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The Effects of Self-Regulation Strategy Instruction on EFL Learners' Reading Comprehension and Metacognitive Awareness: An Experimental Study

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ABSTRACT: Background: Reading comprehension is a multidimensional process that requires learners to regulate their cognitive, metacognitive, and motivational resources effectively. Self-regulation strategy instruction may therefore provide an effective approach to improving both reading performance and learners' awareness of their own comprehension processes. This study examined the effects of self-regulation strategy instruction on EFL learners' reading comprehension and metacognitive awareness.
Methods: A randomized controlled experimental design was employed with 40 intermediate EFL learners who were randomly assigned to an experimental group (n = 20) or a control group (n = 20). The experimental group received an 8-week self-regulation strategy instruction program, whereas the control group followed conventional reading instruction. Reading comprehension and metacognitive awareness were assessed before and after the intervention. Data were analyzed using ANCOVA, controlling for pretest scores.
Results: After controlling for pretest performance, the experimental group demonstrated significantly higher reading comprehension scores than the control group, $F(1, 37) = 18.64$, $p < .001$, partial $\eta^2 = .335$. The experimental group also showed significantly greater metacognitive awareness, $F(1, 37) = 14.92$, $p < .001$, partial $\eta^2 = .287$. The effect sizes indicated moderate-to-large intervention effects. Improvements were particularly evident in learners' planning, monitoring, and evaluation of reading processes.
Conclusions: The findings suggest that systematic self-regulation strategy instruction can significantly enhance both EFL learners' reading comprehension and metacognitive awareness. Integrating explicit self-regulatory strategies into EFL reading instruction may therefore support more autonomous, strategic, and effective language learning.

Keywords: Self-Regulation Strategy Instruction, EFL Learners, Reading Comprehension, Metacognitive Awareness, Reading Strategies.

INTRODUCTION

Reading comprehension is widely recognized as a fundamental component of second and foreign language learning because it enables learners to access academic knowledge, develop linguistic competence, and engage with information beyond the immediate classroom environment (Magyar, et al., 2022). For learners of English as a foreign language (EFL), however, successful reading involves considerably more than decoding vocabulary and grammatical structures (Soleimani, et al., 2022). EFL learners must coordinate multiple cognitive processes, including identifying relevant information, integrating ideas across sentences and paragraphs, monitoring comprehension, resolving difficulties, and evaluating whether their interpretations are consistent with the text (Friesen, et al., 2022). Consequently, effective reading comprehension depends not only on linguistic knowledge

but also on learners' ability to regulate their own cognitive and learning processes. This has increased scholarly interest in instructional approaches that move beyond the transmission of reading strategies toward approaches that explicitly develop learners' capacity to plan, monitor, control, and evaluate their reading.

Self-regulation provides an important theoretical framework for understanding how learners actively manage their learning (Huang, 2022). Self-regulated learners do not simply respond to instructional demands; rather, they establish goals, select appropriate strategies, monitor their progress, regulate their cognitive and motivational states, and evaluate the outcomes of their efforts (Ateş Akdeniz, 2022). From this perspective, learning is an active and cyclical process in which learners continually adjust their behavior according to feedback and perceived progress. In the context of EFL reading, self-regulation may involve setting a purpose before reading, activating prior knowledge, predicting content, selecting appropriate reading strategies, monitoring comprehension during reading, identifying misunderstandings, allocating effort, and evaluating comprehension after reading (Xu & Qiu, 2021; Cunha, et al., 2023; Singaravelu & Chandrakumari, 2025). Such processes may be particularly important for EFL learners because they frequently encounter linguistic and conceptual difficulties that require them to make strategic decisions rather than rely exclusively on teacher explanations.

Self-regulation strategy instruction is therefore potentially valuable because it can transform reading from a largely teacher-directed activity into a more intentional and learner-controlled process (Backers & Van Keer, 2025). Rather than merely teaching learners what strategies exist, self-regulation-oriented instruction emphasizes when, why, and how strategies should be selected and adapted (Roberts, et al., 2019). Learners can be explicitly guided to establish reading goals, plan their approach, monitor their understanding, identify ineffective strategies, make corrective adjustments, and reflect on their performance (Ursache, et al., 2012). Through repeated practice, these processes may become increasingly internalized, allowing learners to approach unfamiliar texts with greater independence. Such instruction is particularly relevant to EFL contexts, where learners may have limited opportunities to use English outside the classroom and therefore need effective strategies for independently managing their reading experiences (Chen, et al., 2025).

A central outcome associated with self-regulated reading is reading comprehension. Reading comprehension requires learners to construct a coherent mental representation of a text by integrating linguistic information with prior knowledge and drawing connections among textual ideas (Yang, et al., 2026). Difficulties may arise when learners fail to recognize that they have misunderstood a passage, continue using an ineffective strategy, or devote excessive cognitive resources to relatively unimportant information (Dermitzaki, 2025). Self-regulation strategies may help address these difficulties by encouraging learners to monitor their comprehension continuously and intervene when comprehension breaks down (Barth, et al., 2016). For example, learners who are trained to ask themselves whether a paragraph supports their initial prediction, whether they understand the relationship between ideas, or whether they need to reread a particular section may become more capable of detecting and repairing comprehension problems (Pickren, et al., 2022). Accordingly, self-regulation strategy instruction may contribute to more effective and sustained comprehension of EFL texts.

In addition to reading comprehension, metacognitive awareness represents another theoretically important outcome of self-regulation strategy instruction (Agrawal, et al., 2025). Metacognition generally refers to learners' awareness of and knowledge about their own cognitive processes, as well as their ability to regulate those processes (Sabaliauskas, et al., 2025). In reading, metacognitive awareness involves recognizing how one approaches a text, understanding which strategies are useful for particular reading purposes, monitoring comprehension, and evaluating the effectiveness of selected strategies (Akamatsu, et al., 2019). Learners with stronger metacognitive awareness are more likely to recognize when comprehension is inadequate and to make strategic adjustments accordingly (Ratnayake, et al., 2024). Importantly, metacognitive awareness is not simply knowledge about reading strategies. It also involves the ability to make strategic decisions based on task demands, personal capabilities, and the characteristics of the text.

The relationship between self-regulation and metacognition is particularly important because effective self-regulated learning requires learners to become aware of their own cognitive activity (Frazier, et al., 2021). Planning requires learners to recognize what a task demands and determine how to approach it; monitoring requires awareness of ongoing comprehension; and evaluation requires learners to judge whether their strategies have been effective (Akamatsu, et al., 2019). Thus, systematic instruction in self-regulation strategies may simultaneously strengthen learners' metacognitive awareness and their ability to apply that awareness during reading. This connection provides a strong rationale for examining reading comprehension and metacognitive awareness together rather than treating them as entirely independent outcomes.

