

Psychometric Properties of the Persian Version of the Online Student Engagement Questionnaire: A Transcultural Adaptation and Psychometric Study

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ABSTRACT

Background: Given the significance of learner engagement in distance education, particularly in online learning settings, scholars are continuously seeking appropriate tools to assess it with greater precision. Therefore, this research aimed to investigate the psychometric properties of the Online Student Engagement Questionnaire (OSEQ) within the Iranian context.

Methods: This transcultural adaptation and psychometric study was carried out on 330 students who were engaged in online studies using a convenience sampling across five Iranian universities (Farhangian University, Shahid Rajaei Teacher Training University, Tehran University, Mehr Alborz University, and Iran University of Science and Technology) from October 2022 to December 2023. The OSEQ, comprising 16 self-report items across four engagement dimensions (cognitive, behavioral, social, and affective engagements), was employed. The questionnaire underwent initial translation using a standard forward-backward technique. The psychometric characteristics including face, content, and construct validities, along with reliability, were appraised using both Cronbach's alpha and McDonald's omega coefficients.

Results: The linguistic and conceptual equivalence of the translated questionnaire exceeded 1.5, while the content validity values (CVR=0.81; CVI=0.85) were determined based on the viewpoints of nine experts. No items out of 16 were excluded, considering the face and content validity coefficients. Through the execution of an Exploratory Factor Analysis (EFA), four factors were extracted, accounting for 56.74% of the overall variance. The structure of the factors, supported by suitable fit indices ($X^2/df=2.33$, RMSEA=0.064, GFI=0.92, NFI=0.90, CFI=0.93, RMR=0.044, SRMR=0.046) derived from four first-order factors, was validated. The questionnaire demonstrated satisfactory reliability, as indicated by McDonald's omega coefficient ranging from 0.70 to 0.79 and Cronbach alpha coefficient ranging from 0.70 to 0.79.

Conclusion: The findings demonstrated that the OSEQ has strong psychometric properties, making it an appropriate instrument for assessing online student engagement within the Iranian setting.

Keywords: Education, Distance, Online Learning, Engagement, Psychometrics, Transcultural Adaptation

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Introduction

Recent developments in information and communication technologies have dramatically transformed the educational landscape, fundamentally altering the delivery of learning and teaching. With the surge in online learning's popularity, there has been a corresponding rise in the enrollment of students opting for virtual courses over traditional on-campus classes (1). In light of the necessity to develop effective instructional methods that enhance the academic performance of online students, it is crucial to promote student persistence and reduce dropout rates stemming from a lack of engagement (2). Student engagement in higher education is consistently identified as a critical factor affecting student outcomes, including the likelihood of completing their studies. Lack of engagement is often associated with poor academic performance and lower retention and graduation rates at universities (3). Identifying students at risk of disengagement and potential dropout is crucial and requires a comprehensive understanding of the student engagement framework and its fundamental components (2, 4, 5). This concern is escalating due to the prevalent sentiment among students of feeling marginalized and detached within online learning environments (6). The literature underscores the significance of engagement in both online and traditional educational settings (7-9). Bergdahl and colleagues noted that engagement in technology-enhanced learning settings differs from that in conventional classrooms due to technological aspects like synchronous communication (10). Additionally, From a self-system motivational perspective, engagement is perceived as the outcome of students' interactions with their educational environment (5). Engagement is believed to adopt to changes in the learning environment and is characterized by students' enthusiastic, focused, and sustained efforts concerning a learning task (4). Recent studies suggest that there is a social dimension to engagement, which has gained considerable empirical

support. According to this motivational framework, student engagement is a multi-dimensional concept that includes behavioral, cognitive, and affective dimensions (4, 11). Recent studies also suggest the inclusion of a social dimension, supported by empirical evidence (5, 12, 13). Each dimension of student engagement is outlined as follows: Behavioral engagement encompasses students' active participation in academic endeavors, positive behavior demonstration, and refraining from disruptive behaviors (14). Previous research often measured behavioral engagement through surveys evaluating attention, attendance, concentration, task completion, adherence to rules, and other on-task behaviors (15). In online learning contexts, in addition to using surveys, engagement metrics also include digital footprints such as login frequency, post numbers, views, responses, and completed exercises (2). Cognitive engagement refers to a student's psychological commitment and focused effort toward acquiring, comprehending, and proficiently mastering knowledge, skills, or crafts (16). Beyond "psychological investment", cognitive engagement also includes strategic learning, focusing on self-regulated learning processes and deep learning techniques (5, 14). Previous research has utilized items that assess cognitive engagement through behaviors indicative of self-regulation, persistence, and a readiness to invest effort beyond basic requirements (5, 17, 18). Due to its nature as an internal psychological process, cognitive engagement may not be directly observable, necessitating self-reported measures in both traditional and online educational settings (2). Affective engagement encompasses students' favorable emotional reactions to learning activities, their peers, and academic content, as well as their enthusiasm within the learning environment and their recognition of the value of the learning process (5, 17, 19). This aspect was previously defined by indicators of students' positive emotions, including joy, pleasure, and excitement, as well as their perceived

