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Validation and Evaluation of Online an Self-Regulation Questionnaire for Students Using Online Native Learning Management Systems

Leili Mosalanejad [1], Mohsen Keshavarz [2*], Sajad Ghanateyan [3], Sara Maghsodzadeh [4]

[1] Medical Education Department, Jahrom University of Medical Sciences, Jahrom, Iran
[2] Department of E-Learning in Medical Sciences, School of Paramedical Sciences, Torbat Heydariyeh University of Medical Sciences, Torbat Heydariyeh, Iran
[3] Jahrom University of Medical Sciences, Jahrom, Iran
[4] Research Center for Neuromodulation and pain, Shiraz, Iran

*** Corresponding author email: Keshavarzm1@thums.ac.ir**
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Abstract

Self-regulated learning is an active and self-directed process in which the learner systematically directs, evaluates, and monitors their cognitive, environmental, motivational, and behavioral factors to achieve their learning goals by using specific strategies. This aimed conducted to validate and evaluate an online self-regulation questionnaire in students using online native learning management systems at Jahrom University of Medical Sciences. It was a cross-sectional descriptive study conducted among students at Jahrom University of Medical Sciences in the academic year of 2019-2020. The research tool used was a short online self-administered learning questionnaire (OSLQ), and 200 students were selected using consensus sampling in three fields. The validity of the questionnaire including translation, content, convergent, and construct validity (exploratory and confirmatory factor analysis), was assessed. The stability and internal consistency of the questionnaire were evaluated using Cronbach's alpha coefficients, and statistical analyses were performed with IBM SPSS 21. During the exploratory analysis of the questionnaire, five areas were identified: goals, time management, self-evaluation, environment structure, and support. The high correlation coefficient of components in the learning self-regulation questionnaire was confirmed with the aligned questionnaire. Confirmatory factor analysis confirmed the five domains and their items. The reliability of the questionnaire showed acceptable values for internal consistency. Overall, this research confirmed the internal consistency, validity, and reliability of a short form of an online learning self-regulation questionnaire, providing a standardized tool to measure self-regulation of learning in students. This questionnaire can be utilized in Iranian research.

Keywords: self-regulation, online learning, Active learning, reflection, medical education

Introduction

Electronic learning has gradually become more vital for universities and has potentially become one of the most important developments and applications of information technology (IT) (1-3). Popular web applications can be a potential new way to engage instructors and students in meaningful learning activities and further increase interaction between participants (4-6). Using various tools such as recorded and online media and video, in addition to eliminating the limitations caused by class size, available time, and limited facilities, provides an opportunity for students and professors to participate together in developing research and creative activities (7-10). This method can improve the level of motivation and study skills in users (11).

Facilitating learning in course materials and providing opportunities is important (12). Additionally, designing content in various methods of virtual learning, considering individual differences and diverse approaches, enhances the self-confidence of beginners with limited teaching experience (13). In comparison to traditional education, this method can offer a more engaging and stimulating environment for acquiring knowledge. Therefore, it is recognized as an effective approach in fostering motivation and heightening interest in learning, which is crucial factor in enhancing the learning performance of students with varying levels of experience (14-16).

Different methods of electronic education can create an environment where learners take on a more active role, participate in building their knowledge through self-regulation, and thus enhance meaningful learning (17). The importance of self-regulation in electronic education requires a clear definition and examination. Self-regulated learning (SRL) is a dynamic, constructive process in which learners independently acquire knowledge through intellectual, behavioral, and cognitive engagement. Without relying on teachers or external guidance, learners take the initiative, set goals, and, while considering environmental factors, assess and regulate their cognitive, motivational, and behavioral processes. Self-regulation combines habitual and reflective actions, social interactions, and formal learning settings, allowing learners to effectively manage their educational journey. This process is essential for promoting autonomy and flexibility in electronic education. (18). Self-regulated learning strategies are essential as they optimize mental resources, reducing cognitive strain. This enables students to focuse more on higher-order tasks, such as problem-solving and mastering complex content, ultimately improving their academic performance and depth of comprehension.

