



## Factor structure and validity of Gomez and colleagues' electronic self-regulation questionnaire among high school students

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### Abstract

**Introduction:** Self-regulation is an essential skill for students affected by the COVID-19 pandemic. This study aimed to investigate the factorial structure and validity of Gomez and colleagues' electronic self-regulation questionnaire among high school students.

**Materials and Methods:** The statistical population of this cross-sectional study consisted of all high school students in Tehran, Iran, in the academic year 2021-2022. To assess concurrent validity, Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), and reliability, 100, 350, 250, and 40 students were selected, respectively. They filled the Gomez and colleagues' self-regulation questionnaire and the Magno's academic self-regulation questionnaire. The self-regulation questionnaire underwent a rigorous translation and validation process, ensuring conceptual equivalence. Validity was assessed using the Content Validity Ratio (CVR) and Content Validity Index (CVI). At the same time, reliability was confirmed through Cronbach's alpha, split-half reliability, Average Variance Extracted (AVE), and Composite Reliability (CR). Data analyzed using SPSS 22 and LISREL 8, descriptive statistics, Pearson correlation, EFA, and CFA.

**Results:** Validation of self-regulation questionnaire demonstrated strong content validity (CVR: 64%-87%, CVI: 0.73) and significant concurrent validity with Magno's questionnaire ( $r = 0.68$ ,  $P = 0.01$ ). EFA revealed a four-factor structure explaining 61.70% of the variance, confirmed by CFA (Root Mean Square Error of Approximation (RMSEA) = 0.033). High reliability was evident with Cronbach's alpha (0.84-0.86) and split-half coefficients (0.71, 0.72), supported by AVE (0.521-0.556) and CR (0.902-0.918), indicating robust internal consistency.

**Conclusion:** The Gomez and colleagues' self-regulation questionnaire is a valid and reliable tool for measuring self-regulation among high school students.

**Keywords:** COVID-19 pandemic, Factor analysis, Scale, Self-regulation, Students

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### Introduction

The COVID-19 pandemic has caused unpleasant consequences for families, students, economic stability, and health (1), among which

health outcomes such as stress, depression, anxiety, insomnia, and self-regulation in children are more noticeable than other people (2-4). Self-regulation problems are one of the

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most influential disorders related to the pandemic disease in students (2). During the coronavirus pandemic, stressful factors such as parental health problems, grief and loss, food insecurity, and social isolation have increased (5,6), and supportive behaviors of adults and peers have faded due to school closures and social distancing requirements (7). These conditions have caused students to experience chronic stress (9), leading to decreased self-regulation (8).

Self-regulation is the ability to monitor, evaluate, apply, and control behavior or emotions to achieve a behavioral goal closely related to emotion regulation, fear, and impulsivity (9). Self-regulation becomes a determinant factor for growth, personality, and social behavior of individual decisions to achieve desirable goals and behavioral standards to achieve better well-being and reduce psychosomatic problems; having high self-regulation ability is necessary (10,11).

On the other hand, low self-regulation is associated with a range of negative outcomes, such as depression, suicidal tendencies, and substance abuse among high school students (12,13). Self-regulation assessment is important to help planners create effective preventive actions in the occurrence of negative outcomes (14-16). Also, self-regulation is influenced by various factors such as individual and personality characteristics, cultural and religious beliefs, motivation, self-confidence, and life situations that cause the emergence of the regulation process (17). In addition, since self-regulation leads to different performances in the social domain in terms of explaining and understanding abilities, it needs a tool to measure these abilities (18). Despite the impact of COVID-19 disease on students' self-regulation, so far in studies, less attention has been paid to students' self-regulation during the coronavirus pandemic (2); on the other hand, self-regulation assessment during the coronavirus due to fear of contracting the coronavirus disease through printed forms of questionnaires has been accompanied by problems and concerns such as inaccurate response or refusal to answer (19).

Different tools have been introduced for self-regulation, which has many questions that affect the quality of responses (20,21). Based on this, Gomez and colleagues have presented a scale with 16 questions to solve these problems,

including four dimensions: 1- external, 2- identified, 3- internalized, and 4- intrinsic (22).

The review of sources shows that this questionnaire has yet to be validated; therefore, this tool cannot accurately determine the status of self-regulation, and it is necessary to use another tool to measure self-regulation (20). Also, any tool for use in different cultures needs to adjust the questions based on cultural norms, so it is essential to present a self-regulation scale based on culture and validate it (23).

In addition, the use of online forms of questionnaires helps to receive accurate responses and also prevents the spread of pandemic diseases (24); therefore, due to the lack of validation of the electronic form of the self-regulation questionnaire by Gomez and colleagues, the importance of self-regulation assessment in students and the many benefits of electronic forms such as preventing pandemic diseases, saving time and cost, increasing trust and anonymity of respondents, this study was conducted to investigate the factorial structure and validity of Gomez and colleagues' electronic self-regulation questionnaire among high school students

## Materials and Methods

The statistical population of this cross-sectional study consisted of all high school students in Tehran in the academic year 2022-2021. The sample size was determined based on the sampling methods for validity studies; therefore, for concurrent validity, Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), and reliability, 100, 350, 250, and 40 people were selected, respectively (25-27).

