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Validation of a Tool for Measuring Second Language Learning Self-regulation Strategies

Nasrin Shokrpour[1], Rita Rezaee[2]*, Zahra Saffari[3], Sedigheh Mokhtarpour[4]

1. English Department, School of Paramedical Sciences, Shiraz University of Medical Sciences, Shiraz, Iran. Clinical Education Research Center, Shiraz University of Medical Sciences, Shiraz, Iran.
2. Clinical Education Research Center, Shiraz University of Medical Sciences, Shiraz, Iran (Corresponding author)
3. Clinical Education Research Center, Medical Education Department, Shiraz University of Medical Sciences, Shiraz, Iran
4. Clinical Education Research Center, Medical Education Department, Shiraz University of Medical Sciences, Shiraz, Iran

Abstract

Introduction: This study aimed to validate the tool for measuring self-regulatory strategies in learning a second language using the attitudes of the medical students at Shiraz University of Medical Sciences.

Methods: This is a descriptive-analytical study that examined the psychometrics of the Second Language Learning Self-Regulation Strategies Questionnaire (SRFLLSQ). 252 medical students studying in 2019-2020 participated in this study, using the Cochran's formula. The SRFLLSQ consists of 34 questions at 6 dimensions To determine the validity of the questionnaire in this study, we used exploratory factor analysis, confirmatory factor analysis, and construct validity; as to the reliability or trustworthiness of the questionnaire, Cronbach's alpha was used.

Results: The results showed that the value of all 34 out of the total of preliminary questions, except item 23, were higher than 0.5. Also, the values of factor load in the second-order factor analysis were also desirable, and the value of t corresponding to each factor load was more than its critical value (2.58), which was significant. (P=0.001). The value of composite reliability was 0.957, indicating the high internal consistency of the variables. Also, the value of AVE was reported

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to be 0.508, which is higher than 0.50; as a result, the convergent validity of the model is confirmed.

Conclusion: The results of factor analysis in the present study show that this scale has sufficient validity and is saturated with six factors. The Persian version of the Second Language Learning Self-Regulation Strategies Questionnaire is a tool with high reliability and validity for measuring second language learning self-regulation strategies among the assistants, students and all those involved in second language teaching and learning.

Keywords: Psychometrics, self-regulation strategies, second language learning

Introduction

Research on self-regulated learning (SRL) in educational settings has increased in the last 10 years, most of which focus on how to help learners enhance their SRL skills to succeed in their studies. In addition, recent studies have contributed to the domain knowledge on the use of SRL strategies and how they help improve the academic performance of the learners. Learning self-regulation, as one of the non-intrinsic strategies, causes the students to organize their learning and cognition in terms of metacognitive, motivational, and behavioral beliefs. Self-regulation learning includes an individual's ability to organize and self-manage behaviors, emotions, and abilities to achieve successful learning goals. According to psychologists, self-regulation is a set of stimulus methods in which cognition, feeling, and performance are regulated to achieve the goal (Walker et al, 2006; Amini, 2007; Jabbari et al., 2004).

Review of Literature

In the past, many researchers have studied the relationship between cognitive-motivational processes and academic performance separately; however, today most psychologists pay attention to both cognition and motivation components and their role in learning. Based on new theories such as self-regulatory learning (SRL), the components of cognition, motivation, and academic performance are considered as an intertwined and related set.

According to Yusefi (2016), self-regulation in learning is a significant factor in the students' academic achievements and such learners take part in their learning more

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actively using cognitive and metacognitive strategies. In another study, Garshasebi et al. investigated the effect of teaching self-regulatory learning strategies on nursing students and concluded that the experiment group obtained higher scores in English language courses than the controls. (2018)

More recently, Alamer and Alsagoafi (2023) have used partial least squared structural equation modeling (PLS-SEM) to allow the composite model to validate the constructs of the MARSI-R questionnaire. After confirming the nature of the inventory, they investigated the extent to which MARSI-R is related to reading proficiency statistics, illustrating that problem-solving strategies are the mostly used strategy and that females used the strategies more frequently than their male counterparts.

Also, the results of Naimi et al. (2023) in a study entitled "The Predicting Mathematics Self-Efficacy with Self-Regulation Strategies among Students of Saveh City: A Convergent Validity of Self-Regulation Strategies Inventory" showed that self-regulation strategies predicted students' mathematical self-efficacy (β=0.76, p=0.05). Also, the convergent validity of the self-regulation strategies questionnaire with the math self-efficacy questionnaire was 0.874.