Despite the theoretical relevance of self-regulation to language learning, traditional EFL reading instruction has often emphasized teacher explanation, vocabulary development, translation, and comprehension questions, with comparatively less attention given to the processes through which learners independently regulate their reading. In such contexts, learners may successfully complete individual reading tasks without necessarily developing the ability to determine what strategies they need, monitor their comprehension, or evaluate the effectiveness of their reading behavior. A strategy-oriented instructional approach that explicitly

incorporates self-regulatory processes may therefore provide a more comprehensive means of developing both the outcomes and processes involved in successful EFL reading.

Furthermore, although previous research has highlighted the importance of metacognitive and strategic approaches to language learning (Sun & Zhang, 2022; Qin, et al., 2022; Habók & Magyar, 2018), there remains a need for experimental evidence examining whether systematic self-regulation strategy instruction can produce measurable improvements in both reading comprehension and metacognitive awareness. Examining these outcomes simultaneously is important because improvement in comprehension alone does not necessarily demonstrate that learners have become more independent or strategically competent readers. Conversely, greater metacognitive awareness is educationally meaningful only if learners can translate this awareness into more effective reading performance. An experimental investigation of both outcomes can therefore provide a more integrated understanding of the educational value of self-regulation strategy instruction. Accordingly, the present study was designed to examine the effects of self-regulation strategy instruction on EFL learners' reading comprehension and metacognitive awareness.

METHODS

Research Design

The study employed a randomized pretest–posttest controlled experimental design to investigate the effects of self-regulation strategy instruction on EFL learners' reading comprehension and metacognitive awareness.

Participants and Sampling

The target population consisted of EFL learners enrolled in private English language institutes in Tehran. Participants were recruited through convenience sampling from available language classes, after which eligible learners were randomly allocated to the experimental and control conditions. The study targeted learners at an intermediate level of English proficiency because this level provides a sufficiently developed linguistic foundation for engaging with explicit reading strategies while still leaving substantial room for improvement in reading comprehension and strategic reading behavior. To establish relatively homogeneous language proficiency at entry, participants completed an English placement test before the intervention. Learners whose scores fell within the predetermined intermediate proficiency range were considered eligible. Participants were required to be regular EFL learners, have normal or corrected-to-normal vision, and have sufficient English proficiency to understand the instructions and reading materials. Learners were excluded if they had extensive previous formal training in self-regulated reading strategies, were simultaneously enrolled in another intensive English reading program, or failed to attend the required proportion of intervention sessions.

Sample Size Determination

An a priori power analysis was conducted using G*Power 3.1.9.7 for a repeated-measures design involving two groups and two measurement occasions, with the primary effect of interest being the group × time interaction. A medium effect size was assumed ($f = 0.25$), with an alpha level of .05 and statistical power of .80. The correlation between repeated measurements was conservatively estimated at .50, and the nonsphericity correction was set to 1 because only two measurement occasions were included. The resulting minimum sample size was approximately 34 participants (17 per group). To provide a reasonable allowance for possible attrition, nonattendance, or unusable data, the recruitment target was increased to 40 participants, with 20 learners allocated to each condition. This sample size provides adequate statistical power to detect a medium-sized instructional effect while remaining feasible for a classroom-based intervention. Importantly, the sample-size calculation was based on the interaction effect rather than merely the main effect of time because the central research question concerns whether changes in reading comprehension and metacognitive awareness differ between learners receiving self-regulation strategy instruction and those receiving conventional instruction.

Randomization and Allocation

Following eligibility screening and completion of the proficiency assessment, participants were randomly assigned to either the experimental or control group in a 1:1 ratio. A computer-generated randomization sequence was prepared before group allocation. Participants were assigned numerical identification codes, and the allocation sequence was implemented independently of the pretest scoring process to minimize allocation bias. Because the intervention was delivered in classroom settings, participant and instructor blinding was not feasible. However, the researcher responsible for scoring the reading comprehension assessments was not informed of participants' group membership during scoring. The same instructor taught both conditions to minimize instructor-related differences, while the instructional materials, duration, and amount of classroom exposure were kept comparable across groups.

Intervention

Self-Regulation Strategy Instruction Group

Participants in the experimental group received a structured self-regulation strategy instruction program designed specifically for EFL reading. The program was based on the principle that effective strategic reading involves a cyclical process of planning before reading, monitoring during reading, and evaluating after reading. Rather than simply presenting individual reading strategies, instruction explicitly emphasized when, why, and how learners should select, apply, monitor, and modify strategies. The intervention lasted 8 weeks, with two 60-minute sessions per week, resulting in 16 instructional sessions and approximately 16 hours of intervention. Each session followed a consistent instructional sequence. During the pre-reading phase, learners were trained to establish a specific purpose for reading, preview titles and headings, activate relevant prior knowledge, predict the content and organization of the text, identify potentially difficult vocabulary or concepts, and formulate a reading plan. Learners were encouraged to identify what they already knew about the topic and determine which strategies might be most useful for achieving the reading goal. During the while-reading phase, learners were trained to monitor their comprehension continuously. Strategies included identifying main ideas and supporting details, making predictions, checking predictions against textual information, identifying relationships among ideas, using contextual clues to interpret unfamiliar vocabulary, rereading when necessary, asking comprehension-monitoring questions, and recognizing situations in which their current reading approach was ineffective. The instructor used think-aloud demonstrations to make normally implicit cognitive and metacognitive processes visible to learners. During the post-reading phase, learners evaluated their comprehension and the effectiveness of the strategies they had used. They were asked to summarize the central message of the text, identify areas of uncertainty, judge whether their original reading goals had been achieved, determine which strategies had been useful, and formulate alternative strategies for future reading tasks. The instructional process gradually shifted responsibility from the teacher to the learners. Initially, the instructor explicitly modeled the strategies and demonstrated how to make strategic decisions. Subsequently, learners practiced the strategies with guided support, discussed their strategic decisions, and completed increasingly independent reading tasks. By the final sessions, learners were expected to independently select appropriate strategies, monitor their comprehension, and evaluate their reading performance. A brief self-regulation reading log was also used throughout the intervention. After selected reading tasks, learners recorded their reading goal, strategies used, comprehension difficulties encountered, corrective actions taken, and evaluation of strategy effectiveness. These logs were used as instructional tools rather than as outcome measures.

