

Measuring Emotions During Epistemic Activities: Psychometric Validation of the Persian Epistemic Emotions Scale*

Mohsen Rezaiee Ahvanuiee, Hossein Kareshki**,
& Seyed Amir Amin Yazdi

Department of Psychology and Education Science,
Ferdowsi University of Mashhad, Mashhad, Iran

As there are not enough measurement instruments to assess emotions during epistemic activities, this research aimed to evaluate the psychometric properties of the epistemic emotions scale among speakers of the Persian language. The scale has previously been used and studied in different cultural contexts. The present study sought to expand the application of this scale in the Iranian context. A total of 1153 students (58.6% women) within the age range of 17 to 29 years participated in this study. The mean and standard deviation of the age of the participants were 21.63 and 2.24, respectively. The data collection tools in this study were the Epistemic Emotions Scale, the Achievement Emotions Questionnaire, the Academic Buoyancy Scale, and the Academic Satisfaction Scale. CFA was performed to test the factorial structure ($\chi^2 = 1895.96$, $df = 394$, $GFI = .86$, $CFI = .97$, $IFI = .97$, $NFI = .97$, $NNFI = .96$, $SRMR = .069$, and $RMSEA = .086$) and its validity and reliability were also evaluated. The seven-factor model of the Epistemic Emotions Scale was the same as that of the original scale version, and the Epistemic Emotions Scale showed good internal consistency with Cronbach's alpha for this scale ranging from .85 to .88.. The results showed that the EES scores also correlated in expected directions with measures of related constructs included in this study

Corresponding author: kareshki@um.ac.ir

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Ethical Approval. The present study has been registered with the ethics code IR.UM.REC.1400.234.

Declaration of Interest Statement. The authors declare that there is no conflict of interest.

Data availability. The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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** <https://orcid.org/0000-0003-1990-2365>

thus also supporting the external validity of this version of the scale. We can conclude that the Epistemic Emotions Scale is a valid and reliable tool for measuring students' epistemic emotions, and as a result, researchers can use this tool for research purposes.

Keywords: Epistemic Emotions Scale, Epistemic emotions, Persian language, Iran.

Highlights:

- Epistemic Emotions Scale (EES), an important assessment tool, was validated in Iran.
- Confirmatory factor analysis (CFA) supported the seven-factor model of EES.
- Good psychometric properties of the EES were established on the Iranian data.

Over the past four decades, the study of emotions related to learning has moved towards growth and prosperity. Theorists consider emotions as systems of coordinated psychological processes, including an emotion-specific affective (feeling) experience, cognitive processes, and motivational tendencies, as well as physiological and expressive components (Scherer, 2000; Vogl et al., 2021). It can be stated that due to the importance of emotions in everyone's life, they can determine the direction of life as they help people to follow a specific goal, and also they have a strong direct and indirect presence in reasoning and rationality (Fatemi, 2020).

There are different categories for emotions based on the focus of the object, one of which is epistemic emotions (EEs). Specifically, EEs are types of emotions related to knowledge and knowledge generation (Pekrun et al., 2016; Pekrun & Stephens, 2012) that are taken from an information-based assessment of the consistency or inconsistency between input information and existing beliefs. In the context of extensive, complex, and inconsistent knowledge, EE consists of broad components, ranging from positive emotions such as Enjoyment to negative emotions such as Boredom. More generally, EEs include Enjoyment, Curiosity, Surprise, Confusion, Anxiety, Frustration, and Boredom (Muis et al., 2015; Pekrun et al., 2016).

Curiosity occurs when information is presented as inconsistent, very new, complex, and comprehensible (Silvia, 2010). Surprise is a state of uncertainty and is experienced when people are confronted with information that they do not expect (Reisenzein & Studtmann, 2007). Confusion can be experienced when information is inconsistent, very new, complex, as well as very incomprehensible (Silvia, 2010). When Confusion is resolved, Enjoyment may arise (D'Mello & Graesser, 2012). Enjoyment is a positive emotion that can be experienced when Curiosity is fulfilled (Litman & Jimerson, 2004). People's skepticism

about their beliefs may cause epistemic Anxiety. If the epistemic inconsistency or inconsistency is not resolved, depending on its severity, Surprise (D'Mello & Graesser, 2012), Curiosity, or Frustration may occur, respectively (Pekrun & Linnenbrink-Garcia, 2014). Epistemic Boredom occurs when unsuccessful efforts to solve a problem replace commitment with persistent Frustration (D'Mello & Graesser, 2012).