(19). Based on definitions of self-regulation, learning strategies of self-regulation, interact with participation in metacognitive processes (thinking about thinking) so that, individuals can understand their mental processes (18, 20). Self-regulation is one of the most important components of electronic and online learning. Self-regulation strategies include activities such as reading sources, reviewing new content, and participating in online discussions in this field (21, 13). Self-regulation is the human ability to control the process of thought and action to achieve different educational goals (22). Self-regulation requires students to use meta-cognitive, meta-motivational, and meta-emotional strategies to change their behavior toward goals. In this sense, metacognition as the most effective and important component can be defined as a complex structure that includes students' cognitive knowledge and cognitive regulation (23). By monitoring the process of thinking, recognizing and evaluating goals and cognitive maps, metacognitive capacities can be achieved, and this important aspect will be realized and transformed with the growth and development of self-regulation of learning (24). One of the most important features of virtual education is providing feedback and its impact on learning and progress. Through the collaborative and interactive environment, methods and

approaches used in teaching and learning can affect rethinking and reviewing of individual performance, motivation, and internal control, and facilitate self-regulation. Self-regulation is one of the processes that has been considered in electronic education and its importance is such that it is one of the important indicators of learners in this form of learning (25-27).

According to psychologists, all behaviors originate from learning, implying that a sequence of simpler learning processes culminates in more complex learning. Furthermore, humans must adapt to environmental changes through learning, as their living conditions are constantly evolving (28). In recent decades, the significance of self-regulation strategies in learning has gained increasing attention. The self-regulation approach is a multifaceted process that fosters changes in learners' skills, self-regulation, strategic knowledge, abilities, and motivation (29). Self-regulation focuses on the individual's role in the learning process. This concept was initially introduced by Bandura in 1967. Later, in 1986, Zimmerman, a prominent theorist in social-cognitive theory, proposed self-regulation strategies, emphasizing that students transition from relying on teachers, parents, or external factors to independently initiating and directing their efforts to acquire skills and knowledge (30). In other words, self-regulated learning involves the learner's active participation in behavioral, motivational, cognitive, and metacognitive aspects of the learning process to enhance its effectiveness (31).

Bandura defines self-regulation as the psychological efforts exerted to control internal states, processes, and functions to achieve higher goals (32). Self-regulated learning not only improves students' academic performance but also empowers them to actively manage processes such as goal setting, self-monitoring, self-evaluation, and self-motivation. Students who employ self-regulatory strategies—such as striving for success, embracing challenges, utilizing appropriate learning strategies, setting specific goals, and demonstrating high self-efficacy—achieve significant academic progress. Conversely, students who use these strategies less frequently tend to engage in superficial, repetitive learning, akin to rote memorization (33, 34). This research was conducted to validate and evaluate an online self-regulation questionnaire in students using native learning management systems online at Jahrom University of Medical Sciences.

Methods

Study design

The current research is a cross-sectional descriptive study conducted in the academic year of 2019-2020 among students at Jahrom University of Medical Sciences. A total of 200 students were selected to participate in this study using a convenience sampling method. The sample included students from three groups: Medicine, Laboratory Science, and Health, all of whom were users of the Navid Learning Management System (LMS). The inclusion criteria for this study included all students from the three groups who used the LMS and were willing to participate. The exclusion criteria consisted of incomplete questionnaires. This methodology ensured a diverse representation of students actively engaged with the Navid LMS, allowing for a comprehensive examination of their insights and experiences.

Ethical Considerations

The students participated in the study willingly, at the request of the research implementers, driven solely by their personal interest. There was no pressure on them to complete the questionnaire. It was explained to these students that the study results would be used for research purposes, and all information would be published anonymously.