connections with teachers and classmates (15). In virtual learning contexts, affective engagement has also been evaluated through visible displays of positive emotions (20, 21). However, similar to cognitive engagement, affective engagement often remains an internal state that may not be easily detected by others, especially as learners mature (2). Consequently, self-reporting is considered the most accurate method for assessing this type of engagement (22). Social engagement pertains to the quality of interpersonal interactions among educators, peers, and the wider school community within the context of educational activities (5, 13, 19). This construct has been measured through students' involvement in academics, their tendency to build and maintain relationships, and how well they interact with classmates and instructors (17). In the realm of online education, fostering social engagement is crucial to ensure that students feel interconnected and nurtured, thereby significantly contributing to their success within such educational frameworks (23, 24). Hoi and Le Hang (25) developed the Online Student Engagement Questionnaire (OSEQ), a 16-item self-report instrument based on a new combination of existing questionnaires in this field (5, 17, 26), considering four mentioned types of engagements (cognitive, behavioral, social and affective engagements). Their study defines behavioral engagement as students' active involvement and positive conduct in online settings, assessed via self-report survey rather than digital tracking. Also, cognitive engagement is defined as students' mental commitment to online education, evaluated through items related to perseverance and self-regulation in online education. Affective engagement refers to students' positive emotional responses to online education and is gauged through students' positive emotional responses like interest and enjoyment in online contexts. Lastly, social engagement is assessed through questions regarding students' perceived interaction quality and their eagerness to build and sustain relationships with

classmates and instructors in an online setting (25). Several validated instruments exist for assessing learner engagement within the Iranian context (27-30), but these tools primarily cater to traditional face-to-face settings. In contrast, online education research in Iran for measuring engagement often relies on questionnaires lacking documentation of their psychometric properties. Additionally, there was no tool as comprehensive as this questionnaire to assess engagement in online education contexts, encompassing behavioral, cognitive, and affective social dimensions. As a result, a significant gap persists in the availability of robust tools for evaluating learner engagement in the context of online courses in Iran. Furthermore, recognizing the critical role of learner engagement in academic success and effective learning, it becomes imperative to develop culturally appropriate instruments tailored to measure this construct in online settings. Notably, the OSEQ (25) offers a comprehensive means of evaluating learner engagement, furnishing educators with valuable insights for targeted structure. The notable advantages of this questionnaire include its applicability across various academic levels and its concise item structure. It is essential to underscore that while a tool may demonstrate validity and reliability in one cultural setting, its efficacy following translation into other languages remains uncertain, given the influence of cultural, linguistic, and geographical factors. Furthermore, the growing need for standardized questionnaires capable of cross-cultural application stems from the increasing globalization of research initiatives, marked disparities in socio-economic and cultural contexts worldwide, and researchers' aspirations to extend the generalizability of their findings beyond singular cultural boundaries.

This research was carried out to adapt the OSEQ into Persian and assess its psychometric features. The research aimed to analyze the validity and reliability of the OSEQ within the Iranian context.

Methods

Study Design and Setting

This transcultural adaptation and psychometric study was conducted from October 2022 to January 2023 across five universities in Iran (Farhangian University, Shahid Rajaei Teacher Training University, Tehran University, Mehr Alborz University, and Iran University of Science and Technology).

Participants and Sampling

The study participants comprised a diverse array of groups, consisting of two bilingual translators proficient in Persian, one native English speaker with a strong grasp of Persian during the initial stage of the study (translation phase), nine experts in educational sciences and psychology familiar with psychometric procedures for assessing face and content validities, and 350 students were selected through convenience sampling.

These students were surveyed online to complete the OSEQ; out of the 350 questionnaires received, 330 were eligible for use. The questionnaire was provided to several instructors teaching online courses at five Iranian universities, and they were asked to distribute the questionnaires to their students to complete. The sample size was deemed sufficient, as in Exploratory Factor Analysis (EFA), 10 or 20 samples are needed for each variable, but a minimum sample size of 200 is justifiable. For Confirmatory Factor Analysis (CFA), approximately 20 samples are needed for each factor (latent variable). The recommended sample size for CFA is around 200 samples for 10 factors (31). The inclusion criteria involved students who had completed a minimum of two semesters online and expressed a willingness to participate in the study, while the first-semester students were excluded due to their limited exposure to the university environment.

