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Elementary School Students' Ability to Solve Mathematical Story Problems

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ABSTRACT

Elementary school students' ability to solve mathematical story problems is important in implementing contextual learning in everyday life, but students often have difficulty understanding and solving story-based problems. This study analyses students' ability to solve mathematical story problems, namely conceptual understanding, operational abilities, and problem-solving. This type of research is descriptive quantitative research carried out in stages from September 2023 to April 2024. The study subjects were 34 fifth-grade students who were given five essay story problems. The data analysis technique in this study used descriptive statistics with percentages. The results showed that in the aspect of conceptual understanding, the average score of students was 2.18, with the majority of answer categories at a low level (47.05%). Regarding operational abilities, the average score reached 2.35 for multiplication and 2.32 for division operations, with the highest answer categories at a low level (35.29% and 35.29%). In the problem-solving aspect, the average student score was 1.76 for question 4 and 1.88 for question 5, with most students (58.82% and 44.11%) in the low category. Overall, the average score of students in solving story problems was 52.65, with a standard deviation of 18.80; the highest score was 90, and the lowest score was 25. These results indicate that students' ability to solve mathematical story problems still needs to be improved, especially in problem-solving. More structured learning interventions based on problem-solving steps are recommended to improve students' abilities.

INTRODUCTION

Education is very much needed (Anturichana et al., 2021). One of the levels or paths of education is elementary school (Wuryandani et al., 2014). Elementary school is the earliest formal education level in Indonesia (Yanto, 2020). Elementary school age usually starts when children are 6 years old to approximately 12 years old (Aini, 2018). One of the compulsory

subjects for students to learn in elementary school is mathematics (Utami et al., 2018). Mathematics is one of the disciplines that can foster thinking skills (Nisa et al., 2024) and argumentation (Wulandari et al., 2016), provide support for the development of science and technology, and contribute to solving problems in everyday life and the world of work.

Learning, especially mathematics, is a teaching and learning process carried out by teachers to develop creative thinking in students who can train their thinking skills and the ability to build new knowledge to improve mastery of mathematics material (Kurniawati & Ekayanti, 2020). According to the Ministry of National Education in Yayuk (2019), the objectives of mathematics learning in elementary schools are: (1) Students can think critically, logically, and systematically in terms of making general conclusions and compiling evidence; (2) Teach students to carry out arithmetic and measurement operations carefully, precisely, and accurately; (3) Students can use concepts and procedures in solving mathematical problems effectively and efficiently; (4) Teach students to think communicatively by expressing their ideas and ideas through tables, diagrams or in the form of symbols, and; (5) Train students to have a high curiosity and the ability to try and solve mathematical problems.

Various problems cause a low level of mathematics learning. Including problems in mathematics learning, namely that most students think mathematics is a difficult and boring subject, many students do not like it, and they even consider mathematics a disaster that must be avoided (Nabillah & Abadi, 2020). Mathematics is one of the important subjects because it is a reference or basis for understanding other sciences. Mathematics is important for student's life, so mathematics learning must run according to the expected learning objectives. The success of a learning process can be seen in student learning outcomes (Sadewo et al., 2022). Mathematics has an important and useful role in life, namely in solving problems faced in everyday life (Mansur, 2018). One of the mathematical materials often used in everyday life is the arithmetic operation of numbers, which is the basis for understanding subsequent mathematical concepts (Siregar, et al., 2014). Putra (2020) explains that there are four operations on numbers: addition operations, subtraction operations, multiplication operations and division operations.

Mathematics learning should not be something that students fear because mathematics is a science that contains symbols, formulas, and concepts that are very useful in solving life problems (Suci & Taufina, 2020). In mathematics learning, if students experience learning difficulties, it is considered an everyday thing. It has become a reality because students consider mathematics a lesson that is a scary spectre for them (Yeni, 2015). The fear that comes from

these students can come from anger or punishment from teachers and fear of getting low grades, which causes students to have difficulty in learning (Kusumabangsa, 2016).

Mathematics learning in elementary schools often faces various challenges, one of which is students' difficulty in solving story problems. Story problems, one form of mathematical concept application problems, require more than just arithmetic skills. In addition to having to understand basic mathematical concepts, students also need to connect real-world situations with appropriate mathematical representations (Bowers & Stephens, 2011). This condition makes story problems more complex than other types of problems, such as fill-in-the-blank or multiple-choice problems, which focus more on testing conceptual understanding directly.

