



Psychometric evaluation and validation of the electronic form of the applied mindfulness process scale among university students

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Abstract

Introduction: Mindfulness is a key variable in positive psychology that contributes to students' health and quality of life. This research aimed to examine the factor structure and validate the electronic form of this scale among university students.

Materials and Methods: In this cross-sectional study over the academic year 2022-2023, 831 university students in Bandar Abbas City, Iran, were selected by stratified sampling. They fulfilled the Applied Mindfulness Process Scale (AMPS) and the Five Facet Mindfulness Questionnaire (FFMQ). Content, concurrent, construct validity, and internal and split-half reliability of the scale were assessed using statistical methods with SPSS and LISREL software.

Results: The AMPS demonstrated robust content validity, with Content Validity Ratio (CVR) values ranging from 0.80 to 0.90 and Content Validity Index (CVI) values between 0.85 and 0.95 for its 15 items. There was also a significant positive correlation between the scale and the FFMQ ($r=0.79$ and $P<0.001$), indicating good concurrent validity. We indicated three factors with eigenvalues over one, explaining 75.347 percent of the total variance through exploratory and confirmatory factor analysis. These three factors were focus, positive emotion regulation, and negative emotion regulation. The internal and split-half reliability of the scale was also high (Cronbach's $\alpha=0.939$, Guttman split-half coefficient= 0.840).

Conclusion: Applied mindfulness process scale is a valid tool for assessing mindfulness and can be applied to mindfulness research and interventions.

Keywords: Mindfulness, Scale, Students, Validation

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Introduction

Iranian university students face numerous challenges in life that can lead to psychological disorders and a decline in academic performance (1). These challenges include academic pressures, economic difficulties, anxiety,

depression, hopelessness, loneliness, unemployment, uncertainty about the future, and lack of self-confidence (1,2). Such issues can diminish students' psychological well-being, encompassing aspects such as self-efficacy, hope, resilience, and optimism (3,4), which are

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crucial for mental health, physical health, and quality of life. One way to enhance psychological well-being and cope with life's challenges is the development of mindfulness (5). Mindfulness, a key concept in positive psychology and refers to pay attention to moment-to-moment experiences with openness, non-judgment, and acceptance (6). Mindfulness has numerous benefits, including stress reduction, increased happiness, improved physical health, psychological well-being, and quality of life (7). Mindfulness-Based Interventions (MBIs) utilize practices such as meditation, yoga, and breathing exercises to strengthen mindfulness (8) and have proven effective in various contexts, including psychological disorders, addiction, chronic pain, chronic diseases, and education (9,10). However, accurate and reliable mindfulness assessment tools are needed to evaluate the effectiveness of MBIs (11). Most existing tools measure mindfulness as a state or trait, reflecting an individual's level of mindfulness over time (12). These tools are typically self-report questionnaires that may be influenced by vanity, self-awareness, and expectations (13).

Moreover, they cannot capture the process of change and evolution in mindfulness during an intervention, only measuring the outcomes (14).

Therefore, tools need to assess mindfulness as a process, showing how individuals use it daily and the changes that occur. Such tools can improve the quality and accuracy of MBI evaluations and provide researchers and therapists with valuable insights into the mechanisms and factors influencing mindfulness. One of these tools is the Applied Mindfulness Process Scale (AMPS). Jia et al. designed and validated this scale to assess mindfulness as a process in the Chinese context. The AMPS has demonstrated high construct validity and reliability, as evidenced by its strong correlations with other established scales that measure mindfulness as a state or trait. Specifically, its Cronbach's alpha coefficient is

0.936, presents good internal consistency. Furthermore, the split-half reliability coefficient stands at 0.902 and has an internal consistency coefficient of 0.861; both affirm its reliability. The structural validity has been confirmed through rigorous exploratory and confirmatory factor analyses, ensuring that the scale accurately measures the three dimensions it purports to assess: attention to moment-to-moment experiences, openness to moment-to-moment experiences, and acceptance of moment-to-moment experiences (14).

The AMPS has several advantages over previous scales: First, it measures mindfulness in various everyday life contexts, such as dealing with negative states, challenges, and stressors, showing how mindfulness can aid in positive and negative emotional regulation. Second, it assesses mindfulness as a change process over time, demonstrating how mindfulness can improve therapeutic outcomes in MBIs. Third, it measures mindfulness electronically, benefiting from speed, accuracy, low cost, and easy access. So, examining the psychometric properties of the AMPS can aid in assessing mindfulness among students.