Moreover, the relationship between self-regulatory learning strategies and academic achievement was investigated by Zare et al. (2017); they found that self-regulatory learning dimensions could predict the students' academic achievement. In this regard, Meshkat (2014) found time management and effort regulation, as the dimensions of self-regulatory learning strategies, had a significant effect on the students' success.

Many other studies in other contexts have been conducted to increase our understanding that the use of SRL skills effectively enhances academic performance of learners, such as those of Adam et al. (2017), Garcia et al. (2018), Lee et al. (2019), Roth et al. (2016), and Wong et al. (2018).

Despite these developments in SRL, to the best of our knowledge, there is limited investigation on validation of the measurement tools and instruments developed by researchers, especially in our Iranian context. During the past 20 years, a vast number of assessment tools have been developed to assess self-regulation such as

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those of Zimmerman and Kitsantas (2002), Bruning et al. (2013), Artuch-Garde et al. (2017), and De la Fuente et al. (2017b)

The most widely accepted measurement tool for self-regulated learning for decades has been the Language Learning Strategies Questionnaire (LLS) developed by Oxford (1990). Recently, due to many criticisms of the psychometric properties of this questionnaire in terms of cultural differences that affect the results, other tools have been developed. In line with the development of tools, the psychometric characteristics of the tools used to assess the SRL were also seriously criticized by some researchers as Dörnyei (2005) Woodrow (2005), Rose (20), and Amerstorfer (2018).

New approaches to language learning strategies have led to the development of different questionnaires. The importance of self-regulation in successful academic, professional, etc. in learning is such that different experts have presented different models of it. Among them, the pattern of Pintrich and De Groot can be mentioned (1990). According to Carlos Núñez et al. (2003), the most commonly used models include Zimmerman's, Boekaerts', Winne and Hadwin's, Pintrich's, Efklides', and Hadwin, Järvelä and Miller's models. These models describe the stages, processes, and dimensions that can be summed up into SRL strategies that can be used in a learning process. The leaners using some or all these identified strategies function better than those with low-level SRL skills. (Araka, 2020)

Salehi and Jafari (2015) have also developed a Self-Regulated Learning Questionnaire with a focus on language learners' SRL capacity and behavior. The 41-item questionnaire contained 13 sub-scales. Except for memory strategies in this tool, the Cronbach reliabilities of the questionnaire ranged from 0.70 to 0.94.

Moreover, De la Fuente et al. (2017a) conducted a study to determine how personal self-regulation and regulatory teaching processes are associated to learning approaches and how we can predict motivational-affective variables, academic achievement and satisfaction; they revealed the significance of interactive relationships in the teaching and learning processes, and the significance of personal self-regulation.

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All these developed tools contain various subscales and items. However, few of them have considered the different cultural backgrounds of the learners. In this regard, some researchers have made an attempt to use Oxford's S2R taxonomy and adjust it to their specific national, cultural, social, or educational contexts. For example, Seker developed a 30-item self-regulated language learning questionnaire for the Turkish context. Exploratory Factor Analysis (EFA) yielded five factors that corresponded to the five sub-constructs in his concept. (2005)

Also, Chen and Lin's research re-validated Carey et al.'s. (2003) Short Self-Regulation Questionnaire (SSRQ) based on a national sample of Taiwanese college students. The Taiwanese Short Self-regulation Questionnaire (TSSRQ) was successfully employed to various contexts, and it was also used to deal with different issues beyond learning. (2018)

Furthermore, Köksal and Dündar made an attempt to develop a tool for the Turkish context, consisting of 35 items as the subcategories of the six factors in Oxford's S2R Model (1990). It was shown that he reliability of the questionnaire was acceptable with a Cronbach's alpha statistic of 0.85. Both EFA and Confirmatory Factor Analysis (CFA) applied by the researchers confirmed the construct validity of the scale. (2017)

One of the self-regulation learning assessment tools developed in the field of second language learning is the Self-Regulated Foreign Language Learning Strategy Questionnaire (SRFLLSQ). This questionnaire was validated by Anita Habók and Andrea Magyar in 2018. In spite of much research on self-regulation strategies in educational settings in different areas, there is still a lack of such studies in many disciplines, especially medicine. Also, despite these developments in SRL, to the best of our knowledge, there is limited investigation on validation of the measurement tools and instruments developed by researchers, especially in our Iranian context.

