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Comprensión de textos en la resolución de problemas de enunciado verbal: Una revisión de literatura

Text comprehension in solving word problems: A literature review

Compreensão de texto na resolução de problemas de matemática: uma revisão da literatura

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Resumen

En la resolución de problemas en general, y de problemas de enunciado verbal en particular los estudiantes manifiestan diferentes dificultades, algunas asociadas con la comprensión de textos. Se realizó una revisión de la literatura con los objetivos de identificar los tipos de estudios que han abordado la comprensión de textos durante la resolución de problemas, para reconocer elementos de la comprensión lectora y su incidencia en los procesos de resolución. Se analizaron 54 artículos publicados durante los últimos 42 años en revistas de educación matemática, psicología e investigación educativa siguiendo el protocolo PRISMA. Los estudios se clasificaron de acuerdo con la manera en que abordan las dificultades, los procesos de lectura, las características de los textos y las estrategias de evaluación o

intervención. Se identificaron algunas limitaciones de estos estudios y la necesidad de desarrollar investigaciones que profundicen en la manera en que los estudiantes leen y comprenden los enunciados de los problemas. Se concluyó que un adecuado proceso de lectura es una condición necesaria pero no suficiente para la resolución de problemas, por lo que se considera conveniente desarrollar investigaciones que aborden esta problemática y lleven a proponer acciones que favorezcan la comprensión, a través de estrategias de lectura y contextos significativos para los estudiantes.

Palabras clave: Comprensión de textos, problemas de enunciado verbal, procesos de lectura, resolución de problemas, revisión de literatura.

Abstract

In general problem solving, and particularly in solving word problems, students display various difficulties, some of which are associated with text comprehension. This literature review aimed to identify the types of research that have addressed text comprehension in the context of problem solving, as well as to examine elements of comprehension and their influence on the solving process. A total of 54 papers published over the past 42 years in mathematics education, psychology, and educational research journals were analyzed following the PRISMA protocol. The studies were classified according to how they address difficulties, reading processes, text characteristics, and assessment or intervention strategies. Certain limitations of these studies were identified, along with the need for further research that explores in greater depth how students read and understand problem statements. The review concluded that an adequate reading process is a necessary but not sufficient condition for successful problem solving; therefore, it is recommended to conduct studies that address this issue and lead to proposing actions that foster comprehension through reading strategies and meaningful contexts for students.

Keywords: Text comprehension, word problems, reading processes, problem solving, literature review.

Resumo

Na resolução de problemas em geral, e em particular de problemas com enunciados, os alunos apresentam diversas dificuldades, algumas das quais relacionadas à compreensão textual. Realizou-se uma revisão da literatura para identificar os tipos de estudos que abordaram a compreensão textual durante a resolução de problemas, a fim de reconhecer elementos da compreensão leitora e seu impacto nos processos de resolução de problemas. Cinquenta e quatro artigos publicados nos últimos 42 anos em periódicos de educação matemática, psicologia e pesquisa educacional foram analisados seguindo o protocolo PRISMA. Os estudos foram classificados de acordo com a forma como abordam as dificuldades, os processos de leitura, as características do texto e as estratégias de avaliação ou intervenção. Algumas limitações desses estudos foram identificadas, bem como a necessidade de mais pesquisas que aprofundem a forma como os alunos leem e compreendem os enunciados dos problemas. Concluiu-se que um processo de leitura adequado é uma condição necessária, mas não suficiente, para a resolução de problemas. Portanto, considera-se aconselhável desenvolver pesquisas que abordem essa questão e levem à proposição de ações que promovam a compreensão por meio de estratégias e contextos de leitura significativos para os alunos.

Palavras-chave: Compreensão textual, problemas com enunciados, processos de leitura, resolução de problemas, revisão da literatura.

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Introduction

Problem-solving is considered a priority skill in various educational systems, such as the Mexican one, as a key skill to be developed from basic education onward (Secretaría de Educación Pública, 2022), as it constitutes a tool for everyday life and a foundation for developing more complex learning (García et al., 2006). Authors such as Lindquist et al. (2017) understand problem-solving as the ability to resolve a wide variety of situations, which requires mathematical knowledge, its application, and reasoning of different types and levels of difficulty. Santos (2014) points out that problem-solving represents an alternative for developing different mathematical concepts within the school context.

Word problems used in basic education describe situations and pose questions that students can solve by applying mathematical operations to the data presented in the text (Verschaffel et al., 2000). These problems also involve cognitive processes associated with reading, comprehension, and modeling. Reading the problem statement is fundamental because it allows students to recognize the information presented and identify which data is relevant and which questions need to be answered.

Students have been found to experience difficulties with problem-solving in general (Pimpenton & Nation, 2010) and with word problems in particular (Sanz et al., 2019). Swanson et al. (2008) mention that these difficulties arise in word problems even when students possess sufficient mathematical skills. Verzosa and Mulligan (2012) consider that these difficulties stem primarily from linguistic errors or difficulties in reading comprehension, which prevent children from transforming the problem statement into mathematical models. This has been the subject of numerous studies focusing on the development of reading comprehension and the identification of elements that influence comprehension, such as the mathematical concepts involved and the structure of the texts (Favier & Dorier, 2024).

Given the role assigned to text comprehension in problem-solving as a source of difficulty during the problem-solving process, this article documents a literature review that includes research studying the influence of text comprehension on the process of solving word problems and that were published between 1983 and 2025. The objectives are to identify the types of research that have addressed text comprehension during problem-solving, to recognize elements of comprehension and its impact on the problem-solving process.

Conceptual framework

Both the processes of reading and understanding texts and problem-solving are key concepts in the development of this review, so it is considered important to describe some theoretical elements related to these concepts for their study.

Reading and text comprehension processes

Reading can be understood as a process through which a person deciphers a series of graphic symbols presented in a visual medium (Paradiso, 2008). This view considers the elementary levels of linguistic analysis, such as phonetics and phonology. To achieve effective reading that leads to comprehension, it is not enough to interpret the symbols or decode the words and achieve a literal understanding of the ideas that make up the text; readers must reconstruct the text and interpret it based on their prior knowledge (Fernández de Castro, 2013; León Cascón, 2009). Thus, it is recognized that reading processes develop in different stages, from recognizing the structure of a text to achieving its deep understanding through a dialogue between the author and the reader for the interpretation of the text.