Conventional Reading Instruction Group

The control group received conventional EFL reading instruction for the same duration and number of sessions. The control condition included reading texts, vocabulary explanation, teacher-led discussion, comprehension questions, and feedback on answers. However, systematic instruction in self-regulation, explicit planning-monitoring-evaluation cycles, think-aloud demonstrations of metacognitive processes, and self-regulation reading logs were not incorporated. Both groups worked with comparable reading materials, had equivalent instructional time, and completed comparable reading activities. The principal difference between the conditions was therefore the explicit integration of self-regulation strategy instruction into the experimental group's reading lessons.

Reading Materials

Reading materials were selected according to the learners' intermediate proficiency level and were comparable in length, lexical difficulty, syntactic complexity, and thematic diversity. Texts covered familiar academic and general-interest topics, including education, health, technology, environment, culture, and everyday social issues. Text difficulty was determined through a combination of vocabulary profiling, readability estimates, and expert judgment. Different but equivalent texts were used for the pretest and posttest to minimize the possibility of learning effects resulting from repeated exposure to the same passages. The texts were reviewed by three experienced EFL teachers to ensure appropriate difficulty, clarity, cultural appropriateness, and alignment with the targeted reading comprehension skills.

Instruments

English Proficiency Test: An English placement test was administered before the intervention to establish the participants' baseline proficiency and ensure that the sample represented a relatively homogeneous intermediate-level population. The test assessed core English language knowledge and skills and was used primarily as a screening and descriptive measure rather than as an outcome variable. Participants whose scores fell within the predetermined intermediate proficiency range were eligible for participation. The same proficiency assessment was not used as the primary pretest or posttest measure of the intervention outcomes.

Reading Comprehension Test: Reading comprehension was assessed using a researcher-developed test consisting of 30 multiple-choice items based on three short academic/general-interest passages. The test

assessed several dimensions of comprehension, including identification of main ideas, recognition of supporting details, understanding of explicitly stated information, interpretation of relationships among ideas, vocabulary meaning in context, and drawing appropriate conclusions from the text. Each item had four response alternatives, with one correct answer. Correct responses received one point and incorrect responses received zero points. Total scores therefore ranged from 0 to 30, with higher scores indicating stronger reading comprehension. To establish content validity, an initial pool of 45 items was developed based on the theoretical definition of reading comprehension and relevant language-assessment literature. Three university faculty members specializing in applied linguistics and EFL reading independently evaluated the items for relevance, clarity, representativeness, and alignment with the intended comprehension skills. Items that did not meet the predetermined content-validity criteria were revised or removed, resulting in the final 30-item test. A pilot administration was conducted with approximately 30 EFL learners who had characteristics comparable to those of the main sample but who did not participate in the intervention. Item difficulty and discrimination indices were examined. Items showing extremely low or high difficulty or inadequate discrimination were revised or replaced. Internal consistency was estimated using the Kuder–Richardson Formula 20 (KR-20) because the items were dichotomously scored. A coefficient of .70 or higher was considered acceptable for research purposes. To provide additional evidence of construct validity, the test structure was examined in relation to the theoretically defined reading comprehension domains. The final version was administered under standardized conditions with identical time limits for all participants.

Metacognitive Awareness of Reading Strategies: Metacognitive awareness was assessed using the Survey of Reading Strategies (SORS) developed by Mokhtari and Sheorey. The SORS was specifically designed to assess adolescent and adult ESL learners' metacognitive awareness and perceived use of strategies while reading English academic or school-related materials. The original instrument contains 30 items rated on a five-point Likert scale ranging from 1 ("I never or almost never do this") to 5 ("I always or almost always do this"). The instrument assesses three broad dimensions of strategic reading: Global Reading Strategies, which involve intentional planning and management of reading; Problem-Solving Strategies, which involve actions used to resolve comprehension difficulties during reading; and Support Reading Strategies, which involve supplementary mechanisms that facilitate comprehension. Higher scores indicate greater perceived awareness and use of reading strategies. The original instrument has demonstrated strong internal consistency, with reported reliability coefficients of approximately .92 for global reading strategies, .90 for problem-solving strategies, .88 for support strategies, and approximately .94 for the complete instrument. Because the present study focuses on EFL learners, the SORS was considered conceptually appropriate. Nevertheless, its psychometric properties were reassessed in the present sample rather than relying exclusively on previously published coefficients. Content validity of the translated/adapted version was evaluated by three experts in applied linguistics and EFL reading. The instrument was then pilot-tested with a small group of comparable EFL learners to assess comprehensibility and linguistic clarity. In the main sample, internal consistency was examined using Cronbach's alpha and composite reliability. Construct validity was assessed using confirmatory factor analysis (CFA). Standardized factor loadings, average variance extracted (AVE), and composite reliability (CR) were examined to evaluate convergent validity. Discriminant validity was assessed using the heterotrait–monotrait ratio (HTMT). Values of α and CR $\geq .70$, factor loadings preferably $\geq .50$, and AVE $\geq .50$ were considered indicative of acceptable measurement quality. For discriminant validity, HTMT values below .85 were considered evidence that the constructs were empirically distinguishable. The use of CFA is particularly appropriate because the three-factor structure of reading-strategy awareness should not simply be assumed from previous applications. Indeed, later psychometric research has questioned whether the original three-factor SORS structure is equally stable across populations, highlighting the importance of verifying its structure in the sample under investigation.

Validity and Reliability Procedures

Before the main analyses, the psychometric quality of all instruments was evaluated. For the reading comprehension test, content validity, item difficulty, item discrimination, and internal consistency were examined. For the SORS, content validity, internal consistency, convergent validity, and discriminant validity were assessed. For the SORS, CFA was conducted using the hypothesized measurement structure. Model fit was evaluated using multiple complementary indices, including the chi-square statistic, comparative fit index (CFI), Tucker–Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). Acceptable model fit was interpreted using commonly applied criteria rather than a single cutoff value. Cronbach's alpha and composite reliability were used to evaluate internal consistency. Convergent validity was assessed through standardized factor loadings and AVE, while discriminant validity was evaluated using HTMT. These procedures provided evidence that the measures used in the study were sufficiently reliable and valid for evaluating the proposed intervention effects.