Tools/Instruments

Online Student Engagement Questionnaire: To assess learners' engagement in online courses, the OSEQ (25) questionnaire was

utilized, consisting of 16 self-report items that measured four types of engagement: behavioral, cognitive, affective, and social. Each item was rated on a 5-point Likert scale (1=strongly disagree, 2=disagree, 3=moderately agree, 4=agree, and 5=strongly agree), with higher scores indicating increased engagement. The Omega coefficient indicated excellent reliability for the overall engagement factor ($\omega=0.964$) and acceptable levels for cognitive ($\omega=0.610$), affective ($\omega=0.629$), and social ($\omega=0.635$) engagement, as measured by the questionnaire reliability. The reliability of the behavioral engagement factor was notably low, with a coefficient of 0.246 ($\omega=0.246$). In the first stage, the Translation and transcultural adaptation were carried out, and then the questionnaires' validity and reliability were determined.

A. Translation technique and transcultural adaptation: The questionnaire was translated into Persian using the standard forward-backward technique. The technique involved the following steps:

- Two native Persian speakers translated the English questionnaire into simplified Persian in the initial phase (forward translation).
- The translators resolved any inconsistencies found in the initial translation. Following that, a native English speaker proficient in Persian conducted a back-translation of the Persian draft into English without referring to the original English text. This back-translated version was then compared to the original English questionnaire to ensure consistency in psychological meaning between the two versions.
- All translated versions were reviewed and slightly modified during an expert review session to refine and finalize the Persian questionnaire ([Supplementary file](#)).

B. Validity and Reliability - The process of validating the questionnaire entailed evaluating its face validity, content validity, and construct validity as outlined below:

Face Validity: Quantitative face validity was assessed by calculating an impact score

for each of the 16 items using a 5-point Likert scale ranging from “strongly agree=5” to “strongly disagree=1”. The questionnaire was distributed to 37 students, and face validity was confirmed using the following item impact formula: “Importance * frequency (percentage)=impact score” (32).

Content Validity: To evaluate the qualitative content validity, we consulted a panel of nine experts in educational sciences and psychology, all with expertise in psychometrics. They provided feedback on the positioning of items, grammatical accuracy, word choice within phrases, the significance of questions, as well as the appropriate placement, and estimated completion time of the items. Additionally, quantitative measures such as the Content Validity Ratio (CVR) and the Content Validity Index (CVI) were utilized to evaluate the questionnaire content validity.

CVR: For the CVR, nine specialists in education (who possessed relevant expertise), independently evaluated each item using a 3-point scale: necessary, useful but not essential, and not necessary. Based on their assessments and applying the formula:

$$CVR = \frac{N_e - N/2}{N/2}$$

along with Lawshe’s table, items achieving a CVR higher than 0.78 (given nine experts) were kept in the questionnaire; others were removed (33).

CVI: The CVI was determined following Waltz and Basel’s content validity index (34) methodology. Each item was rated on a 4-point Likert scale from one to four in terms of relevance, clarity, and simplicity. The CVI was calculated by dividing the number of experts who rated the items as three or four by the total number of experts. Items with a CVI greater than 0.79 were included in the final questionnaire.

Construct Validity: We initially utilized EFA in SPSS version 28 to determine the factor structure and assess the questionnaire’s construct validity. Following this, CFA was conducted using LISREL 10.20, a structural

equation modeling technique. Subsequently, a first-order CFA model was developed, and the corresponding fit indices were documented.

Reliability: To assess the questionnaire’s reliability, we calculated Cronbach’s alpha and McDonald’s omega coefficients, ultimately measured the internal consistency of the instrument.

Data Collection

The study was carried out in two stages; the first stage involved translating the tool and adapting it culturally during an in-person session with translators. The second phase focused on evaluating the tool’s psychometric features, including its validity (face, content, and construct validity) and reliability. Upon confirmation of the content validity, the translated questionnaire was distributed to nine experts via email for their evaluation. Subsequently, upon receipt of the students’ details from the educational deputy, the final e-questionnaire link was dispatched to the students’ emails to validate the construct validity.

Data Analysis

The analysis of the data involved employing descriptive statistics, including the mean and standard deviation. Additionally, the statistical software SPSS Version 25 and LISREL Version 8.80 were used to examine the structural relationships within the research model, with a confidence level of 0.05 set for hypothesis testing

Ethics - Participants in this study were provided informed consent prior to their involvement, and data were collected anonymously. Each participant was assured that their information would remain confidential and the authors consistently highlighted the confidentiality of their responses during the study. All the ethical issues were approved by the research committee of Farhangian University of Tehran, Iran.

