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Teacher-Implemented Cognitive and Metacognitive Strategies to Improve Elementary Students' Reading Skills: A Literature Review

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ABSTRACT

Objective: The primary objective of this review is to evaluate the effectiveness of metacognitive reading strategy interventions when implemented within regular classroom environments for elementary-aged students. Given the importance of fostering independent and strategic reading—particularly for students struggling with literacy—this research addresses the current gap in evidence regarding metacognitive skill activation in standard educational settings.

Methods: A systematic review was conducted of peer-reviewed literature published between 2000 and 2024. Inclusion criteria required studies to involve elementary-aged participants, focus on metacognitive reading strategy interventions, and utilize experimental or quasi-experimental designs. An initial search identified 30 relevant studies, of which 19 met all inclusion criteria and were selected for final synthesis.

Results: The synthesis of the selected studies consistently demonstrated that metacognitive instruction effectively improves students' reading skills and comprehension. The evidence suggests that integrating these strategies enables students to become more independent and metacognitive readers.

Conclusions: Despite the documented efficacy of metacognitive instruction, these practices remain underutilized in elementary classrooms. This research underscores the need for wider implementation of these intervention strategies and provides actionable insights for teachers and reading specialists to enhance literacy outcomes in the regular classroom.

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Introduction

Reading draws on multiple strategies—cognitive tools like reasoning and brainstorming, as well as metacognitive practices such as checking one's understanding and posing questions to oneself. Together, these approaches make reading purposeful and intentional. The concept of metacognition is supported by four historical foundations, each of which has provided a basis for developing training strategies.(Torres, 2025)Metacognition in reading is grounded in four major traditions. The first concerns how researchers use verbal reports to analyze people's descriptions of their own thinking. The second comes from information-processing theories, which view executive control as a central system responsible for planning, reviewing, monitoring, and revising mental activity. The third foundation is self-regulation, which involves the strategies learners use to guide and adjust their own behavior. The fourth, identified by Brown and colleagues, highlights the shift from reliance on external guidance to the development of internal self-regulation. Many of the metacognitive elements within these four foundations—such as planning, monitoring, evaluating, and regulating—are essential components of effective reading comprehension. (Hacker et al., 2009; Kökçü, 2023; Pahrizal et al., 2025; Wang, 2023). Reading instruction and metacognition. Mastering the skill of reading from a young age is crucial, as it enables students to broaden their knowledge, communicate effectively, and pursue further education. Reading involves a complex set of behaviors that rely on the interplay among perceptual processes, cognitive abilities, and metacognitive knowledge. While understanding print and phonological sensitivity is a key element in developing comprehension, it is insufficient on its own. Additional factors, such as vocabulary knowledge and metacognitive skills, become increasingly important as students advance through various levels of reading comprehension. Insufficient development in either of these components can hinder comprehension (Seban et al., 2024). Reading comprehension involves actively interacting with text to extract and create meaning (Yang, 2023)comprehension involves various levels, including literal, inferential, critical, and creative. Skilled readers deeply engage with these processes, constantly monitoring and evaluating what they read, and effectively utilizing the information they gain. Consequently, teaching students to become proficient readers is a complex and demanding endeavor that necessitates specific instruction focused on comprehension. Children who encounter difficulties with reading in the early years of primary school are at greater risk of academic challenges later in primary school.

Consequently, teachers need to deliver high-quality reading instruction during the early grades (Denton et al., 2022; Duke & Block, 2012). Metacognitive strategies are techniques individuals use before, during, and after reading to become aware of their reading process. When students have metacognitive awareness, they can monitor and manage their reading processes, thereby structuring their reading practices. Essentially, this means that students can follow a reading process, read with the intention of self-evaluation, and determine any deficiencies in their reading process that need to be addressed (Babayigit, 2019). Metacognitive strategies are generally categorized into three phases: planning, monitoring, and evaluating. The first phase, called Pre-reading, occurs before beginning reading and involves metacognitive strategies such as advanced organizing, Organizational Planning, Selective Attention, and Self-Management. The second phase of monitoring, during reading, involves comprehension monitoring, production monitoring, and self-assessment. The third phase can involve metacognitive reading strategies used during post-reading (Channa et al., 2015) .Over the past 30 years, there has been a growing interest in researching the use of self-regulation and metacognitive strategies for mastering learning content, particularly in reading, due to their significant impact on learners. (Cubukcu, 2008; Tandean, 2020; Tibken & Tiffin-Richards, 2025). Reading comprehension can be developed through systematic instruction in metacognitive language learning strategies. The instructional model helped students understand when, why, and how to use the strategies of declarative, conceptual (conditional), and procedural knowledge; Gradually, they started thinking metacognitively about the strategies they could use to improve their reading comprehension, becoming not merely readers but also strategic readers. The present study aims to address this gap by conducting a PRISMA review of teacher-implemented cognitive and metacognitive strategy interventions designed to improve elementary students' reading skills. Specifically, this review examines how such strategies have been applied in classroom contexts, the outcomes they produce, and the factors that influence their success. This research is significant for both theoretical and practical reasons. Theoretically, it contributes to the growing body of literature linking metacognitive awareness with reading comprehension and self-regulated learning. Practically, it provides insights for teachers, curriculum designers, and policymakers on how to implement evidence-based strategies that foster students' independent and reflective reading habits. By highlighting effective instructional models and identifying areas for improvement, this review aims to support educators

in promoting sustained reading comprehension development among elementary-aged learners. The following lines will explain the main metacognitive strategies to boost reading skills in elementary-age students during post-reading:

