The validity and reliability of the Turkish version of revised metacognitive awareness of reading strategies inventory

Rabia Börekci [1,*], **Caner Börekci** [2]

[1] Ministry of National Education, Balıkesir, Türkiye
[2] Balıkesir University, Research Center for Distance Learning, Balıkesir, Türkiye

Abstract: This study aims to adapt the revised Metacognitive Awareness of Reading Strategies Inventory (MARSI- R) into Turkish. MARSI-R is a self-report instrument designed to assess students' metacognitive awareness of reading strategies and perceived strategy use when reading school-related materials. 525 students (65% female, 35% male, M_{age} = 13 years old.) from multiple school types and degrees participated in this study. A stepwise validation procedure was used to translate and produce a Turkish version of the inventory. Evidence of structural and external aspects of validity for the inventory was collected. The 15-item inventory had a three-factor solution (global reading strategies, problem-solving strategies, and support reading strategies), as supported by confirmatory factor analysis. Turkish version scores were positively correlated with students' perceived reading ability, which provides evidence of MARSI-R's external validity. The coefficient of stability was calculated using data from 85 students who took the Turkish version of the MARSI-R twice in a five-week interval. The study's overall results provided evidence of the reliability and validity of the inventory. According to the results presented in this study, the Turkish version of the inventory can be implemented to assess the students' metacognitive awareness of reading strategies and perceived strategy use. The findings show that the adapted inventory can be used to obtain valid and reliable results for Turkish lower and upper secondary school students.

1. INTRODUCTION

Researchers have been highly interested in the metacognitive aspect of reading comprehension for almost three decades The source of this growing interest in metacognition stems from its effects on the reading process because metacognition, which is defined as "knowledge that takes as its object or regulates any component of any cognitive attempt" (Flavell, 1979, cited in Kusiak, 2013, p. 67), encourages readers to think about thinking and monitor reading comprehension because thinking and monitoring the process affect the nature of reading (Alderson & Alderson, 2000). In that way, readers identify what they already know, monitor the progress in the process, define the problematic areas, and repair them (Grabe & Stoller, 2013). Thus, while assessing reading comprehension, metacognition affects reading

comprehension, and this effect has been the subject of several studies in language learning (Aghaie & Zhang, 2012; Köse & Günesli, 2021; Phakiti, 2008; Wenden, 1998).

Reading comprehension is "a process of simultaneously extracting and constructing meaning through interaction and involvement with written language" (RAND Reading Study Group, 2002, p. 11), and based on this perspective, reading comprehension is interactive and involves multiple processes, knowledge, and procedures. Skilled readers are better comprehenders and efficient strategy users (Zhang et al., 2017). Metacognitive reading strategies are implemented by skilled readers and are referred to as strategic competence (Bachman & Palmar, 2010). Thus, metacognitive reading strategies enable readers to comprehend better while monitoring and regulating the cognitive processes (Devine, 1993), and skilled readers implement more than one strategy at a time (Grabe & Stoller, 2013) to take control of their learning by planning, monitoring, and evaluating the process (Brown, 2000). Moreover, metacognitive reading strategies enable readers to identify possible ways to overcome some reading comprehension-related problems (Villanueva Aguilera, 2014). By reflecting upon reading, monitoring the process by asking comprehension questions, and taking charge of the process (Soto et al., 2019), skilled readers can handle these issues by implementing multiple strategies.

Readers' awareness of metacognitive reading strategies improves the reading comprehension process, and this level of consciousness supports learners in paying specific attention to the process. This awareness is also the indicator of knowledge of metacognition, the ability to use that knowledge and strategy (Zhang et al., 2017). But how to assess language learners' awareness or "perceived use of reading strategies" as stated by Moktari et al. (2018) is a fundamental question. And this brings us to the Revised Metacognitive Awareness of Reading Strategies Inventory (MARSI-R). This inventory is widely used due to its ease of use, better interpretation of responses, and speed of inventory screening in comparison to other instruments for measuring metacognitive awareness of reading strategies, such as the SORS (Mokhtari & Sheorey, 2002) or the Metacomprehension Inventory (Soto et al., 2018). Although the inventory was revised in 2018, the widespread use of the old version in the Turkish context indicated a gap and the need for a new adaptation study, which was also the motivation for this study. In other words, the adapted version of MARSI by Öztürk in Turkish (2012) has been widely used in the Turkish context (e.g., Boyraz, & Altinsoy, 2017; Sarıçoban & Behjoo, 2017), and although the revised version has been available since 2018, the old version is still implemented in some recent studies (e.g., Bagcı & Unveren, 2020; Erdoğan & Yurdabakan, 2018; Köse & Günesli, 2021; Tamin & Büyükahska, 2020). In conclusion, before giving detailed information about the methodology of the study, a piece of brief information will be given for a better understanding of the revision and enhancement of the old form into a revised 15-item inventory.

Metacognitive Awareness of Reading Strategies Inventory developed by Mokhtari and Reichard (2002) comprises three latent factors: global reading strategies (13 items), problem-solving strategies (9 items), and support reading strategies (8 items), for a total of 30 items. It is a Likert survey on a five-point scale (1 = "I never or almost never do this," and 5 = "I always or almost always do this"). This inventory was designed to assess the metacognitive awareness of reading strategies of adult or adolescent language learners. Thus, the target group in the main study is adults and adolescents, but only adolescents are included in this study because the term "adolescent" covers the period of life between childhood and adulthood, between the ages of 10 and 19 (Encyclopedia Britannica, 2023), which is also the age range of the participants in this study. In the relevant literature, the development of metacognition can also be seen as an early stage of adolescence (Kolić-Vehovec et al., 2010; Wall, 2008). MARSI has been translated into various languages, and Turkish is one of them. As mentioned above, Öztürk (2012) conducted a study to adapt the inventory to Turkish. For the piloting stage, 29 6th-grade students, and for the main study, 250 5th-grade students participated in the study. Fit indices

were examined, and the values were consistent with the standard values. The results of the confirmatory factor analysis of the adaptation study conducted by Öztürk demonstrated that the Turkish version of the MARSI was consistent with the main study of Mokhtari and Reichard (2002).