Kintsch (1998) provides a general framework for explaining the cognitive phenomena of comprehension, highlighting that it occurs through a process of construction and integration. From his perspective, comprehension can be said to occur when most elements, such as common terms, perceptions, concepts, emotions, memories, knowledge, beliefs, or goals, are meaningfully related by a reader and incorporated during the integration phase to give meaning to the text's information. Therefore, the process of reading and understanding texts consists of a construction based on the reader's existing knowledge. These elements allow us to recognize the cognitive processes involved in reading and understanding texts, and to investigate their role in solving word problems.

Solving word problems

Several authors have studied problem-solving processes. Alan Schoenfeld (1985) divides the problem-solving process into stages, ranging from analysis, design, exploration, implementation, and verification. On the other hand, when discussing word problems, there is the mathematization perspective, where the student translates the problem statement from natural language into a mathematical model (Jupri & Drijvers, 2016).

The diversity in these approaches allows us to recognize the role given to understanding the problem statement. For Schoenfeld, understanding could be implicit in the problem analysis. From the mathematization perspective, the reading process leads to generating a mathematical model of the problem, in what De Lange (2006) calls horizontal mathematization. In both cases, understanding influences the actions taken to solve the problem, but from the mathematization perspective, the role of understanding is more clearly distinguished.

According to van Dijk and Kintsch (1983), problem-solving is based on three interrelated mental representations: the source text, the situation model, and the problem model. The source text refers to the exact structure and content of the text; the situation model refers to the reader's representation of the problem situation by linking the text's content with their prior knowledge; and the problem model is the representation of the problem's mathematical structure, in which arithmetic operations are performed to arrive at the solution (Kintsch, 1994; Nathan et al., 1992).

Questions that guided the literature review

To guide the literature review, a series of guiding questions were posed:

- What types of research related to text comprehension in problem solving are identified in the literature?
- In previous research, what relationship does text comprehension have with problem solving?
- What elements of text comprehension influence the above relationships?
- How is text comprehension assessed in problem solving in the analyzed research?

Method

To conduct the literature review, the PRISMA protocol was implemented, which aims to identify, evaluate, and comprehensively synthesize all relevant studies on a given topic (Petticrew & Roberts, 2006). These studies typically aim to answer a specific question, test a hypothesis, or compare results from different studies. The protocol's implementation consists of three phases: identification, screening, and inclusion of articles.

First phase: search and identification of references in academic publications

The search period for references was conducted from October 2024 to April 2025. Fifty-four digital articles published on digital platforms of publishers such as Springer and Elsevier, as well as institutional databases hosting specialized publications accessible through their search engines, were consulted. The search was conducted using keywords such as "text comprehension," "problem solving," and "reading" in both Spanish and English, as well as

combinations of these using the Boolean operator AND. Publications addressing reading, text comprehension, or problem solving processes in isolation were excluded from the review.

Second phase: screening of identified references

In the first phase of the search, 54 references were identified (Table 1). The abstracts and conclusions were then read, and the correspondence between the keywords and the search terms was verified. Selection criteria included references to text comprehension and problem-solving in the abstract or conclusions, or the presence of these terms in the keywords.

Table 1 references selected per publication and year

Publication	Year	Selected references
Acta Psychologica	2021	1
University Minutes	2023	1
AIEM - Research advances in mathematics education	2022	1
American Educational Research Journal	2018	1
Complex & Intelligent Systems	2024	1
Conference: MADIF	2007	1
Culture and Education	2018, 2021	2
Discover Artificial Intelligence	2025	1
Education Sciences	2021	1
Educational Psychology	2008	1
Educational Psychology Review	2024	1
Educational Studies in Mathematics	2013, 2022, 2023, 2024	4
European Journal of Educational Research	2024	1
European Journal of Psychology of Education	2024	3
Humanities & Social Sciences Communications	2023	1
International Journal of Mathematical Education in Science and Technology	2020	1
International Journal of Science and Mathematics Education	2022	2
Journal for Research in Mathematics Education	2004	1
Journal of Educational Psychology	2008	1
Journal of King Saud University - Computer and Information Sciences	2023	1
Journal of Memory and Language	2010	1
Lithuanian Mathematical Journal	2024	1
New York: Academic Press	1983	1
Participatory Educational Research	2020	1
Praxis & Knowledge	2020	1
Procedia - Social and Behavioral Sciences	2010, 2014	2
Proceedings of the forty-third annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education	2021	1
Reading and Writing	2022, 2023, 2024	4
Reading Psychology	2006	1
Research in Mathematics Education	2021	1
Research in Science Education	2022	1
Redipe Bulletin Magazine	2021	1
educ@rnos magazine	2020	1
SN Computer Science	2024	1
The Development of Mathematical Thinking	1983	1
The Journal of Mathematical Behavior	2024	1

Transformation	2017	1
Universal Journal of Educational Research	2022	1
FEMALE	2015	1
Ximhai	2014	1
ZDM Mathematics Education	2019, 2022	3

Source: Own elaboration

Third phase: Inclusion of references

In the third phase, a content analysis of each study was conducted using categories related to the methodology employed (quantitative or qualitative), the relationship between reading comprehension and problem-solving variables (difficulties, correlation of skills, problem structure, educational materials), and the type of study (descriptive, exploratory, intervention proposals). This allowed for the identification of relevant results and an understanding of how the relationship between reading comprehension and solving word problems has been previously studied.