This research was approved by the Ethical Committee at Jahrom University of Medical Sciences with code number IR.JUMS.REC.1399.094.

Questionnaires

To validate the convergence of the questionnaire, two self-directed and self-regulated learning readiness questionnaires were utilized. The self-management questionnaire used in this research is Gaglimino's self-management readiness scale (1978). This scale is a self-report questionnaire with Likert-type items ranging from rarely (1) to always (5), which includes three areas: self-management (1-16), desire to learn (17-26) and self-control (27-41). The internal correlation of questions was 0.95 and the reliability of the test was calculated as 0.68. Grades for each field were calculated out of 100 and grading was done as follows: scores less than 33.3 were considered low, scores between 33.3 and 66.7 were considered medium, and scores higher than that were considered high. Cronbach's alpha coefficient was calculated as follows: for self-management subscales 0.81, desire to learn 0.78, and self-control 0.84. This questionnaire was evaluated by Nadi and Sajjadian in 2013 on 1135 medical and dental students, confirming its validity and reliability. The maximum score obtained in this tool is 205 and the minimum score is 41 (35). Another questionnaire used in this study was Bouffard's (1995) self-regulation questionnaire, which contains 14 questions. This questionnaire examines and evaluates the level of self-regulation in people. The scoring system utilized was a Likert scale, ranging from "completely agree" (score of 5) to "completely disagree" (score of 1). It is important to note that questions 5, 13, and 14 were scored in reverse order, the minimum score will be 14 and the maximum score will be 70. Scores between 14 and 28 indicate low self-regulation, scores between 28 and 42 indicate moderate self-regulation, and scores higher than 42 indicate a high level of self-regulation. For construct validity of Boufard's self-regulation questionnaire, the results of factor analysis showed that the correlation coefficient between questions was appropriate and the measurement tool consisted of two factors. The value load related to factors was acceptable (36). A short online self-regulation questionnaire was one of the main questionnaires examined for validity and reliability. The online self-regulated learning questionnaire (OSLQ) is a 24-question scale with a scoring method using a 5-point Likert scale ranging from completely agree (5) to completely disagree (1). The OSLQ was constructed from 86 items and then examined for internal consistency and the results of exploratory factor analysis for collected data. Higher scores on this scale indicated better self-regulation in online learning by students. The OSLQ consists of six subscale constructs: environment structure, goal setting, time management, search assistance, work strategies, and self-evaluation. Scores obtained from this measurement showed sufficient internal consistency with $\alpha = 0.90$. The internal consistency of subscales for Cronbach's alpha ranged from 0.67 to 0.90, demonstrating reliability at the subscale level. (37, 38).

The statistical analysis conducted in this study ranged from descriptive statistics to assess the level of validity and reliability. Descriptive statistics were used to summarize and describe the characteristics of the sample data, providing insights into the distribution and central tendencies. This approach facilitated the evaluation of the data's validity and reliability, ensuring that the findings accurately reflect the participants' experiences and perspectives.

Validation of questionnaire (Validity and reliability)

The questionnaire was initially translated to ensure content validity. Following the translation process, face validity was assessed by 5 students and 10 educational experts specializing in E-learning, medical education, and educational management. Four sentences with grammatical errors were identified and correct. Additionally, the content validity of the questionnaire was reassessed, using the Content Validity Index (CVI) method, incorporating feedback from 10 educational experts (39, 40). Experts were asked to determine the level of relevance of each item in three key: relevance, simplicity, and clarity, using a four-part spectrum. At the end of this