Inclusion criteria included being a high school student in the selected schools of Tehran during the academic year 2022-2021. Exclusion criteria included students with any cognitive impairments that affected their ability to complete the questionnaire, those who were absent during the data collection period, and those who did not consent to participate.

The sampling method of this study was multistage cluster sampling. In the first stage, four districts (4,11,7,18) were randomly selected from among 22 districts of Tehran. In the second stage, one region was randomly selected from among the regions of each district. In the third stage, one high school was randomly selected from among the high schools of each region. In the fourth stage, two classes were randomly

selected from among the classes of each high school. In the fifth stage, all the students in these classes were considered the sample, and their mobile numbers were obtained from the school.

After contacting the students and their parents by phone, they were verbally asked for permission to participate in the study. The link to the questionnaire was sent to the participating students via email, WhatsApp, and Instagram. For students without internet access, the questionnaire was completed by the researcher's face-to-face visit and using a tablet. Finally, 723 valid questionnaires were collected.

**Translation process:** This study introduces the first Persian translation of the Gomez and colleagues' self-regulation questionnaire. Initially, the original author obtained permission from Gomez and colleagues to translate and validate the self-regulation questionnaire. Subsequently, the questionnaire was translated using a forward-backward translation method. Two bilingual translators, fluent in English and Persian, independently translated the questionnaire. The translations were then compared, and any discrepancies were resolved through discussion. A third independent translator carried out the backward translation, and the final Persian version was reviewed for conceptual and cultural equivalence. The original authors were contacted for permission to validate the questionnaire; however, they have yet to respond to subsequent emails regarding the review of the backward translation. Despite this, the research team continued with the validation process to ensure that the translated questionnaire maintained the integrity of the original (28,29).

#### Research instruments

*A) Gomez and Colleagues' Self-Regulation Questionnaire:* This questionnaire has 16 questions that consist of four dimensions: 1- external (questions 1 to 4), 2- identified (questions 5 to 8), 3- internalized (questions 9 to 12), and 4- intrinsic (questions 13 to 16). The answers are scored on a 5-point scale from zero (never) to four (always). Cronbach's alpha coefficient of 0.89 and test-retest coefficient of 0.92 have been reported. Also, the construct and content validity have been confirmed (22).

*B) Magno's Academic Self-Regulation Questionnaire (2010):* This scale has 55 questions and seven subtests as follows: memory strategy (14 questions), goal setting (5 questions), self-assessment (12 questions), help-

seeking (8 questions), environmental structuring (5 questions), learning responsibility (5 questions), and planning and organization (6 questions). Each question has four options (strongly agree, agree, disagree, strongly disagree), and the respondent should choose the option closer to their opinion (30). Several studies have confirmed its validity and reliability in Iran (31).

**Validation techniques:** In this research, the translation of the self-regulation questionnaire into Persian for the first time, coupled with the rapid shifts in the economic and political arenas and the economic sanctions imposed on Iran, necessitated a meticulous examination of the structure and dimensions of the questionnaire. These factors could significantly impact the measured construct, rendering a reevaluation of the validity imperative in the current Iranian context.

**Content validity and Exploratory Factor Analysis (EFA)** were conducted as initial steps to address this. EFA is particularly beneficial when constructs exhibit different characteristics across various cultural or socio-political contexts. It provides the means to identify the underlying factor structure of the questionnaire without the constraints of a pre-established model, offering the flexibility to discover and comprehend the dimensions of self-regulation as they pertain to Iranian high school students amidst these rapid changes.

**Content validity:** The content validity of the self-regulation questionnaire by Gomez and colleagues was rigorously assessed to ensure its appropriateness for the target population, which, in this case, are high school students in Tehran, Iran. The assessment was crucial given that the questionnaire was translated into Persian for the first time, necessitating a thorough validation to maintain the integrity of the measured construct. The Content Validity Ratio (CVR) and the Content Validity Index (CVI) were the primary statistical tools for this validation process. The CVR was calculated using the Lawshe table, which determines the minimum value required for a question to be valid based on the number of experts and their level of agreement. Given that ten experts participated in evaluating this study, a CVR value higher than 0.62 was necessary to validate each question (32,33). The CVI was also calculated to assess the clarity, relevance, and relatedness of the questions to the variables under study, which, according to the standards set by Waltz and Bausell, requires a minimum

acceptable value of 0.7 (1). Using these indices is crucial to ensure that the measurement tools are indeed measuring what they intend to measure and that the questions are suitable and comprehensible for the target population. This is particularly important in studies where measurement tools have been translated from another language to ensure conceptual and cultural equivalence of the instrument (4).

**Concurrent validity:** In the concurrent validity analysis, the Pearson correlation coefficient was employed to measure the relationship between the scores from the self-regulation scale developed by Gomez and colleagues and the academic self-regulation questionnaire by Magno. **Construct validity:** Construct validity was assessed using EFA and CFA within the Structural Equation Modeling (SEM) framework. For EFA, 350 samples were considered, and for CFA, 250 samples were separately taken to ensure that each analysis was performed with sufficient and appropriate data. Utilizing two distinct samples for EFA and CFA is a methodological best practice that enhances the robustness and validity of the construct validation process. EFA is an initial, exploratory step to identify the underlying factor structure without imposing a preconceived model. It allows for the discovery of patterns and the refinement of factor solutions. Using a large sample size of 350 for EFA ensures that the factor structure is stable and representative of the population. The Kaiser criterion and parallel analysis determined the number of factors. The Kaiser-Meyer-Olkin (KMO) measure and Bartlett's Test of Sphericity initially confirmed the suitability of the data set for factor analysis with KMO values higher than 0.60 (34).