Results

Research exploring the relationships between text comprehension and problem solving identifies different approaches: firstly, studies that recognize the difficulties students face when solving problems and that may be related to text comprehension (Verzosa & Mulligan, 2012; Tambychik & Mohd, 2010; Pimperton & Nation, 2010; Phonapichat et al., 2014; Soneira et al., 2023; Capraro & Joffrion, 2006; Swanson et al., 2008; Säfström et al., 2023). Secondly, when studying this relationship itself, studies were found that analyze the cognitive skills that students use when reading and solving problems, others are studies with quantitative perspectives that correlate students' scores on tests that evaluate both types of skills (Vilenius-Tuohimaa et al., 2008; Chacara Montes et al., 2020; Greisen et al., 2021; Can, 2020; Walkington et al., 2018; Pongsakdi et al., 2021; Hijada and De la Cruz, 2022; Patiño et al., 2021). Thirdly, research is recognized that explores the relationship between problem-solving and comprehension by focusing on the characteristics of the texts, the role of vocabulary, as well as the semantic and syntactic structures of the problems (Österholm, 2007; Vondrová, 2020; Páchová and Vondrová, 2021; Riley et al., 1983; Montes-Salas et al., 2014; Cruz Neri et al., 2024; Bernholt et al., 2022; Renninger et al., 2022; Ronqui Leites et al., 2024).

Difficulties in problem solving

In particular, in the case of solving word problems, Verzosa and Mulligan (2012) take up the perspective of van Dijk and Kintsch (1983) and mention that the origin of the difficulties related to the cognitive processes that students need to carry out for the solution, the mastery of mathematical knowledge required for the solution, linguistic errors, or difficulties generated by the semantic structure of the problem which affects the understanding of the texts.

Cognitive difficulties have been identified in mathematical problem-solving, such as accurate interpretations, information retrieval from texts, and the use of logical reasoning (Tambychik & Mohd, 2010); difficulties with working memory and phonological processing have also been found (Pimperton & Nation, 2010). The former manifest as uncertainty, confusion, and impressions in decision-making and connecting information, which can lead to errors in problem-solving, while the latter are characterized by an impairment in the ability to suppress irrelevant information from working memory, which limits reading comprehension.

Another difficulty in solving problems is related to the interpretation of the mathematical content in the statement, specifically the inability to identify relationships between quantities and formalize these relationships through algebraic language to generate the appropriate model (Soneira et al., 2023). Thus, reading and comprehension skills are necessary to understand and identify the important information in a problem, organize it appropriately, and convert the text into symbols (Phonapichat et al., 2014).

In the process of translating word problems into equations, prior knowledge related to conceptual understanding and procedural skills, such as the use of vocabulary to develop an algebraic understanding of the problems, plays a central role (Capraro and Joffrion, 2006); hence, it is recognized that reading in mathematics requires an understanding of the meaning of words and the algebraic relationships to which they refer.

Other difficulties in solving word problems are associated with limitations in reading and language skills and can occur even when students have sufficient mathematical abilities (Swanson et al., 2008). Especially for younger students, reading a problem is not trivial, as deficiencies in text comprehension have been identified as limiting the development of word problem-solving strategies (Säfström et al., 2023).

Reading and text comprehension processes in solving word problems

The literature includes studies that explore the relationship between text comprehension and problem-solving processes. Some research focus on analyzing students' cognitive skills, such as how they carry out reading processes (Österholm, 2007), their ability to make inferences (Pérez et al., 2015), or translate the verbal statement of the problem into a mathematical model (Castro, 2017; Krawitz et al., 2024). Other studies found correlations between text comprehension and other cognitive functions with problem-solving through quantitative methods (Vilenius-Tuohimaa et al., 2008; Chacara Montes et al., 2020; Greisen et al., 2021; Can, 2020; Walkington et al., 2018 ; Pongsakdi et al., 2021; Zhang et al., 2023; Duque de Blas et al., 2021; Klotz et al., 2024), as well as evaluating metacognitive processes and attitudes in problem-solving processes (Hijada and De la Cruz, 2022; Patiño et al., 2021).

Reading and inference process

During reading, a series of cognitive processes occur, such as the use of semantic and syntactic rules, activation of prior knowledge, and inferences. A skilled reader usually does not need to think very actively to create a mental representation of what they read, but problem-solving requires more active thinking, as it is a process that demands more resources (Österholm, 2007). Thus, initiating a problem-solving process requires more than simply reading the text; it requires understanding the problem statement, which involves making inferences. The information and relationships needed to solve the problem are implicitly contained within the statement (Pérez et al., 2015). Through comprehension, the reader identifies information, interprets it, and develops an appropriate mental representation that leads to the solution.

Translation of verbal statement into mathematical model

Understanding the impact of reading processes on problem-solving leads to recognizing the importance of developing specific strategies necessary for understanding problem statements; it is also required to adopt an appropriate methodological approach that facilitates students' translation of problem texts into mathematical expressions (Castro, 2017). One strategy is to pose reading comprehension questions that foster students' interest in the situation presented. This has led to the recognition that reading comprehension is an essential, but not sufficient, condition for modeling (Krawitz et al., 2024).

Correlation between problem-solving and cognitive skills

To understand how cognitive skills are linked to problem-solving, several quantitative studies have explored the correlation between cognitive functions such as reading comprehension and problem-solving. Reading comprehension has been found to be a significant predictor of mathematical achievement, and performance is lower among students whose native language is very different from the language of instruction (Greisen et al., 2021). Some studies show a moderate positive correlation between reading comprehension and problem-solving skills, but it is acknowledged that while students may understand the situations, they do not always arrive at the expected results due to errors in calculations (Chacara Montes et al., 2020).

A correlation has also been found between problem-solving ability and the development of cognitive processes such as memory, visuospatial reasoning, and executive functions; the correlated variable acts as a predictor of students' academic performance not only in learning mathematics, but also in other disciplines (Duque de Blas et al., 2021).

It is recognized that student performance in problem-solving is strongly related to reading comprehension performance, and both require reasoning skills (Vilenius-Tuohimaa et al., 2008). Reading comprehension is understood to play a partial mediating role in the relationship between logical reasoning and verbal problem-solving (Can, 2020). These results suggest that improving problem-solving performance requires supporting it with activities related to logical reasoning and inference.

To solve more difficult problems, students require reading and arithmetic skills to arrive at the solution. It is noted that there appear to be structural characteristics in problems that require deep understanding, such as numerical and linguistic factors that influence the difficulty level of word problems (Pongsakdi et al., 2021). Furthermore, studies have examined how language elements influence comprehension processes, such as the recognition and discrimination of compound words as facilitators in problem-solving (Zhang et al., 2023). This leads to the recognition that cognitive and linguistic pathways are essential for formulating operations and performing calculations during problem-solving.