During cognitive activities, EEs overlap with achievement emotions and are differentiated based on the focus of their objectives (Pekrun, 2017). In the same way, epistemic emotions, which are related to the generation of knowledge, also often occur in achievement situations such as preparing for a test (Muis et al., 2015). If the focus on cognitive incompatibility results from an unresolved problem, then the student's Frustration is considered an EE because of not finding the correct solution to a math problem. And if the focus is on personal failure and inability to solve the problem, then the student's Frustration is considered an achievement emotion, some of these emotions can lead to EE (Vogl et al., 2021). On the other hand, some emotions are inherently epistemic, such as Surprise or Curiosity, while depending on the focus of the object of attention, others can belong to different categories of emotions (Pekrun et al., 2016; Vogl et al., 2020), and even non-epistemic emotions can be epistemically related to each other (Morton, 2010).

Regardless of the classification of emotions, they are related to a wide range of educational variables such as academic buoyancy and academic satisfaction. Academic buoyancy is the ability to respond appropriately to daily challenges, setbacks, and pressures that students experience during their academic life (Martin & Marsh, 2008). Putwain et al. (2020) show that positive and negative emotions are associated with adaptive responses to adversity, including academic buoyancy. Furthermore, it is plausible that academic buoyancy not only reduces the intensity of emotions such as Anxiety and Boredom but also reduces their destructive educational impact. Academic satisfaction refers to the evaluation of various aspects of educational experiences, and it is defined as a subjective state that results from the confirmation or not of the students' expectations (Meneghel et al., 2019). For example, Reyhani et al. (2016) also reported that emotions have a significant relationship with academic satisfaction.

Discrete emotions can include positive activating emotions (e.g., Enjoyment), positive deactivating emotions (e.g., relief), negative activating emotions (e.g., Anxiety), and negative deactivating emotions (e.g., Boredom; Pekrun & Perry, 2014). Different emotions in each group can affect cognitive tasks and knowledge generation through different methods (Pekrun et al., 2016; Vogl et al., 2019).

The original version of this scale was administered as part of Muis et al.'s (2015) study on epistemic beliefs, epistemic processes, and emotions experienced when reading conflicting texts. Pekrun et al. (2016) asked the participants to fill in the 7-item and 21-item scales of EEs while reading texts. The items of this scale include: curious, bored, confused, Surprised, interested,

anxious, frustrated, inquisitive, dull, amazed, worried, happy, muddled, irritated, monotonous, excited, astonished, dissatisfied, nervous, joyful, and puzzled. Based on the results of Pekrun et al. (2016), this scale has adequate goodness of fit indices. Also, the factor loadings were above .60 for all items, and above .70 for 18 items.

Given the prominent place of EEs in the fields of learning and solving cognitive problems, the need to pay attention to these emotions in different cultural contexts, including the Persian-speaking society, is of considerable importance. Epistemic emotions are introduced to facilitate the important functions of learning; thus, it is important to better understand the possible role of EEs in facilitating or limiting learning (Chevrier et al., 2019). Epistemic emotions are of undeniable importance because of their impact on knowledge-creating as well as cognitive activities. This group of emotions can have a strong impact on learning and performance. Although there were tools such as assessing Curiosity (Jirout & Klahr, 2012) or emotion checklists (D'Mello & Graesser, 2012), there are no systematic multi items tools to assess a broader range of emotions. In this study, statistical descriptions of items and scale, reliability, validity of internal test and external validity of epistemic emotions scale (EES) were examined.

Method

Participants

The present study was a cross-sectional survey conducted in 2021. The sample included students from universities in Semnan province, Iran. The sample included 1153 participants, of which 676 (58.6%) are women and 477 (41.4%) are men with an age range of 17–29 years ($M = 21.63$, $SD = 2.24$) sampled by multi-stage random sampling. That is, first, three universities were randomly selected from among the universities of Semnan province, then ten classes were randomly selected from among the common classrooms for all students in each selected university, and finally, the research instruments were administered to selected participants. Participants were excluded if they were diagnosed with specific concurrent medical or psychiatric conditions disrupting their educational function.