According to research by NCTM (2000), story problems are important in mathematics learning because they help students develop the ability to think critically, solve problems, and apply mathematical concepts in real-life contexts. However, in reality, many students have difficulty solving story problems, both in terms of understanding the text, choosing a solution strategy, and correctly representing mathematical problems (Schoenfeld, 1985).

Several studies show that this difficulty is related to cognitive aspects and psychological and emotional factors. Students often feel stressed or anxious when faced with story problems, which affects their ability to process information effectively (Asanjarani & Zarebahramabadi, 2021). However, although many studies examine students' difficulties in story problems, there is still a lack of studies that discuss the mapping of this problem in certain areas or contexts. Further research is needed to identify the characteristics and factors that cause students' difficulties in solving story problems, especially in the context of education in certain areas.

In particular, although word problems are widely discussed in the mathematics education literature (Farida, 2015), the lack of studies that map the differences in the difficulty of word problems compared to other types of problems remains an important research gap. This statement has the potential to provide new insights into designing more effective learning strategies that follow the characteristics of students in various regions.

Based on an interview with the homeroom teacher of grade IV MI Guppi Wironanggan, students' mastery and understanding of mathematics in story problems is still relatively low. This condition is because students are less able to understand the meaning of the problem and are confused when determining the arithmetic operation to be used. Students need a very long time to solve story problems. So, students often make mistakes when calculating and are not careful when working on math story problems.

Based on this background, knowing the students' ability to solve mathematical story

problems in class IV MI Guppi Wironanggan is necessary. This study aims to determine students' ability to solve mathematical story problems in Madrasah Ibtidaiyah.

METHOD

This type of research is descriptive quantitative research. The purpose of choosing this type of research is to provide a detailed description of students' difficulties in learning mathematics. This research was conducted at MI Guppi Wironanggan in Dukuh Betikan, Wironanggan Village, Gatak District, Sukoharjo Regency, Central Java Province. The subjects in this study were 34 students of grade IV MI Guppi Wironanggan. The instrument was in the form of an essay test consisting of 5 items. The data analysis technique in this study used descriptive statistics. Indicators of the analysis in solving mathematical story problems are shown in Table 1.

Table 1. Indicators of Mathematics Story Problems

Story question indicators	Question number
conceptual understanding	1
Operational capabilities	2,3
solution to problem	4,5

RESULTS AND DISCUSSION

The research data were analyzed using quantitative descriptive analysis techniques. Data with a five-question test describes students' ability to solve mathematical story problems. Data from students' work on questions regarding students' ability to solve mathematical story problems consisting of five questions and three indicators, namely difficulty in understanding concepts (question number one), operational (questions number two and three), and difficulty in solving problems (questions number four and five), as follows:

Conceptual Understanding Ability

The ability to understand concepts experienced by students is the ability of students to understand mathematical story sentences that contain certain concepts. Most students can only answer questions but do not use the steps and the wrong answer on question number 1. Conceptual understanding is a strong cognitive foundation for students, as emphasized by Piaget (1952). These basic concepts become a framework for thinking that allows students to connect new information with existing knowledge. Based on the results of data analysis related to conceptual understanding abilities are shown in Table 2.

Table 2. Percentage Results of Concept Understanding Ability for Question Number 1

Question score	Information	Number of students	Percentage
4	Students can answer questions by explaining the steps correctly and the correct answers.	9	26,47%
3	Students can answer questions by explaining the steps correctly but using the wrong steps and answers	4	11,76%
2	Students can answer story questions but do not use the steps, and the answers are wrong	5	14,70%
1	Students can answer questions but do not use the steps, and the answers are wrong	16	47,05%
	Amount	**34**	**100%**

The results of the study in Table 2. show that students' conceptual understanding ability in solving mathematical story problems, especially in question number 1, tends to be low. As many as 47.05% of students are at a score of 1, indicating that they can only answer questions without using the correct steps and with the wrong answers. A small number of students, namely 26.47%, achieved the highest score (score 4) by answering questions correctly, completely, and correctly, including explaining the steps to solve them.