Studies have shown evidence of a relationship between reading comprehension skills and problem-solving performance. Cognitive factors are considered significant predictors of mathematical solutions, and reading comprehension mediates the impact of students' cultural resources on their problem-solving competence (Klotz et al., 2024). These types of studies are relevant because they allow for the identification of correlations between specific skills associated with problem-solving.

Other studies show that the readability characteristics (length, pronouns, word difficulty and real-world context) of word problems in mathematics have a different impact on different groups of students, differentiated by socioeconomic level, gender or place of birth (Walkington et al., 2018).

Self-assessment and attitudes during problem solving

When investigating students' self-perceptions of their learning processes, it was found that many students perceive themselves as incompetent and express feelings of frustration when solving problems. Among the causes they perceive are factors such as their teachers' teaching methods or strategies, their motivation and concentration, their arithmetic skills, and the curricular materials they use, in addition to the reading comprehension they believe they can achieve (Hijada & De la Cruz, 2022). They also perceive difficulties associated with problem-solving processes, such as identifying variables, recognizing contextual elements, communicating mathematical content, and creating diagrams or drawings that represent the problem, among others (Patiño et al., 2021). While there is no explicit mention of the processes involved in reading problem statements, the importance of comprehension for problem-solving is emphasized.

Most of the studies analyzed employ quantitative methods and statistical analyses (Vilenius-Tuohimaa et al., 2008; Chacara Montes et al., 2020; Greisen et al., 2021; Can, 2020; Walkington et al., 2018; Pongsakdi et al., 2021) to correlate students' scores on different tests, both reading and mathematical reasoning, as well as their strategies and attitudes in problem-solving processes (Hijada & De la Cruz, 2022; Patiño et al., 2021). The role of text comprehension in improving students' problem-solving performance is evident; however, the studies do not delve deeply enough into how students actually carry out these processes.

Characteristics of texts and their relationship to solving word problems

When exploring the relationship between text comprehension and problem solving, studies focus on the characteristics of texts and factors that influence their complexity, such as the consistency of language in problems (Pape, 2004; de Koning et al., 2022; Vondrová, 2020; Páchová and Vondrová, 2021), their semantic structure (Hackemann et al., 2022; Riley et al., 1983; Welder et al., 2021; Kwok et al., 2022; Gilbert Delgado et al., 2023; Vessonon et al., 2024), as well as the types of problems present in textbooks (Vicente et al., 2018; 2021; 2022;

2024; Kiliéné, 2024). Furthermore, these studies analyze the effectiveness of the Cloze test as an instrument for assessing text comprehension (Bråten et al., 2024; Jensen & Elbro, 2022; Moncada et al., 2023) and the effect of implementing reading strategies for intervention (Ludewig et al., 2022; Cruz Neri et al., 2024; Bernholt et al., 2022; Ronqui Leites et al., 2024; Montero & Mahecha, 2020; Montes-Salas et al., 2014; Xin, 2019). Some studies on the use of artificial intelligence were also found (Mondal et al., 2025; He et al., 2024; Lyu, 2023; Yigit & Amasyali, 2024), which offer guidelines regarding the semantic and syntactic structures of the problem texts.

Language consistency

Some relevant factors for interpreting and solving the problems presented are the consistency of the language, as well as the role of variables and relational terms (Pape, 2004). When solving word problems with inconsistent wording—that is, where the keywords do not match the operation required to solve the problem (de Koning et al., 2022)—linguistic interpretation may require verbal or graphical support. Elements that help make sense of the problems, such as keywords, are fundamental to their interpretation. Therefore, semantic clues with inconsistencies in the wording of the problems can lead to distractions and language inconsistencies, which presents greater difficulty for students (Páchoová & Vondrová, 2021). These points allow us to recognize variations in the semantic structure of the problems that could either facilitate or hinder their interpretation and solution. Furthermore, the presence of irrelevant numbers and inconsistencies in language allows us to determine the difficulty of the problems, as well as the strategies that students use in the problem-solving processes (Vondrová, 2020).

Semantic structure of problems

The reading process is a complex interaction between the properties of a text and the reader, where linguistic demands can affect text comprehension. Elements such as syntactic structures and word frequency within texts generate a greater cognitive load (Hackemann et al., 2022) and influence the linguistic demands of a text, which in turn can affect students' problem-solving abilities.

Some relevant aspects for problem-solving are the conceptual relationships implicit in the problem statements and the level of complexity of the procedures required for their resolution. Understanding and solving problems are influenced by the characteristics of the semantic and syntactic structures of the problem statement, related to its mathematical content, as well as the resources available to the student, their individual problem-solving ability, and their general reading skills (Riley et al., 1983).

Systemic functional linguistics provides tools for interpreting the language of additive word problems, analyzing ideation, examining the taxonomic relationships of participants, and identifying types of processes and logical connectives. Linguistic patterns are recognized in the structure of problems to explore how meaning is interpreted based on its semantics (Welder et al., 2021; Kwok et al., 2022), allowing for the identification of key language features in different types of problems, based on the numerical relationships present in the problem structure and their transformation over time.

The effectiveness of text comprehension in solving mathematical problems can be improved through the use of semantic cues associated with relevant elements in the problem structure, which contributes to enhancing students' comprehension and problem-solving processes (Gilbert Delgado et al., 2023). For example, this includes making inferences to extract information from the mathematical text and decoding knowledge based on the student's context. Differences in problem characteristics may be related to students' performance in the problem-solving process, but they are not the determining factor (Vessonen et al., 2024).

Types of problems in textbooks

Textbooks are an important resource as they are the source of the types of problems presented to students. By analyzing the semantic and syntactic structures of different types of problems: additive (change, comparison, equalization, and combination) and multiplicative (ratio, Cartesian product, comparison, rectangular matrix), the key words for their solution are identified, allowing for the association of a level of difficulty (Vicente et al., 2018; 2021; 2022; 2024). Furthermore, there are relevant linguistic and numerical factors that influence the difficulty of the problems (Kilienè, 2024); hence the importance of paying attention to the structure of the statements presented to students and the materials used to generate approaches that facilitate the problem-solving process.