Results

Demographic Characteristics

Out of 350 distributed e-questionnaires, 330 were found to be eligible (94%). The age of the

participants ranged from 18 to 49 years, with an average age of 28.31 (SD=8.23). The group consisted of 208 males (63%) and 122 females (37%), with 129 undergraduate students (39%) and 201 graduate students (61%).

Descriptive Statistics

All scores from the questionnaire ranged from 16 to 80, with a mean score of 63.52 (SD=7.95, N=330), indicating a relatively high level of online engagement among participants. The descriptive analysis of individual questionnaire items, as shown in Table 1, revealed average item scores close to 4 on a

scale from 1 to 5. Indices for skewness and kurtosis showed values within normal limits (thresholds for concern set at greater than 3 for skewness and greater than 2 for kurtosis).

Also, in relation to face validity, the impact score of each item is reported. Besides, for the content validity, the values of CVR and CVI indicate that these two indices are acceptable (Table 1).

Face Validity: The impact scores for each item averaged 2.33, surpassing the threshold of 1.5. This supports the inclusion of all questions in the survey and confirms the face validity of the tools used (32).

Table 1: Descriptive characteristics of quantitative face validity and content validity of the questionnaire

Items	Mean±SD	Impact Score	CVR	CVI	Skewness	Kurtosis
1. I take notes when I participate in online discussions.	4.40±0.74	2.34	0.79	0.86	-1.428	2.97
2. I stay focused during online learning activities.	4.20±0.73	2.02	0.82	0.84	-0.747	0.73
3. I talk about online learning topics even when I am offline.	4.08±0.75	1.98	0.83	0.83	-0.433	-0.27
4. I complete all online learning tasks on time.	4.08±0.91	2.31	0.78	0.89	-1.040	1.01
5. I go through learning materials before I participate in online discussions.	3.94±0.85	3.04	0.82	0.85	-0.442	-0.34
6. I try to connect what I am learning online with what I learned before.	3.86±0.87	2.58	0.80	0.86	-0.521	0.05
7. I try to find extra learning resources to understand a difficult concept when learning online.	4.04±0.82	1.99	0.78	0.84	-0.604	0.03
8. I try to understand my mistakes if I get something wrong during online learning activities.	4.00±0.85	3.02	0.84	0.84	-0.589	0.18
9. I enjoy online learning activities.	3.75±0.86	2.47	0.79	0.88	-0.352	-0.05
10. I look forward to online learning activities.	3.82±0.86	2.65	0.78	0.80	-0.288	-0.34
11. I feel comfortable participating in online discussions.	3.75±0.96	1.99	0.80	0.87	-0.437	-0.10
12. I feel inspired to improve my online learning skills.	3.86±0.95	2.09	0.82	0.83	-0.512	-0.29
13. I share learning materials with other online classmates.	3.97±0.84	2.24	0.83	0.87	-0.527	-0.14
14. I build on other ideas during online discussions.	3.89±0.89	2.12	0.84	0.85	-0.490	-0.22
15. I ask teachers if I do not understand something when learning online.	3.98±0.83	2.35	0.79	0.82	-0.583	0.18
16. I respond to other classmates' questions in online discussion boards.	3.96±0.84	2.17	0.80	0.85	-0.514	-0.14
Total Mean	3.97±0.85	2.33	0.81	0.85	-0.59	-0.20

*SD: Standard Deviation

Content Validity: Referring to the Lawshe table (33), a minimum CVR of 0.78 is needed based on evaluations from nine experts. The overall CVR for all items was calculated to be 0.81, with each item surpassing this benchmark (0.78). Additionally, the mean CVI for each item and the mean CVI for the items was 0.85, which is higher than the acceptable standard of 0.79, confirming the scale content validity (Table 1).

Construct Validity: The construct validity of the questionnaire was measured using both the EFA and CFA.

Exploratory Factor Analysis

Initially, the Kaiser-Meyer-Olkin measure and Bartlett's test of Sphericity were used to assess the suitability of data for factor analysis. The Kaiser-Meyer-Olkin index was recorded at 0.756, indicating adequate sampling, while the Bartlett Sphericity Index was significant (1412.774 / 120, $P < 0.001$), verifying that the correlation matrix was distinct from an identity matrix. The analysis

included reviewing eigenvalues (greater than one), explaining variance, and a scree plot to identify the number of factors present. According to Table 2 and Figure 1, both the principal components analysis and the scree plot, respectively, supported the extraction of four factors that explained 56.749% of the total variance, validating the structure of the scale.