Researchers and practitioners have implemented MARSI in their studies and provided feedback, which has been used to shape the revised version. The initial aim of revising the inventory is to make it more effective in assessing metacognitive reading strategy awareness and perceived use of strategy. Mentioned as "enhancements", the focus of these changes is on the readability and comprehensibility of the items related to strategy awareness and implementation for even fourth-grade students, allowing them to easily understand and complete the form. One of the changes in wording is illustrated with an example; "I try to get back on track when I lose concentration" (Problem-solving Strategies) evolved to "getting back on track when getting sidetracked or distracted." The format of the inventory and the response type were improved for a better interpretation of the results. Likert-type scale items were revised to assess participants' degree of knowledge of reading strategies. This enhancement was explained in the article as "5", which means "I always or almost do this" in the old version turned into "I know this strategy quite well, and I often use it when I read." Mokhtari, Dimitrov, and Reichard conducted another study to provide validity and reliability for the revised instrument. The revised version of the instrument has fifteen items, five for each of three latent factors same as in the old version: global reading strategies, problem-solving strategies, and support reading strategies. The inventory takes about 15-20 minutes to complete, and there is some background knowledge information that aims to identify each participant's age, level, and type of school, as well as a reader scale that asks participants to label themselves as readers.

This study aims to adapt the Revised Metacognitive Awareness Reading Strategies Inventory into Turkish and provide evidence for valid and reliable results for Turkish lower and upper secondary school students while evaluating their awareness and perceptions of metacognitive reading comprehension strategies. The old version was adapted into Turkish and implemented in several studies, but the revised version of the inventory hasn't been adapted into Turkish yet. The revised version was strengthened based on feedback from on-site implementations, the reflections of the implementers, and the statistical analysis of the data gathered with the old version. Thus, a more recent, readable, and comprehensible version is available. Researchers of this study aim to contribute to the related literature by adapting the inventory into Turkish. In this way, MARSI-R can be administered in multiple classrooms or to multilevel readers in the Turkish context with fewer items, improved wording, and scale instruction, and it is more convenient for multiple screenings.

2. METHOD

2.1. Sample

This study involved the voluntary participation of Turkish lower and upper secondary school students. The study group was selected by convenience sampling and consisted of students from multiple school types and levels. After the ethics committees of Çanakkale Onsekiz Mart University and the Ministry of Education approved the study, the survey was conducted in face-to-face classes. The scales were applied to a total of 537 students, and the data of 12 students were removed from the data set as a result of the detection of outliers. In this way, the sample was reduced to a total of 525 (346 female, 179 male) Turkish students (M_{age} = 13 yr., SD = 2.2, range 10 to 19). These students attended public lower and upper secondary schools in Turkey and had different grade levels. The sample included 305 lower and 220 upper secondary school students.

2.2. Instrument

MARSI-R, which is a self-report instrument, is used to measure students' metacognitive awareness of reading strategies while they read school-related materials. (Moktari et al., 2018). The inventory's revised version consists of 15 items categorized as three factors and graded on a five-point scale (1. "I have never heard of this strategy before." 2. "I have heard of this strategy, but I don't know what it means." 3." I have heard of this strategy, and I think I know what it means." 4. "I know this strategy, and I can explain how and when to use it." 5. "I know this strategy quite well, and I often use it when I read."). The original study's three-factor structure had a loading of at least .40 (the factor loadings of the original version are shown in Appendix A). The internal consistency and reliability of MARSI-R were measured by Cronbach's alpha coefficient, which was equivalent to .850. Per the latent factors, the support reading, problem-solving, and global reading strategies' alpha values were .703, .693, and.743, respectively. The fit indices of the 3-factor scale were CFI = .972, TLI = .966, WRMR = 1.188, and RMSEA = .046, with 90% CI [.016 .027], respectively. The three broad categories of strategies measured by the MARSI-R include:(1) Global reading strategies (GRS), also described as generalized or global reading strategies, are meant to prepare readers for the reading process (e.g., setting a purpose for reading, previewing text content, predicting what the text is about, etc.). (2) Problem-solving Strategies (PSS), which are localized, focused problem-solving or repair strategies used when difficulties are encountered in comprehending textual information (e.g., verifying one's comprehension when confronted with conflicting information, rereading for clarity, etc.). (3) Support reading strategies (SRS), which provide the mechanisms or tools necessary to keep readers' responsiveness (e.g., the use of reference materials such as dictionaries and other support systems). When used in the process of deriving meaning from text, these three subcategories of strategies interact and reinforce each other. The inventory also provides a reader scale that has four options to self-report what level of reader they are. These are: I consider myself (1) an excellent reader, (2) a good reader (3) an average reader, and (4) a poor reader. Moktari and colleagues (2018) suggest interpreting the scores on the instrument as (1) high level of awareness (3.5 points or above) (2) medium level of awareness (2.5 -3.4) and (3) low level of awareness (2.4 points or under). The scores of the items for each reading strategy are summed and divided by five for each subscale score, and all the items' scores in the inventory are summed and divided by the number of items for a composite score. They advise administering the MARSI-R instrument two or three times per school year to track student metacognitive awareness of and use of reading strategies in relation to overall reading performance.