Cloze test to assess text comprehension

Studies have examined how students' linguistic skills and background, word recognition, and working memory influence their performance on tests of deep comprehension, which is defined as the ability to make global situational inferences from text content (Bråten et al., 2024). One tool for assessing reading comprehension in mathematics is the Cloze test. This test explores readers' ability to draw inferences from the overall coherence of a text and their comprehension processes at different levels of textual analysis (Jensen & Elbro, 2022). The test's validity has been verified by correlating students' results with those of standardized tests, demonstrating its effectiveness in assessing text comprehension beyond the sentence level (Moncada et al., 2023).

Reading and intervention strategies

There are several cognitive predictors that impact text comprehension. Vocabulary knowledge is one of the most important elements for text comprehension and for students to be able to make connections with prior knowledge (Ludewig et al., 2023) in order to interpret texts. In addition to vocabulary, reading strategies are significant predictors of text content and the student's motivation to explore that content (Cruz Neri et al., 2024).

Implementing reading strategy interventions has shown improvements in word and phrase processing at the literal, propositional, and situational model comprehension levels (Bernholt et al., 2022) as part of reading and problem-solving processes. Strategies such as thinking aloud, monitoring, self-instruction, underlining, analyzing titles, memorizing, and making inferences are effective in improving reading comprehension (Ronqui Leites et al., 2024) because they promote students' self-regulation in these processes.

There are other methodological proposals to improve student performance that focus on the study of textual macrostructure, integrating the areas of mathematics and language in problem-solving (Montero & Mahecha, 2020). The use of macro-rules in reading comprehension triggers a series of psycholinguistic and syntactic cognitive resources for processing the information contained in texts, identifying main ideas in each paragraph, as well as the relationships between the propositions that make them up (Montes-Salas et al., 2014).

Technology-mediated interventions have also been developed, such as a web-based tutor that incorporates systematic instructional practices, including visual and verbal support for teaching mathematical language. These provide evidence of improved performance

among students who received virtual support (Xin, 2019). A wide range of resources are used to promote reading and text comprehension processes for problem-solving.

Artificial intelligence tools

Of particular note are some recent studies that develop artificial intelligence tools for solving word problems in arithmetic and consider elements of the problems' syntactic structure (Mondal et al., 2025; He et al., 2024; Lyu, 2023; Yigit and Amasyali, 2024). These tools could support students' problem-solving processes and shed light on the relevance of semantic and syntactic structures in the interpretation of the statements.

Discussion

This literature review revealed that problem-solving is a complex process influenced by key components of text comprehension. While Österholm (2007) notes that a skilled reader generally does not need to think very actively to create a mental representation of what they read, the review's findings suggest that reading alone is insufficient for problem-solving. These results are consistent with Krawitz et al. (2024) and Säfström et al. (2023), who argue that reading comprehension is a necessary but not sufficient condition for solving word problems, as deficiencies in text comprehension limit the development of strategies for arriving at a solution.

Most of the reviewed studies that identify a relationship between problem-solving and text comprehension employ quantitative approaches to correlate scores on reading tests, mathematical reasoning, and other cognitive skills (Can, 2020) or linguistic variables (Walkington et al., 2018). However, these studies do not typically delve into how students carry out the specific processes of reading and text comprehension during problem-solving.

Analysis of research focused on text characteristics (Cruz Neri et al., 2024; Bernholt et al., 2022) suggests that vocabulary and reading strategies are significantly associated with text content comprehension. These findings offer guidelines for designing interventions aimed at strengthening text comprehension in problem-solving contexts.

Furthermore, the importance of considering the context in which the problems are raised is recognized according to Renninger et al. (2022), since the reader's interest in the content of the texts can favor the comprehension processes.

A major limitation of the review relates to access to publications in languages other than Spanish and English, as well as to restricted access articles, which may have reduced the coverage of the corpus and limited the diversity of perspectives considered.

Conclusions

The reviewed literature identifies text comprehension as a difficulty hindering students' optimal performance in problem-solving, especially with word problems. Contributions from various disciplines have highlighted the complexity of this phenomenon and its impact on the development of problem-solving skills, which are fundamental to the education of elementary school students. This also reinforces the need for continued research that incorporates diverse perspectives to gain a deeper understanding of how text comprehension and problem-solving processes occur, as well as to design intervention strategies that address this need.

Two main trends were identified in the study of text comprehension during problem-solving, which aligns with the objectives of this review. On the one hand, there are studies that employ quantitative methods to correlate students' scores on reading and problem-solving tests; on the other hand, there is research that has focused on analyzing the structure of problem statements. However, neither approach delves into how students actually carry out these two processes.

The analysis of the publications allowed us to identify elements that influence text comprehension, such as the semantic and syntactic structure of the problem statements. Likewise, we observed the role of numerical complexity, the vocabulary used, the context to which the problems allude, and the cognitive skills students employ during problem-solving, particularly reading and text comprehension. The reviewed research leads us to conclude that reading is recognized as a necessary but not sufficient condition for solving word problems.

The Cloze test is also recognized as an effective technique for assessing mathematical text comprehension, as it allows for the identification of students' overall interpretation during reading and the development of inferences. Some intervention strategies include analyzing the vocabulary used in the problems and proposing contexts that facilitate understanding of the problem statement, especially if these contexts are relevant and meaningful to the students.

Future lines of research

Based on the results, there is a clear need to develop research that delves deeper into how students carry out text comprehension processes for problem-solving through qualitative methods, in order to describe the relationship between text comprehension and problem-solving, considering elements such as the semantic and syntactic structure of the problems, the vocabulary they use, reading strategies, and the relevance of meaningful contexts to promote comprehension.

The results of this review allow us to identify the relevance of conducting research along the lines of intervention in reading strategies for problem solving and to explore in greater depth the relevance of designing contextualized problems that favor students' interest and comprehension.