Table 3. Results of Analysis of Students' Ability Units in Solving Story Problem Number 1 in Mathematics Subject

Information	Results of students' conceptual understanding abilities
Mean	2,18
Median	2
Modus	1

Unit analysis in Table 3 shows the average value (mean) of students' ability is 2.18, which is included in the low category. The middle value (median) is 2, and the most frequently appearing value (mode) is 1, indicating that most students can only provide answers with incorrect steps or even without clear solution steps.

Overall, these results indicate that most students struggle to understand and apply mathematical concepts to story problems. More effective learning interventions are needed to improve conceptual understanding skills, based on previous research through the use of a contextual approach (Dharmayanti, 2019), providing scaffolding in solving problems (Sidik, 2016), and strengthening problem-based exercises based on systematic steps can improve understanding of mathematical concepts (Fitrah, 2017).

Operational Capability

Operational ability in mathematical problem analysis refers to students' ability to systematically apply mathematical concepts, principles, and rules in solving problems, especially in the form of story or contextual problems. This analysis involves logical thinking processes, appropriate procedures, and the ability to perform mathematical operations correctly. Based on the results of the data analysis shown in Table 4:

Table 4. Results of Percentage of Operational Ability for Question Number 2

Question score	Information	Number of students	Percentage
4	Students can answer questions using multiplication operations by explaining the steps correctly and providing the correct answers.	9	26,47%
3	Students can answer questions about using multiplication operations by explaining the steps correctly, but the answers are wrong.	6	17,64%
2	Students can answer questions about using multiplication operations by misdescribing the steps and giving incorrect answers.	7	20,58%
1	Students can answer questions using multiplication operations but do not use the steps, and the answers are wrong	12	35,29%
	Amount	34	**100%**

Table 4 shows the study results on question number 2, which measures students' operational abilities in using multiplication operations on mathematical story problems, showing that most students still have limited abilities. As many as 35.29% of students scored 1, which means they did not use the correct solution steps and gave the wrong answer. Only 26.47% of students scored 4, meaning they successfully answered the question with the correct steps and answers. Some other students showed partial understanding: 17.64% achieved a score of 3 (correct steps but wrong answers), and 20.58% achieved a score of 2 (imprecise steps and wrong answers).

Table 5. Results of the Analysis of Operational Ability Units in Solving Story Problems in Mathematics Subjects in Question Number 2

Information	Student operational ability results
Mean	2,35
Median	2
Modus	1

Table 5 shows the analysis of students' ability units, showing an average value (mean) of 2.35, which indicates a tendency for students' operational abilities in the low to moderate

category. The middle value (median) of 2 indicates that half of the students have abilities below or equal to the less precise category. The most frequently appearing value (mode) is 1, which confirms that most students still experience significant difficulties in solving story problems that require multiplication operations. These results indicate the need to improve learning related to mathematical operations, especially multiplication in the context of story problems, through a more applicable, contextual learning approach oriented towards understanding systematic solution steps (Halimatusadiah et al., 2017).

Question number 3 uses the division operation of mathematical story problems students learned in semester II. The percentage of students' answers to question number 1 is more completely described in Table 5.

Table 6. Results of Percentage of Operational Ability for Question Number 3

Question score	Information	Number of students	Percentage
4	Students can answer questions about the use of division operations by explaining the steps correctly and providing correct answers	9	26,47%
3	Students can answer questions about using division operations by explaining the steps correctly, but the answer is wrong.	5	14,70%
2	Students can answer questions about using division operations by misdescribing the steps and giving incorrect answers.	8	23,52%
1	Students can answer questions using division operations but do not use the steps, and the answers are wrong.	12	35,29%
	Amount	**34**	**100%**

Table 6 shows the study results on question number 3, which measures students' operational abilities in using division operations in mathematical story problems, showing that most students still face difficulties. Most students (58.81%, scores 1 and 2) have not been able to solve the problem with the correct steps, indicating that they have difficulty understanding the concept of division operations in the context of story problems. Although 26.47% of students managed to solve the problem perfectly (score 4), these results indicate a need to improve learning related to division operations.

Table 7. Results of Operational Ability Unit Analysis in Solving Story Problems in Mathematics Subjects

Information	Student operational ability results
Mean	2,32

Information	Student operational ability results
Median	2
Modus	1

Unit analysis in Table 7 shows that the mean value is 2.32, indicating that the average student is at a low to moderate operational ability. The median value is 2, meaning half of the students have abilities in the less precise category or below. The most frequently occurring value (mode) is 1, emphasizing that most students are at the lowest ability level.

