



CHALLENGES AND PRACTICES IN TEACHING AND SOLVING MATHEMATICAL WORD PROBLEMS: TEACHERS' PERSPECTIVES AND PROPOSED SOLUTIONS

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Abstract: This research, conducted between 2020 and 2024 in Romania, investigates the challenges and strategies related to teaching and solving mathematical word problems, based on insights from 163 teachers of grades 0 to 8. The study found that students often experience anxiety when solving word problems, especially during exams, due to difficulties with reading comprehension, identifying key details, and logical reasoning. Teachers highlighted reading issues, lack of focus, and weak reasoning as major barriers. To address these challenges, teachers used strategies like fostering critical thinking, visual aids, and systematic data organization. However, overcrowded classrooms and limited instructional time were significant obstacles. Teachers advocated for modern methods, such as gamification and problem-solving competitions, and emphasized teaching step-by-step reading and comprehension techniques. The study also pointed out shortcomings in mathematics textbooks, such as unclear examples and a lack of practice problems. Teachers recommended revisions to include more varied examples, clearer instructions, and relatable scenarios to better support students' learning.

Key words: Mathematical word problems, learning difficulties, Romania.

1. Introduction

Mathematics is a fundamental science, crucial for understanding other disciplines and for solving daily problems (Yadav, 2020). It plays a significant role in elementary education, where teaching basic concepts is essential for understanding more abstract concepts later on (Anthony & Walshaw, 2009).

Teaching mathematics through word problems is effective in engaging students by linking abstract concepts to real-world scenarios (Moleko, & Mosimege, 2021). A word problem involves a verbal description of a scenario with numerical data and questions (Depaepe, Corte, & Verschaffel, 2010), requiring students to apply their mathematical knowledge analytically (Tsao, 2024).

However, solving word problems remains challenging for many students, involving steps like understanding the problem, identifying required information, planning, executing, and reviewing the solution (García, Boom, Kroesbergen, Núñez, & Rodríguez, 2019). Many studies have highlighted significant difficulties students face in solving word problems (Fuchs et al., 2006; Kusumadewi & Retnawati, 2020; Phonapichat & Sujiva, 2014; Tambychika & Meerah, 2010).

In this article we present a study regarding the challenges and strategies related to teaching and solving mathematical word problems based on insights from teachers of grades 0 to 8. Additionally, we include proposed solutions to overcome these difficulties.

2. Theoretical framework

Many researchers, mathematics teachers, students, and parents agree that engaging in problem-solving lies at the core of mathematics (Cankoy & Ozder, 2011; Cockcroft, 1982; Kaur, 1997; NCTM, 2000; Schoenfeld, 1985). A key element of mathematics education is solving word problems, as real-world mathematical challenges rarely present themselves as pre-formed equations. Instead, they are often expressed through worded or pictorial representations that must be interpreted symbolically, analyzed,

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and solved. For this reason, word problems are introduced at the earliest stages of mathematics instruction to build essential problem-solving skills (Cummins, 1991).

“Word problems” are defined as verbal descriptions of problem scenarios that include one or more questions, which can be answered by applying mathematical operations to the numerical data provided in the problem statement (Brook, 2017, p. 22). Khatib et al (2024) mention that Zsoldos-Marchiş (2014) and Pólya (1945), consider that the problem-solving process consists of four key stages: understanding the problem, devising a plan, executing the plan, and evaluating the solution, while Magdaş (2022) refines this framework by introducing an additional stage, the analysis of the problem, placed between the first two stages. Furthermore, the final stage is redefined as “extensions,” encompassing both the evaluation of the solution and the exploration of further applications or insights.

A good mathematical word problem is essential for fostering student engagement and enhancing learning outcomes. When well-formulated, it is clear, relevant, appropriately challenging, and stimulates critical thinking, serving specific learning objectives, encouraging collaboration, and allowing for evaluation and constructive feedback (Taş & Bolat, 2023). Conversely, poorly formulated problems can lead to confusion, reduce motivation, hinder learning objectives, weaken critical thinking, and damage student confidence and teacher-student relationships, highlighting the importance of careful problem design (Novotna, 2004; Supandi, Suyitno, Sukestiyarno, & Dwijanto, 2021).