Self-regulated learning (SRL)

It involves a student's "self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals" (Sins et al., 2024). Implicit in this definition is that, when these phases are applied to reading, readers first engage in forethought about the text to be read. They might assess the text's difficulty, set goals for it, and plan strategies for reading it. This phase is influenced by reading efficacy—the degree to which readers are interested in the text—and the reasons for reading it. (De Leeuw et al., 2016) In the next phase, performance, readers focus on reading the text and actively use reading strategies to comprehend. They must stay engaged and motivated to persist in attaining the self-set goals for understanding the text. The use of 'fixes its monitoring strategies would fit within the performance phase. After these initial phases, during the self-reflection phase, readers judge their performance through self-evaluations of comprehension and by asking themselves review questions to ensure understanding. During this phase, readers may attribute their performance to various causes such as effort or ease of the task. These reactions then feed back into the forethought phase, where readers decide their following action, such as re-reading portions of the text, answering questions assigned by their teacher, or simply closing their books and watching TV. Therefore, not only the cognitive and metacognitive processes involved in the SRL cycle are essential, but the motivation processes that characterize the performance phase cannot be disregarded and are as essential as the cognitive processes These will have a direct influence on the self-reflection phase, and then determine next steps such as persistence and continued reading or disengagement and abandoning the task We see the reading engagement model as supporting multiple aspects of the metacognitive.

Self-Monitoring

Self-monitoring (or self-observation) refers to deliberate attention to aspects of one's behavior. Self-monitoring is an essential component of self-regulated learning, or self-generated thoughts, feelings, and actions systematically designed to affect one's knowledge and motivation. (Zimmerman, 2023). Self-regulatory processes include attending to and concentrating on instruction; organizing, coding, and rehearsing information to be remembered; establishing a

productive work environment; using resources effectively; holding positive beliefs about one's capabilities, the value of learning, the factors influencing learning, and the anticipated outcomes of actions; and experiencing pride and satisfaction with one's efforts (Zimmerman, 2023).

Self-questioning

Self-questioning, a strategic approach to monitoring comprehension, has shown promising results for a range of diverse learners across grade and ability levels (Torres, 2025) Self-questioning strategy interventions require students to monitor their reading comprehension by asking themselves a series of self-generated questions or teacher-provided questions before, during, and after reading a passage. Using a self-questioning strategy helps students focus on the text's critical information (Brown & Pyle, 2021) Several variations of self-questioning interventions have demonstrated increased reading comprehension for narrative and expository texts. For example, the RAP strategy (Read a paragraph, ask yourself the main idea and details, and Paraphrase) was used with sixth graders, who substantially increased their reading comprehension of expository texts as a result of this intervention (Brown & Pyle, 2021)

Think aloud

Teachers have widely used the think-aloud method as a strategy of instruction to model the thinking process for students (To'ychiyev & Mamatkulova, 2024) this, in turn, can help promote comprehension The think-aloud helps enhance students' thinking processes and understanding of what they comprehend, and it allows the reader to connect meaning and understanding with the te Moreover, students perceive the think-aloud strategy as beneficial to their cognitive processes when it is correctly modeled. It also helps teachers enhance instructional effectiveness. Through think-alouds, teachers demonstrate their thought processes and make explicit how meaning is constructed during reading, particularly for students who struggle with comprehension. By verbalizing their thinking while reading, teachers can model the mental strategies that skilled readers use to make sense of a text (To'ychiyev & Mamatkulova, 2024). For students to effectively utilize metacognitive strategies, teachers should provide structured guidance on metacognition and learning strategies. This instruction will enhance students' understanding of these new strategies and enable them to apply them successfully to various reading tasks (Muhid et al., 2020). Several meta-analyses on reading instruction, with different foci, have shown the benefits of supporting the development of Reading skills. Some have focused on the effect of strategy instruction

interventions on students' Reading performance. For example, the article titled "Reciprocal Effects of Self-Regulation, Semantic Knowledge, and Reading Comprehension in Early Elementary School," written by CMD Connor, SL Day, and B Phillips, explores the relationship between cognitive and linguistic processes, such as semantic knowledge (SK) and self-regulation (SR), and learning skills like reading comprehension in early elementary school children. The authors hypothesize that these factors exhibit reciprocal effects and test this hypothesis using a sample of 852 children in first to second grade (5.9-10.4 years of age). The study reveals reciprocal effects between reading and SR, and between reading and SK, but not between SR and SK. The authors suggest that effective literacy instruction should target both cognitive and linguistic processes, as well as self-regulation (Connor et al., 2016). The article titled "A Quantitative Review of the Effects of Self-Regulation Interventions on Primary and Secondary Student Academic Achievement" is a systematic review that examines the impact of self-regulation interventions on academic outcomes for children and adolescents. The authors conducted a meta-analysis of multiple studies and found a positive overall effect of self-regulation interventions on academic outcomes, particularly in reading, writing, and math. This suggests that self-regulation interventions can improve academic achievement among students (Elhusseini et al., 2022). Thus, there were three research questions, as stated below:

What is the effectiveness of teacher-implemented cognitive and metacognitive strategies in improving elementary students' reading skills in regular classroom settings?