Likewise, the line of research in artificial intelligence offers an important opportunity to develop tools in natural language processing, the identification of semantic networks that help to understand the structure of problems and the articulation between mathematical knowledge to facilitate the problem-solving processes of students.

References

- Bernholt, S., Härtig, H., y Retelsdorf, J. (2022). Reproduction rather than comprehension? Analysis of gains in students' science text comprehension. *Research in Science Education*, 53(3), 493-506. <https://doi.org/10.1007/s11165-022-10066-6>
- Bråten, I., Haverkamp, Y. E., y Anmarkrud, Ø. (2024). Gaining a deeper understanding of the deep cloze reading comprehension test: Examining potential contributors and consequences. *Reading and Writing*. <https://doi.org/10.1007/s11145-024-10521-y>
- Can, D. (2020). The mediator effect of reading comprehension in the relationship between logical reasoning and word problem solving. *Participatory Educational Research*, 7(3), 230-246. <https://doi.org/10.17275/per.20.44.7.3>
- Capraro, M. M., y Joffrion, H. (2006). Algebraic equations: Can middle-school students meaningfully translate from words to mathematical symbols? *Reading Psychology*, 27(2-3), 147-164. <https://doi.org/10.1080/02702710600642467>
- Castro, E. A. (2017). Abordaje didáctico de la comprensión de los problemas algebraicos en el nivel secundario de la República Dominicana. *Transformación*, 13(3), 314-326. http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S2077-29552017000300003

- Chacara Montes, M. M., Escamilla, R. G., Chacara, A., y Estrada, M. (2020). Correlación entre la comprensión lectora y la resolución de problemas en quinto grado. *Revista Educ@mos*, 10(37), 11-30.
- Cruz Neri, N., Bernholt, S., Härtig, H., Schmitz, A. y Retelsdorf, J. (2024). Cognitive and motivational characteristics as predictors of students' expository versus narrative text comprehension. *European Journal of Psychology of Education*, 39, 885-905. <https://doi.org/10.1007/s10212-023-00717-1>
- de Koning, B. B., Boonen, A. J. H., Jongerling, J., van Wesel, F. y van der Schoot, M. (2022). Model method drawing acts as a double-edged sword for solving inconsistent word problems. *Educational Studies in Mathematics*, 111, 29-45. <https://doi.org/10.1007/s10649-022-10150-8>
- De Lange, J. (2006). Mathematical literacy for living from OECD-PISA perspective. *Tsukuba Journal of Educational Study in Mathematics*, 25, 13-35.
- Duque de Blas, G., Gómez-Veiga, I., y García-Madruga, J. A. (2021). Arithmetic word problems revisited: Cognitive processes and academic performance in secondary school. *Education Sciences*, 11, 155. <https://doi.org/10.3390/educsci11040155>
- Favier, S., y Dorier, J. L. (2024). Heuristics and semantic spaces for the analysis of students' work in mathematical problem solving. *Educational Studies in Mathematics*, 115, 407-431. <https://doi.org/10.1007/s10649-023-10297-y>
- Fernández de Castro, J. (2013). Perspectivas en torno al desarrollo de la comprensión lectora. *Revista de Evaluación Educativa*, 2(1). <http://revalue.mx/revista/index.php/revalue/issue/current>
- García, O., Jiménez, E., y Flores, R. (2006). Un programa de apoyo para facilitar el aprendizaje de solución de problemas de suma y resta en alumnos con bajo rendimiento. *Educación Matemática*, 18(2), 95-99. <https://www.redalyc.org/articulo.oa?id=40558507005>
- Gilbert Delgado, R. P., Naranjo Vaca, G. E., y Gorina Sánchez, A. (2023). Comprensión textual en la resolución de problemas matemáticos. *Acta Universitaria*, 33, e3809. <https://doi.org/10.15174/au.2023.3809>
- Greisen, M., Georges, C., Hornung, C., Sonnleitner, P., y Schiltz, C. (2021). Learning mathematics with shackles: How lower reading comprehension in the language of mathematics instruction accounts for lower mathematics achievement in speakers of

- different home languages. *Acta Psychologica*, 221, 103456.
<https://doi.org/10.1016/j.actpsy.2021.103456>
- Hackemann, T., Heine, L., y Höttecke, D. (2022). Challenging to read, easy to comprehend? Effects of linguistic demands on secondary students' text comprehension in physics. *International Journal of Science and Mathematics Education*, 20(1), 43-68.
<https://doi.org/10.1007/s10763-022-10306-1>
- He, B., Yu, X., Huang, L., Meng, H., Liang, G. y Chen, S. (2024). Comparative study of typical neural solvers in solving math word problems. *Complex & Intelligent Systems*, 10, 5805-5830. <https://doi.org/10.1007/s40747-024-01454-8>
- Hijada, M., y De la Cruz, M. (2022). The gap between comprehension level and problem-solving skills in learning mathematics. *Universal Journal of Educational Research*, 10(1), 35-43.
- Jensen, K. L., y Elbro, C. (2022). Clozing in on reading comprehension: A deep cloze test of global inference making. *Reading and Writing*, 35(5), 1221-1237.
<https://doi.org/10.1007/s11145-021-10230-w>
- Jupri, A., y Drijvers, P. (2016). Student difficulties in mathematizing word problems in algebra. *Eurasia Journal of Mathematics, Science & Technology Education*, 12(9), 2481-2502. <https://doi.org/10.12973/eurasia.2016.1299a>
- Kilienė, I. (2024). Analyzing arithmetic word problems: Blink of an eye for textbooks authors. *Lithuanian Mathematical Journal*, 64, 315-331.
<https://doi.org/10.1007/s10986-024-09642-2>
- Kintsch, W. (1994). Text comprehension, memory, and learning. *American Psychologist*, 49(4), 294-303. <https://doi.org/10.1037/0003-066X.49.4.294>
- Kintsch, W. (1998). *Comprehension: A paradigm for cognition*. Cambridge University Press.
- Klotz, E., Ehmke, T., y Leiss, D. (2024). Text comprehension as a mediator in solving mathematical reality-based tasks: The impact of linguistic complexity, cognitive factors, and social background. *European Journal of Educational Research*, 14(1), 23-39. <https://doi.org/10.12973/eu-jer.14.1.23>
- Krawitz, J., Hartmann, L., y Schukajlow, S. (2024). Do task variables of self-generated problems influence interest? Authenticity, openness, complexity, and students' interest in solving self-generated modelling problems. *The Journal of Mathematical Behavior*, 73, 101129. <https://doi.org/10.1016/j.jmathb.2024.101129>