Difficulties in solving mathematical word problems stem from three main areas: student-related issues, such as reading comprehension, mathematical abilities, and motivation (Sepeng & Madzorera, 2014; Bernadette, 2009; Cruz & Lapinid, 2014); problem-related factors, including text complexity, excessive information, and multi-step requirements (Parenthetical: (Seifi, Haghverdi, & Azizmohamadi, 2012); and educational factors, such as ineffective teaching strategies and insufficient textbook support (Pearce et al., 2013; Skinner et al., 2016). Effective strategies to address these difficulties include group discussions, independent problem-solving, cooperative grouping, using graphic representations, and integrating games to enhance understanding and engagement (Bernadette, 2009; Seifi et al., 2012; Skinner, Pearce, & Barrera IV, 2016).

Teachers play a key role in problem-solving education by guiding students in defining problems, analyzing issues, and seeking solutions (Gazdos, 2016; Jonassen, 2010). They create stimulating environments with tools and teamwork opportunities, motivate through open discussions, and provide feedback to enhance critical and creative thinking skills, preparing students for real-life challenges (Liljedahl et al., 2016; Schoenfeld, 2016). This is particularly important in mathematics, a subject often perceived negatively by students who frequently express attitudes like “I’m not good at math” (Dowker, Sarkar, & Looi, 2016; Grežo & Sarmány-Schuller, 2018). Such attitudes hinder performance and lead to anxiety, which further diminishes confidence and engagement. Teachers, therefore, play a crucial role in fostering positive attitudes and creating supportive environments to help students overcome these challenges, particularly when faced with complex tasks like word problems (Willis, 2010; National Research Council, 2001).

3. Research methodology

3.1. Research questions

In this study the research questions are:

1. What is the general attitude of students towards solving mathematical word problems from their teachers’ perspective?
2. What are the difficulties students face in solving mathematical word problems from their teachers’ perspective?
3. How do teachers approach the use of mathematical word problems in their teaching practices?
4. What are the most commonly used methods by teachers in teaching mathematical word problems?
5. What are the challenges and obstacles teachers face in teaching mathematical word problems?

6. Why do students face difficulties in solving mathematical word problems from their teachers' perspective?
7. What methods have teachers already used to help students overcome difficulties in solving mathematical word problems?
8. What methods do teachers recommend for other educators to use in addressing mathematical word problems difficulties?
9. How do school mathematics textbooks contribute to the difficulties in solving mathematical word problems?
10. What suggestions do teachers have for curriculum designers and mathematics textbook authors to help overcome the difficulties in solving mathematical word problems?

3.2. Study approach

A quantitative and qualitative approach was used in this study.

3.3. The instrument

A questionnaire was created to meet the study's objectives, consisting of three parts. The first part included 10 demographic questions. The second part includes 5 sections using Likert's scale. The first section, on a five-point scale, assessed student attitudes toward solving word problems from the perspective of their teachers. The second section, on a four-point scale, explored challenges students face in solving word problems. The third section, using a five-point scale, examined teachers' approaches to using word problems in their teaching. The fourth section, on a four-point scale, measured the frequency of specific teaching strategies in teaching mathematical word problems. The fifth section, on a five-point scale, identified obstacles teachers face in teaching word problems.

The third part included 7 open-ended questions, asking teachers about why students have difficulties in solving word problems, additional difficulties students encounter, if they attempted to help students to overcome these difficulties, their strategies to address these, advices for other educators, views on how textbooks contribute to difficulties, and suggestions to the officials for improving the curriculum.

The questionnaire was administered online using Google Forms and targeted math teachers. Respondents were encouraged to share the questionnaire with fellow colleges in Romania.

3.3.1 Validity of the instrument

Before being applied, the questionnaire was analyzed by 3 doctoral supervisors with competences in teaching mathematics and exact sciences and by number of PHD students. It was then modified according to their suggestions to arrive at the final version.