phase, we calculated the proportion of experts who selected options 3 and 4. This was done by dividing the number of experts who chose these options by the total number of experts surveyed. This calculation provided a clear understanding of the consensus among the experts regarding the evaluated options. If the resulting value was less than 0.70, the item was rejected. If it fell between 0.70 and 0.79, it was reviewed, and if it was above 0.79, it was deemed acceptable. Upon reviewing the opinions of 10 experts, it was found that, except for three questions, the remaining questions had an agreement score of over 85%. Two questions had a lower simplicity index score, but after amendments, they were ultimately confirmed with an agreement of over 0.80. In the reliability check, the internal correlation of the questionnaire was used. In checking the internal consistency of the final questionnaire, the questionnaire had good reliability with Cronbach's alpha of 0.76. Initially, exploratory factor analysis was conducted, followed by confirmatory factor analysis. The final step involved assessing the reliability of the questionnaire. This was done by examining the general correlation between questions and using the retest method. The questionnaire was administered to 200 LMS users, with 5 to 10 participants considered for each item.

Statistical analysis

In the inferential statistics section, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were utilized to assess construct validity. Pearson's correlation coefficient was then employed to examine the relationships between research variables. The significance level for the questionnaire was set at 0.05. Total Cronbach's alpha was calculated to evaluate the reliability of the questionnaire on terms of internal consistency. Additionally Pearson's correlation test was conducted to assess concurrent validity. The statistical analysis included descriptive statistics such as mean, standard deviation, frequency, and percentage.

Results

The results of descriptive statistics are shown in Table 1. The domains of goals, environmental structure, and time management scored above average compared to other areas.

Exploratory Factor Analysis (EFA) can be defined as a systematic and straightforward method for categorizing scales and variables that are internally related. EFA is utilized to identify the underlying factor structure within a set of observed variables, such as questionnaire items, without making any prior assumptions about the data. Additionally, EFA serves to reduce a large number of variables into a smaller number of factors, allowing these factors to explain the covariance among the variables. This reduction happens because the factors share a common source of variance, simplifying the complexity of the data while retaining essential information.

Factor extraction criteria

It is necessary to explain how many factors can be extracted from a set of observable variables

(Questionnaire questions). Four methods have been proposed to answer this question:

A) Kaiser-Meyer-Olkin and Bartlett's test state that factors with an eigenvalue higher than 1 will be considered common factors.

B) In the Scree plot diagram: In this diagram, the point where the axis (X) becomes parallel to the x-axis is considered a suitable place to remove factors below it, creating balance.

C) Predicted variance: This method involves starting with a default assumption that any factor explaining less than 5 or 10% of material variance is not considered. Additionally, choosing the number of factors that predict about 70 to 80 percent of the variance in variables is a criterion for selecting the number of factors.

D) Interpretable criteria of factors: This method involves categorizing factors by considering the following points:

Table 1. Descriptive statistics of mean areas in participants (200 people)

Areas	Mean	Standard deviation	Minimum	Maximum
Objectives (5 questions)	17.38	4.19	5.00	25.00
Structure of environment (4 questions)	14.43	3.37	4.00	20.00
Homework strategy (4 questions)	13.64	3.56	4.00	20.00
Time management (4 questions)	14.30	3.41	4.00	20.00
Getting support (4 questions)	14.10	3.37	4.00	20.00
Self-assessment	10.58	2.79	3.00	15.00
Total score	84.41	17.56	24.00	120.00

Table 2. Results of KMO and Bartlett's test

KMO test	Bartlett's test statistic	Df	Significance level
0.925	2655.787	276	0.000

I) Presence of at least three significant factors greater than 0.3 in each factor 2) Items that load on a factor have common conceptual meanings.

Constructs and Factor Loadings

In exploratory factor analysis (EFA), variables that load on different factors indicate measuring distinct constructs. Each factor represents a unique underlying dimension, and the association of variables with specific factors suggests that they capture different theoretical concepts. This distinction is essential for accurately interpreting the results of EFA, as it highlights the multifaceted nature of the data and ensures that each construct is appropriately represented in the analysis.

After translating the 24-question questionnaire, we conducted exploratory factor analysis (EFA) to group related variables. The questionnaire used a 5-point Likert scale. Following the assessment of face and content validity by experts and professors, it was distributed among 200 students, and data were collected.