2.3. Procedure and Data Analysis

The MARSI-R was translated and adapted into Turkish using a step-by-step validation approach. The items ' semantic equivalence was established through a translation and back translation procedure (Mallinckrodt & Wang, 2004). A group of Turkish lower and upper secondary school students provided feedback on the items' clarity. Experts in reading comprehension and metacognitive awareness who are native speakers of Turkish and proficient in English were consulted to determine the content equivalency of the Turkish version of the inventory. The measurement's criterion equivalence was investigated following the establishment of construct validity. Below is a detailed explanation of the validation and data analysis process.

Step 1: Two EFL instructors in the school of foreign languages at the university independently translated the MARSI-R items into Turkish. The translated items were then given to two other EFL instructors who were fluent in both languages for back translation. These instructors translated the items into Turkish and then back into English independently.

Step 2: The researchers reviewed the back-translated items and contrasted them with the

original MARSI-R items. Researchers examined the back-translated items to determine whether they were semantically equivalent to the original items and made sure that the translation procedure had maintained the original items' intended meaning. A draft version of the MARSI-R in Turkish was created based on the suggested elements.

Step 3: Two experts, one in ELT and the other in curriculum and instruction, evaluated the first draft of the Turkish version of MARSI-R for content equivalence and cultural appropriateness. The wording of a few items in the Turkish version's initial draft was changed based on feedback from experts to better convey the concepts that the inventory developers intended. The field experts' revision suggestions served as the basis for the second draft of the Turkish MARSI-R.

Step 4: To test the items' readability and clarity for the targeted users, the MARSI-R's second draft in Turkish was given to five lower secondary and five upper secondary school students. Students who took part in this pilot study were asked if they thought the items' meanings were clear. Additionally, students were encouraged to offer substitutes for any phrases or items that they felt were unclear. Two items underwent minor adjustments in response to student comments. The Turkish version's final form was created based on the student's feedback.

Step 5: To establish the validity and reliability of the inventory scores in the Turkish sample, the final form of the MARSI-R was administered to lower and upper secondary school students in face-to-face classes. Unidimensional Confirmatory Factor Analysis, Standard Confirmatory Factor Analysis, Bifactor Confirmatory Factor Analysis, and Exploratory Structural Equation Modelling (ESEM) were used to determine the inventory's structural validity. MPlus (ver. 8.1) and Jamovi (ver. 2.3.21) open statistical software, were used to conduct the analyses (Gallucci & Jentschke, 2021) on the three-factor, 15-item model (see Figure 1) to inspect the structural validity. Jamovi is built on the R statistical language and the *lavaan* package used for FA (Rosseel, 2019). Factor analysis required several presumptions to be met before the analysis could begin. Univariate normality, univariate outliers, multivariate normality, and multivariate outliers were thus investigated. Based on kurtosis and skewness values, as well as z standard scores, univariate normality and univariate outlier analyses were performed. Multivariate outliers and multivariate normality were determined using Mahalanobis distance and residual calculations. According to MacCallum et al. (1999), sample size can affect the accuracy of parameter estimates, the model's fit to the data, the influence of observable variables on the proportion of variance explained by common factors, and all these aspects in factor analytic models. For this reason, it was intended to reach the highest possible number of participants. The sample size (N = 525) is considered suitable for FA. After checking the assumptions, it was seen that the most appropriate methods for the analysis of the data were Maximum Likelihood (ML) and Robust Diagonally Weighted Least Squares (known as one of the categorical variable modeling alternatives). It is an alternative to the DWLS model for ordinal data, especially when the responses also have a high degree of skewness, kurtosis, or both (Distefano & Morgan, 2014; Muthén, 1993). The fit indices were based on conventional guidelines introduced by Hu and Bentler (1998). CFI and TLI values in the region of 0.95 indicate a good model fit, but values around 0.90 may be acceptable. The RMSEA should be equal to or less than .07 and .05 to reflect acceptable and good model fits respectively. In the ESEM model, cross-loadings are 'targeted' to be as close to zero as possible to reflect the confirmatory approach of ESEM (Morin et al., 2020). Average Variance Extracted (AVE) measures were also used to determine the scale's convergent and discriminant validity for each dimension. The square roots of all AVEs are displayed on the diagonal in Table 4 to establish discriminant validity. The correlation between the latent factors (GRS, PSS, and SRS) was examined for convergent validity. The reader variable, used as an external measure of perceived reading ability, was used to measure the Pearson correlation coefficients between the student's scores on each of the three MARSI-R latent factors (GRS, PSS, and SRS). Internal consistency

and coefficient of stability approaches were used to calculate the measurement's reliability. The Cronbach's Alpha, McDonald's Omega, and Composite Reliability scores were used as indicators of internal consistency. The test-retest method was preferred to examine the coefficient of stability. A total of 85 students took part in the test-retest procedure. The retest was done after 5 weeks, 45 of them were lower secondary and 40 were upper secondary school students.

3. RESULTS

Descriptive Statistics: Table 1 presents the means and standard deviations for the overall MARSI-R score by gender, school type, and sample size of 525 students. According to the descriptive statistics, the sample's MARSI-R mean score was 3.59 (*SD* = .70). In addition, the descriptive statistics of the items and the correlation between the items are presented in Appendix B.

Table 1. *Means and standard deviations of MARSI-R scores by gender, school type, and the total sample.*

		GRS		PSS		SRS		Total	
	N	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Gender									
Female	346	3.56	.84	3.80	.82	3.61	.74	3.66	.69
Male	179	3.44	.88	3.63	.89	3.26	.88	3.44	.77
School Type									
L. Secondary	305	3.46	.91	3.68	.85	3.47	.79	3.54	.74
U. Secondary	220	3.61	.78	3.81	.85	3.52	.83	3.65	.71
Total	525	3.52	.86	3.74	.85	3.50	.81	3.59	.70

Note. *N* = Sample size, *M* = Mean, *SD* = Standard deviation

3.1. Examining the Factorial Validity of the MARSI-R

Table 2 shows the calculated normality values for the items for univariate normality. For multivariate normality, Mardia's multivariate skewness and kurtosis coefficients and p values were calculated. Mardia's Test determines whether a group of variables follows a multivariate normal distribution (Von Eye & Bogat, 2004).