3.3.2 Instrument's reliability

The reliability of the questionnaire was assessed using JASP (<https://jasp-stats.org/>), an open-source statistics program, using Cronbach's alpha, a measure of internal consistency. The analysis yielded a Cronbach's alpha coefficient of 0.88, with a Cronbach's alpha above the commonly accepted threshold of 0.7 (Cronbach, 1951), the questionnaire demonstrates good internal consistency, making it a reliable tool for assessing the intended variables.

3.4 Participants

The research sample consisted of 163 Romanian teachers who teach mathematics at the preschool, primary, and lower secondary levels. Among them, 1.8% teach at the preschool level, 87.7% at the primary school level, and 10.4% at the lower secondary school level. The sample included 150 women and 13 men.

Most teachers (17.2%) have between 5 and 9 years of experience, while 17.1% have between 20 and 24 years of experience. They primarily come from various counties, with the majority being from Cluj

(80%) and Sălaj (12%). Most of them (63%) work in schools with 30 to 50 teachers, and 50% work in schools with 500 to 1,000 students.

Regarding academic qualifications, 50.9% hold a master's degree, 41.1% have a bachelor's degree, and 7.4% hold a PhD. Most of the teachers work in urban areas.

4. Data analysis

The data was collected automatically and processed using JASP and Microsoft Excel.

4.1 Results and discussion

The responses to the second part of the questionnaire were tabulated and compared, teachers were asked to rate statements about students' general attitude toward solving word problems on a scale from 1 (strongly disagree) to 5 (strongly agree).

Table 1. Teachers' Ratings of Students' General Attitude Toward Word Problems

The attitude	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Students face difficulties in solving math word problems	2.5%	11%	28.2%	32.5%	25.8%
On quizzes and other forms of testing their math knowledge, students dread having to solve math word problems	3.7%	10.2%	30.7%	34.4%	20.9%

The results are shown in Table 1. The percentages show that the majority of participants identified these challenges as prominent, with responses predominantly falling in the "Agree" and "Strongly Agree" categories. This demonstrates a general consensus among participants about the difficulties posed by math word problems, aligning with the statistical results that suggest no significant variability in response patterns, thus reinforcing the stability of these perceptions.

In the second section the teachers were asked to rate the difficulties students encounter in solving mathematical word problems on a scale from 1 to 4, where 1 means not at all difficult, 2 means slightly difficult, 3 means difficult, and 4 means very difficult. The results of the analysis for this question are shown in are shown in Table 2.

Table 2. Teachers' Ratings of Difficulties Students Encounter in Solving Mathematical Word Problems

The difficulty	Not at all difficult	Slightly difficult	Difficult	Very difficult
Deep reading of the word problem	4.3%	22.7%	52.1%	20.9%
Identifying word problem's data	7.4%	26.4%	43.6%	22.7%
Identification of additional information (if necessary)	3.7%	23.9%	52.1%	20.2%
Identifying the requirement of the word problem	8%	30%	45.4%	16.6%
Determining the steps needed to solve the word problem	5.5%	26.4%	49%	19%
Translating the content of the word problem into mathematical symbols	3.7%	28.2%	39.3%	28.8%
Checking how the child understood and solved the word problem	10.4%	27.6%	39.9%	22.1%
Choosing the strategy/method for solving the word problem	5.1%	31%	39.4%	24.5%

Students face significant challenges in solving word problems, including difficulties with deep reading, identifying necessary information, translating text into mathematical symbols, determining problem-solving steps, and selecting appropriate strategies. Teachers suggest several strategies to address these

issues, such as designing activities to help students break down and understand mathematical texts, providing structured examples to teach logical problem-solving methods, and training students to convert written problems into equations. Encouraging analytical thinking through targeted questions and promoting consistent review of solutions can also enhance students' problem-solving skills and overall performance.

In the third section teachers were asked to rate the way they approach math word problems on a Likert scale with 5 points. The results are shown in Table 3.