To analyze the existing items, we used the principal component analysis method with vertical rotation using the varimax technique. The Kaiser-Meyer-Olkin (KMO) index was calculated at 0.925, indicating a high level of sampling adequacy. The KMO value ranges from 0 to 1, with values of 0.5 or higher considered suitable for factor analysis.

Additionally, Bartlett's test of sphericity was significant ($p = 0.000$), further confirming the appropriateness of the correlation matrix for conducting factor analysis on the data.

An exploratory factor analysis was conducted on the research questionnaire using vertical rotation, resulting in the identification of 5 main factors e, that align with pebble diagram generated by the software. Table 3 displays the eigenvalues and variance explained by each factor.

The first factor has an eigenvalue of 8.50, approximately explaining 28.34% of the total variance across all questions. With 7 eigenvalues exceeding one, a total of seven main factors were identified, collectively explaining 67.8% of the variance.

After applying Varimax rotation to identify the questions comprising each factor, the percentage of variance explained by each factor

Table 3. Explained variance based on exploratory factor analysis

Factor	Initial eigenvalues			The sum of square powers in extracted factor loads			The sum of squared factor loadings after varimax rotation		
	special value	Percentage of explained variance	Cumulative variance percentage	special value	Percentage of explained variance	Cumulative variance percentage	special value	Percentage of explained variance	Cumulative variance percentage
1	11.32	47.18	47.18	11.32	47.18	47.18	4.10	17.10	17.10
2	1.46	6.10	53.25	1.46	6.10	53.28	3.77	15.73	32.83
3	1.31	5.48	58.77	1.31	5.48	58.77	3.60	15.03	47.87
4	1.111	4.62	63.40	1.11	4.62	63.40	2.62	10.49	58.82
5	1.07	4.48	67.89	1.07	4.48	67.89	2.17	9.06	67.89
6	0.93	3.89	710.78						
7	0.72	3.02	74.80						
8	0.68	2.84	77.65						
9	0.63	2.65	80.30						
10	0.58	2.42	82.73						
11	0.50	2.08	84.81						
12	0.46	1.93	86.74						
13	0.44	1.85	88.59						
14	0.39	1.65	90.24						
15	0.357	1.48	91.73						
16	0.321	1.33	93.07						
17	0.31	1.30	94.37						
18	0.26	1.11	95.49						
19	0.238	0.99	96.48						
20	0.21	0.88	97.36						
21	0.18	0.75	98.12						
22	0.17	0.71	98.83						
23	0.15	0.65	99.48						
24	0.12	0.51	100.00						

in details in Table 3: the first factor accounts for 17%, the second factor for 32%, the third factor for 47%, the fourth factor for 58%, and the fifth factor for 67%of the total variance. Table 3 presents all 5 extracted factors, along with the variance explained by each factor and the factor loading for each items (see Figure 2).

In the exploratory analysis of the questionnaire, five areas were identified. These five areas included goals, time management, self-evaluation, environment structure, and support (Table 5).