The aim of this study was to validate the Persian version of the Self-Regulated Foreign Language Learning Strategy Questionnaire (SRFLLSQ) tool for measuring self-regulation strategies for learning a foreign language in the students

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of Shiraz University of Medical Sciences. Self-regulation strategies in this study are assumed to be classified into six categories including cognitive, metacognitive, emotional, meta-emotional, social, and cultural interaction, meta-interactive, and social and cultural factors.

Methodology:

This is a descriptive-analytical cross-sectional study that was performed on the students of medicine studying a in Shiraz University of Medical Sciences in the academic year of 2019-20. We aimed to evaluate the validity and reliability of the Persian version of the Self-Regulation Strategies Questionnaire (SRFLLSQ) and its dimensions in foreign language learning.

The statistical population of this study consisted of medical students of Shiraz University of Medical Sciences and the sample size was estimated 252 subjects who were randomly selected from medical students who had enrolled in language courses, using Cochran's formula. There were no exclusion criteria in the sample. All the students who filled out the questionnaire completely were enrolled in the study since all their data were valuable. In this study, first the SRFLLSQ questionnaire was translated into Persian by two people whose mother tongue was Persian; then, as to validity, the back-translation was done by two English language experts, and disagreements were resolved by the panel of experts. Finally, the questionnaire was prepared to be completed by the students. The SRFLLSQ self-regulation strategies questionnaire designed by Habók and Magyar in 2018, was our tool in this study. This scale includes 34 questions in 6 dimensions. These dimensions include cognitive, metacognitive, emotional, meta-emotional, social, and cultural interaction, and meta-interaction, social and cultural factors. The cognitive dimension includes 6 questions, metacognition 8 questions, emotional dimension 2 questions, meta-emotional dimension 7 questions, social and cultural interaction dimension 3 questions, and meta-interaction, social and cultural dimension 8 questions. In order to collect the data, after translating and compiling the questionnaire, assessing its validity and reliability, and obtaining the ethical code (IR.SUMS.REC.1393.1062) from the relevant authorities of Shiraz University of Medical Sciences, the researcher distributed the questionnaires to be

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completed by the students. In order to determine the validity of the questionnaire in this study, we used exploratory factor analysis, confirmatory factor analysis, and construct validity. To determine the reliability or trustworthiness of the questionnaire, we used Cronbach's alpha and structural reliability methods. Cronbach's alpha value in this study was calculated 0.85. According to Kline , a threshold value of 0.85 is an acceptable eligibility criterion. (2015) Data were analyzed using SPSS software version 22.

Findings:

First-order exploratory factor analysis:

First, first-order exploratory factor analysis was performed on the data. Since the value of KMO (Kaiser-Meyer-Olkin Measure) test statistic is equal to 0.905 and more than 0.70, the collected data are suitable for factor analysis. Also, since the level of significance measured for Bartlett statistic is equal to zero and lower, the significance level is 0.05. Therefore, the data structure obtained from the Second Language Self-Regulation Strategies Questionnaire is suitable for heuristic factor analysis (Table 1).

Table 1:

KMO and Bartlett test for heuristic factor analysis

Index		Value
KMO (test statistic)		0.905
Bartlett test	Chai-square approximation	19524.09
	Degree of freedom	561
	Measured significance level	0.000

Table 2 shows the eigenvalues and variance explained by the agents. The eigenvalue of the first factor is 13.9, which explains about 40.88% of the total variance, considering the total of 34 (number of questions). Given that six values of the eigenvalues are more than one, six main factors with a total explained

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variance of 84.76% are identified. Varimax rotation was used to identify the questions that constitute each factor. The eigenvalue of each factor and the percentage of variance explanation are displayed in Table 2, so that after varimax rotation, the first factor is 23.58%, the second factor 19.94%, the third factor 18.27%, the fourth factor 13.13%, the fifth factor 6.00%, and the sixth factor 3.80% of the total variance.