- Kwok, M., Welder, R. M., Moore, J. y Williams, A. M. (2022). Beyond keywords: Applying systemic functional linguistics to unpack the language of additive word problems. *International Journal of Science and Mathematics Education*, 20(1), 163-186. <https://doi.org/10.1007/s10763-022-10290-6>
- León Cascón, J. A. (2009). Neuroimagen de los procesos de comprensión en la lectura y el lenguaje. *Psicología Educativa: Revista de los Psicólogos de la Educación*, 15(1), 61-71. <https://www.redalyc.org/articulo.oa?id=613765489008>
- Lindquist, M., Philpot, R., Mullis, I., y Cotter, K. E. (2017). TIMSS 2019 mathematics framework. En I. V. S. Mullis y M. O. Martin (Eds.), *TIMSS 2019 assessment frameworks*. <http://timssandpirls.bc.edu/timss2019/frameworks/>
- Ludewig, U., Hübner, N., y Schroeder, S. (2023). Vocabulary, text coverage, word frequency and the lexical threshold in elementary school reading comprehension. *Reading and Writing*, 36, 2409-2431. <https://doi.org/10.1007/s11145-022-10385-0>
- Lyu, X., Yu, X., y Peng, R. (2023). Vector relation acquisition and scene knowledge for solving arithmetic word problems. *Journal of King Saud University - Computer and Information Sciences*, 35(8), 101673. <https://doi.org/10.1016/j.jksuci.2023.101673>
- Moncada, F., Ibáñez, R., Santana, A. y Guerra, C. (2024). Spanish adaptation of a cloze procedure to assess reading comprehension beyond the sentence level. *Reading and Writing*, 37, 2595-2617. <https://doi.org/10.1007/s11145-023-10488-2>
- Mondal, S., Khatua, D., Mandal, S., Prasad, D. K. y Sekh, A. A. (2025). BMWP: The first Bengali math word problems dataset for operation prediction and solving. *Discover Artificial Intelligence*, 5, 25. <https://doi.org/10.1007/s44163-025-00243-7>
- Montero, L., y Mahecha, J. (2020). Comprensión y resolución de problemas matemáticos desde la macroestructura del texto. *Praxis & Saber*, 11(26), e9862. <https://doi.org/10.19053/22160159.v11.n26.2020.9862>
- Montes-Salas, A. M., Rangel-Bórquez, Y., y Reyes-Angulo, J. A. (2014). Comprensión lectora. Noción de lectura y uso de macrorreglas. *Ra Ximhai*, 10(5), 265-277.
- Nathan, M. J., Kintsch, W., y Young, E. (1992). A theory of algebra-word-problem comprehension and its implications for the design of learning environments. *Cognition and Instruction*, 9(4), 329-389. https://doi.org/10.1207/s1532690xci0904_2

- Österholm, M. (2007). A reading comprehension perspective on problem solving. *Conference: MADIF 5, the 5th Swedish Mathematics Education Research Seminar*, 136-145.
- Páchová, A., y Vondrová, N. (2021). The effect of semantic cues on the difficulty of word problems and the interplay with other complicating variables. *Research in Mathematics Education*, 23(1), 85-102. <https://doi.org/10.1080/14794802.2020.1867229>
- Pape, S. J. (2004). Middle school children's problem-solving behavior: A cognitive analysis from a reading comprehension perspective. *Journal for Research in Mathematics Education*, 35(3), 187-219. <https://doi.org/10.2307/30034912>
- Paradiso, J. C. (2008). *Estudio científico, estrategias de abordaje y didáctica de los textos. Enfoque cognitivo*. Textos y cognición (3).
- Patiño, K. N. P., Prada, R. P., y Hernández, C. A. H. (2021). La resolución de problemas matemáticos y los factores que intervienen en su enseñanza y aprendizaje. *Revista Boletín Redipe*, 10(9), 459-471. <https://doi.org/10.36260/rbr.v10i9.1453>
- Pérez, K., Hernández, J. E., y Álvarez, M. (2015). Las inferencias en la comprensión de problemas aritméticos en la enseñanza primaria. *Varona*, (61), 1-10.
- Petticrew, M., y Roberts, H. (2006). *Systematic reviews in the social sciences: A practical guide*. Blackwell Publishing. <https://doi.org/10.1002/9780470754887>
- Phonapichat, P., Wongwanich, S., y Sujiva, S. (2014). An analysis of elementary school students' difficulties in mathematical problem solving. *Procedia - Social and Behavioral Sciences*, 116, 3169-3174. <https://doi.org/10.1016/j.sbspro.2014.01.728>
- Pimperton, H., y Nation, K. (2010). Suppressing irrelevant information from working memory: Evidence for domain-specific deficits in poor comprehenders. *Journal of Memory and Language*, 62(4), 380-391.
- Pongsakdi, N., Kajamies, A., Veermans, K., Lertola, K., Vauras, M., y Lehtinen, E. (2019). What makes mathematical word problem solving challenging? Exploring the roles of word problem characteristics, text comprehension, and arithmetic skills. *ZDM*, 52(1), 33-44. <https://doi.org/10.1007/s11858-019-01118-9>
- Renninger, K. A., Gantt, A. L., y Lipman, D. A. (2022). Comprehension of argumentation in mathematical text: What is the role of interest? *ZDM*, 55(2), 371-384. <https://doi.org/10.1007/s11858-022-01445-4>