Table 2. *Skewness and kurtosis values of items.*

Item	Kurtosis (s.e.)	Skewness (s.e.)	Item	Kurtosis	Skewness
GRS1	-.876 (.213)	-.128 (.106)	SRS1	-.182	-.499
GRS2	-.045	-.954	SRS2	-.637	-.583
GRS3	-.833	-.515	SRS3	-.842	-.409
GRS4	-.939	-.590	SRS4	.249	-1.11
GRS5	-.942	-.429	SRS5	-1.03	-.014
PSS1	-.686	-.565	GRS	-.113	-.537
PSS2	-.372	-.920	PSS	.155	-.686
PSS3	-1.23	-.315	SRS	-.026	-.579
PSS4	.140	-1.02	MARSI-R	.250	-.594
PSS5	-.109	-.932			

From the results, both the skewness ($\gamma 1_p = 2.96$, $p = 0.1772$) and kurtosis ($\gamma 2_p = 18.1$, $p = 0.112$) estimates indicate multivariate normality. Therefore, according to Mardia's MVN test, this data set follows a multivariate normal distribution. The assumption of multicollinearity, variance inflation factor (VIF), and tolerance values were analyzed (Tabachnick & Field, 1996). As a result of the analysis, the VIF and tolerance values were found to be within acceptable ranges (GRS = 1.77 - .56; PSS = 2.10 - .47, SRS = 190 - .52). This indicates that there is no multicollinearity problem as the VIF value is not greater than 10 and the tolerance value is not less than .10. The fit values and factor loadings of the four models were calculated after testing the assumptions. The models are illustrated in Figure 1.

Figure 1. *Visual representation of the four models tested in the present study.*

| Unidimensional Model | Standard CFA |

| Bifactor CFA Model | ESEM |
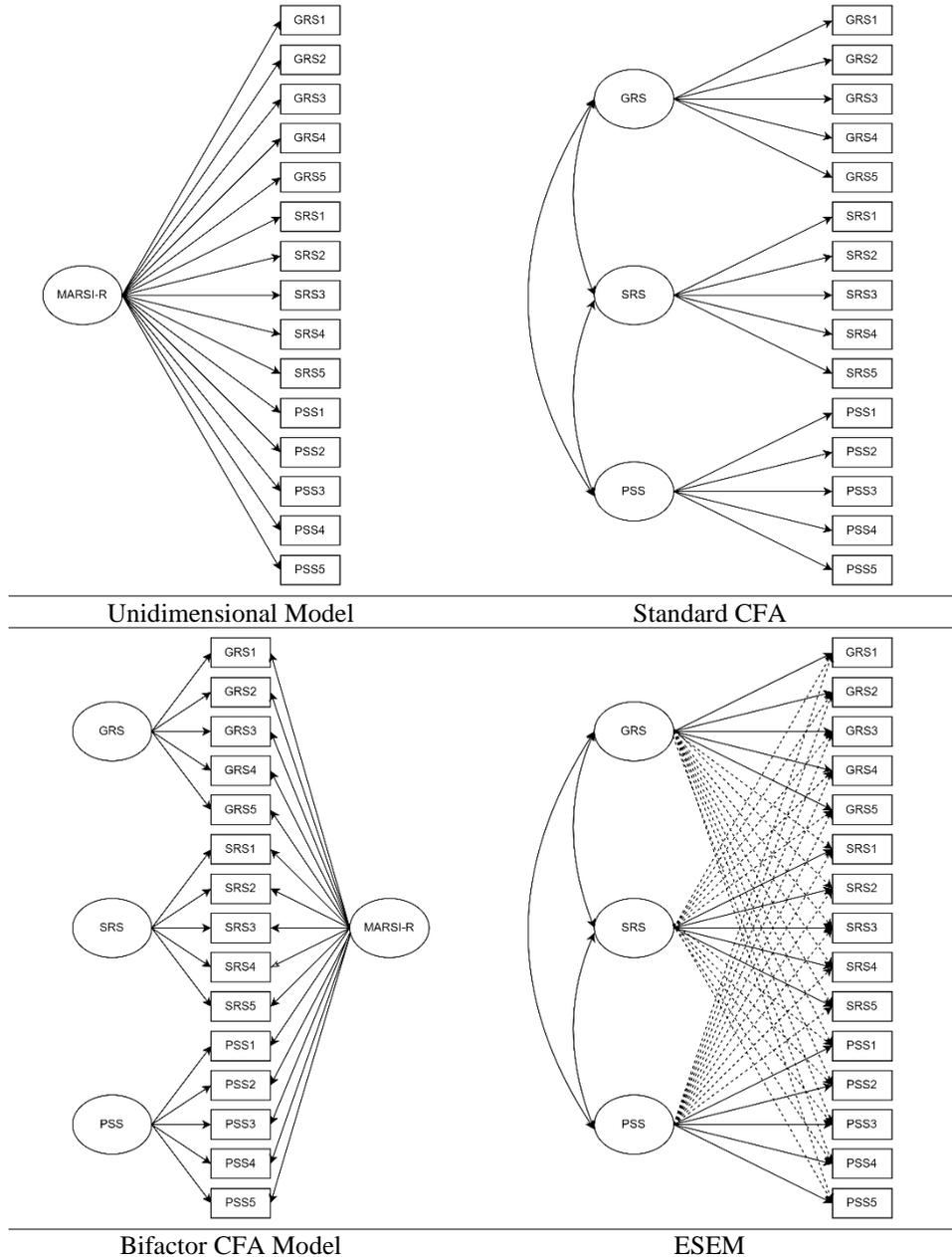
As shown in Table 3, the values obtained for the unidimensional model are acceptable and for the others are good (Hu & Bentler, 1998; Schumacher & Lomax, 2010). Although the analyses showed good model fit, it was important to inspect the factor loadings of all models to see how each solution functioned in estimating model parameters. The factor loadings of bifactor and