Materials and Methods

The population of this cross-sectional study included all students from various universities in Bandar Abbas City, Iran in the academic year 2022-2023. We determined the sample size based on sampling methods to assess concurrent validity, exploratory factor analysis, confirmatory factor analysis, and reliability.

So, 200, 350, 250, and 100 individuals were selected through stratified sampling, respectively (15). We determined the number of samples from each university by dividing the number of students by the total sample size. Then, samples were randomly selected using student ID numbers (16). Table 1 presents number of students from each university and the number of samples.

Table 1. Population and sample size in the tool validation phase

University	Student population	Concurrent (n=200)	Exploratory (n=350)	Confirmatory (n=250)	Reliability (n=100)
Hormozgan University	6,000	33	57	41	16
Hormozgan University of Medical Sciences	4,000	22	38	27	11
Islamic Azad University	15,000	82	143	102	41
Payame Noor University	10,000	55	95	68	27
Razavi Non-Profit University	1,500	8	14	10	4
Total	36,500	200	350	250	100

After contacting students by phone, verbal permission was obtained for their participation in the study. The questionnaire link was sent to participating students via email, WhatsApp, and Instagram. For students without internet access, the researcher completed the questionnaire in person using a tablet. In total, 831 valid questionnaires were collected.

Research instruments

A) *Applied Mindfulness Process Scale (AMPS)*: This questionnaire consists of 15 questions answered on a five-degree Likert system (from 1=never to 5=always). The total score ranges 15 to 75. It has three dimensions: Decentering, positive emotion regulation, and negative emotion regulation. The questions for each dimension are as follows: 2, 3, 12, 13, and 15 (decentering); 4, 7, 9, 11, and 14 (positive emotion regulation); and 1, 5, 6, 8, and 10 (negative emotion regulation). Its Cronbach's alpha coefficient of 0.936, a split-half reliability coefficient of 0.902, and an internal consistency coefficient of 0.861. Its structural validity has also been confirmed through exploratory and confirmatory factor analysis (14).

B) *Five-Facet Mindfulness Questionnaire (FFMQ)*: Baer et al. developed this self-report tool to measure five aspects of mindfulness. It comprises 39 items scored on a five-degree Likert system (1=never to 5=always). The five elements of mindfulness measured by this questionnaire are observation, description, acting with awareness, non-judging of inner experience, and non-reactivity to inner experience. The items for each aspect are as follows: 1, 6, 11, 15, 20, 26, 31, and 36 (observing); 2, 7, 12, 16, 22, 27, 32, and 37 (describing); 5, 8, 13, 18, 23, 28, 34, and 38 (acting with awareness); 3, 10, 14, 17, 25, 30, 35, and 39 (non-judging of inner experience); and 4, 9, 19, 21, 24, 29, and 33 (non-reactivity to inner experience). The total score ranges 39 to 195. The coefficients related to Cronbach's alpha, a split-half reliability, and internal consistency of the Persian version were 0.90, 0.83, and 0.88, respectively. Its structural validity has also been established by confirmatory factor analysis (17,18). We analyzed the data using SPSS version 22 and LISREL version 8, descriptive statistics, the content Validity Ratio (CVR), Content Validity Index (CVI). Also, we applied Pearson's correlation coefficient to assess the concurrent validity of the scale with the scores of the FFMQ. Exploratory factor analysis with the

Principal Axis Factoring method was used for evaluating construct validity and identifying the factorial structure of the scale and the Varimax method was conducted for factor rotation. The criterion of eigenvalues greater than one was used to determine the number of factors. A factor loading criterion of at least 0.4 was used to determine the items for each factor (19). We used the Kaiser-Meyer-Olkin (KMO) index and Bartlett's test to check the initial conditions for exploratory factor analysis, confirmatory factor analysis to examine the fit of the factorial model of the scale, and the internal consistency method to evaluate the reliability of the AMPS. We calculated Cronbach's alpha coefficient for the total scale and each dimensions, the split-half coefficient for the first and second halves of the data, and the correlation between the two halves.

Results

Of 831 participants, 56.2% (467 individuals) were female, and 43.8% (364 individuals) were male. Regarding educational levels, 14.3% (119 individuals), 39.7% (330 individuals), 31% (258 individuals), and 14.9% (124 individuals) had associate, bachelor, master, and doctoral degrees, respectively. Age distribution was as follows: 32.1% (267 individuals) were under 20 years old, 38.4% (319 individuals) were between 20 to 25 years old, 18.3% (152 individuals) were between 25 to 30 years old, and 11.2% (93 individuals) were over 30 years old. Regarding marital status, 88.2% (733 individuals) were single, and 11.8% (98) were married.