Subsequently, Principal Component Analysis (PCA) was employed as a method for factor extraction in EFA. PCA, a dimensionality reduction technique within EFA, facilitates data transformation into a space with fewer dimensions, where factors are identified with prominent factor loadings. The principal factors were identified using eigenvalues greater than 1, and varimax rotation enhanced interpretability and further distinguished factors. These processes delineated the underlying factor structure and provided potential models for future CFA. **CFA:** The CFA phase entailed fitting a theoretical factor model to the observed data. This process was predicated on a set of meticulously evaluated assumptions to ensure the validity. These assumptions encompass

multivariate normality, the absence of multicollinearity and singularity, as well as linearity and homoscedasticity of the data. The Maximum Likelihood (ML) estimation method was employed, prevalently utilized in Structural Equation Modeling (SEM), and deemed appropriate when the assumptions above are satisfied. The adequacy of model was appraised using an extensive array of fit indices, including the Root Mean Square Error of Approximation (RMSEA < 0.05-0.08), Comparative Fit Index (CFI > 0.90), Normed Fit Index (NFI > 0.90), Non-Normed Fit Index (NNFI > 0.90), Incremental Fit Index (IFI > 0.90), Standardized Root Mean Square Residual (SRMR < 0.05), Goodness of Fit Index (GFI > 0.90), and Adjusted Goodness of Fit Index (AGFI > 0.90) (35,36). Each index offers a distinct perspective on the model fit, with established thresholds for acceptable fit levels in the literature to aid interpretation.

The rationale for using the ML estimation method is its efficiency and consistency in parameter estimation under multivariate normality. Moreover, it provides a full-information approach, utilizing all available data to estimate model parameters, which is particularly advantageous when dealing with complex models. The selection of fit indices provides a holistic evaluation of the model fit, considering various aspects such as the overall fit (GFI, AGFI), the discrepancy between the observed and estimated covariance matrices (RMSEA, SRMR), and the comparative fit to a baseline model (CFI, NFI, NNFI, IFI) (36).

In addition to conducting CFA on 250 samples, the analysis was also performed on the entire set of samples, which included 740 samples. In this analysis, the four-factor model was compared with three-factor and five-factor models to determine the best fit for the observed data. This comparison aided in confirming the factorial structure of the questionnaire and in selecting the final model.

**Reliability:** In this study, the reliability of the self-regulation questionnaire was assessed using several standard indices. The Cronbach's alpha coefficient was utilized to evaluate the internal consistency of the entire scale and its dimensions. Split-half reliability was determined by dividing the questionnaire based on odd and even questions and calculating coefficients for each half. The correlation coefficient between the two halves was calculated to confirm consistency between the two sections of the

questionnaire. Lambda coefficients were used to assess the reliability of each dimension. Additionally, the Average Variance Extracted (AVE) and Composite Reliability (CR) were employed to confirm the reliability of the construct structures and the internal consistency of each dimension. Data analysis was performed using SPSS version 22 and LISREL version 8 software. Descriptive statistics were used to estimate frequency and percentage. For content validity, CVR and CVI were estimated. For concurrent validity, the Pearson correlation coefficient was used between the scores of the self-regulation scale by Gomez and colleagues and the academic self-regulation questionnaire by Magno.

EFA using principal component analysis with varimax rotation was performed to determine the factorial structure of the scale under study for construct validity and determining the factorial structure under study. In this analysis, factors with eigenvalues greater than one were considered the main factors (4).

CFA was also used to examine the fit of the scale. To examine the reliability of the self-regulation scale, internal consistency methods were used; for this purpose, the alpha coefficient obtained for the total scale and its dimensions, the split-half coefficient for the first half of the data for the second half of the data, and the correlation between the two halves were calculated.

**Results**

The study sample consisted of seven hundred twenty-three students, three hundred fifty-four (48.96%) boys, and three hundred sixty-nine (51.04%) girls. Fathers of three hundred seventy students (51.18%) had higher education levels,

while mothers of three hundred twelve students (43.15%) had higher education levels.

Content validity: All questions were approved by experts. The CVR for sixteen scale questions ranged from sixty-four to eighty-seven percent. Based on the Lawshe table for evaluating ten experts, a CVR higher than 0.62 is required (31). The CVI was also estimated to be 0.73, an acceptable value. The minimum acceptable value of CVI is 0.7 (1). Concurrent validity: To investigate concurrent validity, Gomez and colleagues' self-regulation questionnaire was performed alongside Magno's academic self-regulation questionnaire. The results showed that the correlation between two questionnaires was positive and significant ( $P= 0.01, r= 0.68$ ) (36). EFA: According to the Kaiser criterion, four factors had eigenvalues greater than 1, and the eigenvalues derived from the actual data were compared with those from random data, indicating that these four factors should be retained, as their eigenvalues were higher than those corresponding to the random data. Using the principal component method and Varimax rotation, these four factors explained 61.70 percent of the variance. The first factor explained 15.579 percent, the second factor 15.467 percent, the third factor 15.360 percent, and the fourth factor 15.295 percent of the variance. Based on the extraction coefficients, none of the scale items were removed because the extraction coefficients of the questions were more than 0.4. Additionally, according to Table 1, the questions associated with each factor are shown and named as follows: Factor 1: Items, Questions 1 to 4 (External); Factor 2: Items, Questions 5 to 8 (Identified); Factor 3: Items, Questions 9 to 12 (Internalized); Factor 4: Items, Questions 13 to 16 (Intrinsic).