Procedure

First, the EES was translated into Farsi by a group of three Farsi-speaking, psychologists and then back-translated into English by an independent translator. The author of the original version of the EES reviewed the back translation and provided several suggestions. Amendments were made and reviewed after back translation. This process continued until the author of the EES and the group of experts agreed upon the translation.

In the next stage, after obtaining the necessary permission from the selected universities of Semnan province, namely Semnan, Payame Noor, and Damghan universities, the relevant questionnaires were administered to the participants who were in general course classes because all students had to pass this course. Indeed, they are from different fields of study and in different academic years. Therefore, the criterion for participation in this research was students who were studying at the undergraduate level and were willing to participate in this

study. Sample selection was multi-stage random sampling. Finally, instructions were provided for participants.

To complete the ESS, participants were given a text with information on the cause of climate change (man-made), which was adopted from Bråten and Strømsø (2009). This text was a popular science text published by the CICERO at the University of Oslo. After reading the text, they responded to the EES to report the emotions they had experienced while reading.

In this stage, this instrument was completed by 100 students in the pretest stage. They confirmed that the items were understandable and clear, and it took them about 15 minutes to complete. Then the scale was examined statistically, and the results showed that it had acceptable internal consistency ($\alpha = .84$).

In the last stage, 1300 questionnaires were delivered to the target student participants. In the conditions of the COVID-19 pandemic, the scales were made available online to the students of the selected courses. After receiving the completed questionnaires, 1153 questionnaires met the criteria. All participants had given their informed consent for inclusion before they participated in this survey. The internal consistency of the scale was examined by Cronbach's alpha and McDonald's Omega coefficients. The relationships between EES and achievement emotions questionnaire (AEQ-S), academic buoyancy scale (ABS), and academic satisfaction scale (ASS) were examined.

Measures

Demographic Information

For this study, the participants were asked to give certain demographic information such as gender, age, university, academic field, and years of university education.

Epistemic Emotions Scale (EES)

The scale has 21 items and uses a five-point Likert type scale, ranging from 1 (*not at all*) to 5 (*very strong*), that requires participants to read a text about climate change and then report the intensity of different emotions while reading the EES items (Pekrun et al., 2016). Each subscale consists of three items, and a high score in each subscale indicates a type of emotion (e.g., "Enjoyment"). The reliability of the scale is satisfactory ($\alpha = .76$ to $.88$ range). In addition, the correlation between long and short form scores ranged from $.65$ to $.85$, which indicates an adequate level of convergent construct validity of the scale (Pekrun et al., 2016).

Achievement Emotions Questionnaire (AEQ-S)

Bieleke et al. (2021) developed a short version of the achievement emotions questionnaire as part of a multidimensional self-report instrument to measure achievement emotions. This questionnaire measures different achievement emotions in three situations of academic achievement including classroom, learning, and exam. In the achievement emotion questionnaire, participants should answer each item on a five-point scale (1 = *strongly disagree* to 5 = *strongly agree*). Emotion scales for class, learning, and exam consist of 96 items (each scale contains 32 items). Bieleke et al. (2021) reported that Cronbach's alpha coefficient of the scale for students was in the range of $.74$ to $.77$ and the total reliability coefficient was $.76$.

Academic Buoyancy Scale (ABS)

This scale was developed by Martin and Marsh (2008) using 4 items with a 5-point Likert scale (1 = *strongly disagree*, and 5 = *strongly agree*). This scale has a single score. Internal consistency of the scale expressed through Cronbach's alpha was $.81$ and confirmatory

factor analysis showed factor loadings of individual items to be .68, .68, .78, and .73 for items 1 to 4, respectively (Martin & Marsh, 2008).

Academic Satisfaction Scale (ASS)

This scale was developed by Salehi (2014) including 5 items with a 6-point Likert scale (1 = *not at all* to 6 = *very high*). This scale did not have subscales. Convergent construct validity was estimated by calculating the correlation between the test and student grade point average ($r = .67$ and $p < .01$) and discriminant construct validity was obtained by examining the correlation between the scale and academic burnout test ($r = -.52$ and $p < .01$). Reliability of the test was .92 expressed by Cronbach's alpha (Salehi, 2014).