Data Collection Procedure

Data collection was conducted in four stages. First, participants were screened according to the inclusion and exclusion criteria and completed the English proficiency assessment. Eligible learners then completed the demographic questionnaire and pretest measures of reading comprehension and metacognitive awareness. Second, participants were randomly allocated to the experimental or control condition. The intervention was subsequently implemented for eight weeks. Attendance was recorded at every session, and participants who attended fewer than 80% of sessions were considered noncompliant with the intervention protocol. Third, immediately after completion of the eight-week intervention, both groups completed the posttest measures under conditions comparable to those used during the pretest. The reading comprehension assessment used parallel forms rather than the identical passages used at pretest. Finally, all questionnaires and tests were coded using participant identification numbers. Data were entered into SPSS and independently checked for coding and entry errors before statistical analysis.

Statistical Analysis

Data analysis was performed using IBM SPSS Statistics and an appropriate structural equation modeling/CFA package where required. Descriptive statistics, including means, standard deviations, minimum and maximum scores, skewness, and kurtosis, were calculated for all study variables. Prior to hypothesis testing, the data were screened for missing values, univariate outliers, and influential observations. The assumptions underlying the planned analyses were assessed through appropriate diagnostic procedures. Normality was examined using skewness and kurtosis statistics and graphical inspection. Homogeneity of variance was evaluated using Levene's test. Baseline equivalence between the two groups was examined using independent-samples t-tests for continuous demographic and proficiency variables and chi-square tests for categorical variables. The purpose of these analyses was to determine whether randomization resulted in reasonably comparable groups before the intervention. The principal intervention effects were evaluated using analysis of covariance (ANCOVA) for each posttest outcome, with the corresponding pretest score entered as a covariate. Separate ANCOVA models were estimated for reading comprehension and metacognitive awareness. This approach was selected because it provides a direct comparison of post-intervention group differences while controlling statistically for baseline differences and generally provides greater precision than comparing raw posttest means alone. Before interpreting ANCOVA results, assumptions of linearity, homogeneity of regression slopes, independence of observations, normality of residuals, and homogeneity of error variances were evaluated. Partial eta squared (ηp^2) was reported as the primary effect-size measure, with approximately .01, .06, and .14 interpreted as small, medium, and large effects, respectively. In addition to statistical significance, adjusted group means and 95% confidence intervals were reported to facilitate interpretation of the magnitude and direction of the intervention effects. Where appropriate, standardized mean differences were also calculated to provide an interpretable estimate of the practical magnitude of the treatment effect. A significance level of $\alpha = .05$ was used for all primary analyses. Because two primary dependent variables were examined, the results were interpreted with attention to the familywise error rate, and adjusted significance levels were considered where multiple inferential comparisons were conducted.

RESULTS

Participant Characteristics and Baseline Equivalence

A total of 40 intermediate-level EFL learners participated in the study and were randomly assigned to either the self-regulation strategy instruction group (n = 20) or the conventional reading instruction group (n = 20). All participants completed both the pretest and posttest assessments, and no participant withdrew from the study. Therefore, the final analytical sample consisted of 40 learners. The participants had a mean age of 21.43 years (SD = 1.84), with ages ranging from 18 to 25 years. The self-regulation strategy instruction group had a mean age of 21.35 years (SD = 1.92), whereas the conventional instruction group had a mean age of 21.50 years (SD = 1.78). An independent-samples t-test indicated that the two groups did not differ significantly in age, $t(38) = -0.26$, $p = .797$. The groups were also comparable in terms of gender distribution, previous years of English learning, and baseline English proficiency. The experimental group consisted of 11 female and 9 male learners, while the control group included 10 female and 10 male learners. Chi-square analysis showed no significant difference in gender distribution between the groups, $\chi^2(1) = 0.10$, $p = .752$. Similarly, no significant between-group differences were observed in previous years of English learning or placement-test scores ($p > .05$). These findings indicate that the two groups were sufficiently comparable before the intervention and that subsequent differences in the dependent variables were unlikely to be attributable to systematic baseline differences (Table 1).

Table 1. Demographic and Baseline Characteristics of the Participants

Variable	Self-Regulation Group (n = 20)	Conventional Instruction Group (n = 20)	Test Statistic	p
Age (years), M ± SD	21.35 ± 1.92	21.50 ± 1.78	$t(38) = -0.26$	.797
Previous English learning (years), M ± SD	6.35 ± 1.63	6.55 ± 1.73	$t(38) = -0.38$	.706
Female, n (%)	11 (55.0)	10 (50.0)	$\chi^2(1) = 0.10$	.752
Male, n (%)	9 (45.0)	10 (50.0)	—	—
Placement-test score, M ± SD	67.40 ± 4.81	66.85 ± 5.13	$t(38) = 0.35$	.729

Note. M = mean; SD = standard deviation. The placement test was scored on a 100-point scale.

Preliminary Data Screening and Assumption Testing

Prior to the primary analyses, the dataset was screened for missing values, outliers, normality, and other assumptions relevant to ANCOVA. There were no missing observations in the final dataset, and no extreme univariate outliers were identified based on standardized scores and graphical inspection. Skewness and kurtosis values for reading comprehension and metacognitive awareness were within the generally acceptable range of ±2, suggesting no substantial departure from normality. Shapiro–Wilk tests were also nonsignificant for the primary outcome variables at both measurement occasions ($p > .05$). The assumption of homogeneity of variance was examined using Levene's test. The results were nonsignificant for both reading comprehension, $F(1, 38) = 0.84$, $p = .365$, and metacognitive awareness, $F(1, 38) = 0.57$, $p = .455$, indicating comparable error variances across the two groups. The linearity assumption was supported by inspection of scatterplots between pretest and posttest scores. Furthermore, the homogeneity-of-regression-slopes assumption was satisfied for both dependent variables, as the interaction between the pretest score and instructional condition was not statistically significant for reading comprehension, $F(1, 36) = 0.91$, $p = .346$, or metacognitive awareness, $F(1, 36) = 0.72$, $p = .402$. Accordingly, the assumptions required for ANCOVA were considered adequately satisfied.

Descriptive Statistics and Pretest–Posttest Changes

Table 2 and Figure 1 presents the means and standard deviations for reading comprehension and metacognitive awareness before and after the intervention. At pretest, the two groups had comparable reading comprehension scores. The self-regulation group obtained a mean score of 17.85 (SD = 2.31), while the conventional instruction group obtained a mean score of 17.60 (SD = 2.47). Following the intervention, reading comprehension increased to 23.90 (SD = 2.42) in the self-regulation group, whereas the conventional instruction group increased to 20.35 (SD = 2.66). A similar pattern was observed for metacognitive awareness. At pretest, the mean metacognitive awareness score was 3.02 (SD = 0.36) in the self-regulation group and 3.00 (SD = 0.39) in the conventional instruction group. Following the intervention, the experimental group's mean increased to 3.82 (SD = 0.38), whereas the control group's mean increased to 3.35 (SD = 0.41). Thus, both groups showed improvement from pretest to posttest; however, the magnitude of improvement appeared substantially greater among learners who received self-regulation strategy instruction.