**Table 1.** Questions related to each extracted dimension of the Gomez and colleagues' self-regulation questionnaire

	Dimensions			
	Identified	Internalized	External	Intrinsic
i1	0.09	0.00	0.75	0.13
i2	0.11	0.10	0.80	0.13
i3	0.11	0.09	0.76	0.10
i4	0.15	0.12	0.73	0.13
i5	0.75	0.12	0.11	0.10
i6	0.77	0.13	0.09	0.12
i7	0.75	0.09	0.12	0.11
i8	0.80	0.03	0.13	0.13
i9	0.06	0.77	0.08	0.07
i10	0.12	0.75	0.09	0.11
i11	0.08	0.78	0.04	0.11
i12	0.09	0.76	0.08	0.12
i13	0.11	0.11	0.15	0.76
i14	0.10	0.12	0.10	0.77
i15	0.09	0.08	0.17	0.76
i16	0.16	0.12	0.08	0.74

CFA: Subsequently, the general fit indices of the self-regulation scale are presented in Table 2. According to the results of the ratio of Chi-square to degrees of freedom, the goodness of fit index, the adjusted goodness of fit index, the

normed fit index, the adaptive fit index, the incremental fit index, the root mean square error of approximation and also the acceptable fit indices, it can be said that the data support the four-factor model (Table 2 and Figure 2).

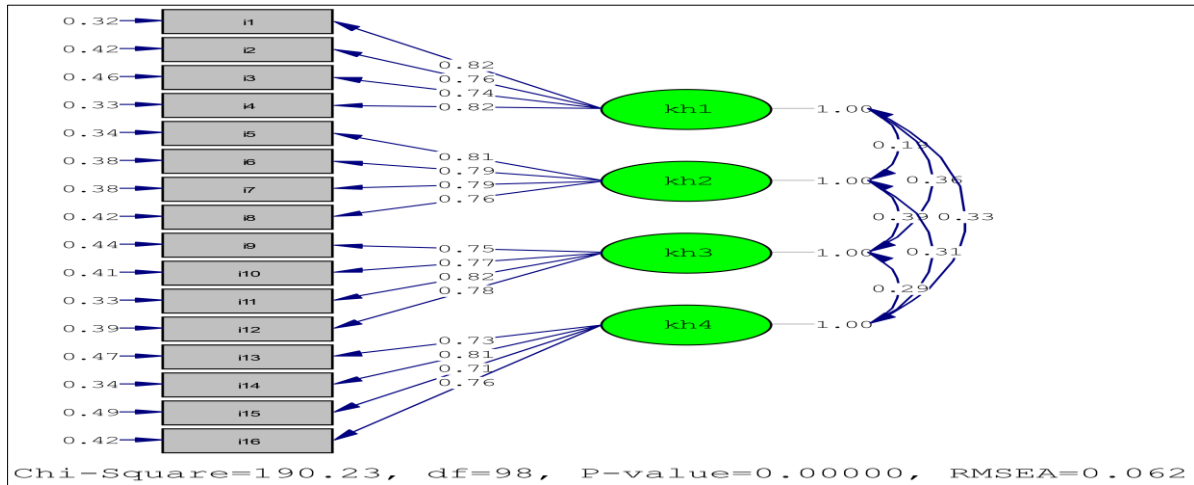


Figure 1. Standardized coefficients model for CFA data

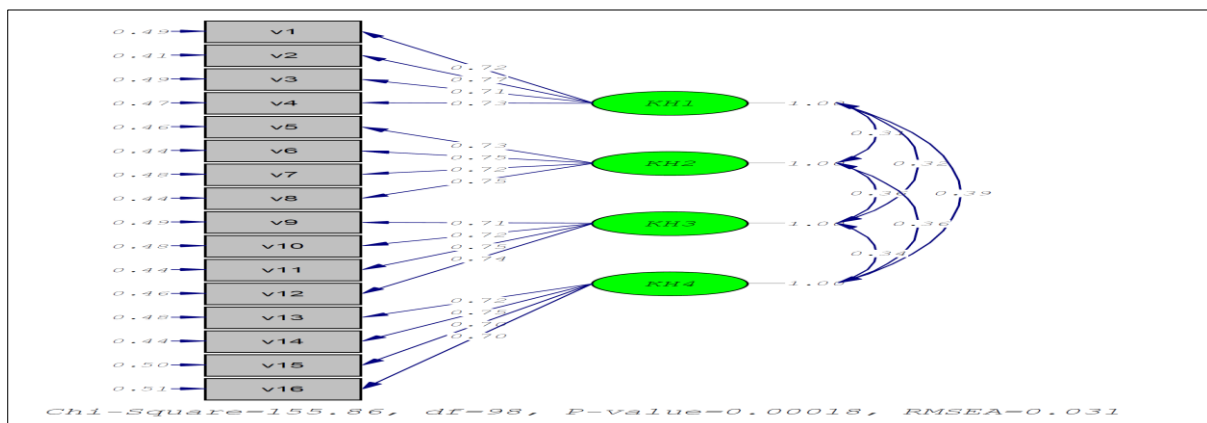


Figure 2. Standardized coefficients model for the analysis of the entire dataset

CFA on the entire dataset: Based on the model fit indices and comparison with acceptable standards, the data support the four-factor model. These results confirm that the four-

factor model is suitable for the self-regulation scale by Gomez and colleagues among high school students (Table 2 and Figure 2).