Analyses

Internal consistencies were assessed using Cronbach's alpha, and the normality of each scale was assessed by computing skewness and kurtosis. An α equal to or above .90 is considered very high, an α equal to or above .70 acceptable, and an α equal to or above 0.60 is considered marginally acceptable. An absolute value of skewness or kurtosis exceeding 1 was taken to indicate a non-normal distribution (Kline, 2015).

In confirmatory factor analysis, several indices were employed to evaluate the model's goodness of fit: root mean square error of approximation, comparative fit index (CFI), standardized root mean square residual (SRMR), goodness-of-fit index (GFI), and adjusted goodness-of-fit index (AGFI). RMSEA values lower than .05 were taken to indicate a good model fit, values between .05 and .10 an acceptable fit, and values greater than .10 a poor fit (Browne & Cudeck, 1992). Values greater than .90 for CFI, GFI, and AGFI were taken to indicate an acceptable fit, and values greater than .95 a good fit (Byrne, 1998). A model fit is considered acceptable with SRMR values lower than .08, and good with values lower than .05 (Hu & Bentler, 1995, 1999).

As a final step, Pearson correlation coefficients of the EES subscales were calculated between EE scales, achievement emotion, academic buoyancy, and academic satisfaction.

Results

Demographic Characteristics of Participants

In the present study, a total of 1153 students participated (58/6% women) and this included 539 students (46.7%) from Payame Noor University, 391 students (33.9%) from Semnan University, and 223 students (19.3%) from Damghan University. Among the participants, 413 students (35.8%) were studying in the first year, 251 (21.8%) in the second year, 235 (20.4%) in the third year, and 254 (22%) in the fourth year. In addition, 459 students (39.8%) were studying mathematics, 118 students (10.2%) were studying natural sciences, and 576 students (50%) were studying humanities. The lowest number of participants was in the age range of 27 to 29 years (4.6%) and the highest number of participants was in the age range of 21 to 23 years (51.3%).

Measurement Properties

AEQ-S

In this study, confirmatory factor analysis (CFA) showed that all items had factor loadings between .45 and .98. Goodness-of-fit indices indicated that the model fitted the data adequately ($\chi^2 = 16383.16$, $df = 4427$, CFI = .96, GFI = .91, AGFI = .90, SRMR = .069, RMSEA = 1.0), and Cronbach's alpha coefficients indicated acceptable internal consistency for the total of questionnaire (.93, and .80 for class-related emotions, .80 for learning-related emotions, .80 for test-related emotions).

ABS

CFA showed that all items had factor loadings between .63 and .84. Goodness-of-fit indices indicated that the model fitted the data adequately ($\chi^2 = 5.80$, $df = 2$, CFI = .99, GFI = .99, AGFI = .99, SRMR = .010, RMSEA = .041), and Cronbach's alpha coefficients indicated acceptable internal consistency for the questionnaire (.82).

ASS

CFA showed that all items had factor loadings between .74 and .89. Goodness-of-fit indices indicated that the model fitted the data adequately ($\chi^2 = 20.07$, $df = 5$, CFI = .99, GFI = .98, AGFI = .95, SRMR = .016, RMSEA = .089), and Cronbach's alpha coefficients indicated acceptable internal consistency for the questionnaire (.90).

Content Validity

To validate the content of EES, 5 mental health professionals working in the field of emotion were asked to evaluate its contents. The Persian form of EES and task instructions, conceptual definition of the construct, and its aspects were sent to these evaluators. Each item was evaluated using a 4-point Likert response scale (1 = *irrelevant*, 2 = *somewhat related*, 3 = *relevant*, 4 = *highly relevant*) to see whether the item was relevant to the target construct. The content validity index (CVI) for each item and total items were calculated from the proportion of evaluators who scored items as either 3 or 4. CVI scores higher than .80 were considered acceptable (Davis, 1992).

Confirmatory Factor Analysis

Using LISREL, we performed a maximum likelihood CFA to evaluate the fit of the data to the model.

Table 1 shows the factor loading, t-value, Cronbach's alpha, mean, standard deviation, skewness, and kurtosis and as indicated, all factor loadings are greater than .59.