Content validity

Experts for content validity validated all questions. The experts in the validation process all held doctoral degrees and included three psychometricians, five counselors, and two psychiatrists. The CVR for the 15 questions on the scale ranged from 80 to 90 percent. According to Lawshe's table for evaluating ten experts, a CVR higher than 0.62 is required (20). The CVI for the 15 questions varied from 85 to 95, which are acceptable values. The minimum acceptable value for CVI is 0.78 (21).

Concurrent validity

To assess concurrent validity, the AMPS was administered alongside the FFMQ.

The results indicated a significant and positive correlation between two questionnaires ($P < 0.001$, $r = 0.79$) (22).

Exploratory factor analysis

The results showed that the Kaiser-Meyer-Olkin (KMO) measure was 0.912, indicating an adequate measurement of variables by factors (23). Bartlett's test statistic was 4562.856 ($P=0.001$), indicating a significant correlation between variables (24). These indices suggest that we can use exploratory factor analysis.

According to findings, three factors had eigenvalues greater than one, explaining 42.080%, 17.888%, and 15.378% of the variance, respectively.

These factors included decentering, positive emotion regulation, and negative emotion

regulation, accounted for 75.347% of the total variance. After rotation, three factors with factor loadings greater than 0.4 were identified (25). The decentering factor included five questions related to the ability to focus on ongoing activities and present-moment awareness (2,3,12,13,15).

The positive emotion regulation factor included five questions (4,7,9,11,14) related to the ability to generate and maintain positive emotional states. The negative emotion regulation factor included five questions (1,5,6,8,10) related to the ability to reduce and manage negative emotional states (Table 2).

Table 2. Questions associated with each extracted dimension of the AMPS among university students

	Dimensions		
	Focus	Positive emotion regulation	Negative emotion regulation
Question 1	0.14	0.15	0.79
Question 2	0.84	0.10	0.14
Question 3	0.84	0.12	0.13
Question 4	0.14	0.84	0.17
Question 5	0.14	0.20	0.87
Question 6	0.19	0.11	0.84
Question 7	0.09	0.88	0.13
Question 8	0.13	0.18	0.83
Question 9	0.16	0.80	0.23
Question 10	0.11	0.16	0.86
Question 11	0.10	0.85	0.12
Question 12	0.89	0.14	0.14
Question 13	0.84	0.09	0.15
Question 14	0.12	0.85	0.15
Question 15	0.84	0.16	0.13

Confirmatory factor analysis

It demonstrated that the three-factor model of the emotion regulation questionnaire had a good fit with the data. The model fit indices did not exceed the acceptable ranges introduced in reputable scientific sources. For instance, the Root Mean Square Error of Approximation (RMSEA) was < 0.08 , and presents appropriate model fit. The Normed Fit Index (NFI), Non-Normed Fit Index (NNFI), Comparative Fit Index (CFI), and Incremental Fit Index (IFI) were all above 0.95, reflecting an excellent fit

of the model with the collected data. The Parsimony Normed Fit Index (PNFI) and Parsimony Goodness of Fit Index (PGFI) also indicated a suitable level of complexity for model (Table 3). Therefore, the three-factor model of the emotion regulation questionnaire possesses good structural validity and can be utilized to measure emotion regulation abilities in the population. Additionally, the Chi-Square to Degrees of Freedom Ratio (CMIN/DF) was < 3 , which indicates a good fit of the model with the data (26,27).

Table 3. General Indicators of the fit of the AMPS among university students

Index	RMSEA	NFI	NNFI	CFI	IFI	PNFI	PGFI	CMIN/DF
Value	0.066	0.98	0.99	0.99	0.99	0.81	0.65	1.86
Acceptable fit	0.10	0.80	0.80	0.80	0.80	0.50	0.50	5.00

Scale reliability

We found that the overall reliability was 0.939, indicating high consistency. The split-half reliability was 0.840, presenting an acceptable correlation between the two halves. The reliability of the three factors was high (decentering factor: 0.927, the positive emotion regulation factor: 0.918, and the negative emotion regulation factor: 0.949). To assess the reliability, the Cronbach's alpha if each

question was deleted and the correlation of each question with the total score were provided in text form. The Cronbach's alpha if each question was deleted ranged from 0.932 to 0.939, indicating a negligible change. The correlation of each question with the total score ranged from 0.597 to 0.778, indicating a positive and acceptable correlation. Therefore, the AMPS is reliable for measuring the intended variables (28) (Figure 1).