Table 2. Comparative fit indices for the self-regulation questionnaire: CFA and total data analysis

Results		CMIN/DF	GFI	AGFI	NFI	CFI	IFI	PNFI	RMSEA
CFA data		1.94	0.92	0.90	0.94	0.97	0.97	0.77	0.062
Total data	Three-factor	7.52	0.82	0.76	0.88	0.89	0.89	0.74	0.12
	Four-factor	1.59	0.98	0.98	0.98	0.98	0.97	0.87	0.033
	Five-factor	3.66	0.94	0.92	0.95	0.96	0.96	0.74	0.060
Acceptable fit		3	0.90	0.90	0.90	0.90	0.90	0.50	0.10

Comparative analysis of factorial models in structural equation modeling: In the realm of structural equation modeling, the fit of a model is paramount. Despite its Root Mean Square

Error of Approximation (RMSEA) of 0.12, the three-factor model indicates a suboptimal fit, suggesting a potential misrepresentation of the data (refer to Table 2 for additional indices).

Conversely, the four-factor model exhibits an exemplary fit with an RMSEA of 0.033, closely aligning with the ideal model characteristics. The five-factor model also demonstrates a commendable fit, marked by an RMSEA of 0.060, although it does not quite match the precision of the four-factor model. Overall, the four-factor model stands out as the most robust representation, while the three-factor model fit is comparatively inadequate, potentially necessitating further refinement (Table 2).

Scale reliability: The reliability results of the self-regulation questionnaire indicate a high level of reliability.

Cronbach's alpha for the total scale is 0.86, and for the first to fourth dimensions, it is respectively 0.85, 0.86, 0.84, and 0.84. The split-half reliability coefficients for the first and second halves are 0.71 and 0.72, respectively (the split was based on odd and even questions), and the correlation coefficient between the two halves is 0.87, demonstrating the high stability and validity of the questionnaire. The lambda values range from 0.66 to 0.91, indicating satisfactory reliability, although lambda 4 has the lowest value (37). These evaluations confirm that the questionnaire can serve as a valid tool in self-regulation research (Table 3).

**Table 3.** Internal consistency calculations of the Gomez and colleagues' self-regulation questionnaire

	Cronbach's alpha
Total scale	0.86
First dimension	0.85
Second dimension	0.86
Third dimension	0.84
Fourth dimension	0.84
Split-half reliability coefficient of the first half	0.71 (8 questions)
Split-half reliability coefficient of the second half	0.72 (8 questions)
Correlation coefficient between two halves	0.87
Lambda1	0.80
Lambda2	0.87
Lambda3	0.86
Lambda4	0.66
Lambda5	0.84
Lambda6	0.91

The Average Variance Extracted (AVE) and Composite Reliability (CR) for the four dimensions are as follows: Dimension 1 has an AVE of 0.529 and a CR of 0.905; Dimension 2 has an AVE of 0.556 and a CR of 0.918; Dimension 3 has an AVE of 0.547 and a CR of 0.914; Dimension 4 has an AVE of 0.521 and a CR of 0.902 (Table 4).

These values highlight the robustness of the constructs and affirm the reliability and validity of the questionnaire for assessing self-regulation among students. The high CR values, in particular, indicate strong internal consistency within each dimension, reinforcing this scale as a reliable measurement tool in educational research (37).

**Table 4.** Scientific measurement of constructs reliability and validity

Dimension	AVE (Average Variance Extracted)	CR (Composite Reliability)
1	0.529	0.905
2	0.557	0.918
3	0.547	0.914
4	0.521	0.903

**Discussion**

This study aimed to investigate the validity and reliability of Gomez and colleagues' electronic self-regulation questionnaire among high school students. The results showed that this instrument had high content, concurrent, structural, and

internal consistency validity and could be used to measure self-regulation among high school students. In the following section, a general conclusion from each finding is presented, and this conclusion is compared and explained by similar studies. The results of content validity

showed that this instrument had high content validity, and its questions were suitable for measuring the concept of self-regulation in the scientific field according to the experts' opinions and statistical criteria. This finding is consistent with the original researcher's and other researchers' results (22,38-41). This finding shows that the self-regulation questionnaire has conceptual validity and can be used to measure self-regulation in the scientific field. The high content validity in our study is probably because this questionnaire was designed based on the social-cognitive theory of Bandura and the self-regulation model of Zimmerman, and valid and reliable methods for content validity assessment were used.

The results of concurrent validity showed that the self-regulation questionnaire had acceptable concurrent validity and had a positive and significant correlation with the academic self-regulation scale by Magno, which is a valid and famous scale. This finding is consistent with the original researcher's and other researchers' results (22,38-41). This finding shows that Gomez and colleagues' self-regulation questionnaire has criterion validity. In the probable explanation of this finding, this questionnaire and the academic self-regulation scale measure a common concept, self-regulation, and use similar theories to explain this concept.