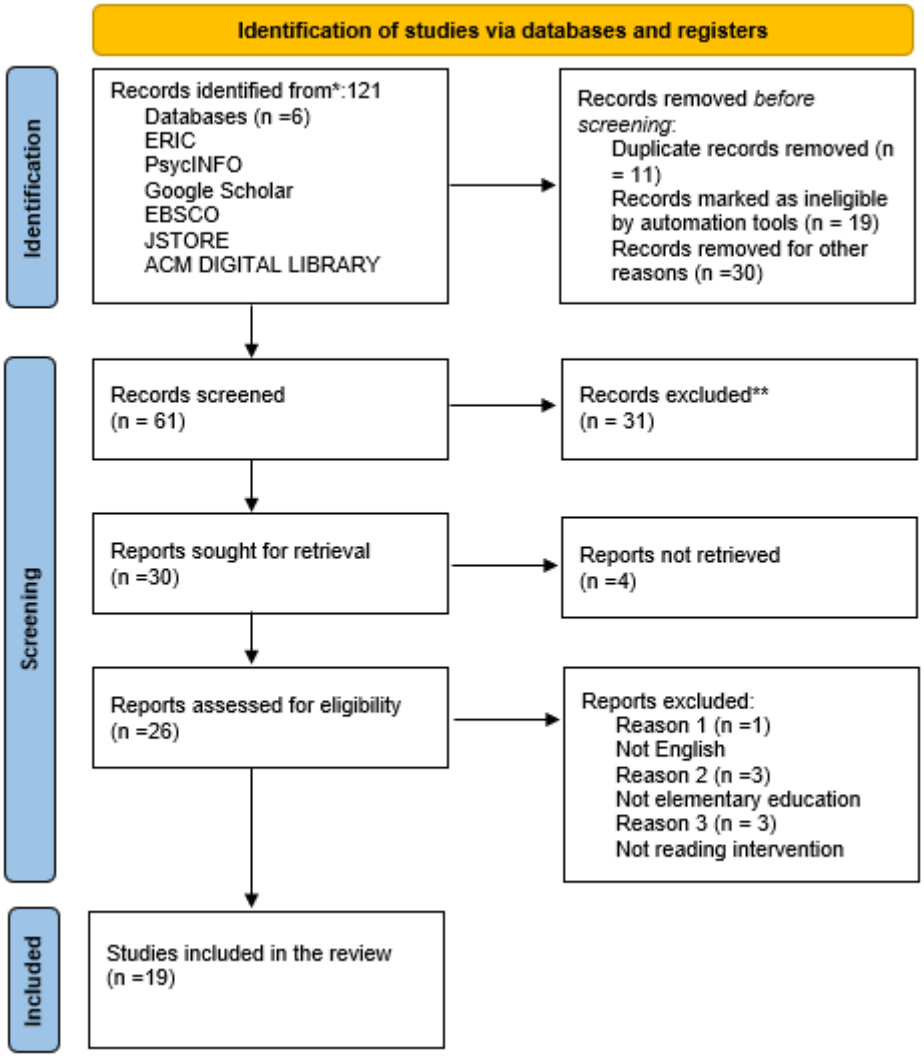
Which teacher-implemented metacognitive strategies show the greatest improvement in reading comprehension and fluency?

How do metacognitive reading interventions affect diverse learners, including bilingual students and those with disabilities?

There has been limited research on the reading instruction implemented by elementary classroom teachers and the support they receive as they aim to develop student reading outcomes. It is critical to review research on teacher-implemented Reading instruction in elementary school settings because many elementary teachers report receiving inadequate training in Reading instruction and experiencing difficulties when implementing evidence-based practices grounded in researcher-implemented Reading interventions.