Table 2. Descriptive Statistics for Reading Comprehension and Metacognitive Awareness

Variable	Measurement	Self-Regulation Group (n = 20)	Conventional Instruction Group (n = 20)
Reading comprehension	Pretest	17.85 ± 2.31	17.60 ± 2.47
	Posttest	23.90 ± 2.42	20.35 ± 2.66
Metacognitive awareness	Pretest	3.02 ± 0.36	3.00 ± 0.39
	Posttest	3.82 ± 0.38	3.35 ± 0.41

Note. Reading comprehension scores range from 0 to 30. Metacognitive awareness scores range from 1 to 5.

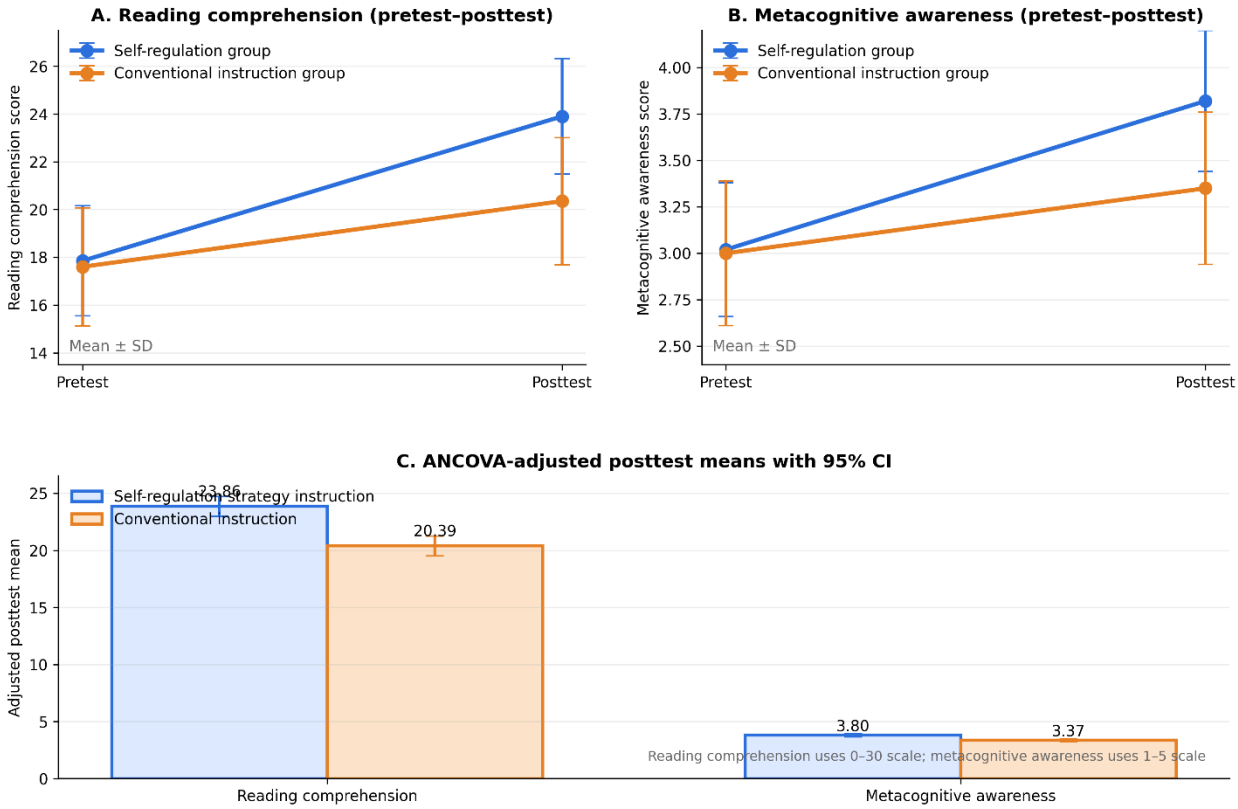

Figure 1. Effects of Self-Regulation Strategy Instruction on Reading Comprehension and Metacognitive Awareness. (A) Mean pre-test and post-test scores for reading comprehension. (B) Mean pre-test and post-test scores for metacognitive awareness. (C) Adjusted post-test means comparison for both variables, derived from ANCOVA, highlighting the efficacy of the self-regulation strategy instruction. Error bars represent the standard error of the mean.

Reliability and Construct Validity of the Instruments

Before testing the intervention effects, the psychometric properties of the measurement instruments were examined using the data obtained from the study sample. The reading comprehension test demonstrated satisfactory internal consistency, with a KR-20 coefficient of .84. Item-level analyses indicated acceptable item difficulty and discrimination, with the majority of items demonstrating moderate difficulty and satisfactory discrimination indices. For the SORS, Cronbach's alpha coefficients were .89 for the total scale and ranged from .82 to .87 across its three dimensions. Composite reliability coefficients ranged from .86 to .91, exceeding the recommended threshold of .70. Confirmatory factor analysis supported the hypothesized three-dimensional structure of metacognitive awareness. The measurement model demonstrated acceptable fit to the data, χ^2/df = 1.74, CFI = .94, TLI = .93, RMSEA = .072, and SRMR = .061. Standardized factor loadings ranged from .56 to .84. The AVE values for the three dimensions ranged from .51 to .58, supporting convergent validity. HTMT values were below .85, providing evidence of adequate discriminant validity. Overall, the results suggested that the instruments demonstrated acceptable reliability and construct validity for the present sample (Table 3 and 4).

Table 3. Reliability and Validity Indices for the Study Measures

Measure/Construct	Cronbach's α / KR-20	Composite Reliability	AVE	Range of Factor Loadings
Reading comprehension	.84 (KR-20)	—	—	—
Global Reading Strategies	.87	.89	.55	.58–.82
Problem-Solving Strategies	.89	.91	.58	.61–.84
Support Reading Strategies	.82	.86	.51	.56–.78
SORS total	.89	—	—	—

Note. AVE = average variance extracted; SORS = Survey of Reading Strategies.