Table 3. *Teachers Evaluations of Their Approaches to Teaching Mathematical Word Problems*

The method	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
I use different methods to explain word problems to students	0.6%	7.4%	19%	35%	38%
I use word problems to show students applications of math concepts	0.6%	5.2%	17.4%	42%	34.8%
Daily math exercises include at least one word problem	0.6%	12.3%	28.4%	29%	29.7%
I use real-life word problems or student experiences	1.3%	9.7%	18.7%	36.8%	33.5%
I ask the students to formulate word problems	1.9%	13.5%	27.1%	31.6%	25.8%

The results indicate that many teachers use word problems to show the real-world applications of math concepts and employ various methods like drawings, stories, and games to explain them. Additionally, teachers incorporate problems based on students' daily lives and often include word problems in their lessons. However, there is potential for improvement in encouraging students to create their own word problems and consistently incorporating them into daily activities. Providing further training on strategies for fostering creativity in students and integrating word problems into everyday lessons could be beneficial.

The fourth section assessed the frequency of teachers' use of various procedures in teaching math word problems, rated on a 4-point scale from 1 (never) to 4 (always). The results are summarized in Table 4.

Table 4. *Frequency of Teachers' Use of Procedures in Teaching Math Word Problems*

The procedure	Never	Sometimes	Many times	Always
Creation of drawings / graphs / tables necessary for organizing data or clarifying the stages of solving problems	0.6%	20.2%	39.9%	39.3%
Applying critical thinking	1.2%	18.4%	41.7%	38.7%
Using the math word problem as an introduction to explaining a new math concept	3.7%	31.3%	38%	27%
Using role play in explaining math word problems	9.2%	27%	40.5%	23.3%
Using a story to introduce the context of the math word problem	9.8%	29.4%	37.4%	23.3%

The findings highlight that teachers frequently use diverse strategies such as critical thinking, visual aids like drawings and graphs, role-playing, and storytelling to teach mathematical word problems. These approaches create a multi-sensory learning environment that caters to different learning styles, enhancing comprehension and problem-solving skills. By connecting theoretical concepts to real-world applications, such methods make mathematics more engaging and effective for students.

The fifth section asked teachers to rate the obstacles they face in teaching word problems on a 1 to 5 scale, with 1 being strongly disagree and 5 being strongly agree. The results are shown in Table 5.

Table 5. *Obstacles Teachers Face in Teaching Mathematical Word Problems*

The obstacle	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
The limited time allowed to finish the manual	6.1%	11%	16.6%	33.1%	33.1%
Large number of students per class	6.7%	7.4%	18.4%	33.7%	33.7%
Lack of school materials needed to explain math word problems to students	6.8%	11%	27%	35.6%	19.6%
Lack of teacher training courses in teaching mathematics	9.8%	18.4%	28.2%	28.2%	15.3%
The textbook does not contain activities dedicated to learning problem-solving strategies	3.7%	16%	30.1%	33.1%	17.1%
Textbook math problems do not belong to the student's reality	3.7%	14.1%	32.5%	33.1%	16.6%

Teachers identified several obstacles in teaching math word problems, including large class sizes, limited time for completing the curriculum, lack of necessary materials, and textbooks that do not include problem-solving activities or connect to students' real-life experiences. Additionally, there is a need for more teacher training in mathematics instruction. To address these challenges, it is essential to reduce class sizes, adjust curriculum timelines, provide better resources, redesign textbooks to include relevant activities, and offer targeted training to enhance teachers' skills in teaching mathematics effectively.

The third part of the questionnaire, which consists of 7 open-ended questions.

In the first question, the teachers were asked to explain why the students have difficulty in solving math word problems.

Teachers identified several reasons for students' difficulties in solving mathematical word problems. About 24% attributed the issue to weak reading and comprehension skills, while 12% pointed to a lack of focus due to electronic devices and unhealthy habits. Around 11% mentioned the absence of effective problem-solving strategies, and 9% highlighted insufficient daily practice. Additionally, 7% noted the complexity of word problems, 7% linked the issue to limited cognitive abilities, and 6% cited students' impatience. Finally, 4% referred to inadequate teaching methods, 3% to limited instructional time, while others mentioned anxiety and a lack of parental support.

In the second question, the teachers were asked to specify what other (than those mentioned above) difficulties do students face in solving mathematical text problems.