ESEM solutions many items are below .40 in bifactor and ESEM analyses (see Appendix A). The factor loadings for items indicate how much of the average respondent's answer to that item is due to his or her general interest in agentic goals, as opposed to something unique to that item. In other words, the factor loadings are an indication of how well the items represent the underlying factor. Therefore, it can be said that using unidimensional and standard CFA models is more appropriate.

Table 3. *Model fit indices for four measurement models of the MARSI-R.*

Model	X^2	p	df	RMSEA (%95 CI Low-High)	CFI	TLI
Unidimensional CFA	237	<.001	90	.056 (.047 - .064)	.912	.897
Standard CFA	219	<.001	87	.053 (.044 -.062)	.988	.966
Bifactor CFA	114	<.001	69	.035 (.023 - .046)	.973	.956
ESEM	71.2	.153	60	.019 (.010 - .034)	.993	.998

3.2. Discriminant Validity

Average Variance Extracted (AVE) values are shown in Table 4. All AVE values were higher than .40, which provides evidence for the convergent validity of the scale (Fornell & Larcker, 1981). The square roots of all AVE values (diagonally shown) were higher than the correlations shown below them or to their left, supporting the discriminant validity of the scale (Hair et al., 1995).

3.3. Convergent Validity

The factors under MARSI-R were found to be correlated: (1) $r = .624$ between global reading and problem-solving strategies, (2) $r = .570$ between global reading and support reading strategies, and (3) $r = .658$ between problem-solving strategies and support reading strategies (Table 4).

3.4. External Validity

The correlation between the latent factors scores and total scores on the MARSI-R with the scores on the variable reader was calculated as part of the process of gathering evidence relating to the external aspect of validity (Moktari et al., 2018). The Pearson Correlations between the factor scores under the MARSI-R and reader scores of the students are all statistically significant, (1) $r = .382$ between reader and global reading strategies, (2) $r = .346$ between reader and problem-solving strategies, (3) $r = .320$ between reader and support reading strategies, and (4) $r = .406$ between reader and the total score on the MARSI-R (Table 4).

Table 4. *Correlations, average variance extracted, and composite reliability values for each factor (N = 525, p < .001).*

	AVE	CR	GRS	PSS	SRS	Total Score	Reader Score
GRS	.50	.83	(.71)				
PSS	.50	.83	0.624[*]	(.71)			
SRS	.49	.71	0.570[*]	0.658[*]	(.70)		
Total Score			0.851[*]	0.883[*]	0.855[*]	—	
Reader Score			0.382[*]	0.346[*]	0.320[*]	0.406[*]	—

Note: [*] *p*<.001, AVE is average variance extracted; CR is composite reliability

3.5. Reliability and Item Analysis

By latent factors, the alpha values for global reading, problem-solving, and support reading strategies were .763, .693, and .743, respectively. McDonald's ω for the sample was .849. By latent factors, the ω values for global reading, problem-solving, and support reading strategies were .771, .705, and .752, respectively. The Stratified Alpha calculated for the whole scale is .848. These scores were an indication of the consistency of the participants' responses to the inventory items (McNeish, 2018; Taber, 2018). Reliability estimates of the adapted inventory were compatible with the original study. Composite Reliability (CR) scores are shown in Table 4. All CR values (GRS$_{CR}$ =.83, PSS$_{CR}$ = .83, SRS$_{CR}$ = .71) were higher than .70. Values greater than .60 are generally considered acceptable (Bagozzi & Yi, 1988). Inter-item correlations and corrected item-total correlations ranged from .45 to .56 and .48 to .61, respectively. The corrected item-total correlations were above the minimum level of 0.3. The inter-item correlations were also within the acceptable range (greater than 0.3). Test-retest reliability is a measure of the stability of scores on a stable construct from the same person on two or more separate occasions. The coefficient of stability was calculated using data from 85 students who took the Turkish version of the MARSI-R twice in a five-week interval. The Pearson correlation was r = .82, again demonstrating strong reliability.

4. DISCUSSION and CONCLUSION

This study examined the validity and reliability of the Turkish adaptation of MARSI-R using a sample of Turkish lower and upper secondary school students. Factor analysis results supported the structure of the 15-item MARSI-R for Turkish lower and upper secondary school students. The results provide evidence about (1) the structural aspect of validity, with a three-factor structure (GRS, PSS, and SRS), and (2) the external aspect of validity, with correlations between the students' scores on each of the three MARSI-R latent factors (GRS, PSS, SRS) and their scores on the reader scale as an external measure of perceived reading ability. The Turkish version of the inventory's reliability estimations were within the acceptable range, and they were equivalent to the reliability coefficients reported in the original study. Several adaptation studies of MARSI-R have been conducted in various contexts, such as Iranian by Amini et al. (2020), Spanish by Ondé et al. (2022), Vietnamese by Do and Phan (2021), Hungarian by Tary and Molnár (2022), and this study in the Turkish context is one of them. According to the results presented in this study, the Turkish version of the inventory can be implemented to assess the students' metacognitive awareness of reading strategies and perceived strategy use when reading school-related materials. This version is valid and reliable for Turkish lower and upper secondary school students.