Based on the data analysis results, students' operational abilities still show that many students do not understand the operational steps in mathematical story problems. Many students have difficulty understanding mathematical story problems, especially when transforming information into mathematical form and carrying out operational steps, due to a lack of understanding of concepts and inaccuracy (Dwidarti et al., 2019; Aziz, 2019).

Problem-Solving Skills

Question number 4 is understanding the sequence of steps of operations involving brackets "()" that students have learned in semester II. The following describes students' abilities in understanding operations involving brackets "()".

Table 8. Results of Percentage of Problem-Solving Ability for Question Number 4

Question score	Information	Number of students	Percentage
4	Students can answer questions about using the "( )" sign operation by explaining and answering the steps correctly.	4	11,76%
3	Students can answer questions about using the "( )" sign operation by explaining the steps correctly, but the answer is wrong.	4	11,76%
2	Students can answer questions about the use of the "( )" sign operation by misdescribing the steps, but the answer is wrong	6	17,64%
1	Students can answer questions about using the "( )" sign operation but do not use the steps, and the answers are wrong.	20	58,82%
	Amount	**34**	**100%**

These results indicate that 70.58% of students (scores 1 and 2) do not understand the concept of the order of operations using parentheses well. Only a small number of students (11.76%, score 4) could answer the questions correctly and with the proper steps. This result indicates a significant weakness in mastering the material on mathematical operations with parentheses.

Table 9. Analysis of Problem-Solving Ability Units in Solving Story Problems in Question Number 4 of Mathematics Subject

Information	Results of students' problem-solving abilities
Mean	1,76
Median	1
Modus	1

Table 9 explains that the average of 1.76 shows that the majority of students have very low problem-solving ability in understanding operations with parentheses. The median value emphasizes that most students have the lowest ability level (score 1). The most frequently occurring value is 1, which means that most students cannot answer questions with the correct steps.

Question number 5 is understanding the sequence of steps of operations involving brackets "( )" that students have learned in semester II. The following describes students' abilities in understanding operations involving brackets "( )".

Table 10. Results of Percentage of Problem-Solving Ability for Question Number 5

Question score	Information	Number of students	Percentage
4	Students can answer questions about using the "( )" sign operation by explaining and answering the steps correctly.	3	8,82%
3	Students can answer questions about using the "( )" sign operation by explaining the steps correctly, but the answer is wrong.	5	14,70%
2	Students can answer questions about using the "( )" sign operation by misdescribing the steps, but the answer is wrong.	11	32,35%
1	Students can answer questions about using the "( )" sign operation but do not use the steps, and the answers are wrong.	15	44,11%
	Amount	**34**	**100%**

The results of the study on question number 5 in Table 10, which aims to measure students' ability to understand the sequence of steps of operations using brackets "( )", show that many students still face difficulties in this topic. These results indicate that 76.46% of students (scores 1 and 2) have low problem-solving abilities in understanding operations with brackets. Only 8.82% of students were able to answer the questions correctly and use the right steps, while the rest experienced conceptual or procedural errors. The difficulties experienced by students include: 1) Lack of in-depth understanding of the sequence of

mathematical operations; 2) Inability to apply the concept of brackets consistently; 3) Weaknesses in reading and understanding complex story problems. According to research by Muntaha et al. (2020), students' difficulties in solving math problems are due to not understanding the steps in modelling mathematics. Meanwhile, according to Putri & Pujiastuti (2021), students' difficulties in solving math problems are because they are still unable to perform multiplication operations and understand the contents of story-based questions, thus affecting their ability to identify the information in the questions.

Table 11. Results of the Analysis of Problem Solving Ability Units in Solving Story Problems in Number 5 of the Mathematics Subject

Information	Results of students' problem-solving abilities
Mean	1,88
Median	2
Modus	1

Table 11 shows that the average (Mean) is 1.88. This average indicates that students' problem-solving ability is below the sufficient category, with most students at a low ability level. The median value indicates that more than half of the students have low to very low ability levels (scores 1 and 2). The most frequently occurring value is 1, indicating that many students do not understand the correct problem-solving steps.

