance). By so doing, the flow of experiences is interrupted, and thus accepting an experience may be understood as a way of reacting to it, which would indicate mindless functioning. This may justify some negative contribution of this component to the construct; however, we need new studies on these variables, so this result is appropriately understood.

The factor *Acceptance* also seems to provide support to the factor *Mindfulness*. We may imagine that people, when initiating their self-awareness meditation practices, or even experienced practitioners, will eventually face potentially painful experiences. In this case, if the practitioner does not have a modicum of acceptance over these experiences, awareness of them may lead him or her to experience suffering. Thus, the negative association pattern between *Mindfulness* and *Acceptance* suggests that the latter focuses on the maintenance of emotional balance, offering support to consciousness.

The psychometric properties of the four extracted factors and of their 47 items have shown to be adequate according to psychometric literature (Embretson, & Reise, 2000; Hair et al., 2005). One shortcoming identified was the low internal consistency of the factor *Novelty seeking*, but it is understood that it may still be used for general research purposes. At any rate,

in a future revised MAP version, this aspect may be observed. It should be noted that the results obtained are like those displayed in most of the national and international literature, in terms of factor loading, variance, quantity of items and precision (Baer et al., 2004, 2006; Barros et al., 2014, 2015; Brown, & Ryan, 2003; Cardaciotto et al., 2006; Feldman et al., 2007; Hirayama, 2014; Lau et al., 2006; Silveira et al., 2012; Walach et al., 2006). On the other hand, none of the international scales selected items by IRT, which is another point in favor of MAP.

Regarding IRT analyses, it should be noted that the factor *Mindfulness* presented items with good psychometric properties in terms of the evaluation of items with low, intermediate and medium-high *theta* levels, which to some extent corroborates the validity of its contents. However, future research must elaborate items with high *theta* (with content of more difficult endorsement), thus guaranteeing items for all levels of mindfulness. The same goes for the factor *Attention*, which presented items with difficulty akin to the level of mindfulness in the sample, but is found lacking in items with extreme-case *thetas* (either light or severe). Similarly, the disorder in the category of responses identified in one item of this factor seems to have occurred due to the low endorsement of intermediate responses, which indicates that, in this item, participants endorsed most frequently categories 1 or 5, thus generating category disorder.

Regarding factors 3 and 4, it is understood to be necessary, in a revised MAP version, the elaboration of extreme-case items (light and severe) to fill in the *theta* zones so far with no items. However, it is necessary to note that, in the first factors, items that evaluate the same factors were found, albeit positively. From this we may infer that there is some correspondence between the negative items belonging to the factor *Acceptance* and the four negative items in *Novelty seeking*, on the one hand, with those allocated under factor 1, on the other, which approach acceptance, mindful states and orientation toward present moment.

Despite being criticized by some authors (Grossman, & Van Dam, 2011), the presence of factors with inverted items, pointing to the negative pole of the construct, follows the tendency of other instruments for mindfulness assessment, revealing it to be important in the evaluation of the construct. FFMQ (Baer et al., 2006), for example, possesses five dimensions with positive labels, and only two of them (*Act with awareness* and *Not judging*) evaluate negative aspects. Also, we must not ignore the importance of the information that these items are able to collect for the assessment of the mindfulness construct.

Regarding differences in score between meditator and non-meditator respondents, logistic regression results showed to be in accordance with studies that obtained significant differences between the two participant profiles (Baer et al., 2008; Barros et al., 2014; Brown & Ryan, 2003; Lau et al., 2006; Walach et al., 2006). This suggests MAP sensibility to capture individual differences, besides indicating criterial validity evidence, as noted by the American Educational Research Association, American Psychological Association, National, Council on Measurement in Education (1999). This result corroborates that meditation is efficient in promoting mindfulness (Baer et al., 2006).

## Final Remarks and Conclusion

It was possible to maintain 47 items with appropriate psychometric properties, out of the 145 preliminary items. The internal MAP structure was shown to represent different mindfulness conceptions. On the one hand, it is possible to perceive the composition of mindful and mindless states, as indicated by Langer (2014), represented by the positive and negative formats of the items. However, when considering only factors *Mindfulness* and *Acceptance*, given logistic regression, we may perceive a structure akin to that championed by Cardaciotto et al. (2008) in PHLMS. On the other hand, when considering the different components converging in the first factor, *Mindfulness*, we may perceive the complex factor composition in FFMQ (Baer et al., 2006), which represents a compilation of five other mindfulness instruments. Furthermore, when comparing MAP factors with those extracted for FMI in Brazil (Hirayama, 2014), a certain similarity in noticeable.

Regarding the sample for this research, four aspects are relevant: (a) the high level of female participants; (b) the high level of formal education of the participants; (c) the higher frequency of participants from one state (Santa Catarina); (d) the higher participation of Psychology students. These features may have biased the result. Regarding the level of formal education, it seems worthy of note that MAP is more precise to evaluate adults that indicated at least some level of university education.

It is expected that new studies with MAP will be conducted, to test its factor structure and internal consistency. We point that new MAP studies should approach: (a) assessment of acquiescence bias; (b) analysis from polychoric correlation matrices, since this procedure would minimize the effect of factor extraction from item poles; (c) procedures based on confirmatory factor analysis; (d) use of bi-factor analysis, which, in a measure, can differentiate between the effects of general factors from those of specific factors. We conclude that MAP displays evidence attesting its validity, based on its internal structure and criterial validity.

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