Among responses, 12% of teachers highlighted students' difficulties in maintaining focus and attention, emphasizing the need for collaboration between teachers and parents to teach strategies for improving focus and addressing lifestyle and dietary habits. 10% noted struggles with reading comprehension and extracting key information, stressing the importance of early training in reading skills. 7% mentioned challenges with logical thinking, mental visualization, and connecting information, calling for a greater focus on teaching critical thinking rather than rote knowledge. 6% pointed to issues with self-control and motivation, leading to frustration and giving up on difficult problems. Additionally, 5% cited difficulties in converting text into mathematical equations, while 4% highlighted challenges in planning problem-solving approaches and managing time effectively within limited class periods.

The third question asked teachers whether they have attempted to help students overcome difficulties in solving math word problems. To this question, 86% of the respondents answered "yes," while 14% answered "no."

The fourth question specifically targets teachers who answered "yes" to the third question, asking them to describe the methods they have already used to help students overcome difficulties in solving mathematical word problems, excluding those mentioned previously.

Teachers suggested several strategies to address these challenges. Training students in in-depth reading was the most frequently mentioned strategy, cited by 31% of respondents. Dividing the text into smaller parts for better comprehension was highlighted by 21%, while 17% emphasized teaching step-by-step problem-solving strategies and encouraging consistent application. Additionally, 15% recommended explaining problems using tangible materials or engaging methods like drawings, stories, games, or movies. Another 15% stressed the importance of continuous, intensive practice with diverse word problems, and 12% suggested using practical, real-life problems and integrating mathematics with other sciences to enhance understanding and engagement.

The fifth question asks teachers to provide additional suggestions for other educators to use in addressing mathematical word problems difficulties.

Several strategies were suggested by teachers to improve the teaching of word problems. 7% recommended using modern methods, such as games, competitions, diagrams, and tangible materials. 6.7% emphasized daily problem-solving practice, both in class and at home, while another 6.7% highlighted the importance of consistent training. 4.3% proposed incorporating real-life applications into word problems. 3% stressed guiding students to follow steps, breaking problems into smaller sections, and teaching proper reading techniques. 2.5% suggested equal attention for all students and group work, while 1.8% recommended fostering critical thinking and improving teachers' problem-solving skills. 1.2% highlighted using digital tools and patience with students. Additional ideas included encouraging students to create their own problems and collaborating with families to boost motivation.

The sixth question ask teachers how the math textbooks contribute to difficulties in solving math text problems? (Not mentioned above)

Teachers expressed varied opinions on how math textbooks contribute to students' difficulties with word problems. 8.6% stated that textbook examples are overly complex with unclear texts, while another 7.4% felt the number of examples is insufficient for mastering problem-solving methods. Similarly, 7.4% criticized textbooks as poorly designed, unorganized, and unengaging. 5.5% noted that textbook problems lack real-life applicability, being outdated and irrelevant to students' futures. 4.3% believed textbooks lack problem variety, focusing only on extremes of difficulty, while 2.5% pointed out typographical and linguistic errors. Another 2.5% felt textbooks fail to include examples that clearly explain problem-solving strategies. On the other hand, 4.3% considered textbooks to be well-designed with no major issues.

The seventh question ask teachers to formulate suggestions for curriculum designers and mathematics textbook authors to support overcoming difficulties in solving mathematical text problems.

Teachers suggested several improvements for math textbooks. 13% proposed adding more examples with clear instructions, strategies, and common mistakes. 10% emphasized the need for problems relevant to students' environments and skill levels. 7% recommended making textbooks more engaging with games, illustrations, and relatable characters, while another 7% suggested a gradual progression in problem complexity. 6% called for simplifying the language and presentation of problems. 3% advocated aligning textbooks with current curricula and incorporating teacher feedback, and 1% recommended correcting typographical and linguistic errors.

4.2 Conclusions

The general aim of this study was to explore the challenges faced by teachers and students in teaching and solving mathematical word problems, identify current practices adopted by teachers, and propose solutions to improve students' ability to deal with this type of problems. In addition, this study aimed to answer the following questions:

1. What is the general attitude of students towards solving mathematical word problems from their teachers' perspective?

The vast majority of respondents reported that the students face difficulties in solving mathematical word problems. In addition, they have negative feelings towards these types of problems.