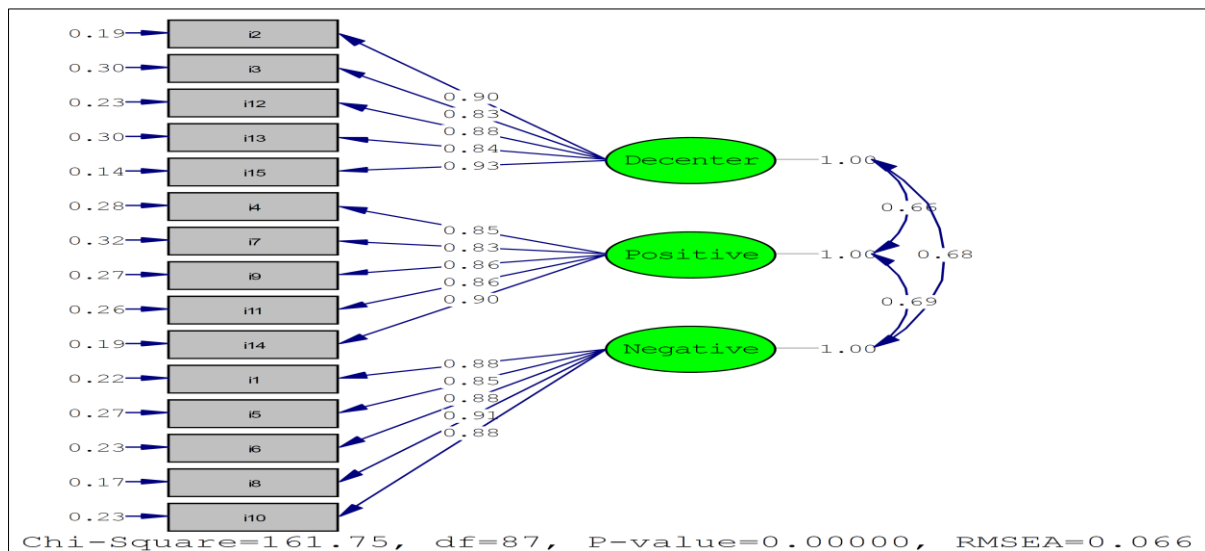


Figure 1. Standard coefficients model

Discussion

This study examined the validity and reliability of the Applied Mindfulness Process Scale (AMPS) among Bandar Abbas university students. The results indicated that the scale has high content, concurrent, structural, and internal consistency validity and can be used to measure mindfulness.

The findings of this study showed that the AMPS has appropriate content validity. This means that the items are consistent with the intended criteria for measuring applied mindfulness and have been validated by experts. This finding aligns with the original researcher who administered the questionnaire in a Chinese context, demonstrating that the scale has high content validity and that its items correspond with the concepts of applied mindfulness (14).

This alignment indicates that the AMPS has cultural and environmental validity and can be employed in various societies. It can be explained that this scale is designed based on a practical and applied perspective of mindfulness, encompassing three factors: decentering, positive emotion regulation, and negative emotion regulation, which relate to the ability to

attend to moment-to-moment experiences with openness, non-judgment, and acceptance. These factors align with theories and models of positive psychology and cognitive psychology, suggesting that applied mindfulness can be associated with increased happiness, reduced stress and depression, improved emotion regulation, and enhanced mental and physical health (29-32). Therefore, the AMPS has high content validity.

The results also showed that the AMPS has high concurrent validity and is significantly correlated with the FFMQ. This finding is consistent with the original researcher's findings in a Chinese context (14), indicating that this tool has high concurrent validity and significant correlations with other measures of mindfulness. This consistency suggests that the AMPS can be a benchmark tool for assessing mindfulness in different societies.