Table 2:

Table of eigenvalues and explained variance based on first-order exploratory factor analysis

Agent	Initial special values			Total square of the extracted factor loading			Total square of the factor loading after varimax rotation		
	eigenvalue	Percentage of explained variance	Percentage of accumulated	eigenvalue	Percentage of explained variance	Percentage of accumulated	eigenvalue	Percentage of explained variance	Percentage of accumulated
1	13.900	40.884	40.884	13.900	40.884	40.884	8.019	23.586	23.586
2	5.417	15.933	56.816	5.417	15.933	56.816	6.783	19.949	43.535
3	4.206	12.369	69.186	4.206	12.369	69.186	6.212	18.271	61.806
4	2.780	8.177	77.363	2.780	8.177	77.363	4.470	13.146	74.952
5	1.409	4.143	81.506	1.409	4.143	81.506	2.043	6.008	80.961
6	1.107	3.256	84.762	1.107	3.256	84.762	1.292	3.801	84.762
7	0.993	2.920	87.682						
8	0.731	2.151	89.833						
9	0.668	1.965	91.798						
10	0.622	1.830	93.628						
11	0.548	1.613	95.241						

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12	0.461	1.355	96.596						
13	0.370	1.089	97.685						
14	0.288	0.846	98.532						
15	0.084	0.246	98.777						
16	0.064	0.189	98.967						
17	0.058	0.171	99.138						
18	0.051	0.151	99.289						
19	0.038	0.111	99.400						
20	0.033	0.096	99.496						
21	0.029	0.086	99.582						
22	0.024	0.069	99.651						
23	0.022	0.066	99.717						
24	0.019	0.055	99.772						
25	0.014	0.042	99.813						
26	0.013	0.039	99.852						
27	0.011	0.032	99.884						
28	0.010	0.030	99.914						
29	0.008	0.025	99.939						
30	0.008	0.024	99.963						
31	0.005	0.016	99.979						
32	0.004	0.012	99.991						
33	0.002	0.007	99.998						
34	0.001	0.002	100.00						

In general, in this analysis, six general factors were identified for questions related to second language self-regulation strategies, which according to their nature, questions 1 to 8 were related to the first factor (metacognitive strategy), questions 9 to 14 related to the second factor (cognitive strategy), questions 15 to 21 related to the third factor (meta-emotional strategy), questions 22 and 23 related to the fourth factor (emotional strategy), questions 24 to 31 related to the fifth factor (socio-cultural interaction strategy), and questions 32 to 34 were related to the sixth factor (strategy of socio-cultural interaction). As it was observed, exploratory

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factor analysis is able to identify the components of the second language self-regulation strategies questionnaire.

The following Scree Plot is drawn based on the eigenvalues of each factor in the initial solution and helps to identify the optimal factors. Factors that fall with a high slope are generally selected. Factors that are on a gentle slope of the chart generally have less involvement in problem solving. As you can see, the first six factors fell with a relatively high slope, and the rest of the factors are almost in line. Thus, it can be intuitively concluded that this data is classified into six domains.

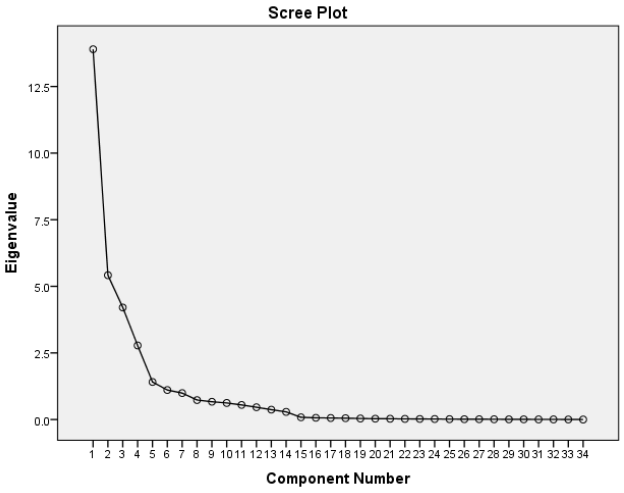

Figure 1: Scree Plot

Evaluation of reflective measurement models

The reflective measurement models of the present study are metacognitive strategy, cognitive strategy, meta-emotional strategy, emotional strategy, socio-cultural interaction strategy and socio-cultural interaction strategy. Therefore, these models are examined first. Moreover, the general structure of second language self-regulation strategies consists of several components, and each of these components has been measured by items (observable variables). Thus, in the first-order confirmatory factor analysis, we seek to determine whether the markers selected to measure the structures (components) in question are accurate.