Material and Methods

We developed five inclusion criteria to identify research relevant to our study.(Finlayson & McCrudden, 2020) First, the article had to be published in a peer-reviewed journal from 2000 to 2024. Second, the study had to include elementary school participants, including special education students. Third, the intervention needed to involve metacognitive strategies. Fourth, the articles had to use an experimental or quasi-experimental design—the latter needed to include measurement of reading performance at both pre- and post-intervention. We used computer database sites ERIC, PsycINFO, Google Scholar, EBSCO, JSTORE, and ACM DIGITAL LIBRARY to search for articles that met these criteria. We used the following search terms: comprehension instruction, meta-cognitive strategies, and elementary school. The next step was to conduct an ancestral search, which involved reviewing the relevant studies cited in the articles found in the database search. We identified 121studies in the initial searches. After coding agreement, we synthesized 19. The coding process involved systematically classifying each study into predefined categories: participant characteristics (e.g., grade level, gender, special needs), study design, intervention type (e.g., self-regulation, self-monitoring, self-questioning), measures, and primary outcomes. Two independent researchers conducted the initial coding after jointly developing the codebook based on the PRISMA framework and prior reviews concerning the participant, setting, research design, dependent variables, measures, the intervention used by instructors, and general outcomes. We also then searched for studies in the following journals: Journal of Educational Psychology, Journal of learning Disabilities Research& Practice, Scientific Studies of Reading, Journal of Literacy Research, Topics in Language Disorders, Reading and Writing Quarterly, Reading Psychology, Elementary School Journal—the Journal of Educational Research and Metacognition and Learning, Metacognition, and Learning.



Results

We analyzed the results of 19 studies, accounting for participants, research design, methods, measures, and outcomes. In general, the studies demonstrated that strategy instruction successfully improved student reading performance, regardless of age, gender, ethnicity, or the duration of the intervention.

Student participants

A total of 8473 student participants participated across the 19 studies. Regarding gender, eight studies reported participants' gender (42.1%). In these studies, 173 (1.29%) were male, and 171 (1.27%) were female. Six of the studies did not specify gender (Blything et al., 2020)., Boulware-

Gooden et al., 2007; Guthrie et al., 2004; ÖZENÇ & Ferhat, 2022) (Michalsky et al., 2009; Sanders, 2020) (Kolić-Vehovec & Bajšanski, 2006). Regarding grade level across the 19 studies, 187 (3.07%) students were in grades 1-5. One article shows that metacognitive strategies can be implemented in kindergarten. Ethnicity was reported in 5 out of the 19 studies. In these six studies, a total of 2,581 participants were included. The exact percentages of students by ethnicity were not provided, but the designations included Italian, Croatian, Hispanic, Israeli, German, Turkish, American, and Caucasian. In three papers, students with disability were involved, and one of them mentions that two students in the experimental group were not included in the study because one of them had a mild mental disability and the other had a stuttering problem. In the end, the experimental group had 10 students (six girls and four boys). Three of the students in the control group were not included in the study because one of them was always absent, and the other two had a mental disability. In the end, the control group had 10 students (five girls, five boys) (effect of self-regulation), and one of them showed that participants included people of different races and ethnic identities.

Teacher participant

Of the 19 papers, 12 emphasize teacher participation in the research. Several additional findings emerged from the reviewed studies. None of the studies reported information about the teachers' ethnic backgrounds. In some papers, Guthrie, J. T. randomly assigned teachers to receive professional development in either ISI reading or ISI math (Connor et al., 2016). Both CORI and SI teachers participated in professional development workshops that provided training on the instructional models. CORI teachers participated in a 10-day workshop that included viewing examples of instruction, performing the reading strategies, discussing motivational practices, constructing reading–science integrations, identifying books appropriate for this instruction, and planning for the 12-week theme using a teacher's guide supplied by the project. SI teachers participated in a 5-day workshop that included viewing examples of instruction, performing the reading strategies, discussing motivational practices, identifying books appropriate for this instruction, and planning 12 weeks of instruction using a teacher's guide supplied by the project. In Boulware-Gooden's research, the teachers received training in the intervention. It is mentioned that the teachers received training in the use of metacognitive strategies and the Six-Way Paragraphs curriculum (Boulware-Gooden et al., 2007). The teachers also received training on

implementing the interventions in their classrooms. The study used experienced trainers to instruct teachers on implementing the interventions, and a detailed teaching manual was developed in advance and used by both trainers (Schünemann et al., 2013). Teachers received training. Before the study began, the four teachers involved in the study all participated in the larger in-service training program on the science learning unit. For the present study, the four teachers were randomly assigned to one of the four research groups: three groups that would provide metacognitive instruction to their students at different phases of reading scientific texts, and one control group. The four teachers were then trained separately in a 2-day individual in-service training program focused on teaching and understanding scientific texts (Michalsky et al., 2009). Also, they had some form of training or guidance on implementing the self-evaluation-based oral reading method, as the study mentions that the students were informed about the appropriate reading speed, what constitutes a reading mistake, and reading prosody. The whole class made criticisms on this subject, and ideas about good reading were shared. Additionally, the study notes that semi-structured interviews were conducted with teachers to gather their views on the method's implementation, suggesting that the teachers were involved in the research process (Özenç & Saat, 2022). The teachers received training before the study began. All four teachers participated in a larger in-service training program regarding the science learning unit. Then, the four teachers were each trained separately in a 2-day individual in-service training program that focused on teaching and comprehending scientific texts (Michalsky et al., 2009).

Research design

Twelve (63.15%) of the 19 studies used comparison-group designs, and the remaining study (36.85%) used a multiple-baseline design. Of the studies that used comparison-group designs, three used randomized control-group designs, and nine used quasi-experimental designs.