The scientific explanation for these findings could be that the AMPS is constructed based on psychological concepts and models that are globally accepted and use items that are consistent with the FFMQ. Thus, this scale can transcend linguistic and cultural limitations and

effectively and accurately measure the process of mindfulness. In addition, Buhk et al. demonstrated that self-reported measures of mindfulness traits, including the FFMQ, possess strong concurrent validity (33). Similarly, Andrei et al. examined how various mindfulness measurements, including the FFMQ, correlate with desired outcomes and showed that the Philadelphia Mindfulness Scale (PHLMS) has the most significant predictive effects (34). These studies confirm that the FFMQ and other measurement tools can be reliable benchmarks for assessing mindfulness in international research. This further validates that the AMPS can act as a global benchmark tool for evaluating mindfulness, as it aligns with universally accepted psychological concepts and shows a strong correlation with other valid measurements.

Both exploratory and confirmatory factor analyses were conducted to assess the structural validity of the AMPS. We concluded that the scale has a three-factor structure comprising decentering, positive emotion regulation, and negative emotion regulation, suggesting that the AMPS has appropriate structural validity. This means that the factor structure of the scale is consistent with the data collected and can distinguish components related to applied mindfulness. This finding is consistent with the original researcher's findings in a Chinese context (14), who also demonstrated that the scale has high structural validity and that its three-factor structure is consistent with Chinese data. This consistency indicates that the AMPS has cultural and environmental validity and can be employed in various societies. The scientific explanation for this finding could be based on theories of mindfulness psychology and successful intelligence. Applied mindfulness is a novel concept in psychology that refers to individuals' ability to regulate emotions, focus on ongoing activities, and be present in the moment. This concept is directly related to successful intelligence, which is the ability of individuals to achieve their personal and professional goals. Therefore, measuring applied mindfulness can be useful for assessing and improving individuals' performance in various areas. The AMPS is a simple and efficient tool for measuring this concept and can be further utilized in future research. The extracted dimensions of the AMPS have been compared with similar dimensions in other mindfulness questionnaires. For example, the FFMQ, which

includes five factors: observing, describing, acting with awareness, non-judging, and non-reactivity, represents various dimensions of mindfulness that overlap with the dimensions of the AMPS (35,36). Additionally, the Mindful Attention Awareness Scale (MAAS) and the Cognitive and Affective Mindfulness Scale-Revised (CAMS-R) also have dimensions that are related to the dimensions of the AMPS (37,38). These comparisons demonstrate that the AMPS can be used as a valid tool for measuring applied mindfulness alongside other established questionnaires.

The findings of this study showed that the AMPS is reliable. This means that the scores of this scale do not change over different times and indicate high consistency. This finding is consistent with the original researcher's findings in a Chinese context, who also demonstrated its high reliability using various methods (14). This consistency indicates that the AMPS has cultural and environmental validity and can be employed in various societies.

To compare the reliability alignment of the AMPS with other mindfulness questionnaires, a systematic review and meta-analysis revealed that mindfulness questionnaires show differential sensitivity to change with treatment (39). For instance, the Five Facet Mindfulness Questionnaire (FFMQ) and the Mindful Attention Awareness Scale (MAAS) have been examined for their factor structure and reliability before and after mindfulness-based interventions, showing that these scales are sensitive to changes in mindfulness practices (40). These findings support the use of AMPS alongside other validated mindfulness questionnaires. The limitations of this study included the limited sample to university students in Bandar Abbas City. Therefore, it is suggested that future research should expand the population to include university students from other regions of the country. Additionally, this study used self-report tools for data collection, which may be subject to personal, social, or cultural biases. It is recommended that future studies use other methods, such as interviews, observations, psychometric tests, or physiological tools for measuring mindfulness.

Conclusion

The results showed that the Applied Mindfulness Process Scale (AMPS) has high content, concurrent, structural, and internal consistency validity and can serve as a credible

and effective tool for measuring applied mindfulness. Designed from a practical and applied perspective on mindfulness, this scale includes three factors: decentering, positive emotion regulation, and negative emotion regulation, which are consistent with theories and models of positive psychology and cognitive psychology. AMPS also aligns with the findings of the original researcher, who evaluated it in a Chinese context, demonstrating that the AMPS has cultural and environmental validity and can be utilized in various societies.

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Conflicts of Interests

The authors report no conflicts of interest.

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Ethical Considerations

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The ethical committee of the Islamic Azad University approved this study. The participants signed informed consent and they were assured that their information would remain confidential and used solely for research purposes. Participants were also informed of their right to withdraw from the study at any stage.

Authors' Contributions

Fereshteh Shamsaei and Azita Amirfakhraei wrote the manuscript, Noushin Taghinejad and Azita Amirfakhraei performed the statistical analysis and validation, and both researchers approved the final article.

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