Table 1
Factor loadings and t-value of the items of the EES subscales

Variable	Subscale	Factor loading	t-Value	α	M	SD	SK	KU	Items
Curiosity	Curios	.77	29.18	.88	3.21	1.26	-.21	-.74	D1
	Interested	.84	33.17	.88	3.40	1.34	-.39	-.92	D5
	Inquisitive	.59	20.74	.87	3.14	1.19	-.13	-.63	D8
Surprise	Surprised	.67	24.41	.85	2.69	1.21	.24	-.72	D4
	Amazed	.62	22.29	.85	2.60	1.21	.28	-.72	D10
	Astonished	.82	31.80	.85	2.35	1.25	.57	-.61	D17
Confusion	Confused	.69	26.35	.85	2.89	1.27	.11	-.87	D3
	Muddled	.80	32.14	.85	2.61	1.32	.35	-.94	D13
	Puzzled	.73	28.03	.85	2.34	1.23	.61	-.49	D21
Enjoyment	Happy	.87	34.26	.88	3.13	1.30	-.10	-.95	D12
	Excited	.68	24.73	.87	2.92	1.28	.06	-.91	D16
	Joyful	.67	24.14	.87	2.86	1.30	.11	-.96	D20
Anxiety	Anxious	.74	29.04	.85	2.64	1.29	.31	-.89	D6
	Worried	.80	32.34	.85	2.62	1.34	.35	-.96	D11
	Nervous	.81	32.86	.85	2.29	1.39	.70	-.79	D19
Frustration	Frustrated	.80	32.44	.85	2.50	1.29	.46	-.77	D7
	Irritated	.84	34.63	.85	2.31	1.31	.62	-.71	D14
	Dissatisfied	.84	35.08	.85	2.47	1.36	.50	-.94	D18
Boredom	Bored	.59	21.45	.85	2.74	1.30	.27	-.86	D2
	Dull	.77	29.90	.85	2.46	1.23	.47	-.60	D9
	Monotonous	.66	24.58	.85	2.56	1.20	.29	-.67	D15

To examine the homogeneity and distinctiveness of the scales (long versions), we used CFA and compared three models that differed in the degree of differentiation between emotions. Model 1 was a one-factor model that contained one bipolar factor representing all emotions. Model 2 was a two-factor model that differentiated between positive and negative epistemic affect. Curiosity and Enjoyment items showed positive emotional indicators, and Confusion, Anxiety, Frustration, Boredom, and Surprise items showed negative emotional indicators. Finally, Model 3 was a seven-factor model that differentiated between all seven emotions.

Table 2 shows that in contrast to the one-factor and two-factor models, the seven-factor model has a good fit. Data distribution indices (skewness and kurtosis) were used to test the normality of data. If skewness and kurtosis indices are between ± 1 , the data distribution can be considered normal. Therefore, the obtained values show that the form of data distribution is normal.

Table 2
Goodness of fit indices of the three models of EES

Variable	χ^2	df	CFI	GFI	IFI	RMSEA	RMSEA 90% CI	NFI	NNFI	SRMR
Model 1	5976.65	435	0.90	0.55	0.90	0.21	.21-.21	0.90	0.89	0.14
Model 2	3003.79	434	0.95	0.77	0.95	0.13	.12-.13	0.95	0.95	0.095
Model 3	1895.96	394	.97	.86	.97	.086	.083-.090	.97	.96	.069

Correlations with related constructs

The EES subscales are significantly related to several other constructs, including the subscales of achievement emotions, academic buoyancy, and academic satisfaction. For example, there is a statistically significant relationship at the level of .01 between the EE of Curiosity with academic buoyancy ($r = .17$), academic satisfaction ($r = .13$), and positive emotions like enjoyment ($r = .18$), hope ($r = .18$), pride ($r = .16$), relief ($r = .10$), while the relationships between the EE of Curiosity with negative emotions are not statistically significant. The EE of Surprise had no statistically significant relationship with emotions such as enjoyment, pride, relief, as well as academic buoyancy, and academic satisfaction, while it had a statistically significant negative relationship with the emotion of hope ($r = -.64$), and a statistically significant positive relationship with anxiety ($r = .33$), shame ($r = .34$), frustration ($r = .32$), and boredom ($r = .24$). See Table 3 to examine the relationship between the other components of EEs. Finally, the correlation between long and short forms of this scale for the subscales of Curiosity, Surprise, Confusion, Enjoyment, Anxiety, Frustration, and Boredom were .84, .83, .82, .84, .85, .87, and .79, respectively. According to the results, emotions with positive valence have a positive and significant correlation with each other, and emotions with negative valence have a positive and significant relationship with each other. Surprise also showed that it has a positive relationship with negative emotions and a negative relationship with positive emotions.