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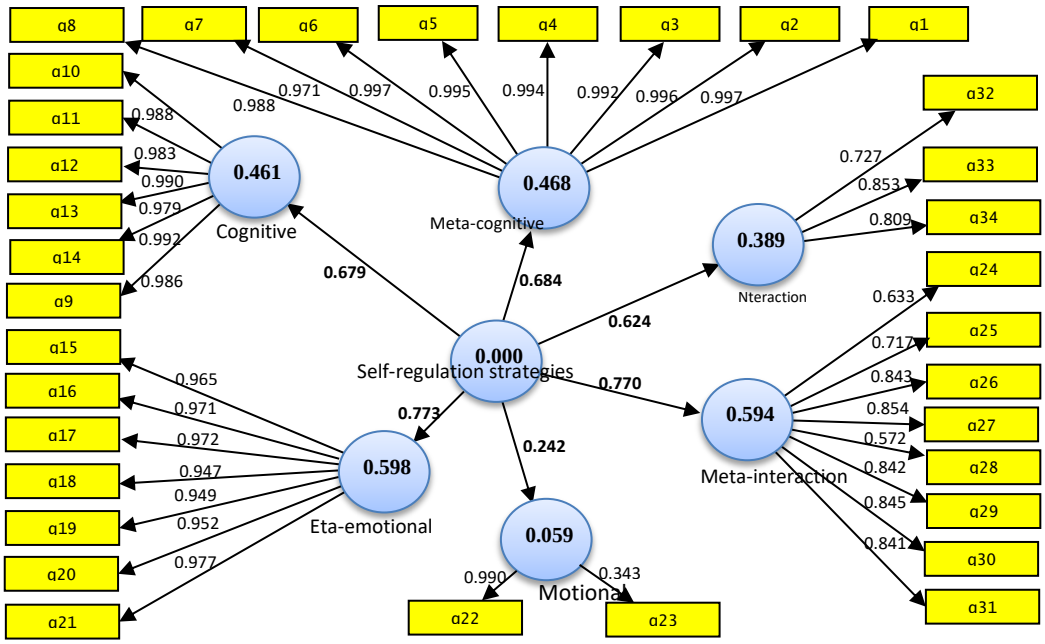

Figure 2. Reflective measurement model

In Figure 2, the values on the path (from the general variable to each of the components) are the path coefficients that indicate the intensity of the relationship. The values within the circles indicate the coefficients of determination (R2) and the values on the arrow from the components to the explicit variables represent the factor loadings.

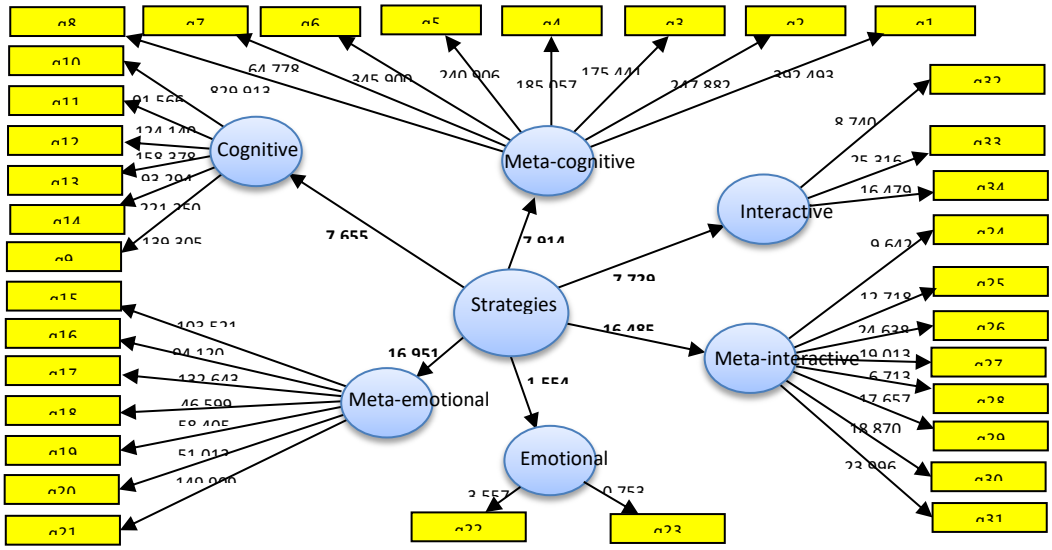

Figure 3. T-values

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The conceptual model of the research, which was designed using explicit variables of second language self-regulation strategies, was tested using the partial least squares method by Smart Pls statistical software. T-values for most of the routes are higher than the standard absolute value of 96.1 and indicate significant relationships between research dimensions. (Figure 3)