Confirmatory factor analysis

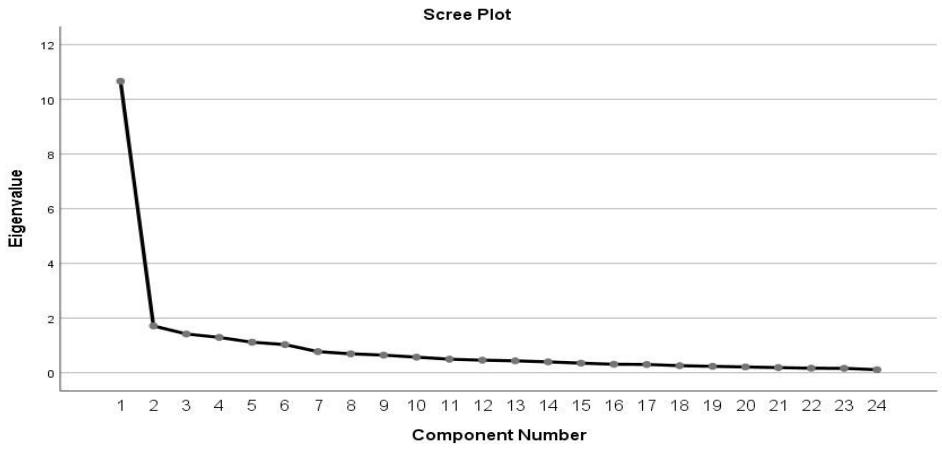

Figure 2. Factor extracted from questionnaire

Table 4. Extracted factor loadings of components after Varimax rotation, allowing for a comparison between them

Component matrix					
	Components				
Questions	**Goals**	**Time management**	**Self-evaluation**	**Environment structure**	**Support**
3	0.78	0.54	0.25	0.18	0.14
14	0.65	0.75	0.21	0.26	0.22
13	0.63	0.73	0.192	-0.13	0.27
1	0.72	0.29	0.29	-0.23	0.45
2	0.720	-0.22	0.18	0.39	0.49
4	0.701	0.25	0.15	0.67	-0.21
21	0.377	0.124	0.53	-0.322	-0.11
7	0.61	0.57	0.14	0.23	0.78
20	0.45	0.34	0.38	0.64	-0.17
11	0.414	-0.10	0.58	0.21	0.11
12	0.64	-0.20	0.32	-0.11	0.21
19	0.43	-0.17	0.53	0.68	-0.12
15	0.43	0.62	0.42	-0.397	0.27
6	0.31	0.25	0.61	0.12	0.73
10	0.60	-0.17	-0.12	-0.16	0.32
8	0.43	-0.37	0.49	0.58	0.64
23	0.38	0.41	-0.27	0.32	0.27
17	0.36	0.39	0.50	-0.277	-0.32
5	0.56	0.18	0.247	0.18	0.26
9	0.35	0.24	0.50	-0.37	0.15
16	0.33	0.56	-0.18	0.53	0.26
22	0.13	0.50	-0.36	0.74	0.27
24	-0.30	0.34	0.34	-0.17	-0.26
18	0.25	-0.18	0.55	0.31	0.18

Table 5. Confirmatory factor analysis: Correlation of items with total score on the test

questions	Correlation with the whole test
1	0.70
2	0.62
3	0.75
4	0.74
5	0.67
6	0.62
7	0.60
8	0.72
9	0.55
10	0.68
11	0.62
12	0.63
13	0.70
14	0.75
15	0.68
16	0.69
17	0.68
18	0.64
19	0.64
20	0.62
21	0.65
22	0.62
23	0.62
24	0.72

Table 6. Correlation coefficients of components in learning self-regulation questionnaire with Fisher's self-directed learning questionnaire and self-regulation questionnaire

Components	Self-management questionnaire	Self-administered questionnaire
Factor 1	0.59	0.63
Factor 2	0.42	0.47
Factor 3	0.63	0.56
Factor 4	0.67	0.69
Factor 5	0.47	0.57

The analysis revealed that every item in the questionnaire exhibited a correlation of 0.50 with the overall score. As shown in Table 4, the factor loading value of all questions was calculated to be more than 0.4, indicating that the questions are well loaded on underlying variables. There is no need to change or remove any question from the questionnaire.

Concurrent Validity

Concurrent validity is determined by calculating the correlation coefficient between scores obtained from two instruments. The validity index of the desired test is determined by this coefficient, with a larger coefficient indicating a more valid instrument. In order to achieve the fourth specific goal of research and assess validity simultaneous, Fisher's self-directed learning questionnaire and self-regulation questionnaire were utilized. When the results of both tests are similar, the researcher has the option to replace one test with the other. Therefore, determining concurrent validity between two tests aims to facilitate this substitution. This substitution is beneficial when there is a high correlation between the scores of both tests and the new test has offers significant advantages over the old test.