Metacognitive reading strategy awareness and perceived reading strategy use are also important in higher education. Also, adult language learners may be the target group of another study. Reading comprehension strategy awareness and perceived strategy use affect the comprehension process. Different proficiency levels in the target language, reading habits, perceptions of themselves as readers, and multiple learners of different ages could be the subject of further studies. Scale development studies can be conducted for these groups, and their development can be monitored. Furthermore, this adapted scale can be tested for measurement invariance between genders or different groups, and it can be investigated whether there is consistency in interpreting the reading strategy statements between these groups. In terms of the convergent validity of the inventory, it can be compared with scales that measure similar characteristics. In addition, the scores obtained from the scale can be compared with students' performance in Turkish, Turkish language and literature, and foreign language courses, where their performance in reading comprehension is crucial.

This study has several potential limitations. First, this study is limited to the Turkish (EFL) context. Second, the grade level of the participants was limited to 5th to 12th grade. This means that the age range of the students was limited to those between the ages of 10 and 19. Last, the size of the sample that was chosen for the study could also be considered a limitation of the study.

Declaration of Conflicting Interests and Ethics

The authors declare no conflict of interest. This research study complies with research publishing ethics. The scientific and legal responsibility for manuscripts published in IJATE belongs to the authors. **Ethics Committee Number**: Çanakkale Onsekiz Mart University, E-84026528-050.01.04-2200276328.

Authorship Contribution Statement

Authors are expected to present author contributions statement to their manuscript such as; **Rabia Börekci**: Conception, Design, Supervision, Materials, Data Collection and Processing, Literature Review, Writing. **Caner Börekci**: Conception, Design, Materials, Data Collection and Processing, Analysis and Interpretation, Literature Review, Critical Review.

Orcid

Rabia Börekci https://orcid.org/0000-0001-5678-7365
Caner Börekci https://orcid.org/0000-0001-5749-2294

REFERENCES

Aghaie, R., & Zhang, L.J. (2012). Effects of explicit instruction in cognitive and metacognitive reading strategies on Iranian EFL students' reading performance and strategy transfer. *Instructional Science, 40*(6), 1063-1081. https://doi.org/10.1007/s11251-011-9202-5

Alderson, C.J., & Alderson, J.C. (2000). Assessing reading. Cambridge University Press. https://doi.org/10.1017/CBO9780511732935

Amini, D., Hosseini Anhari, M., & Ghasemzadeh, A. (2020). Modelling the relationship between metacognitive strategy awareness, self-regulation and reading proficiency of Iranian EFL learners, *Cogent Education, 7*(1), 1-17. https://doi.org/10.1080/2331186X.2020.1787018

Bachman, L.F. & Palmer, A.S. (2010). *Language assessment in practice: Developing language assessments and justifying their use in the real world*. OUP.

Bagci, H., & Unveren, D. (2020). Investigation of the relationship between metacognitive awareness of reading strategies and self-efficacy perception in reading comprehension in mother-tongue: Sample of 8th graders. *International Journal of Educational Methodology, 6*(1), 83-98. https://doi.org/10.12973/ijem.6.1.83

Bagozzi, R.P., & Phillips, L.W. (1982). Representing and testing organizational theories: A holistic construal, *Administrative Science Quarterly, 27* (September): 459-489. https://doi.org/10.2307/2392322

Brown, H.D. (2000). *Principles of language learning and teaching* (Vol. 4). Longman.

Boyraz, S., & Altinsoy, E. (2017). Metacognitive awareness of reading strategies in EFL context. *International Journal of Language Academy, 5*(5), 159-167. https://doi.org/10.18033/ijla.3655

Devine, J. (1988). The relationship between general language competence and second language reading proficiency: Implications for teaching. *Interactive approaches to second language reading*, 260-277. https://doi.org/10.1017/CBO9781139524513.024

Distefano, C., & Morgan, G.B. (2014). A comparison of diagonal weighted least squares robust estimation techniques for ordinal data. *Structural Equation Modeling: A Multidisciplinary Journal*, 21, 425- 438. https://doi.org/10.1080/10705511.2014.915373

Do, H.M., & Phan, H.L.T. (2021). Metacognitive awareness of reading strategies on second language Vietnamese undergraduates. *Arab World English Journal, 12*(1) 90-112. https://dx.doi.org/10.24093/awej/vol12no1.7

Encyclopædia Britannica, inc. (2023, March 28). Adolescence. Encyclopædia Britannica. Retrieved May 1, 2023, from https://www.britannica.com/science/adolescence

Erdoğan, T., & Yurdabakan, İ. (2018). Adaptation of metacognitive awareness of reading strategies inventory: Turkish higher education sample. *Electronic Turkish Studies, 13*(19), 669-680.

Fornell, C., & Larcker, D.F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39–50. https://doi:10.1177/002224378101800104

Gallucci, M., & Jentschke, S. (2021). *SEMLj: Jamovi SEM Analysis*. [jamovi module].

Grabe, W.P., & Stoller, F.L. (2013). *Teaching and researching: Reading*. Routledge. https://doi.org/10.4324/9781315833743

Hair, J.F., Jr., Anderson, R.E., Tatham, R.L., & Black, W.C. (1995). *Multivariate data analysis with readings* (4th ed.). Prentice-Hall.

Hu, L., & Bentler, P.M. (1998). Fit indices in covariance structure modeling: Sensitivity to under parameterized model misspecification. *Psychological Methods*, *3*, 424-453. https://doi:10.1037/1082-989X.3.4.424

Kolić-Vehovec, S., Bajšanski, I., & Zubković, B.R. (2010). Metacognition and reading comprehension: Age and gender differences. *Trends and Prospects in Metacognition Research*, 327-344. https://doi.org/10.1007/978-1-4419-6546-2_15

Köse, N., & Güneş, F. (2021). Undergraduate students' use of metacognitive strategies while reading and the relationship between strategy use and reading comprehension skills. *Journal of Education and Learning, 10*(2), 99-108. https://doi.org/10.5539/jel.v10n2p99

Kusiak, M. (2013). *Reading comprehension in Polish and English: Evidence from an introspective study*. Jagiellonian University Press.