The study results of students' ability to solve mathematical story problems are in solving problems understanding the sequence of steps involving the brackets "( )". This ability is shown when students cannot use the steps to answer story problems. Problem-solving is in question number 4, using brackets "( )". It can be seen that the average student, or mean student, is working on mathematical story problems to understand the sequence of operational steps involving brackets "( )" is 1.76. The results of the student's problem-solving ability show that many students still do not understand problem-solving when working on mathematical story problems. Problem-solving in question number 5, namely using brackets "( )". It is known that the average student, or mean student, works on mathematical story problems to understand the sequence of operational steps involving brackets "( )" at 1.88. The results of the students' problem-solving ability show that many students still do not understand problem-solving when working on mathematical story problems. Many students have difficulty understanding, planning, and completing the steps to solve mathematical story problems, which indicates problems at each problem-solving stage (Putri & Pujiastuti, 2021).

Based on the results described, the following are the overall results of students' scores from the story question test in mathematics obtained from 34 students with five essay story question statements in Table 12.

Table 12. Frequency Distribution of Learning Outcome Values

Class	Interval Class	Frequency	Presentation
1	25 - 35	6	17.64%
2	36 - 46	11	32.35%
3	47 - 57	5	14.70%
4	58 - 68	5	14.70%

Table 12 shows the frequency indicating six students (17.64%) in this group are at a very low ability level. This result indicates significant difficulties in understanding or solving mathematical story problems. The largest group of students is in the low-ability category of 11 students (32.35%). Most students face obstacles in understanding problems or applying mathematical concepts correctly. As many as five students (14.70%) have begun to show an increase in ability, although they are still classified as lower middle category. As many as five students (14.70%) have medium ability. They can better understand mathematical story problems than students in the previous category. Furthermore, the data that has been collected is then calculated in units with the results in Table 13.

Table 13. Results of Analysis of Problem-Solving Ability Units in Solving Story Problems in Mathematics Subjects

Information	Variables of students' ability to solve math story problems
Mean	52,65
Median	47,50
Modus	40
Standar Deviasi	18,80
Nilai Terendah	25
Nilai Tertinggi	90

Table 13 shows the average value indicating that most students have abilities in the sufficient category. However, this score is still far from the ideal value (90). The lower mean value of 47.50 indicates that more students have scores below the average, indicating that the data distribution tends to be centred in the low category. The most frequently occurring value, 40, is in the low range. This result strengthens the finding that most students have not mastered

problem-solving skills in story problems. The variation in student scores is quite large, indicating significant differences in student abilities. This result may indicate a gap in understanding between individuals in the class.

Students with the lowest score of 25 showed they did not understand the basic concepts and had difficulty solving story problems. Meanwhile, students with the highest score of 90 had very good abilities in understanding and solving story problems. However, the number of students in this category was insignificant, indicating the need for more attention to the students with low scores.

Most students (more than 50%) are in the low score category (interval 25–46). This result indicates a general weakness in mathematical problem-solving abilities. Only a few students achieved high scores (scores >68), meaning that most students have not achieved the expected competencies. The wide spread of scores (high standard deviation) indicates that students' understanding of the material is uneven. Some students are very good, but many are left behind. Overall, these results indicate the need for improved learning strategies and special interventions to help students understand mathematical concepts through story problems, such as a contextual approach (Dharmayanti, 2019), providing scaffolding in solving problems (Sidik, 2016), and strengthening practice questions based on systematic steps can improve understanding of mathematical concepts (Fitrah, 2017), as well as reducing the gap in ability between individuals in the class (Isma et al., 2023).

Questions 1, 2, 3, 4 and 5 above show that, on average, students do not change the story problem into a mathematical sentence first and immediately calculate it. It can be concluded that many students still do not understand the concept and calculation skills, which means that students still have difficulty solving problems when working on mathematical story problems. Through motivation and habituation, students' abilities to solve mathematical story problems can be improved (Nafisah & Bisri, 2024).

CONCLUSION

Based on the results of the analysis and discussion that have been described, students' ability to solve mathematical story problems is included in the low category. These research results are evident from the difficulties experienced by students in understanding and solving mathematical story problems. The causes of this low ability include a lack of understanding of concepts, accuracy, and frequency of practising working on mathematical story problems.

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