Following the rotation process, factor loadings for 16 items are depicted in Table 3. Accordingly, items 1, 2, 3, and 4 on factor 1 (Behavioral engagement), items 9, 10, 11, and 12 on factor 2 (Affective engagement), items 5, 6, 7, and 8 on factor 3 (Cognitive engagement), and items 13, 14, 15, and 16 on factor 4 (Social engagement) were loaded (Table 3).

Confirmatory Factor Analysis

To confirm the questionnaire's factor structure, a CFA model using LISREL was performed; the findings are depicted in Table 4.

Table 2: Indices for questionnaire factors after a Varimax rotation

Factors	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.802	23.764	23.764	3.802	23.764	23.764	2.572	16.074	16.074
2	2.153	13.458	37.222	2.153	13.458	37.222	2.349	14.679	30.753
3	1.755	10.969	48.191	1.755	10.969	48.191	2.190	13.685	44.438
4	1.369	8.558	56.749	1.369	8.558	56.749	1.970	12.311	56.749

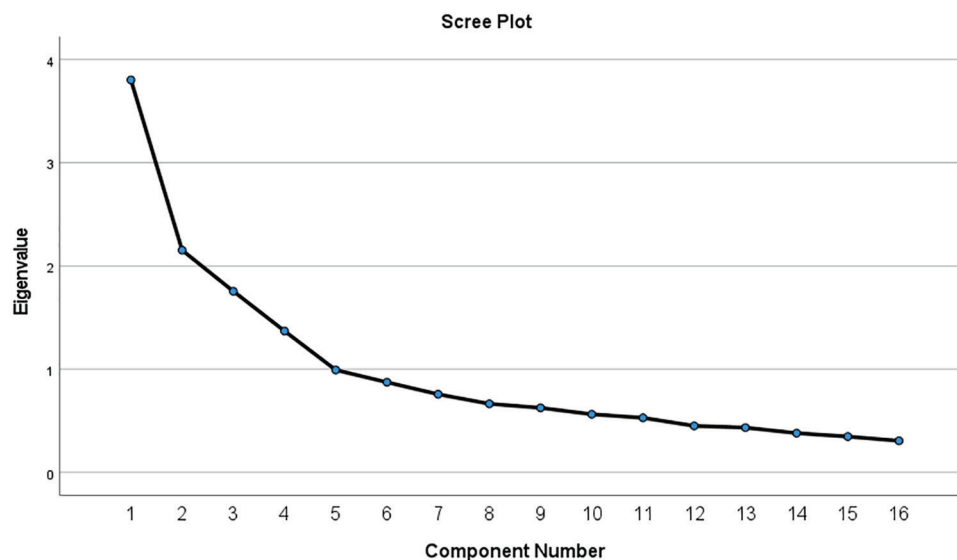


Figure 1: The scree plot of the principal component number

Table 3: Factor loadings of items in each subscale

Items	Subscales			
	Behavioral engagement	Affective engagement	Cognitive engagement	Social engagement
Q1. I take notes when I participate in online discussions.	0.720			
Q2. I stay focused during online learning activities.	0.816			
Q3. I talk about online learning topics even when I am offline.	0.767			
Q4. I complete all online learning tasks on time.	0.733			
Q9. I enjoy online learning activities.		0.828		
Q10. I look forward to online learning activities.		0.803		
Q11. I feel comfortable participating in online discussions.		0.818		
Q12. I feel inspired to improve my online learning skills.		0.514		
Q5. I go through learning materials before I participate in online discussions.			0.635	
Q6. I try to connect what I am learning online with what I learned before.			0.658	
Q7. I try to find extra learning resources to understand a difficult concept when learning online.			0.738	
Q8. I try to understand my mistakes if I get something wrong during online learning activities.			0.751	
Q13. I share learning materials with other online classmates.				0.676
Q14. I build on other ideas during online discussions.				0.731
Q15. I ask teachers if I do not understand something when learning online.				0.702
Q16. I respond to other classmates' questions in online discussion boards.				0.586

Table 4: Fit indices for the first-order factor model

Model	χ^2/df	RMR	GFI	NFI	CFI	SRMR	RMSEA
First-order factor model	228.19/98=2.33	0.044	0.92	0.90	0.93	0.046	0.064

*CFI: Comparative Fit Index, NFI: Normed Fit Index, GFI: Goodness of Fit Index, RMR: Root Mean Square Residual, SRMR: Standardized Root Mean Square Residual, RMSEA: Root Mean Square Error of Approximation