MacCallum, R.C., Widaman, K.F., Zhang, S., & Hong, S. (1999). Sample size in factor analysis. *Psychological methods, 4*(1), 84. https://doi.org/10.1037/1082-989X.4.1.84

Mallinckrodt, B., & Wang, C.-C. (2004). Quantitative methods for verifying semantic equivalence of translated research instruments: A Chinese version of the experiences in close relationships scale. *Journal of Counselling Psychology, 51*(3), 368–379. https://doi.org/10.1037/0022-0167.51.3.368

McNeish, D. (2018). Thanks coefficient alpha, we'll take it from here. *Psychological Methods, 23*(3), 412–433. https://doi.org/10.1037/met0000144

Mokhtari, K., Dimitrov, D.M., & Reichard, C.A. (2018). Revising the metacognitive awareness of reading strategies inventory (MARSI) and testing for factorial invariance. *Stud. Sec. Lang. Learn. Teach., 8*, 219–246. https://doi.org/10.14746/ssllt.2018.8.2.3

Mokhtari, K., & Reichard, C.A. (2002). Assessing students' metacognitive awareness of reading strategies. *Journal of Educational Psychology, 94*(2), 249. https://doi.org/10.1037/0022-0663.94.2.249

Mokhtari, K., & Sheorey, R. (2002). Measuring ESL students' awareness of reading strategies. *Journal of Developmental Education, 25*(3), 2-11.

Morin, A., Myers, N., & Lee, S. (2020). *Modern factor analytic techniques: Bifactor models, exploratory structural equation modeling (ESEM) and bifactor-ESEM*. In G. Tenenbaum, & R. C. Eklund (Eds.), Handbook of Sport Psychology (4th Edition). Wiley.

Muthén, B.O. (1993). *Goodness of fit with categorical and other nonnormal variables*. In K. A. Bollen & J. S. Long (Eds.), Testing structural equation models (pp. 205–243). Sage.

Ondé, D., Jiménez, V., Alvarado, J.M., & Gràcia, M. (2022). Analysis of the structural validity of the reduced version of metacognitive awareness of reading strategies inventory. *Frontiers in psychology, 13*, 894327. https://doi.org/10.3389/fpsyg.2022.894327

Öztürk, E. (2012). The validity and reliability of the Turkish version of the metacognitive awareness of reading strategies inventory. *Elementary Education Online, 11*(2), 292-305.

Phakiti, A. (2008). Construct validation of Bachman and Palmer's (1996) strategic competence model over time in EFL reading tests. *Language Testing, 25*(2), 237-272. https://doi.org/10.1177/0265532207086783

RAND Reading Study Group. (2002). Reading for understanding: Towards an R&D program in reading comprehension. Report prepared for OERI.

Rosseel, Y. (2019). lavaan: An R package for structural equation modeling. *Journal of Statistical Software*, *48*(2), 1-36. https://doi.org/10.18637/jss.v048.i02

Sarıçoban, A., & Behjoo, B.M. (2017). Metacognitive awareness of Turkish EFL learners on reading strategies. *The journal of Social Sciences Institute of Ataturk University*, *21*(1), 159-172.

Schumacher, R.E., & Lomax, R.G. (2010). *A beginner's guide to structural equation modeling* (3rd ed.). Routledge Pub.

Soto C., Gutierrez de Blume A.P., Asún R., Jacovina M., Vásquez C. (2018). A deeper understanding of metacomprehension in reading: Development of a new multidimensional tool. *Frontline Learning Research, 6(1)*, 31-52. https://doi.org/10.147 86/flr.v6i1.328

Soto, C., Gutierrez de Blume, A.P., Rodríguez, M.F., Asún, R., Figueroa, M., & Serrano, M. (2019). Impact of bridging strategy and feeling of knowing judgments on reading comprehension using COMPRENDE: An educational technology. *TechTrends, 63*(5), 570-582. https://doi.org/10.1007/s11528-019-00383-5

Tabachnick, B.G., & Field, L.S. (1996). *Using multivarete statistics*. Harper Collins Publishers

Taber, K.S. (2018). The Use of cronbach's alpha when developing and reporting research instruments in science education. *Research in Science Education,* 48, 1273-1296. https://doi.org/10.1007/s11165-016-9602-2

Tary, B., & Molnár, E.K. (2022). A MARSI-R kérdőív magyar adaptációja–olvasási stratégiák vizsgálata anya-és idegen nyelven egyetemi hallgatók körében. *Iskolakultúra, 32*(5), 57-75. https://doi.org/10.14232/ISKKULT.2022.5.57

Tamin, İ.B., & Büyükahıska, D. (2020). Reading strategy instruction on metacognitive awareness: the case of Turkish high school students. *The reading matrix: An International Online Journal, 20*(2), 85-97. https://www.readingmatrix.com/files/23-f957795j.pdf

Villanueva Aguilera, A.B. (2014). *Strategy intervention to enhance reading comprehension of 15-year-old students in Mexico* [Doctoral dissertation, University of York].

Von Eye, A., & Bogat, G.A. (2004). Testing the assumption of multivariate normality. *Psychology Science*, 46, 243-258.