Measures

The primary measurement instruments were Woodcock-Johnson, Gates-MacGinitie Reading Tests, and the Online Self-Regulated Learning Questionnaire (OSLQ)(Perry et al., 2003), The Strategic Reading Questionnaire (SRQ), Informal Reading Inventory, DMT, The Motivations for Reading Questionnaire (MRQ), scientific literacy skills (TSL), science knowledge (TSK), Metacognitive awareness (MAQ), Drie-Minuten-Toets (DMT)

Setting

All studies were conducted in elementary schools. Four of 19 studies were conducted in the United States. The other studies were conducted outside the U.S. Of the 15 studies, three were in Germany (20%), and one each was conducted in Turkey, Israel, Estonia, Croatia, the Netherlands, Taiwan, the United Kingdom, and Canada.

Reading Intervention

Table 1 outlines the reading interventions used across the reviewed studies. A range of strategies was implemented. Two studies applied direct reading strategy instruction. One investigated the effectiveness of empowering metacognitive reading through the TRAP strategy within the SRSD framework to enhance comprehension among fifth- and sixth-grade students with disabilities The study employed a multiple-probe design, collected data across baseline, intervention, and maintenance phases, and assessed treatment fidelity, social validity, and motivation. Another study compared two instructional frameworks—Concept-Oriented Reading Instruction (CORI) and Strategy Instruction (SI)—both designed to improve comprehension and engagement through motivational and cognitive strategies (Guthrie et al., 2004). Several studies examined self-regulation as a predictor of reading comprehension. Connor et al. (2016) emphasized that self-regulation supports early reading development and highlighted the need for interventions promoting these skills. Similarly, Oruç and Arslan (2016) described a five-step self-regulation strategy involving goal setting, strategy selection, performance evaluation, comparison, and adjustment. Kolić-Vehovec and Bajšanski (2006) used triggers to enhance students' meta-comprehension, suggesting that combining explicit and implicit instruction improves understanding. Michalsky et al. (2009) used self-addressed metacognitive questions before, during, and after reading scientific texts, finding gains in both scientific literacy and metacognitive awareness. Further research explored metacognitive development in bilingual students, showing that those with higher perceived proficiency demonstrated stronger comprehension monitoring and strategy use (Kolić-Vehovec & Bajšanski, 2007). Özenç and Ferhat (2022) implemented a self-evaluation oral reading method that involved recording, reviewing, and correcting reading errors, thereby improving fluency and accuracy. Guided reading interventions were also found to enhance word-reading, fluency, comprehension, and vocabulary (Blything et al., 2020). Additional work linked self-explanation to metacognitive reflection, emphasizing its role in comprehension (McNamara, D.S., 2017). Self-explanation and reading strategy training (SERT) improves the

performance of low-knowledge students in science courses. (McNamara, 2017). (Edossa et al., 2022) noted that stronger subject-matter understanding supports better comprehension monitoring. (Edossa et al., 2022)combined reciprocal teaching with explicit instruction in self-regulated learning, while Gillam et al. (2009) found that children with language impairments produced fewer explanatory statements and recalled fewer details, underscoring the importance of targeted interventions to improve reading comprehension.

General outcomes

Overall, these articles suggest that effective reading instruction and interventions should focus on developing students' self-regulation and metacognitive skills, as well as on explicitly teaching and promoting reading comprehension strategies. Additionally, these articles suggest that interventions that are targeted at early elementary school students may be particularly effective in promoting long-term academic success. Moreover, almost all the articles emphasize metacognitive instruction or the use of instructional models for comprehension instruction. This means that teachers must incorporate metacognitive strategies into their instructional models or assess elementary students' metacognitive skills.

Table 1. Description of studies included in the review

Study	Grade Level	Design/Duration	Participant	Reading Intervention	Method	Measure	Outcomes
(Connor et al., 2016)	The grades of 5th to 7th	Longitudinal study.2 years	285	Integration/Self-regulation	Researchers conducted a longitudinal study with a sample of 184 children from first to third grade. They used a battery of tests to assess the children's self-regulation, semantic knowledge, and reading comprehension.	Two subtests from the Woodcock-Johnson Tests of Achievement-III (WJ-III), the letter-word identification test (LW) and the passage comprehension (PC) test, and the Gates-MacGinitie Reading Tests, 4th ed. (GMRT).	Developing effective interventions that target self-regulation may enable educators to support the development of reading comprehension and other important skills in young learners, thereby highlighting the importance of considering

							self-regulation.
(Mägi et al., 2016)	Grades 1-4, in the age range from 6 to 10 years old.	cross-sectional study/3 years	207 Estonian elementary school students	Self-regulation strategies	The person-oriented approach to investigating the cognitive and behavioral aspects of self-regulation (planning and task-persistent behavior) aimed to clarify how these patterns were associated with children's academic outcomes. The study used a longitudinal design, and the data were analyzed using latent profile analysis (LPA) and latent transition analysis (LTA)	Tests were developed by the Estonian Ministry of Education and Research and were used widely in Estonian schools to assess student learning outcomes. Their classroom teacher rated each student's task persistence.	The high self-regulation group exhibited the best academic performance, whereas the worst was observed in the low self-regulation group with high emotional control, according to the study.
Perry, N. E., Nordby, C. J., & VandeKamp, K. O	1st	Quasi-experimental	2 Canadian first-grade Canadian	Self-Regulation	Task analysis, Goal setting, Task management	Questionnaires and self-report tools, such as learning diaries Observations and interviews 1. Diagnostic assessment tools designed to measure college students' reading, writing, mathematics, and self-regulated learning skills 4. The Online Self-Regulated Learning Questionnaire (OSLQ) is a tool developed to assess	To foster self-regulated learning in elementary school children, the article emphasizes the need for instructional sophistication and student awareness.