Table 3
Correlation of EES subscales with other measures

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	M	SD
1. CU (EES)	1																		9.75	3.14
2. SU (EES)		1																	7.64	3.01
3. CO (EES)			1																7.83	3.18
4. EN (EES)				1															8.91	3.25
5. AX (EES)					1														7.55	3.46
6. FR (EES)						1													7.28	3.51
7. BO (EES)							1												7.76	2.97
8. EN (AEQ-S)								1											42.66	9.46
9. HO (AEQ-S)									1										44.55	9.69
10. PR (AEQ-S)										1									45.77	9.21
11. RE (AEQ-S)											1								15.61	3.63
12. AG (AEQ-S)												1							26.13	10.05
13. AX (AEQ-S)													1						25.99	10.09
14. SH(AEQ-S)														1					22.92	11.12
15. HL(AEQ-S)															1				20.87	10.67
16. BO (AEQ-S)																1			16.91	8.25
17. Buoyancy																	1		12.98	3.69
18. Satisfaction																		1	21.54	5.99

Note. * $p < .05$, ** $p < .01$; CU (EES): Curiosity, SU (EES): Surprise, CO (EES): Confusion, EN (EES): Enjoyment, AX (EES): Anxiety, FR (EES): Frustration, BO (EES): Boredom, EN (AEQ-S): Enjoyment, HO (AEQ-S): Hope, PR (AEQ-S): Pride, RE (AEQ-S): Relief, AG (AEQ-S): Anger, AX (AEQ-S): Anxiety, SH (AEQ-S): Shame, HL (AEQ-S): Hopelessness, BO (AEQ-S): Boredom, Buoyancy: Academic Buoyancy, Satisfaction: Academic satisfaction

Reliability

Cronbach's alpha and McDonald's Omega were used to assess the internal consistency of the EES. Cronbach's alpha of the scale was .86, which was .87 and .86 for male and female students, respectively. Cronbach's alpha for the subscales of Curiosity, Surprise, Confusion, Enjoyment, Anxiety, Frustration, and Boredom were .78, .76, .78, .79, .83, .87, and .72, respectively. Also, McDonald's Omega coefficient for the EES scale was .87 and these coefficients for subscales of Curiosity, Surprise, Confusion, Enjoyment, Anxiety, Frustration, and Boredom were .79, .76, .79, .79, .83, .87, and .72, respectively. Results indicate acceptable internal consistency of the scale.

Discussion and Conclusion

This study aimed to investigate the psychometric properties of the EES in a sample of Persian-speakers. In previous studies, not enough attention has been paid to EEs, while it covers a large part of students' lives, especially their academic life. As a result, there is a need for measurement tools whose reliability and validity are in particular, assessed in a sample of academic students.

Initially, we examined whether the factor structure of EES in the Persian-speaking population corresponded to the factor structure of the main study (Pekrun et al., 2016). CFA was used and the correlation between the scale and achievement emotions, academic buoyancy, and academic satisfaction was assessed. CFA confirmed the EES factorial structure.

To assess the external validity of the questionnaire through examining its nomological network, its correlations with the achievement emotions, academic buoyancy, and academic satisfaction scales was calculated. Curiosity and Enjoyment correlated positively with academic buoyancy, academic satisfaction, and all positive achievement emotions, which was also consistent with our research expectations. Surprise, Confusion, Anxiety, Frustration, and Boredom correlated positively with all negative achievement emotions. The results are consistent with most studies conducted in the field of positive (e.g. Fredrickson, 2001; Sweeny & Vohs, 2012) and negative (Pekrun et al., 2009, 2011) emotions in general. As the results of this study show, EEs can share affective properties with other groups of emotions (Brun & Doguoglu, 2016) such as achievement emotion. Emotions such as Surprise can be generally experienced as positive or negative (Ortony & Turner, 1990). In the present study, Surprise has a positive and significant relationship with negative emotions. EEs are among the emotions that people experience in academic situations and can have a positive or negative correlation on learning strategies and consequently affect learning results (Muis et al., 2015). The results of this study show that positive EEs have a positive relationship with academic buoyancy and academic satisfaction, and negative EEs have a negative relationship with these variables except Surprise and Boredom. According to Scarantino (2014), emotions are behavioral programs that have flexible features and provide solutions to frequent challenges

and problems in the form of motivational states with conditions of behavioral control. That is, states of readiness to achieve a prioritized goal, for example, in the field of education, and can provide the possibility of rational control over the situation by successfully managing daily academic challenges.