The results of this research indicate a high correlation between the components in the self-regulated learning questionnaire and Fisher's self-directed assessment questionnaire, as well as Carey and Neal's self-regulated questionnaire. This confirms the validity of two both questionnaires simultaneously (39, 40).

Reliability of questionnaires

In order to assess the reliability of the questionnaire, we analyzed its internal correlation. The final questionnaire demonstrated good reliability, as evidenced by a Cronbach's alpha score of 0.76.

Discussion

In light of the COVID-19 pandemic and the shift to online classes, this study aimed to validate the Persian version of the short-form online learning self-regulation questionnaire among students at Jahrom University of Medical Sciences. Self-regulation is a key factor in the learning process, as students with these skills can effectively manage their learning (9). Research has shown that students with high self-regulation make better academic progress and are more motivated to continue their studies (41). Enhancing students' self- regulation skills can improve their efficiency and effectiveness in the learning environment, benefiting educators and other stakeholders in education. By guiding students with detailed planning in educational, physical, mental, and psychological aspects, academic success can be maximized. This study evaluated the content validity, construct validity, reliability, and concurrent validity of the Persian version of the short online self-regulation questionnaire (OSLQ) (38, 37). Through EFA analysis with vertical rotation, five main factors were identified, aligning with the software's pebble diagram. The results indicated good internal stability of the factors. The questionnaire identified five key areas: goals, time management, self-evaluation, environmental structure, and support. Concurrent validity assessment confirmed strong alignment between the Persian online learning self-regulation questionnaire and its five domains. Previous studies by Reyna (2019) and Kocdar (42) identified six factors related to self-regulated learning including goal setting, environment structure, time management, planning, help from people, and help from the Internet (41). These six factors overlapped with the findings of this study, expect for self-evaluation. While some studies downplayed the importance of self-evaluation in online learning (43), others emphasized its significant for student success (44, 45).

Studies by Pichardo (46) and Jansen et al. (47) introduced different areas of self-regulation, with varying degrees of overlap with the present study. Notably, Johnsen et al.'s emphasis on time management aligned with the current research. Vilkova et al. (48) found that seeking help in the online environment was less effective, but confirmed the importance of environmental structure, goal setting, time management, task strategies, and self-evaluation (48). Translation studies of the OSLQ into Turkish (49) also confirmed all domains of the original questionnaire, supporting its utility in measuring learners'self-regulation skills in online education.

The consistency between these studies and our findings underscores the robustness of the domains in online self-regulation questionnaires.

Limitations and suggestions

It is recommended that future studies include additional related items to the current research factors to further enhance the psychometric quality of this tool. Employing observations and interviews can supplement the data collected through this tool, leading to a more comprehensive understanding of self-regulation among students in online learning environments. Furthermore, it is advised that this tool be utilized in future studies to evaluate the level of self-regulation in students based on variables such as age, gender, field of study, and academic level.

One of the the limitations of the present study is the restriction of research samples to students of Jahrom University of Medical Sciences. Therefore, it is proposed that in future research, the research sample should be drawn from students in other universities. This would result in higher external validity of the results and allow for comparisons to be made between the self-regulation of students in other universities of medical sciences universities in the country.

Conclusion

This study confirmed the internal consistency, validity, and reliability of a short-form online learning self-regulation questionnaire, providing a standardized tool to measure students' self-regulation in learning. The questionnaire is suitable for use in Iranian research contexts, offering a practical and efficient instrument for assessing self-regulated learning behaviors. Its brevity and reliability make it a valuable resource for researchers and educators aiming to evaluate and enhance self-regulation strategies in academic settings.

Statement of Ethics

All ethical considerations were taken into account in this study. This research was approved by the ethical committee of Jahrom University of Medical Sciences (IR.JUMS.REC.1399.094).

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Conflict of interest

There are no potential conflicts of interest to declare.

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