Table 4. Confirmatory Factor Analysis Model-Fit Indices for Metacognitive Awareness

Fit Index	Obtained Value	Recommended Interpretation
χ^2/df	1.74	< 3.00
CFI	.94	≥ .90
TLI	.93	≥ .90
RMSEA	.072	≤ .08
SRMR	.061	≤ .08

Effects of Self-Regulation Strategy Instruction on Reading Comprehension

An ANCOVA was conducted to determine whether the two instructional conditions differed significantly in posttest reading comprehension after controlling for pretest reading comprehension. The analysis indicated a significant effect of instructional condition on posttest reading comprehension after controlling for baseline performance, $F(1, 37) = 18.64$, $p < .001$, partial $\eta^2 = .335$. The adjusted mean reading comprehension score was substantially higher for the self-regulation strategy instruction group (M_adj = 23.86, 95% CI [22.99, 24.73]) than for the conventional instruction group (M_adj = 20.39, 95% CI [19.52, 21.26]). The effect size was large according to conventional criteria, indicating that the instructional condition accounted for approximately 33.5% of the adjusted variance in posttest reading comprehension. Therefore, H1 was supported. The adjusted mean difference of approximately 3.47 points indicates a meaningful advantage for learners receiving self-regulation strategy instruction. In practical terms, learners in the experimental condition demonstrated considerably greater gains in their ability to comprehend the target EFL texts (Table 5 and 6).

Table 5. ANCOVA Results for Posttest Reading Comprehension

Source	SS	df	MS	F	p	Partial η^2
Pretest reading comprehension	101.46	1	101.46	20.83	< .001	.360
Instructional condition	90.75	1	90.75	18.64	< .001	.335
Error	180.12	37	4.87	—	—	—
Total	9,845.63	40	—	—	—	—

Table 6. Adjusted Posttest Means for Reading Comprehension

Group	Adjusted Mean	SE	95% CI
Self-regulation strategy instruction	23.86	0.43	22.99–24.73
Conventional instruction	20.39	0.43	19.52–21.26

Effects of Self-Regulation Strategy Instruction on Metacognitive Awareness

A second ANCOVA was conducted to examine the effect of instructional condition on posttest metacognitive awareness while controlling for pretest metacognitive awareness. The results revealed a statistically significant effect of instructional condition, $F(1, 37) = 14.92$, $p < .001$, partial $\eta^2 = .287$. The adjusted posttest mean for metacognitive awareness was higher in the self-regulation strategy instruction group (M_adj = 3.80, 95% CI [3.66, 3.94]) than in the conventional instruction group (M_adj = 3.37, 95% CI [3.23, 3.51]). The partial eta squared value of .287 represents a large effect, suggesting that the instructional condition explained approximately 28.7% of the adjusted variance in posttest metacognitive awareness. Thus, H2 was supported. The adjusted mean difference of approximately 0.43 points indicates that the learners who received explicit self-regulation strategy instruction developed greater awareness of their reading strategies than those receiving conventional reading instruction (Table 7 and 8).

Table 7. ANCOVA Results for Posttest Metacognitive Awareness

Source	SS	df	MS	F	p	Partial η^2
Pretest metacognitive awareness	2.84	1	2.84	19.73	< .001	.348
Instructional condition	2.15	1	2.15	14.92	< .001	.287
Error	5.33	37	0.14	—	—	—
Total	468.27	40	—	—	—	—

Table 8. Adjusted Posttest Means for Metacognitive Awareness

Group	Adjusted Mean	SE	95% CI
Self-regulation strategy instruction	3.80	0.07	3.66–3.94
Conventional instruction	3.37	0.07	3.23–3.51

Effects on the Dimensions of Metacognitive Awareness

To provide a more detailed examination of the intervention effect, posttest scores on the three SORS dimensions were also compared between groups while controlling for corresponding pretest scores. The results indicated significant group effects for all three dimensions. The self-regulation strategy instruction group demonstrated significantly higher adjusted posttest scores in Global Reading Strategies, Problem-Solving Strategies, and Support Reading Strategies than the conventional instruction group. The strongest effect was observed for Global Reading Strategies, followed by Problem-Solving Strategies and Support Reading Strategies. These findings suggest that self-regulation strategy instruction was not restricted to a single aspect of strategic reading. Rather, the intervention appeared to improve learners' awareness of planning and managing reading, responding strategically to comprehension problems, and using supplementary strategies to support understanding (Table 9).

Table 9. ANCOVA Results for the Three Dimensions of Metacognitive Awareness

Dimension	Adjusted Mean: Experimental	Adjusted Mean: Control	F(1, 37)	p	Partial η^2
Global Reading Strategies	3.78	3.28	12.86	.001	.258
Problem-Solving Strategies	3.91	3.45	15.37	< .001	.293
Support Reading Strategies	3.70	3.39	6.84	.013	.156

DISCUSSION

The present experimental study examined the effects of self-regulation strategy instruction on EFL learners' reading comprehension and metacognitive awareness. The findings indicated that learners who received systematic instruction in self-regulation strategies demonstrated greater improvement in both reading comprehension and metacognitive awareness than learners who received conventional reading instruction. The observed pattern suggests that explicitly teaching learners how to plan, monitor, regulate, and evaluate their reading processes can contribute not only to better comprehension outcomes but also to greater awareness and control of their own learning processes. These findings provide support for the pedagogical value of integrating self-regulatory principles into EFL reading instruction.

The significant improvement in reading comprehension observed in the self-regulation strategy instruction group can be interpreted in light of the active and strategic nature of reading. Reading comprehension, particularly in a foreign language, requires learners to coordinate multiple cognitive processes, including identifying main ideas, integrating information across sentences, monitoring understanding, making inferences, recognizing discourse relationships, and resolving comprehension difficulties (Huang, 2022; Xu & Qiu, 202). Learners who approach reading without conscious regulation may continue reading despite misunderstanding important information or may fail to recognize when their comprehension has broken down. Self-regulation strategy instruction may address this problem by encouraging learners to establish clear goals before reading, activate relevant prior knowledge, predict content, monitor comprehension while reading, and evaluate their understanding after completing a text (Cunha, et al., 2023; Singaravelu & Chandrakumari, 2025).

The improvement in the intervention group may therefore reflect a shift from relatively passive reading toward more deliberate and controlled reading behavior. Rather than simply receiving information from a text, learners were encouraged to make decisions about how they approached the text and to evaluate whether their strategies were effective. This interpretation is consistent with theoretical perspectives on self-regulated learning, which emphasize that effective learners actively regulate their cognition, motivation, and behavior in accordance with task demands (Backers & Van Keer, 2025). In the context of EFL reading, such regulation is particularly important because learners may encounter linguistic difficulties that can interfere with comprehension. Self-regulatory strategies can provide learners with mechanisms for identifying these difficulties and selecting appropriate responses rather than abandoning comprehension when problems arise (Chen, et al., 2025).