In general, the results of confirmatory factor analysis show that all items have a suitable factor loading on their latent variable and these factor loadings are significant according to the t-score at the level of 0.001. In other words, the value of t corresponding to each factor loading is greater than its critical value (2.58) at the level of 0.001. As a result, it can be said that these indicators have the necessary accuracy to measure the corresponding structures. Also, the results of confirmatory factor analysis along with exploratory factor analysis are able to identify the components of the second language self-regulation strategies questionnaire properly. Therefore, these factors entered the final analysis.

As shown in the diagrams above, the factor loading of all items, except for item 23, is higher than 0.5. Although the factor loading above 0.3 is also acceptable, the value of t corresponding to this indicator is less than the critical value (1.96), and this item is removed from the questionnaire.

Structural model fitness

Table 3 shows the values of each of the fitting indices for the variables. As can be seen, the indicators are positive and more than zero.

Table 3:

Subscript indices (CV Com) and redundant index CV (CV Red)

Variable	CV Com	CV Red
Meta-cognitive	0.986	0.462
cognitive	0.973	0.449
Meta-emotional	0.925	0.552

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Emotional	0.556	0.128
Socio-cultural meta-interaction	0.601	0.345
Socio-cultural interaction	0.637	0.244

In the convergent validity study for the dimensions of the questionnaire, the factor loads obtained from the confirmatory factor analysis are referred to, which are considered significant if the factor loads resulting from the first-order factor analysis are greater than 0.5. (Factor loads more than ± 0.3 are also considered significant if they correspond to a value of t above the critical level.) According to Figure 3, this condition was met for all items. Also, the average extracted variance of each factor should be greater than 0.5. The mean values of the extracted variance for each factor are plotted on the diameter. As can be seen, all of them are greater than 0.5. Convergent validity is, therefore, confirmed for first-order latent factors.

Table 4:

Mean values of extracted variance and quadratic correlation coefficient between first-order latent variables

first-order latent factor	Meta-cognitive	Cognitive	Meta-emotional	Emotional	Socio-cultural meta-interaction	Socio-cultural interaction
Meta-cognitive	0.637	-	-	-	-	-
cognitive	0.314 **	0.601	-	-	-	-
Meta-emotional	0.341 **	0.323 **	0.556	-	-	-

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Emotional	0.011	0.093	0.167 *	0.925	-	-
Socio-cultural meta-interaction	0.327 **	0.450 **	0.530**	0.199 *	0.973	-
Socio-cultural interaction	0.259 **	0.362 **	0.437 **	0.210 *	0.546 **	0.986

In the diagnostic validity test, the mean value of the extracted variance should be more than the square of the correlation coefficient between the latent factors. The square values of the correlation coefficient between the factors are shown in Table 4 (non-diagonal values). As can be seen, this condition is also met. Therefore, diagnostic validity is also confirmed.

Based on the rotating factor matrix in first-order exploratory factor analysis, there is a divergent validity when each question with a hidden factor has a factor load greater than 0.5 and with other factors has a value less than 0.5. In this study, this condition also existed.

Discussion:

The aim of this study was to validate, assess the credit, and localize the SRFLLSQ questionnaire. Since it is validated for the first time in Iran, it is not possible to compare its psychometric results with other studies. The results of the exploratory factor analysis showed that the six components had a specific eigenvalue greater than the value of one, which means that these 34 questions can be summarized in six areas. From the Scree Plot diagram, it can be concluded that in the first six factors, the slope of the diagram is steep, but then it becomes uniform and constant. The six selected factors were able to explain 84.76% of the total variance (changes in observations), so the complexity of the analysis with 34 variables can be reduced using the first six factors.

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To investigate the construct validity and answer the question that the scale for measuring second language self-regulation learning strategies is saturated with several factors, we used the principal component analysis method. Prior to factor analysis, the adequacy of sampling using the KMO size and the rejection of the null hypothesis, that the homogeneity matrix in society is correct, the implementation of factor analysis can be justified by Bartlett sphericity test. Then, using the Varimax rotation method, all questions with a suitable and significant factor load had a high correlation with the whole test and formed a set of scale questions. Therefore, according to the assumptions of factor analysis and the percentage of explanation of variance and slope of the chart, six factors were finally extracted.