- Riley, M. S., Greeno, J. G., y Heller, J. L. (1983). Development of children's problem-solving ability in arithmetic. En H. P. Ginsburg (Ed.), *The development of mathematical thinking* (pp. 153-196). Academic Press.
- Ronqui Leites, V., Trías Seferian, D., y Huertas Martínez, J. A. (2024). Assessing self-regulated processes: What do primary school students do, say and think in the process of understanding a text? *European Journal of Psychology of Education*, 39(3), 2531-2550. <https://doi.org/10.1007/s10212-024-00830-9>
- Säfström, A. I., Lithner, J., Palm, T., Palmberg, B., Sidenvall, J., Andersson, C., Boström, E. y Granberg, C. (2024). Developing a diagnostic framework for primary and secondary students' reasoning difficulties during mathematical problem solving. *Educational Studies in Mathematics*, 115, 125-149. <https://doi.org/10.1007/s10649-023-10278-1>
- Santos, M. (2014). *La resolución de problemas matemáticos. Fundamentos cognitivos* (2a ed.). Editorial Trillas.
- Sanz, M. T., González-Calero, J. A., Arnau, D., y Arevalillo-Herráez, M. (2019). Uso de la comprensión lectora para la construcción de un modelo predictivo del éxito de estudiantes de 4º de primaria cuando resuelven problemas verbales en un sistema inteligente. *Revista de Educación*, 384, 41-69. <https://doi.org/10.4438/1988-592X-RE-2019-384-409>
- Schoenfeld, A. (1985). *Mathematical problem solving*. Academic Press.
- Secretaría de Educación Pública [SEP]. (2022). *Plan de estudios de la educación básica 2022*. Dirección General de Materiales Educativos de la Secretaría de Educación Pública.
- Soneira, C., González-Calero, J. A., y Arnau, D. (2023). Effect of algebraic language and problem text wording on problem model accuracy when solving age word problems. *Educational Studies in Mathematics*, 114, 109-127. <https://doi.org/10.1007/s10649-023-10236-x>
- Swanson, H. L., Jerman, O., y Zheng, X. (2008). Growth in working memory and mathematical problem solving in children at risk and not at risk for serious math difficulties. *Journal of Educational Psychology*, 100(2), 343-379. <https://doi.org/10.1037/0022-0663.100.2.343>

- Tambychik, T., y Mohd, T. (2010). Students' difficulties in mathematics problem-solving: What do they say? *Procedia - Social and Behavioral Sciences*, 8, 142-151. <https://doi.org/10.1016/j.sbspro.2010.12.020>
- van Dijk, T. A., y Kintsch, W. (1983). *Strategies of discourse comprehension*. Academic Press.
- Verschaffel, L., Schukajlow, S., Star, J., y Van Dooren, W. (2020). Word problems in mathematics education: A survey. *ZDM Mathematics Education*, 52, 1-16. <https://doi.org/10.1007/s11858-020-01130-4>
- Verzosa, D. B., y Mulligan, J. (2013). Learning to solve addition and subtraction word problems in English as an imported language. *Educational Studies in Mathematics*, 82(2), 223-244. <https://doi.org/10.1007/s10649-012-9420-z>
- Vessonen, T., Dahlberg, M., Hellstrand, H., Widlund, A., Korhonen, J., Aunio, P. y Laine, A. (2024). Task characteristics associated with mathematical word problem-solving performance among elementary school-aged children: A systematic review and meta-analysis. *Educational Psychology Review*, 36, 117. <https://doi.org/10.1007/s10648-024-09954-2>
- Vicente, S., Manchado, E., y Verschaffel, L. (2018). Resolución de problemas aritméticos verbales: Un análisis de los libros de texto españoles. *Cultura y Educación*, 30(1), 87-104. <https://doi.org/10.1080/11356405.2017.1421606>
- Vicente, S., Sánchez, R., Sánchez-Barbero, B., Rodríguez-Sánchez, M. y Ramos, M. (2024). Theoretical-methodological approaches and textbook design: Analysis of arithmetic word problems in Spanish textbooks. *European Journal of Psychology of Education*, 39, 2483-2508. <https://doi.org/10.1007/s10212-024-00808-7>
- Vicente, S., Verschaffel, L., y Muñoz, D. (2021). Comparison of the level of authenticity of arithmetic word problems in Spanish and Singaporean textbooks. *Cultura y Educación*, 33(1), 106-133. <https://doi.org/10.1080/11356405.2020.1859738>
- Vicente, S., Verschaffel, L., y Ramos, M. (2022). Dificultad de los problemas aritméticos verbales de los libros de texto singapurenses y españoles. *AIEM - Avances de Investigación en Educación Matemática*, 22, 137-156. <https://doi.org/10.35763/aiem22.4412>
- Vilenius-Tuohimaa, P. M., Aunola, K., y Nurmi, J. (2008). The association between mathematical word problems and reading comprehension. *Educational Psychology*, 28(4), 409-426. <https://doi.org/10.1080/01443410701708228>

- Vondrová, N. (2020). The effect of an irrelevant number and language consistency in a word problem on pupils' achievement and reasoning. *International Journal of Mathematical Education in Science and Technology*. <https://doi.org/10.1080/0020739X.2020.1782497>
- Walkington, C., Clinton, V., y Shivraj, P. (2018). How readability factors are differentially associated with performance for students of different backgrounds when solving mathematics word problems. *American Educational Research Journal*, 55(2), 362-414. <https://doi.org/10.3102/0002831217737028>
- Welder, R., Williams, A., Kowk, M., y Moore, J. (2021). Applying systemic functional linguistics to unpack the language of additive word problems. En D. Olanoff, K. Johnson, y S. Spitzer (Eds.), *Proceedings of the forty-third annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (pp. 1011-1015). Philadelphia, PA.
- Xin, Y. P. (2019). The effect of a conceptual model-based approach on “additive” word problem solving of elementary students who are struggling in mathematics. *ZDM Mathematics Education*, 51, 139-150.
- Yigit, G., y Amasyali, M. F. (2024). Data augmentation with in-context learning and comparative evaluation in math word problem solving. *SN Computer Science*, 5, 506. <https://doi.org/10.1007/s42979-024-02853-x>
- Zhang, H., Xu, Z., y Xu, X. (2023). Morphological awareness in arithmetic word-problem solving among Chinese early adolescents. *Humanities & Social Sciences Communications*, 10, 902. <https://doi.org/10.1057/s41599-023-02416-0>

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