Table 4 confirms the validity of the first-order factor model. The Root Mean Square Error of Approximation (RMSEA) value stands at 0.064, which is below the threshold of 0.09. In addition, the chi-square to degrees of freedom ratio is under 3, and the indices for Goodness of Fit Index (GFI), Comparative Fit Index (CFI), and Normed Fit Index (NFI) all exceed 0.9. With Standardized Root Mean Square Residual (SRMR) and Root Mean Square Residual (RMR) values below 0.05 and 0.09, respectively, the data demonstrate a good fit, affirming the acceptability of the model. Figure 2 illustrates that the measurement parameters for the structures are correctly identified within the model outlined in Table 4, thereby verifying the model's appropriateness. The standardized values indicate the factor

loadings for each question relative to the various components, showing the extent to which each question contributes to explaining the variance of the component. Higher factor loadings enhance variance explanation; collectively, these loadings account for the total variance within each component. Figure 3 reveals that the path coefficients for the four-factor model are statistically significant ($T > 1.96$, $P < 0.01$), indicating a robust fit for the OSEQ.

Reliability

Table 5 presents data indicating that both Cronbach's alpha and McDonald's omega values range from 0.70 to 0.79. These metrics affirm that each subscale and the overall scale, maintains acceptable internal consistency, thereby verifying its reliability.

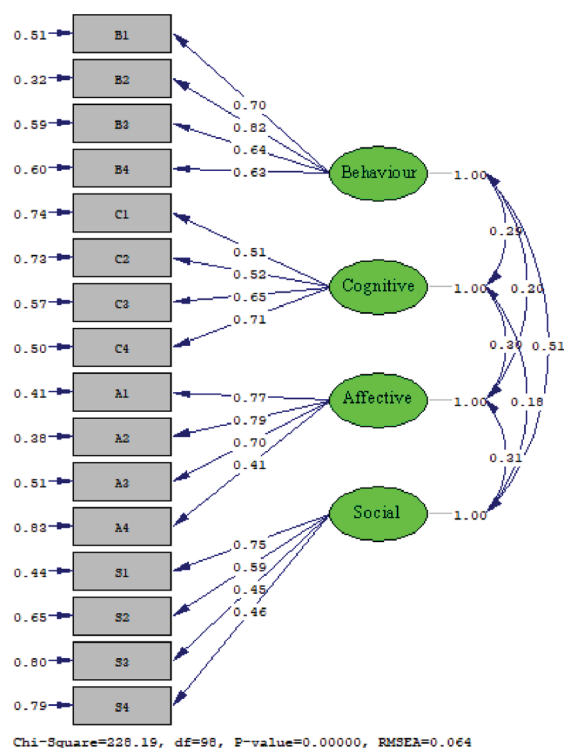


Figure 2: Fully standardized estimates for a 4-factor structure derived from a first-order CFA of the Persian version of the OSEQ.

* CFA: Confirmatory Factor Analysis; OSEQ: Online Student Engagement Questionnaire

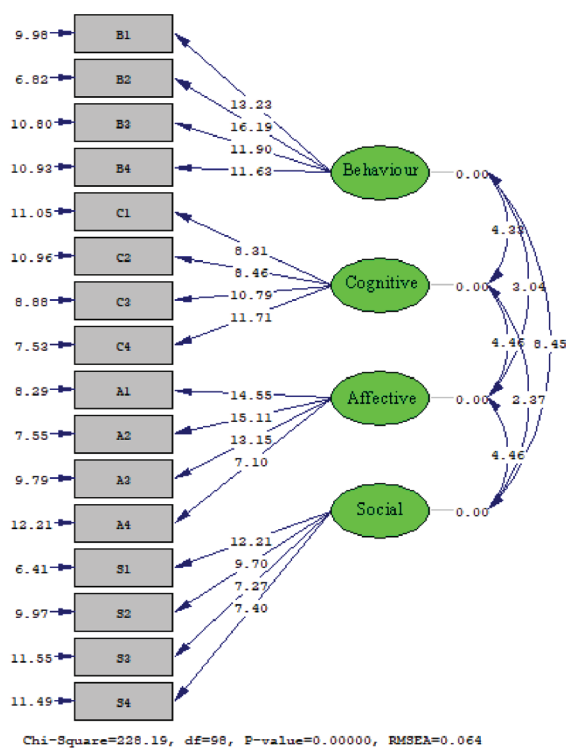


Figure 3: T-values for a four-factor structure derived from a first-order CFA of the Persian version of the OSEQ.