The results of structural validity showed that Gomez and colleagues' self-regulation questionnaire consisted of 15 questions from four factors: 1-identified, 2-internalized, 3-external, and 4-intrinsic. This finding shows that this questionnaire has a four-factor structure consistent with the theoretical concepts related to self-regulation. The social-cognitive theory of Bandura states that self-regulation is a dynamic and interactive process in which individuals strategically use cognitive, behavioral, and environmental strategies to align themselves with their goals (42). The self-regulation model of Zimmerman also models self-regulation as a cyclical process consisting of three phases: prediction, performance, and feedback. These two theories emphasize that motivation is an important factor in self-regulation and that intrinsic motivation helps more than extrinsic motivation in self-regulation (43).

The self-determination theory of Deci and Ryan also defines four types of motivation that differ in the degree of internalization: intrinsic motivation, internalized motivation, identified

motivation, and external motivation. This theory says that intrinsic motivation is a reaction that arises from interest and pleasure and has the highest level of internalization. Internalized motivation is a reaction that arises from the perception of value and meaning and has a high level of internalization. Identified motivation is a reaction that arises from alignment with identity and goals and has a moderate level of internalization.

External motivation is a reaction that arises from being influenced by external factors and has the lowest level of internalization (44). According to these theories, the Gomez and colleagues' self-regulation questionnaire can measure self-regulation in a multidimensional way by using four factors related to four types of motivation. This scale can show how much students have each type of motivation in the scientific field and how these motivations affect their self-regulation strategies. This finding is consistent with the research of other researchers who have shown that this questionnaire has high structural validity and can be used in different countries and cultures (22,38-41).

Regarding internal consistency, the results obtained for the total scale and each of the dimensions showed that the self-regulation questionnaire has sufficient reliability, which is consistent with the results of Gomez and colleagues and other researchers (22,38-41).

The reliability of this instrument means that this scale can measure the level of self-regulation of an individual with high accuracy and without significant changes at different times. The Gomez and colleagues' self-regulation questionnaire is also a valid and reliable tool for measuring self-regulation. Gomez and colleagues explained the high reliability of this instrument by stating that it has been constructed using valid and effective methods such as CFA, path analysis, and impact analysis. These methods help to ensure the structure and relationships between the dimensions and components of the scale.

In aligning the operational methodologies of the current study with previous research, it can be acknowledged that this investigation, in line with studies such as those by Gordeeva et al. (38) and Sousa and Silva (39) has utilized a multistage cluster sampling method. However, the statistical population under examination in this research encompasses high school students in Tehran. In contrast, Gordeeva and colleagues focused on elementary and middle school



students in Russia, and Sousa and Silva concentrated on third-cycle primary school students in Portugal. Regarding the instruments used, self-regulation questionnaires by Gomez and colleagues and the academic self-regulation questionnaire by Magno, also employed in the studies by Gomez et al. and Mata et al. (22,40).

The present study has strengths and limitations. One of the strengths of this study is the use of an electronic questionnaire, which can help reduce costs, increase access, and improve data accuracy. Also, the use of different methods for evaluating the reliability and validity of this scale is another strength of this study.

The factorial structure of the Gomez and colleagues' self-regulation questionnaire can also be another strength of this study, as this structure is consistent with the theories and models existing in the field of self-regulation and can provide a new theoretical framework for examining self-regulation in students. On the other hand, this study also faces some limitations. One of these limitations is that the validity of the Gomez and colleagues' self-regulation questionnaire has been done only in Tehran, one of advanced and equipped cities in Iran; therefore, the generalizability of the results to students in other cities and regions may need some help. Another limitation of this study is that the sample only included high school students, which could lead to sampling bias. To overcome this limitation, it is suggested that in future studies, the Gomez and colleagues' self-regulation questionnaire be validated based on different age groups.

Also, since this scale is a self-report measure, different perceptions of individuals themselves may have a negative impact on the assessment of self-regulation; therefore, it is suggested that in future studies, other methods for measuring self-regulation be used. For example, direct observation, interviews, or cognitive tests can be used. In addition, using this scale in future studies to compare self-regulation between genders, different age groups, and students is also recommended.

## References

1. Sanjari S, Soleimani MRM. Validation of the Persian version of the Engagement in E-Learning Scale in students of the school of nursing and midwifery in Iran. *Middle East journal of rehabilitation and health studies* 2023; 10(3): e134881.
2. Raghunathan RS, Musci RJ, Voegtline KM, Chambers Thomas T, Johnson SB. Children's attention and self-regulatory behavior before and during the COVID-19 pandemic. *J Dev Behav Pediatr* 2022; 43(4): e263-8.
3. Cheng TL, Conca-Cheng AM. The pandemics of racism and COVID-19: Danger and opportunity. *Pediatrics* 2020; 146(5): e2020024836.

## Conclusion

This study was conducted to investigate the validity and reliability of the self-regulation scale by Gomez and colleagues among high school students in Iran. The results showed that this scale has high content, concurrent, structural, and internal consistency validity and can be used to measure the self-regulation of high school students. This scale measures self-regulation in a multidimensional way using four factors related to four types of motivation. It is consistent with the theories and models existing in the field of self-regulation. This scale is a valid and reliable tool for measuring self-regulation and can be used in future studies to compare self-regulation among different groups.