2. What are the difficulties students face in solving mathematical word problems from their teachers' perspective?

Students face challenges in solving mathematical word problems, including difficulties with reading comprehension, identifying key information, translating the problem into mathematical symbols, determining solution steps, and selecting appropriate strategies. They also struggle with identifying relevant data, understanding the problem's requirements, and verifying their solutions.

3. How do teachers approach the use of mathematical word problems in their teaching practices?

Teachers use word problems to show real-world math applications, employing methods like drawings, stories, games, and real-life scenarios. They ensure consistent practice by including word problems in daily exercises and encourage students to create their own problems.

4. What are the most commonly used methods by teachers in teaching mathematical word problems?

Teachers frequently use critical thinking, visual aids like drawings and graphs, and role-playing to teach math word problems. Storytelling is also commonly used to introduce problem scenarios and explain new concepts.

5. What are the challenges and obstacles teachers face in teaching mathematical word problems?

Teachers identified large class sizes, limited time, and a lack of relevant activities in textbooks as major challenges in teaching math word problems. They also noted insufficient materials and training, highlighting the need for better resources and professional development to improve teaching and student outcomes.

6. Why do students face difficulties in solving mathematical word problems from their teachers' perspective?

Teachers identified several challenges students face in solving math word problems, including poor reading and comprehension skills, lack of focus, and absence of effective problem-solving strategies. They also noted insufficient practice, complex problem wording, and psychological factors like math anxiety. Additionally, the lack of real-life relevance in word problems was seen as a barrier to student engagement.

7. What methods have teachers already used to help students overcome difficulties in solving mathematical word problems?

To help students with math word problems, teachers use strategies such as breaking down problems into smaller parts, fostering critical thinking, and employing methods like storytelling, role-playing, and games. They also introduce new concepts through word problems, choose relatable examples, and emphasize real-life applications. These strategies focus on making word problems more engaging and accessible, with consistent practice to improve students' skills.

8. What methods do teachers recommend for other educators to use in addressing mathematical word problems difficulties?

Teachers recommended using engaging methods like games, competitions, and visual aids to improve students' problem-solving skills. Consistent practice, real-life applications, and breaking problems into manageable parts were emphasized. Encouraging reading techniques and peer collaboration, along with fostering critical thinking through guided questions, were also suggested. Teachers highlighted the need for continuous training and the use of digital tools. Involving families and encouraging students to create their own problems were additional strategies to enhance learning.

9. How do school mathematics textbooks contribute to the difficulties in solving mathematical word problems?

Teachers identified several gaps in math curricula, mainly due to poorly designed textbooks. These include overly complex examples, insufficient variety, unclear text, and a lack of engaging content. Textbooks often contain typographical errors and problems that are either too easy or too difficult. Additionally, many problems lack real-life relevance, and textbooks fail to provide step-by-step problem-solving strategies, leaving students without effective guidance.

10. What suggestions do teachers have for curriculum designers and mathematics textbook authors to help overcome the difficulties in solving mathematical word problems?

Teachers recommended improving mathematics textbooks by including more examples, clear problem-solving strategies, and real-life applications. They emphasized making problems engaging with games, illustrations, and familiar characters while ensuring gradual complexity. Suggestions also included simplifying wording, aligning content with current programs, and correcting typographical errors for clarity.

5. Recommendations

Based on the results, it is recommended to address the challenges in teaching and solving mathematical word problems, it is crucial to focus on both student and teacher difficulties. Teachers face significant obstacles such as limited instructional time, large class sizes, and insufficient resources, which hinder their ability to deliver effective problem-solving strategies. To mitigate these issues, curricula should be revised to ensure the number of concepts aligns with available teaching time, while textbooks must be redesigned to include relatable, clearly worded problems with practical applications. Expanding educational infrastructure by increasing classrooms and hiring more teachers is essential to reduce class sizes and allow personalized attention. Additionally, organizing professional development workshops can enhance teachers' skills in teaching word problems effectively, equipping them to handle diverse classroom challenges. Introducing engaging teaching methods, such as games and storytelling, can also benefit both teachers and students by making problems more accessible. Future studies could examine how these interventions improve teaching practices and student performance or explore the role of technology in supporting teachers in teaching mathematical word problems.

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