The results of confirmatory factor analysis test showed that all 34 questions out of the total of preliminary questions, except for item 23, were higher than 0.5, and they remained in the questionnaire due to the high correlation with the whole test or due to having a suitable factor load. About item 23, although the factor load above 0.3 is also acceptable, the value of t corresponding to this indicator was less than the critical value (1.96); therefore, this question was removed from the questionnaire. The validity coefficient of the questionnaire was 0.508. The combined reliability (Delvin-Goldstein p) of all dimensions related to the main categories of measuring second language self-regulation learning strategies was calculated to be 0.957. As a result, the reliability of the measurement model was confirmed.

In general, the results of confirmatory factor analysis in this study showed that all items, except for item 23, had a suitable factor load on the latent variable and these factor loads were significant according to the t-score at the level of 0.01. In other words, the value of t corresponding to each factor load is greater than its critical value (2.58) at the level of 0.01. As a result, it can be said that these indicators had the necessary accuracy to measure the corresponding structures. Also, the results of confirmatory factor analysis along with exploratory factor analysis are well able to identify the components of the questionnaire for measuring second language self-regulated learning strategies.

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In summary, the results of factor analysis in the present study showed that this scale had sufficient validity and was saturated with six factors, indicating that at the emotional domain only two items had an acceptable factor load; given that the value of t corresponds to the factor load of the twenty-third item, 0.753 is less than the critical value (1.96) at the level of 0.001, so it is not significant. From the findings of this study which is based on sampling design and statistical tests based on factor analysis method and principal component analysis method, and using the research background on self-regulation learning strategies, the following results were obtained:

The first factor has a high correlation with 8 questions, which indicates the metacognitive concept. The second factor is highly correlated with 6 questions and indicates cognitive factors. Cognitive and metacognitive strategies help the learners practice their executive control by planning, sorting, focusing, and evaluating their learning process. The third factor is highly correlated with 7 questions, and the fourth factor is highly correlated with 2 questions and expresses extra-emotional and emotional factors. Emotional strategies help the learners to control emotions, motivations, and perspectives related to language learning. The fifth factor has a high correlation with 8 questions and indicates the factors of socio-cultural meta-interaction; the sixth factor has a high correlation with 3 questions, indicating the factors of socio-cultural meta-interaction. Social strategies, such as asking questions and collaborating with others often facilitate interaction with individuals in spoken situations.

In Iran, Saif and Mesrabadi with their study in 2015 showed that the use of cognitive and metacognitive strategies was effective in increasing the comprehension and retention of textbooks.

In a similar study, Somentri et al. determined the validity and reliability of the motivational strategies of learning and concluded that the subdimensions of critical thinking, self-efficiency, feedback and learning in MSLQ were highly correlated with the variable under the study, i.e. learning self-regulation strategy. (2006)

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All in all, our study validated a scale that represents self-regulated language learning strategy use in medical students in Iranian context. We only enrolled medical students, so our results can only be generalized to medical students in other universities of Iran. In case this tool is to be used for a student in other disciplines, another investigation, as recommended by Habook and Andrea, is required to determine the metric characteristics of the instrument, with somehow different structure, which is the feature of that particular sample. (2018)

This scale can be used by teachers of English as a foreign language in universities and other educational settings to assess their students' level of awareness of their own self-regulated learning and raise their knowledge of strategy use in language learning. In spite of the fact that it only includes six aspects of self-regulated learning strategies, it yields a comprehensive view of students' preferences and may be used as a basis for the instructors' future strategy instruction.

Conclusion

The results revealed that self-regulation strategies questionnaire is a reliable and valid questionnaire which has been standardized and localized and can be used by the researchers in our country to measure learning self-regulation strategies in Iranian language learners. This tool can be used to provide both students and teachers with the feedback on the language learning processes.

To provide more evidence for the reliability and validity of the tool validated, individual differences such as gender, age, socio-economic status and other variables are recommended to be included in future research. Also, the use of the tool for other age groups could confirm whether the questionnaire is a reliable tool for other populations as well.

This study had limitations since it was tested on the students of medical education in Shiraz only, and we should be cautious in generalizing its results. It is recommended that similar studies should be conducted in other universities and

cities on the students of other majors with larger sample size and other population such as all the graduate and postgraduate students.

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