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## Conflict of Interest

This research has no conflict of interest.

## Funding

This research was conducted without any financial support.

## Ethical Considerations

This research was approved by ethics committee of Islamic Azad University, Arak branch. This study conducted according to ethical principles and with written consent from the participants. The participants were assured that their information would be kept confidential and used only for research purposes. They could also withdraw from the study at any stage.

## Ethical code

IR.IAU.ARAK.REC.1403.081.

## Authors' Contributions

DT and MA wrote the manuscript, DT and ZP performed the statistical analysis and validation, and DT and MA approved the final article.

4. Torabi B, Amirfakhræ A, Rezaei Gazaki P, Mohammadi Soleimani MR. [Investigation of factor structure and validation of Ryff's Psychological Well-Being Scale in working children in the corona crisis: A descriptive study]. *Journal of Rafsanjan University of Medical Sciences* 2022; 21(2): 149-64. (Persian)
5. Hosseini Nasab A, Sanjari S, Mohammadi Soleimani MR, Alidousti K. Assessing stress, anxiety, and depression in women with menstrual disorders caused by COVID-19 vaccines. *Journal of medicine and public health* 2023; 4(1): 1058.
6. Sajadi Monazah H, Mohammadi Soliemani MR, Jahan F. Investigating the factor structure and validation of the multidimensional scale of acceptance of collective violence among teenagers: An exploratory and confirmatory factor analysis. *Iran J Psychiatry Behav Sci* 2024; 18(2): e137999.
7. Tavan A, Solimani Fard Z. [Investigating the effectiveness of teaching spiritual intelligence based on Islamic education teachings on the afterlife and religious orientation of students]. *Applied issues in quarterly journal of Islamic education* 2022; 7(2): 33-48. (Persian)
8. Yas Salari Pashghi F, Sanjari S, AmirFakhræi A. [Presenting a conceptual model of Islamic strategies for coping with coronavirus stress: A fundamental theory]. *Iranian journal of culture and health promotion* 2023; 6(4): 688-93. (Persian)
9. Wesarg-Menzel C, Ebbes R, Hensums M, Wagemaker E, Zaharieva MS, Staaks JPC, et al. Development and socialization of self-regulation from infancy to adolescence: A meta-review differentiating between self-regulatory abilities, goals, and motivation. *Dev Rev* 2023; 69: 101090.
10. Tresnadiani D, Taufik A. The development and validation of Short Self-Regulation Scale (SSR) on Indonesian college students. *Proceedings of the 5<sup>th</sup> International Seminar of Public Health and Education, ISPHE 2020, 22 July 2020, Universitas Negeri Semarang, Semarang, Indonesia.*
11. Wolff M, Enge S, Kräplin A, Krönke KM, Bühringer G, Smolka MN, et al. Chronic stress, executive functioning, and real-life self-control: An experience sampling study. *J Pers* 2021; 89(3): 402-21.
12. Wang Q, Liu H, Ren Z, Xiong W, He M, Li N, et al. The associations of family functioning, general well-being, and exercise with mental health among end-stage renal disease patients. *Psychiatry Investig* 2020; 17(4): 356-65.
13. Suyanto S, Kandel S, Kemal RA, Arfianti A. The quality of life of coronavirus disease survivors living in rural and urban area of Riau Province, Indonesia. *Infect Dis Rep* 2022; 14(1): 33-42.
14. Chachula KM, Ahmad N. Professional quality of life, stress, and trauma in nursing students: Before and during the novel coronavirus pandemic. *Psychol Trauma* 2022; 14(8): 1333-7.
15. Saniasiaya J, Prepageran N. Impact of olfactory dysfunction on quality of life in coronavirus disease 2019 patients: A systematic review. *J Laryngol Otol* 2021; 135(11): 947-52.
16. Panahi Far S, Maheri Nooryani Z, Ghanbari Z, Sanjari S. [The relationship between self-esteem, resilience and differentiation with covid-19 anxiety in hospital nurses: A cross-sectional study]. *Journal of critical care nursing* 2022; 15(1): 63-72. (Persian)
17. Durand-Bush N, Baker J, van den Berg F, Richard V, Bloom GA. The Gold Medal Profile for Sport Psychology (GMP-SP). *J Appl Sport Psychol* 2023; 35(4): 547-70.
18. Montroy JJ, Bowles RP, Skibbe LE, McClelland MM, Morrison FJ. The development of self-regulation across early childhood. *Dev Psychol* 2016; 52(11): 1744-62.
19. Rodriguez JE, Holmes HL, Alquist JL, Uziel L, Stinnett AJ. Self-controlled responses to COVID-19: Self-control and uncertainty predict responses to the COVID-19 pandemic. *Curr Psychol* 2023; 42(9): 7321-35.
20. Cannavan PMS, Cannavan FPS, Oliveira HC, Walfridsson U, Lopes M. A Brazilian Portuguese translation, cultural adaptation and validation of the arrhythmia-specific questionnaire in Tachycardia and Arrhythmia (ASTA) health-related quality of life (HRQOL) scale. *PLoS One* 2021; 16(8): e0256851.
21. Hamed Y, Hossein P, Mohsen Dehghani G, Mohammadreza Mohammadi S. [Validation of the HSE assessment tools in the Kerman Province Steel Industry Complex: A case study]. *Scientific journal of School of Public Health and Institute of Public Health Research* 2023; 20(4): 423-34. (Persian)
22. Gomes M, Monteiro V, Mata L, Peixoto F, Santos N, Sanches C. [The Academic Self-Regulation Questionnaire: A study with Portuguese elementary school children]. *Psicol Reflex Crit* 2019; 32(1): 1-9. (Portuguese)
23. Yeganeh H, Parvaresh H, dehghani M, Mohammidi Soleimani MR. [Construction and standardization of performance evaluation test of health, safety and environment management systems of industrial sector contractors]. *Journal of health management* 2022; 12(3): 73-86. (Persian)
24. Sanjari S, Mohammadi Soleimani MR. Validation of the knowledge sharing behavior scale among nursing and midwifery faculty members in Iran: Psychometric properties and cross-cultural adaptation. *Middle East journal of rehabilitation health studies* 2024; 11(1): e134886.
25. Martin CR. Minimum sample size Requirements for a validation study of the Birth Satisfaction Scale-Revised (BSS-R). *J Nurs Pract* 2017; 1(1): 25-30.
26. White M. Sample size in quantitative instrument validation studies: A systematic review of articles published in Scopus, 2021. *Heliyon* 2022; 8(12): e12223.