A particularly important finding was the significant increase in metacognitive awareness among learners receiving self-regulation strategy instruction. Metacognitive awareness involves learners' knowledge about their own cognitive processes as well as their ability to consciously plan, monitor, and evaluate learning activities (Agrawal, et al., 2025). The observed improvement suggests that metacognitive awareness can be developed through explicit pedagogical intervention rather than being treated solely as a stable individual characteristic. This is theoretically meaningful because learners may possess reading strategies but fail to use them effectively if they are not aware of when, why, and how those strategies should be applied (Akamatsu, et al., 2019).

The intervention likely enhanced metacognitive awareness by making normally implicit reading processes more explicit. For example, asking learners to formulate reading goals before beginning a text may have increased awareness of the planning phase of reading. Encouraging learners to pause periodically and ask whether they understood the preceding material may have strengthened monitoring processes (Sabaliauskas, et al., 2025). Similarly, requiring learners to reflect on the effectiveness of their strategies after reading may have promoted evaluation. Through repeated exposure to this cycle, learners may have become increasingly conscious of their own strengths, weaknesses, comprehension difficulties, and strategic choices (Ratnayake, et al., 2024).

The relationship between the two outcomes is also noteworthy. The simultaneous improvement in reading comprehension and metacognitive awareness suggests that these outcomes may be mutually supportive. Greater metacognitive awareness can facilitate more effective strategic behavior, while successful strategic reading may in turn reinforce learners' awareness of how they learn (Frazier, et al., 2021). In this sense, self-regulation strategy instruction may initiate a positive cycle in which learners become more knowledgeable about their reading processes, apply strategies more deliberately, experience improved comprehension, and subsequently develop greater confidence in their ability to regulate future reading tasks (Akamatsu, et al., 2019).

The findings also have implications for the role of the EFL teacher. Conventional reading instruction may focus heavily on vocabulary explanation, comprehension questions, translation, and identifying correct answers. Although these activities can support language development, they may provide limited opportunities for learners to understand the processes through which successful comprehension occurs. Self-regulation instruction requires teachers to assume a somewhat different role: rather than simply delivering reading content, teachers model strategic thinking, demonstrate how experienced readers respond to comprehension problems, provide guided practice, and gradually transfer responsibility to learners. This gradual movement from teacher-supported strategy use toward independent strategy application is particularly relevant to the development of autonomous language learners.

Another important implication concerns the transferability of self-regulation strategies beyond the immediate classroom context. Reading strategies such as goal setting, monitoring, and self-evaluation are not necessarily restricted to a particular text or lesson. Once internalized, learners may apply them to academic textbooks, online materials, examination passages, research articles, and other English-language texts. Thus, the value of self-regulation instruction may extend beyond short-term improvements in test performance. It may contribute to the development of more independent and lifelong approaches to foreign-language learning.

The findings should nevertheless be interpreted in light of several limitations. First, the study was conducted with a specific population of EFL learners and within a particular instructional context; consequently, generalization to learners of different proficiency levels, educational backgrounds, or cultural contexts should be made cautiously. Second, the intervention was conducted over a relatively limited period. Although the results suggest beneficial effects, longer interventions are needed to determine whether improvements in reading comprehension and metacognitive awareness are maintained over time. Third, metacognitive awareness was assessed using a self-report instrument. Such measures are useful for examining learners' perceptions of their strategic processes, but they may not always correspond perfectly to actual strategy use during reading. Future research could combine self-report measures with think-aloud protocols, reading-process data, interviews, or performance-based assessments.

Future studies could also investigate whether the effectiveness of self-regulation strategy instruction varies according to learner characteristics. Variables such as English proficiency, reading motivation, reading anxiety, self-efficacy, working memory, and prior strategy knowledge may moderate intervention outcomes. Furthermore, researchers could compare different forms of strategy instruction, including teacher-led explicit instruction, peer-supported strategy learning, digital self-regulated learning environments, and adaptive strategy training. Investigating whether specific components of self-regulation—planning, monitoring, control, or self-evaluation—are particularly influential would also provide a more refined understanding of the intervention.

CONCLUSION

Overall, the findings provide evidence supporting the integration of self-regulation strategy instruction into EFL reading pedagogy. Explicitly teaching learners to plan their reading, monitor comprehension, regulate strategy use, and evaluate their performance appears to offer a theoretically grounded approach to improving both reading comprehension and metacognitive awareness. The results reinforce the view that effective reading instruction should address not only what learners understand, but also how learners regulate the process of understanding. From this perspective, self-regulation strategy instruction represents a promising pedagogical approach for promoting strategic, reflective, and increasingly autonomous EFL readers.

REFERENCES

Agrawal, P. K., Gore, R., Kumar, M., Kushwaha, V., Goenka, S., & Agrawal, S. (2025). Metacognitive Awareness and Academic Performance: Implications from a Cognitive Neuroscience Perspective in Pre-service Teacher Education. *Annals of neurosciences*, 09727531251361976. Advance online publication. [Google Scholar] [Publisher] https://doi.org/10.1177/09727531251361976

Akamatsu, D., Nakaya, M., & Koizumi, R. (2019). Effects of Metacognitive Strategies on the Self-Regulated Learning Process: The Mediating Effects of Self-Efficacy. *Behavioral sciences (Basel, Switzerland)*, *9*(12), 128. [Google Scholar] [Publisher] https://doi.org/10.3390/bs9120128

Ateş Akdeniz A. (2022). Exploring the impact of self-regulated learning intervention on students' strategy use and performance in a design studio course. *International journal of technology and design education*, 1–35. Advance online publication. [Google Scholar] [Publisher] https://doi.org/10.1007/s10798-022-09798-3

Backers, L., & Van Keer, H. (2025). Implementing Self-Regulated Learning in Classrooms: Connecting What Primary School Teachers Think and Do Through Video-Based Observations and Interviews. *Behavioral sciences (Basel, Switzerland)*, *15*(12), 1627. [Google Scholar] [Publisher] https://doi.org/10.3390/bs15121627

Barth, A. E., Vaughn, S., Capin, P., Cho, E., Stillman-Spisak, S., Martinez, L., & Kincaid, H. (2016). Effects of a Text-processing Comprehension Intervention on Struggling Middle School Readers. *Topics in language disorders*, *36*(4), 368–389. [Google Scholar] [Publisher] https://doi.org/10.1097/TLD.0000000000000101