						students' use of self-regulated learning strategies in e-learning environments.	
(Blything et al., 2020)	JCR	quasi-experimental design	115	Self-monitoring	analyzing a corpus of 40 hours of guided reading sessions with 115 students aged 6-11 years, conducted by 19 teachers. The researchers tagged the corpus to enable computer-based searches for different syntactic forms of questions used by the teachers during small-group comprehension instruction	The research used measurement tools to analyze the linguistic complexity of students' responses based on the types of questions teachers asked during small-group comprehension instruction. The study measured grammatical complexity by analyzing the proportion of function words to content words in students' responses.	The research highlights the importance of strategic question-asking in small-group comprehension instruction and the effectiveness of higher-challenge questions in scaffolding students' understanding of the text.
(Oruç & Arslan, 2016)	5th grade	Quasi-experimental	۳۷	Self-regulation	The non-equivalent control group's pre-test and post-test design which is one of the quasi-experimental designs used to analyze the effectiveness of the treatment. In this design, the researcher does not randomly assign individuals to groups. Existing groups were designated as experimental and control groups. The The researcher intervened in the experimental group, not the control group.	Reading comprehension test, the scale of metacognitive thinking skills, which is a sub-scale of MSLQ, developed by Pintrich (1991)	The statement highlights the effectiveness of self-regulated learning instruction in improving students' reading comprehension, attitude towards Turkish courses, and metacognitive thinking.

(Kolić-Vehovec & Bajšanski, 2006)	5th	Empirical study	271	Implicit teaching	Longitudinal study	Comprehension monitoring was the most critical predictor of reading comprehension in all students. Reading comprehension was assessed through a standardized test, while comprehension monitoring was measured using the Metacomprehension test and a cloze task. The Strategic Reading Questionnaire (SRQ) was used as a self-report measure of strategic reading. Additionally, a questionnaire investigating Italian language use and perceived proficiency was administered. The Italian language use scale (LU) and the Perceived Italian proficiency scale (PP) were used to measure language use and perceived proficiency in Italian, respectively.	Comprehension monitoring was the most important predictor Of reading comprehension in all students
(Özenç & Saat, 2022)	4th	Experimental	25	explicit	The research method is a mixed-methods approach that combines qualitative and quantitative data. The study	The Informal Reading Inventory, Prosodic Reading Scale, Reading Comprehension	The research finds that the self-evaluation-based oral reading method has a positive

					employed a nested mixed design, which involves the concurrent or sequential use of qualitative and quantitative data, with the latter being more dominant. The non-dominant data type is used to support the dominant data.	Test, and written student views were used to gather data on the students' thoughts and opinions about the self-evaluation-based reading method.	impact on fourth-grade students' correct reading scores. Both experimental and control groups were equivalent before the intervention in terms of correct reading, and there was a significant difference in proper reading scores after the intervention in favor of the experimental group. In addition, when the pre- and post-test scores of the experimental and control groups were compared, students significantly increased their correct reading scores through self-evaluation-based oral reading practices.
(Helder et al., 2016)	Grade 3,5 elementary school	The study likely involved a sample of middle and upper elementary school students who were classified as good or poor	74	self-paced reading paradigm to investigate coherence monitoring during reading	A variety of measurement tools, including a coherence-monitoring task, a reading comprehension task, and an eye-tracking task, are used to assess online processing.	DMT	Providing a more comprehensive understanding of the metacognitive skills related to reading comprehension in

		comprehenders based on their reading abilities. The offline and online measures of coherence monitoring may have included reading comprehension tests, eye-tracking measures, and other measures of reading fluency and comprehension.					elementary school children.
(Guthrie et al., 2004)	third-grade children	Experimental research	148	Concept-Oriented Reading Instruction (CORI) and Strategy Instruction (SI). CORI is a reading intervention that combines motivational support and cognitive strategies to help students improve their reading comprehension and engagement	The passage describes a study conducted on third-grade students from four schools in a mid-Atlantic state. Eight classrooms used the Concept-Oriented Reading Instruction (CORI) approach, and 11 used a different approach called SI. The demographic characteristics of the participants are presented in Table 1, and chi-square tests showed that the schools did not differ significantly in terms of student demographic variables.	Elicitation of background knowledge, (b) student questioning, (c) searching for information, (d) multiple text reading comprehension (writing knowledge gained from text; there were three alternative forms of these tasks to allow counterbalancing across pretest, posttest, and a possible follow-up), (e) Motivation for Reading Questionnaire (MRQ; Wigfield & Guthrie, 1997), and passage comprehension (three parallel forms). The passage comprehension measure required	While the studies demonstrate the effectiveness of CORI for third-grade students, future research is needed to determine whether a smaller set of two to three practices is equally effective in enhancing reading engagement and comprehension and whether the findings generalize to other age groups.