*CFA: Confirmatory Factor Analysis; OSEQ: Online Student Engagement Questionnaire

Table 5: Internal consistency of the OSEQ

Subscales	The number of items	Cronbach's alpha coefficient	McDonald's omega coefficient
Behavioral engagement	4	0.79	0.79
Affective engagement	4	0.75	0.76
Cognitive engagement	4	0.70	0.70
Social engagement	4	0.70	0.70
Total scale	16	0.78	0.75

* OSEQ: Online Student Engagement Questionnaire

Discussion

Assessing student engagement can pinpoint both students who are thriving and those who require additional support to excel (2). Tools designed to gauge engagement in traditional university settings may not effectively reflect the unique engagement behaviors seen in e-learning environments, where learner competencies, motivations, and navigation methods often differ significantly (35). Studies have underscored the critical role of engagement in predicting academic success in online settings (36-38). However, no validated Persian instrument for measuring online engagement comprehensively existed

before this study. The purpose of this study was to evaluate the psychometric characteristics of the OSEQ. The reason for choosing this questionnaire was primarily due to its novelty. Besides, it is a combination of several relevant questionnaires in this field. This comprehensive tool considers various dimensions of engagement including behavioral, cognitive, affective, and social dimensions, having a high power as a valid tool for assessing learner engagement in online education (5, 17, 25, 26). The process of transcultural adaptation and validation of the questionnaire included several critical stages: translation, back-translation, review by an

expert panel, and pilot testing, which ensured the cultural and linguistic equivalence of the questionnaire.

Face Validity: To ensure face validity, feedback concerning the items' simplicity, fluency, and relevance to the research problem was gathered from the sample population. The impact scores for all items ranged between 1.98 and 3.04, with an average score of 3.12, surpassing the minimum required score (1.5) for face validity (32). This result aligns with prior research utilizing the same tool to assess face validity across various contexts and demographics (5). Consequently, this finding suggests that participants deemed the questionnaire items relevant and appropriate for gauging their online engagement, indicating a robust level of face validity, which reflects how comprehensively the items encompass the concept being measured.

Content Validity: The findings showed that the CVR value for each questionnaire item and the average CVR (0.81) exceeded the minimum acceptable threshold (0.78), according to the Lawshe table (33). Additionally, the CVI for each item and the average CVI reached (0.85), surpassing the minimum acceptable threshold (0.79) based on the Waltz and Basel index (34). Thus, these outcomes affirm the questionnaire's content validity. These findings indicate that the questionnaire has satisfactory content validity for assessing online student engagement. These findings suggest that the questionnaire adequately captures the domain of online student engagement, which encompasses social, cognitive, affective, and behavioral engagement. This implies that the questionnaire is characterized by high relevance, clarity, and simplicity for assessing this construct. These results are aligned with prior studies that have utilized or adapted the questionnaire in different settings and among different populations (25).

Construct Validity and Reliability: In the process of performing EFA, four distinct factors were revealed: Behavioral engagement, Affective engagement, Cognitive engagement, and Social engagement. These

factors collectively explained 56.749% of the total variance. Furthermore, CFA supported a first-order factor structure with robust fit indices, confirming that the questionnaire is valid for assessing various dimensions of online student engagement. This indicates that items of the questionnaire measure the four distinct dimensions of online student engagement, including social engagement, cognitive engagement, affective engagement, and behavioral engagement, as described by the theoretical framework of engagement, thereby affirming the construct validity of its Persian adaptation, as it yielded a similar factor structure to the original instrument. Such consistency aligns with previous studies that utilized the same questionnaire to gauge online student engagement across diverse settings and demographics (5, 17, 25, 26). For instance, Hoi and Hang (25) used the questionnaire on 363 undergraduate students enrolled in an online English as a foreign language program at a large multidisciplinary university in Ho Chi Minh City, Vietnam. Their findings revealed that the questionnaire exhibited a four-factor structure with strong reliability and validity.

Reliability: The complete scale and each of the four subscales (cognitive, behavioral, social, and affective engagements) had Cronbach's alpha and McDonald's omega coefficients exceeding 0.70. This demonstrated acceptable internal consistency and further supported its psychometric robustness. High alpha Cronbach and McDonald's omega coefficients (above 0.7) indicated that the items on a scale consistently measured the intended construct, thereby enhancing the validity of research findings (39). This result aligns with prior studies that utilized the same questionnaire to assess online student engagement across various contexts and populations (25, 26). For instance, Hoi and Hang's study results (25) showed that reliability of the questionnaire by Omega coefficient indicated excellent reliability for the overall engagement factor ($\omega=0.964$) and acceptable levels for cognitive ($\omega=0.610$), affective ($\omega=0.629$), and social engagement ($\omega=0.635$). However, the

reliability for the behavioral engagement factor was notably low ($\omega=0.246$), indicating that the questionnaire items were not sufficiently reliable to accurately measure the unique aspects of behavioral engagement beyond what was already accounted for by the overall engagement factor. The current study findings suggest that the questionnaire consistently produces reliable scores when measuring online student engagement, indicating that its items are clear, straightforward, and pertinent.