Wall, K. (2008). Understanding metacognition through the use of pupil views templates: Pupil views of learning to learn. *Thinking Skills and Creativity*, *3*(1), 23-33. https://doi.org/10.1016/j.tsc.2008.03.004

Wenden, A.L. (1998). Metacognitive knowledge and language learning1. *Applied linguistics, 19*(4), 515-537. https://doi.org/10.1093/applin/19.4.515

Zhang, L., Zhang, L., & Liu. (2017). *Metacognitive and cognitive strategy use in reading comprehension.* Springer. https://doi.org/10.1007/978-981-10-6325-1

APPENDIX

APPENDIX A: FACTOR LOADINGS

Turkish Item [English]	Present Study							Moktari et. al, 2018
Global reading strategies (GRS)	Uni. CFA	CFA	Bif. CFA S-β	CFA G-β	ESEM β	ESEM β	ESEM β	
GRS1. Okurken aklımda bir amaç vardır. [Having a purpose in mind when reading.]	.44	.60	.01	.45	**.32**	.19	.27	.54
GRS2. Metni okumadan önce ne hakkında olduğunu görmek için metni gözden geçiririm. [Previewing text to see what it is about before reading.]	.54	.65	-.01	.49	**.44**	.06	.42	.58
GRS3. Metnin içeriğinin okuma amacıma uygun olup olmadığını kontrol ederim. [Checking to see if the content of the text fits my purpose for reading.]	.49	.77	.12	.56	**.59**	.38	.31	.64
GRS4. Önemli bilgileri ayırt etmek için koyu renk yazı tonu ve italik gibi yazımsal yardımcıları kullanırım. [Using typographical aids like boldface and italics to pick out key information.]	.43	.70	-.20	.46	**.21**	.08	.09	.63
GRS5. Okuduğum metinleri eleştirel olarak analiz eder ve değerlendiririm. [Critically analyzing and evaluating the information read.]	.53	.80	.13	.60	**.52**	.07	.38	.67
Problem-solving strategies (PSS)								
PSS1. Dikkatim dağıldığında ya da kafam karıştığında dikkatimi tekrar toplayabilirim. [Getting back on track when getting sidetracked or distracted.]	.61	.63	-.07	.49	.24	**.30**	.29	.60
PSS2. Okuduğum metne göre okuma ritmimi veya hızımı ayarlarım. [Adjusting my reading pace or speed based on what I'm reading.]	.49	.80	-.04	.61	.13	**.29**	.22	.66
PSS3. Okuduklarımı düşünmek için zaman zaman okumaya ara veririm. [Stopping from time to time to think about what I'm reading.]	.46	.84	.05	.57	.22	**.51**	.43	.66
PSS4. Okuduğumu anladığımdan emin olmak için tekrar okurum. [Re-reading to help ensure I understand what I'm reading.]	.60	.56	-.30	.50	.12	**.30**	.06	.59
PSS5. Bilmediğim kelime ve deyimlerin anlamını tahmin ederim. [Guessing the meaning of unknown words or phrases.]	.54	.65	-.02	.52	.29	**.24**	.67	.52
Support reading strategies (SRS)								
SRS1. Okurken not alırım. [Taking notes while reading.]	.57	.62	.28	.42	.20	.25	**.47**	.56
SRS2. Metni yüksek sesle okumak okuduğumu anlamama yardımcı olur. [Reading aloud to help me understand what I'm reading.]	.49	.68	.37	.26	.27	.32	**.45**	.53
SRS3. Anlayıp anlamadığımı kontrol etmek için okuduklarımı başkalarıyla tartışırım. [Discussing what I read with others to check my understanding.]	.56	.81	-.04	.64	.12	.16	**.24**	.68
SRS4. Metindeki önemli bilgilerin altını çizer ya da daire içine alırım. [Underlining or circling important information in text.]	.47	.66	.49	.24	.50	.43	**.70**	.69
SRS5. Okumamı desteklemek için sözlük gibi kaynakları kullanırım. [Using reference materials such as dictionaries to support my reading.]	.52	.71	.12	.48	.15	.27	**.23**	.73

Target ESEM factor loadings are indicated in bold.

APPENDIX B: ITEM CORRELATIONS

	Mean	Std. Deviation	GRS1	GRS2	GRS3	GRS4	GRS5	SRS1	SRS2	SRS3	SRS4	SRS5	PSS1	PSS2	PSS3	PSS4	PSS5
GRS1	3,08	1,271															
GRS2	3,94	1,233	,231**														
GRS3	3,55	1,332	,301**	,358**													
GRS4	3,58	1,421	,256**	,243**	,206**												
GRS5	3,47	1,343	,274**	,319**	,378**	,270**											
SRS1	3,49	1,093	,257**	,217**	,273**	,371**	,229**										
SRS2	3,57	1,285	,133**	,197**	,166**	,278**	,139**	,263**									
SRS3	3,40	1,298	,270**	,282**	,359**	,245**	,416**	,318**	,230**								
SRS4	4,10	1,156	,196**	,233**	,134**	,372**	,184**	,383**	,330**	,268**							
SRS5	2,92	1,319	,244**	,194**	,224**	,238**	,270**	,336**	,266**	,373**	,199**						
PSS1	3,63	1,274	,191**	,232**	,251**	,222**	,274**	,261**	,258**	,317**	,186**	,275**					
PSS2	3,88	1,333	,268**	,343**	,360**	,309**	,349**	,288**	,280**	,334**	,269**	,320**	,333**				
PSS3	3,27	1,469	,289**	,228**	,310**	,225**	,361**	,305**	,197**	,418**	,185**	,396**	,258**	,341**			
PSS4	4,01	1,186	,169**	,282**	,183**	,252**	,205**	,250**	,309**	,266**	,346**	,331**	,253**	,247**	,256**		
PSS5	3,91	1,245	,194**	,257**	,316**	,237**	,326**	,299**	,195**	,301**	,244**	,253**	,286**	,360**	,299**	,216**	
**. Correlation is significant at the 0.01 level (2-tailed).																	