						students to read a randomly the assigned passage in three alternative forms (bat, bear, shark), followed by a knowledge structure assessment that students completed on the computer. For multiple-text comprehension, the alternative forms consisted of Three reading packets representing multiple trade books developed by the research team.	
(Schünemann et al., 2013)	5th grade	Quasi-experimental	323	Self-regulation	The study found that the interventions had a small, non-significant effect on students' reading comprehension compared with the control group. Still, it did improve students' use of specific reading strategies. The authors suggest that future research should explore the use of process-oriented methods to understand better how students apply their newly acquired strategic knowledge and self-regulation routines during reading	Pretest and posttest using a standardized reading comprehension test, as well as experimenter-developed tasks to assess specific reading strategies (6). Additionally, students completed a self-report questionnaire on their use of self-regulated learning strategies, and their teachers completed a questionnaire on their perceptions of the students' reading abilities and behavior	While the intervention combining reciprocal teaching with explicit instruction in self-regulated learning had a minimal impact on students' reading comprehension, as revealed in the study (12), there was some evidence that it could enhance students' use of specific reading strategies (14). Therefore, the authors

					comprehension tasks.		recommend that future research explore process-oriented methods to understand better how students employ their newly acquired strategic knowledge and self-regulation routines during reading comprehension tasks.
(Chin & Abd Ghani, 2021)	4th 5th	Quasi experimental	27	Think aloud	he study used a mixed-method approach, including a reading comprehension test, think-aloud training (demonstration and practice), and online questionnaires and interviews.	Multiple-Choice Questions Open-Ended Questions .	Despite limitations due to the COVID-19 pandemic, students generally perceived the think-aloud strategy as beneficial for reading comprehension
(Edossa et al., 2022)	5th	Longitudinal research	5870	explicit	The present study focused on the starting cohort of grade 5, consisting of regular students randomly selected using a multi-stage stratified cluster sampling technique. The study followed the main sample of 5,870 students at three time points: grade 5 (10 years old), grade 7 (12 years old), and grade 9 (14 years old).	Test Scores 2) Metacognitive Monitoring Task	The authors suggest that future research should focus on process-oriented methods to understand better how students apply their newly acquired strategic knowledge and self-regulation routines in reading comprehension tasks.

					The analysis was performed in R, and Structural Equation Modeling (SEM) using the lavaan package was conducted to analyze the measurement and main models.		
(Boulware-Gooden et al., 2007)	3RD GRADE	Experimental research		explicit	The purpose of the five-week study was to determine the effectiveness of systematic direct instruction of multiple metacognitive strategies designed to assist students in comprehending text.	The pre- and post-testing battery included multiple instruments to measure students' academic skills before and after the intervention. Students were pretested using the Word Attack, Letter–Word Identification, and Spelling subtests of the 2001 Woodcock-Johnson III (WJ-III) Test of Achievement.	Students can enhance their reading comprehension by generating self-explanations.
(Gillam et al., 2009)	4th grade	Experimental	40	They examine the explicit and implicit statements children generate during comprehension of expository texts.	The Authors collected data by conducting individual think-aloud sessions with 40 4th-grade children, including those with and without language impairments. During the sessions, the children were asked to listen to expository passages one sentence at a time, make comments after each sentence, and then answer questions and	Third Edition (CELF–3) and the Test of Nonverbal Intelligence, Third Edition (TONI–3	The main findings of the study were that statements generated by children during the think-aloud task consisted mainly of paraphrases, which were used significantly more often than exact repetitions or implicit statements.

					recall the passages.		
)Michalsky et al., 2009(	JCR	experimental	108	Explicit	Researchers manipulated the instructional type students received while reading scientific texts and then compared the outcomes across groups. Specifically, they compared the outcomes of students who received no metacognitive instruction, students who received metacognitive instruction before reading, and students who received metacognitive instruction after reading.	Pretests and posttests were administered to all students in the four classes on scientific literacy skills (TSL), science knowledge (TSK), and metacognitive awareness (MAQ). The researchers observed the teachers and students during the study. They met with the teachers after each observation to address their questions about instructional methods and, if necessary, offer recommendations for improvement.	The results of this study suggest that metacognitive instruction can be an effective way to improve students' reading comprehension skills, particularly when reading scientific texts. Teachers can incorporate metacognitive instruction into their lessons by encouraging students to reflect on their thinking while reading.
(Kolić-Vehovec & Bajšanski, 2006)	5th	Experimental	122	Explicit Instruction	To explore comprehension monitoring and perceived use of reading strategies as factors in reading comprehension. Participants were elementary school students from the fifth to the eighth grade.	Meta comprehension test and a cloze task, Strategic reading questionnaire SRQ	Instruction of metacognitive strategies enhances reading comprehension and vocabulary achievement.
Helder, A., Van Leijenhorst, L., & van den Broek, P . .(٢٠١٦)	3rd	Experimental	74	self-paced reading paradigm to investigate coherence monitoring during reading.	To investigate differences in coherence-monitoring skills between good comprehenders and poor comprehenders of different ages	The standardized scores on a word decoding test (Drie Minuten Test) and a reading comprehension test were	The ability to detect coherence breaks during reading improves with age, and children