The current study contributed to ongoing studies into measuring online student engagement by validating the psychometric properties of the OSEQ within a Persian context. It also supports the extensive evidence regarding the reliability and validity of engagement data across various global, socio-economic, and cultural settings.

Compared to other engagement measures designed for virtual learning environments (6, 17, 40), the current studied questionnaire offers a more nuanced understanding of online learner behavior. It captures specific dimensions of engagement, such as social interaction within the online environment and self-directed learning strategies, which might be overlooked by generic instruments. Also, the studied questionnaire's strength lies in its comprehensive approach. It encompasses various engagement aspects (social, cognitive, affective, and behavioral) within a single framework, providing educators with a holistic view of student online learning experiences (25). For instance, the Online Student Engagement Scale (OSE) developed by Dixson (6), comprises 19 items on a 5-point Likert scale that assesses the extent to which individuals perceive their thoughts, behaviors, and feelings as representative of themselves or their conduct. The OSE fails to differentiate among various forms of engagement and instead focuses solely on a single factor. Similarly, Roblyer and Wiencke's (41) Rubric for Assessing Interactive Qualities of Distance Courses (RAIQDC) represents another established measurement tool. The RAIQDC assesses interaction levels by inquiring about

students' observations of their peers' actions. However, as a significant portion of student behavior remains unobservable in the virtual learning setting, particularly their emotional reactions, the RAIQDC may not be deemed suitable. The research findings have several implications for both research and practice in the Persian-speaking educational context. Researchers can now confidently use this tool to measure student engagement in online settings to screen for students who may be struggling with online engagement. Low scores on specific subscales (e.g., social engagement, cognitive engagement) can indicate areas where students need additional support, ultimately improving educational outcomes. Also, based on the results of the online engagement questionnaire, educators can implement targeted interventions to promote online engagement. For instance, activities fostering social interaction within the online platform can be designed for students scoring low in social engagement. Additionally, the questionnaire results can be used by administrators to assess the overall effectiveness of online learning programs. By tracking student engagement trends over time, administrators can identify areas for improvement and make data-driven decisions about online course design and delivery.

Limitations and Suggestions

Several limitations must be considered when interpreting this study's findings. Firstly, data collection was based on self-report, which can introduce bias as individuals may provide inaccurate or biased information about themselves (42). Future studies could employ mixed methods (surveys and interviews) to explore potential biases. Secondly, the study lacked additional tools to assess concurrent validity. Thirdly, the findings of this research may not readily be generalized to other population groups as a result of employing convenience sampling. Finally, the translation of the tool into the local language may have introduced errors or discrepancies that could affect the validity of the results.

Conclusion

This investigation provides strong evidence regarding the psychometric properties of the OSEQ using a sample from Iranian universities, an area previously unexplored. The analysis identified a 4-factor structure—cognitive, behavioral, social, and affective engagements—with satisfactory fit indices and reliability scores. The findings significantly enhance the existing body of knowledge on online engagement metrics by affirming the reliability and validity of the OSEQ tool for utilization within Iranian online learning contexts.

Abbreviations

OSE: Online Student Engagement Scale

OSEQ: Online Student Engagement Questionnaire

CVI: Content Validity Index

CVR: Content Validity Ratio

EFA: Exploratory Factor Analysis

CFA: Confirmatory Factor Analysis

RAIQDC: Assessing Interactive Qualities of Distance Courses

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Authors' Contribution

A.T. was responsible for designing the study, overseeing data gathering and analysis, and supervising the coordination of the project. S.s.M. was involved in data gathering and contributed to the initial concept of the study. S.H.N. drafted the manuscript and assisted in all the steps above. All authors reviewed and approved the final version of the manuscript.

Conflict of Interest

None declared.

Ethical Considerations

This study was approved by the research committee of Farhangian University of Tehran, Iran with code No. 52400/224. All

participants volunteered to take part in this study, and their information was handled anonymously. All participants were provided informed consent prior to their involvement in the study and were assured that their data would remain confidential.

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Availability of Data and Materials

The data that support the findings of this study are available in the [supplementary file](#) and from the corresponding author upon reasonable request.

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