27. Gunawan J, Marzilli C, Aunguroch Y. Establishing appropriate sample size for developing and validating a questionnaire in nursing research. *Belitung Nurs J* 2021; 7(5): 356-60.
28. Lee WL, Chinna K, Lim Abdullah K, Zainal Abidin I. The forward-backward and dual-panel translation methods are comparable in producing semantic equivalent versions of a heart quality of life questionnaire. *Int J Nurs Pract* 2019; 25(1): e12715.
29. Barani H, Mohammadi Soleimani MR, Amirfakhraei A, Wahab Samavi SA. Transcultural adaptation and psychometric evaluation of the online learning self-efficacy scale among high school seniors in Bandar Abbas City. *Interdiscip J Virtual Learn Med Sci* 2024; 15(1): 62-75.
30. Magno C. Validating the Academic Self-Regulated Learning Scale with the Motivated Strategies For Learning Questionnaire (MSLQ) and Learning and Study Strategies Inventory (LASSI). *Int J Educ Psychol Assess* 2011; 7(2): 1-18.
31. Mohammadipour M, Delavar A, Ahadi H, Dortaj F, Asadzadeh H. [Psychometric indices of academic self-regulation learning scale]. *Research in clinical psychology and counseling* 2017; 6(2): 79-95. (Persian)
32. Salari Chineh P, Tavan A, Soltani Nezhad N, Manzari Tavakoli V. [A model of professional ethics education for the student-teachers at Teacher Training University: A qualitative study]. *Journal of higher education curriculum studies* 2023; 14: 143-69. (Persian)
33. Sanjari S, Fakhraei AA, Soleimani MRM, Alidousti K. Validation of the slade fear of childbirth scale for pregnancy in a sample of Iranian women: A cross-sectional study. *Crescent journal of medical and biological sciences* 2022; 9(3): 138-46.
34. Sanjari S, Kamali A, AmirFakhraei A, Mohammadi Soleimani MR, Karimi Afshar E. Construction and validation of a self-report violence scale in Iranian women. *Journal of fundamentals of mental health* 2021; 23(3): 181-9.
35. Heidari A, Babaei Nezhad A. [Evaluation of the relationship between emotional intelligence and social intelligence with employees' job performance (Case study: General Department of Social Security of Kerman province)]. *Political sociology of Iran* 2022; 4(4): 4974-90. (Persian)
36. Sanjari S, Mohammadi Soliemani M, Keramat A. Development and validation of an electronic scale for sexual violence experiences in Iranian women. *Crescent journal of medical and biological sciences* 2023; 10(1): 27-35.
37. Farahani H, Roshan Chesli R. [Essentials for developing and validating psychological scales: Guide to best practices]. *Clinical psychology and personality* 2020; 17(2): 197-212. (Persian)
38. Gordeeva TO, Sychev OA, Lynch MF. The construct validity of the Russian version of the Modified Academic Self-Regulation Questionnaire (SRQ-A) among elementary and middle school children. *Psychol Russ* 2020; 13(3): 2-23.
39. Sousa SP, Silva R. Validity and reliability of the Portuguese version of Mathematics Academic Motivation Scale (MATAMS) among third cycle of basic school students. *Mathematics* 2021; 9(17): 2049.
40. Mata L, Monteiro V, Peixoto F, Santos NN, Sanches C, Gomes M. Emotional profiles regarding maths among primary school children – A two-year longitudinal study. *European journal of psychology of education* 2022; 37(2): 391-415.
41. Nu'Man M, Retnawati H, Sugiman S, Jailani J. Measuring self-regulated learning in the STEM framework: A confirmatory factor analysis. *European journal of educational research* 2021; 10(4): 2067-77.
42. Bandura A. Social cognitive theory of self-regulation. *Organ Behav Hum Decis Process* 1991; 50(2): 248-87.
43. Panadero E. A review of self-regulated learning: Six models and four directions for research. *Front Psychol* 2017; 8: 422.
44. Ryan RM, Deci EL. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *Am Psychol* 2000; 55(1): 68-78.