Chen, R., Wang, X., & Zhu, K. (2025). A bibliometric and content analysis of strategy-based instruction and self-regulated learning in second or foreign language teaching from 1994 to 2024. *Frontiers in psychology*, *16*, 1474689. [Google Scholar] [Publisher] https://doi.org/10.3389/fpsyg.2025.1474689

Cunha, J., Guimarães, A., Martins, J., & Rosário, P. (2023). A Self-Regulation Intervention Conducted by Teachers in a Disadvantaged School Neighborhood: Implementers' and Observers' Perceptions of Its Impact on Elementary Students. *Children (Basel, Switzerland)*, *10*(11), 1795. [Google Scholar] [Publisher] https://doi.org/10.3390/children10111795

Dermitzaki I. (2025). Fostering Elementary School Students' Self-Regulation Skills in Reading Comprehension: Effects on Text Comprehension, Strategy Use, and Self-Efficacy. *Behavioral sciences (Basel, Switzerland)*, *15*(2), 101. [Google Scholar] [Publisher] https://doi.org/10.3390/bs15020101

Frazier, L. D., Schwartz, B. L., & Metcalfe, J. (2021). The MAPS model of self-regulation: Integrating metacognition, agency, and possible selves. *Metacognition and learning*, *16*(2), 297–318. [Google Scholar] [Publisher] https://doi.org/10.1007/s11409-020-09255-3

Friesen, D. C., Schmidt, K., Atwal, T., & Celebre, A. (2022). Reading comprehension and strategy use: Comparing bilingual children to their monolingual peers and to bilingual adults. *Frontiers in psychology*, *13*, 986937. [Google Scholar] [Publisher] https://doi.org/10.3389/fpsyg.2022.986937

Habók, A., & Magyar, A. (2018). The Effect of Language Learning Strategies on Proficiency, Attitudes and School Achievement. *Frontiers in psychology*, *8*, 2358. [Google Scholar] [Publisher] https://doi.org/10.3389/fpsyg.2017.02358

Huang C. (2022). Self-Regulation of Learning and EFL Learners' Hope and Joy: A Review of Literature. *Frontiers in psychology*, *13*, 833279. [Google Scholar] [Publisher] https://doi.org/10.3389/fpsyg.2022.833279

Magyar, A., Habók, A., & Molnár, G. (2022). Exploring the Role of English as a Foreign Language Receptive Skills and Learning Strategy Usage in the Ability to Acquire and Apply Knowledge at the Beginning of Higher Education. *Frontiers in psychology*, *13*, 808546. [Google Scholar] [Publisher] https://doi.org/10.3389/fpsyg.2022.808546

Pickren, S. E., Stacy, M., Del Tufo, S. N., Spencer, M., & Cutting, L. E. (2022). The Contribution of Text Characteristics to Reading Comprehension: Investigating the Influence of Text Emotionality. *Reading research quarterly*, *57*(2), 649–667. [Google Scholar] [Publisher] https://doi.org/10.1002/rrq.431

Qin, C., Zhang, R., & Xiao, Y. (2022). A questionnaire-based validation of metacognitive strategies in writing and their predictive effects on the writing performance of English as foreign language student writers. *Frontiers in psychology*, *13*, 1071907. [Google Scholar] [Publisher] https://doi.org/10.3389/fpsyg.2022.1071907

Ratnayake, A., Bansal, A., Wong, N., Saseetharan, T., Prompiengchai, S., Jenne, A., Thiagavel, J., & Ashok, A. (2024). All "wrapped" up in reflection: supporting metacognitive awareness to promote students' self-regulated learning. *Journal of microbiology & biology education*, *25*(1), e0010323. [Google Scholar] [Publisher] https://doi.org/10.1128/jmbe.00103-23

Roberts, G. J., Solis, M., & Chance, B. (2019). Embedding Self-Regulation Into Reading Interventions to Support Reading and Behavior Outcomes. *Teaching exceptional children*, *52*(2), 78–86. [Google Scholar]

[Publisher] https://doi.org/10.1177/0040059919874306
Sabaliauskas, S., Gražulis, D., Žilinskienė, N., & Kaukėnas, T. (2025). Metacognitive strategies improve self-regulation skills in expert sports coaches. *Scientific reports*, *15*(1), 3434. [Google Scholar] [Publisher] https://doi.org/10.1038/s41598-025-86606-7
Singaravelu, S. L. D., & Chandrakumari, A. S. (2025). Beyond Grades: Harnessing Self-Regulated Learning to Empower Underperforming Students. *Nigerian medical journal : journal of the Nigeria Medical Association*, *66*(1), 26–35. [Google Scholar] [Publisher] https://doi.org/10.71480/nmj.v66i1.689
Soleimani, H., Mohammaddokht, F., & Fathi, J. (2022). Exploring the Effect of Assisted Repeated Reading on Incidental Vocabulary Learning and Vocabulary Learning Self-Efficacy in an EFL Context. *Frontiers in psychology*, *13*, 851812. [Google Scholar] [Publisher] https://doi.org/10.3389/fpsyg.2022.851812
Sun, Q., & Zhang, L. J. (2022). Understanding learners' metacognitive experiences in learning to write in English as a foreign language: A structural equation modeling approach. *Frontiers in psychology*, *13*, 986301. [Google Scholar] [Publisher] https://doi.org/10.3389/fpsyg.2022.986301
Ursache, A., Blair, C., & Raver, C. C. (2012). The Promotion of Self-Regulation as a Means of Enhancing School Readiness and Early Achievement in Children at Risk for School Failure. *Child development perspectives*, *6*(2), 122–128. [Google Scholar] [Publisher] https://doi.org/10.1111/j.1750-8606.2011.00209.x
Xu, J., & Qiu, X. (2021). The Influence of Self-Regulation on Learner's Behavioral Intention to Reuse E-Learning Systems: A Moderated Mediation Model. *Frontiers in psychology*, *12*, 763889. [Google Scholar] [Publisher] https://doi.org/10.3389/fpsyg.2021.763889
Yang, X., Zhang, Y., & Nie, Q. (2026). Unpacking the mechanisms of self-regulated learning: How motivation translates into reading benefits for EFL adolescents. *Frontiers in psychology*, *17*, 1747968. [Google Scholar] [Publisher] https://doi.org/10.3389/fpsyg.2026.1747968