					by manipulating the consistency of narratives given to participants.	obtained from the children's school records, with informed consent from their parents.	with poor comprehension skills outperformed those with good comprehension skills.
(Urban et al., 2023)	۳-۵	Experimental	407	Explicit	A more 'hands-off' scalable approach to strategy instruction was tested, where initial teacher training and materials were provided to Grade 3-5 teachers to integrate into their classrooms over a full academic year.	The Reading Awareness Scale ESCOL	Instruction for elementary students reveals positive effects but also requires extensive teacher training and significant oversight by the research team.
(Sanders, 2020)	Fifth and sixth grades	Experimental research	Not mentioned	Self-regulation	a multiple-probe across-students, single-case design to investigate the effectiveness of the TRAP strategy taught using the SRSD framework on the reading comprehension of elementary students with disabilities.	Using oral retell reading comprehension probes. The probes were selected from the students' reading curriculum and administered during the baseline, intervention, and maintenance phases. The researcher used a rubric to score the oral retells, and interrater reliability was calculated to ensure consistency in scoring.	The TRAP strategy, taught using the SRSD framework, was effective in improving the reading comprehension of elementary students with disabilities.

Discussion

Research on teacher-implemented metacognitive reading interventions in elementary classrooms remains limited. This review aimed to identify evidence-based instructional practices that teachers use to enhance students' reading skills. Overall, interventions generally promoted reading comprehension, highlighting the importance of metacognitive instruction in fostering literacy. Strategies such as self-regulation and self-monitoring enable students to personalize learning, study texts carefully, and improve vocabulary, word-reading accuracy, and fluency (Blything et al., 2020). Activating prior knowledge also positively influences reading development (Fisher et al., 2012). Students' metacognitive empowerment benefits diverse learners, including bilingual students and those with disabilities. For example, comprehension monitoring and perceived use of reading strategies predict reading comprehension beyond grade, age of second-language acquisition, and language proficiency (Kolić-Vehovec & Bajšanski, 2006). Teacher-implemented interventions often involve explicit strategy instruction—self-questioning, self-monitoring, and self-assessment—which fosters students' reflection and regulation of their thinking (Gillam et al., 2009; Schünemann et al., 2013). While some interventions had modest effects on comprehension, they improved students' strategic reading skills, warranting further research on skill application during reading tasks (Schünemann et al., 2013). Nearly all studies indicate that metacognitive reading instruction enhances reading performance compared with regular classroom instruction or alternative treatments (Connor et al., 2010, 2016). Incorporating metacognitive strategies into instructional models like reciprocal teaching activates key metacognitive functions, though teachers require specialized training for effective implementation. Of 17 reviewed studies, 12 emphasized teacher involvement, with interventions delivered at both whole-class (Tier 1) and small-group levels (Mägi et al., 2016). Whole-class interventions are more feasible in general education settings, though small-group work can supplement instruction. Intervention length did not consistently affect outcomes, but teacher training, ongoing support, coaching, and feedback were crucial for success.Metacognitive strategies, especially post-reading activities, support elementary students in managing thoughts, emotions, and behaviors to achieve goals. Semantic knowledge—the understanding of word meanings and their relationships—interacts with reading comprehension, highlighting the interconnectedness of self-regulation, literacy, and academic skills (Connor et al., 2010)(Connor et al., 2016). Students with strong self-regulation demonstrate

better academic performance, emphasizing the need for educators and parents to nurture these skills (Mägi et al., 2016). Diagnostic tools, self-reports, observations, and interviews can help assess and promote self-regulated learning (Perry et al., 2003). Individualized instruction also effectively supports the development of literacy and self-regulation, particularly in the early elementary grades.

Conclusion

The study's findings are valuable for advancing the scientific discussion of reading metacognitive instruction in elementary classrooms. The study demonstrated how metacognitive strategies can improve elementary students' reading skills. It also provided insights into the implications of both underestimating and overestimating one's performance on later reading comprehension. These findings have practical implications, suggesting that teachers should be encouraged to adopt instructional models grounded in metacognition. One way to enhance students' metacognition is to teach metacognitive strategies such as self-regulation and self-monitoring, thereby increasing students' self-efficacy in reading. Despite the importance of metacognitive strategies and instructional models grounded in metacognitive approaches, metacognitive empowerment of students plays a key role in improving elementary students' grades. So, more research is needed on how to use effective instruction to activate students' metacognitive skills during the reading process.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by the ethics committee of Farhangian University. The patients/participants provided their written informed consent to participate in this study.

Author contributions

A.G. and T.A. contributed to the study conception and design, material preparation, data collection, and analysis. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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