Regarding the reliability of the results, the total scale and its subscales had sufficient internal consistency ($\alpha = .85$ to $.88$), indicating that there were substantial correlations between the items. These results were consistent with the findings of Pekrun et al. (2016). The differences between results can be explained by several factors such as the age range of the participants and the context in which the present study was conducted. In general, the results showed that EES has suitable reliability and validity for measuring EEs among university students and, as a result, can be used by researchers and scholars to study emotions in this area.

Since this research in the field of epistemological emotions has been used as the first study in the cultural context of Persian-speakers, it can be considered the beginning of extensive research in this field. Validation of the research tool of this present study certainly develops the research process of EEs in this cultural context faster. On the other hand, from a practical point of view, this instrument can be used by relevant bodies such as Ministries of Education, Science, Research and Technology and Health, and other student-related organizations for studying the current situation and designing practical programs to improve it.

Limitations

Some limitations of the present study should be acknowledged: 1) This scale does not include all EEs and only concentrates on some of them. This study was conducted in one of the Persian-speaking areas, which may limit the generalizability of the results. 2) The sample consists of students from the Semnan province of Iran and students from other Iranian provinces were not included in this study, thereby more research is needed to verify the generalizability of the results to the general population of Iran.

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Merenje emocija tokom epistemičkih aktivnosti: Psihometrijska validacija Persijske skale epistemičkih emocija

Mohsen Rezaiee Ahvanuiee, Hossein Kareshki, &
Seyed Amir Amin Yazdi

Department of Psychology and Education Science,
Ferdowsi University of Mashhad, Mashhad, Iran.

Mernih instrumenata za procenu emocija tokom epistemičkih aktivnosti nema dovoljno. Shodno tome, cilj ovog istraživanja je bio da proceni psihometrijska svojstva skale epistemičkih emocija na uzorku (izvornih, prim. prev.) govornika persijskog jezika. Skala epistemičkih emocija je do sada korišćena i ispitivana u različitim kulturnim kontekstima. Ova studija je imala za cilj da proširi primenu ove skale na Iran. Ukupno 1153 studenta (58.6% žena) sa rasponom godina od 17 do 29 je učestvovalo u ovom istraživanju. Aritmetička sredina i standardna devijacija starosti ispitanika su 21.63 i 2.24 godine, tim redosledom. Instrumenti korišćeni u ovoj studiji su bili Skala epistemičkih emocija (eng. Epistemic Emotions Scale), Upitnik emocija postignuća (eng. the Achievement Emotions Questionnaire), Skala akademskog snalaženja / snalaženja u akademskom okruženju (eng. the Academic Buoyancy Scale), i Skala akademskog zadovoljstva (eng. The Academic Satisfaction Scale). Sprovedena je CFA u cilju testiranja faktorske strukture skale ($\chi^2 = 1895.96$, $df = 394$, GFI = .86, CFI = .97, IFI = .97, NFI = .97, NNFI = .96, SRMR = .069, and RMSEA = .086), a procenjena je i pouzdanost interne konzistencije i eksterna valjanost ovog upitnika. Sedmofaktorski model Skale epistemičkih emocija je bio identičan modelu izvorne verzije skale, a skala je pokazala i dobru pouzdanost interne konzistencije. Raspon Kronbahovih alfa koeficijenta je išao od .85 do .88. Rezultati su pokazali i da postoje statistički značajne veze između skorova ove skale i povezanih konstrukata, što govori u prilog eksternoj validnosti Skale epistemičkih emocija. Nalazi ove studije pokazuju da je skala epistemičkih emocija validan i pouzdan instrument za merenje epistemičkih emocija studenata, i može se koristiti u istraživačke svrhe.

Ključne reči: epistemičke emocije, psihometrijski, validnost, pouzdanost, studenti

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