

Analysis of Grade 5 Elementary School Students' Numeracy Literacy Skills in Solving Math Word Problems

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Numeracy literacy is a basic skill that every student must master. The results of the 2022 Program for International Student Assessment (PISA) indicate that Indonesian students have low numeracy literacy skills. This study aims to analyze the numeracy literacy skills of fifth-grade elementary school students based on three main indicators, namely: (1) the ability to analyze the information presented; (2) the ability to use various types of numbers and symbols related to mathematical concepts in solving problems in various contexts of daily life; (3) the ability to interpret the results of the analysis to make predictions and decisions. This study used a descriptive qualitative approach using tests, observations, and interviews to collect data. Data analysis was carried out by reducing the data, presenting the data, and then concluding the results. The results of the study indicate that the numeracy literacy skills of fifth-grade elementary school students are in the good category. Of the two students with different analytical abilities who were the subjects of the study, only one student was able to achieve indicator 1, while two students achieved indicators 2 and 3. The findings from this study indicate the importance of a narrative approach to numeracy literacy skills. Teachers play an important role in the development of students' numeracy literacy skills, which can be implemented through several actions such as improving the quality of teaching, methods, and learning models for mathematics learning.

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Introduction

Numeracy literacy is the knowledge and skills to use various numbers and symbols related to basic mathematics to solve practical problems in everyday life and analyzing information presented in various forms, as well as interpreting the results of analysis to predict and make decisions (Han et al., 2017). Numeracy literacy includes an understanding of numbers, basic operations, and is useful for applying mathematical knowledge in everyday situations. Numeracy literacy is a crucial component that cannot be separated from mathematics learning (Ambarwati & Kurniasih, 2021). As an integral part of mathematics, the implementation of numeracy literacy is highly dependent on the scope of material contained in the subject. Literacy relates to the ability to understand and respond to texts appropriately, while numeracy refers to the ability to apply numerical concepts in everyday life (Darwanto et al., 2022). Although they have different focuses, literacy and numeracy play an important role in helping individuals make decisions based on accurate data and information.

Indonesia's ranking in the 2022 Program for International Student Assessment (PISA) was 69th out of 80 countries, with a mathematics score of 366, which is far below the Organisation for Economic Co-operation and Development (OECD) average of 472, and a reading score of 359, which is also far below the OECD average of 476 (OECD, 2023). The 2022 PISA data indicates that the level of numeracy literacy among students in Indonesia is still low. The data reflects that the quality of mathematics education in Indonesia, particularly in terms of applying concepts in real-life contexts, is still not optimal. This points to a major challenge in the Indonesian education system, particularly in the development of numeracy literacy from an early age.

Mathematical story problems are one type of assignment in mathematics learning that is presented in narrative or reading text format that describes contextual situations as a means of improving numeracy literacy skills. Numeracy literacy skills play an important role in mathematical story problems because they are closely related to students' understanding of various mathematical concepts linked to real-life situations (Hadi & Zaidah, 2021). Literacy plays a role in understanding the context of the text and the information presented, while numeracy helps in converting that information into mathematical form and solving it systematically. Thus, the purpose of this study is to analyze students' numeracy literacy skills as measured by the context of solving mathematical story problems.

Based on findings obtained through observation in grade 5 at an elementary school in Malang, East Java, it was found that students' numeracy literacy skills varied considerably. Conclusions regarding students' numeracy literacy skills were obtained based on indicators observed during the observation process while students were completing assignments from teachers in the form of math story problems. These indicators included the ability to analyze the information presented, the ability to use various types of numbers and symbols related to mathematical concepts in solving problems in various contexts of daily life, and the ability to interpret the results of the analysis in order to make predictions and decisions (Ate & Lede, 2022). One of the most prominent aspects of these findings is the students' ability to understand the content of the reading or instructions in the questions. Although their understanding of basic mathematical concepts is fairly good, their low interest in reading is an obstacle to understanding the content of the questions presented in narrative text form. These findings indicate a challenge

in adjusting conceptual understanding to its application in real-life contexts, which is the essence of numeracy literacy.

Numeracy literacy has been the focus of a number of previous studies, such as (Siregar, 2022), which examined the implementation of numeracy literacy in elementary schools and suggested efforts to overcome obstacles in its implementation, including organizing, familiarizing, and maximizing training and socialization of numeracy literacy. Another study was conducted by (Samsiyah, 2023). This study explores the effectiveness of differentiated learning through the STAR (Situation, Challenge, Action, and Reflection) model in improving the numeracy literacy skills of elementary school students, which has been proven to support the improvement of numeracy literacy skills as a whole. Another study was conducted by (Utami et al., 2023), which examined the numeracy literacy skills of fourth-grade elementary school students and found that presenting data in the form of graphs, tables, or diagrams was easier for students to understand in measurement materials. Although various studies have examined numeracy literacy from various perspectives, to date, no study has been found that specifically and deeply analyzes students' numeracy literacy skills in the context of solving mathematical story problems.

In the context of education in Indonesia, the low level of numeracy literacy among students is an issue that deserves serious attention. This is due to the importance of numeracy literacy as a foundation for students' future. High numeracy literacy skills play a role in reducing the risk of unemployment, low income, and poor health (Faridah et al., 2022). Numeracy literacy skills are useful for future life in education, health, and the world of work. Therefore, a more in-depth analysis of students' numeracy literacy skills from elementary school age is needed.

Method

This study uses a qualitative approach with a descriptive qualitative research type. The main objective of this study is to describe the numeracy literacy abilities of fifth-grade elementary school students in solving mathematical story problems. The subjects in this study consisted of two fifth-grade students with different analytical abilities at an elementary school in Malang City, who were also the main sources of research data. Data collection was carried out using several techniques, namely tests, observations, and interviews. The instruments used included a test sheet consisting of three mathematical story problems related to the material on the perimeter of flat shapes, an observation guide sheet, and an interview guide sheet. The data collection technique began with the administration of a test in the form of mathematical story problems to fifth-grade students. The results of this test were analyzed to identify students' numeracy literacy skills based on numeracy literacy skill indicators. While the students were working on the questions, the researcher conducted observations to obtain an overview of the situation and the students' responses in solving the questions. Next, interviews were conducted with the subjects to explore in more depth the students' understanding and strategies in solving the story questions. A credibility test was conducted to ensure the validity of the data through triangulation techniques, namely by combining three data collection techniques, namely tests, observations, and interviews. This research process was carried out in three main stages, namely the field preparation stage, the field implementation stage, and the data analysis stage through data reduction, data presentation, and then conclusion of the research results.

Results and Discussion

Result

The results of the analysis of students' numeracy literacy skills in solving mathematical word problems are based on numeracy literacy indicators (NLI), namely NLI 1) the ability to analyze the information presented, NLI 2) the ability to use various types of numbers and symbols related to mathematical concepts in solving problems in various everyday contexts, NLI 3) the ability to interpret the results of the analysis to make predictions and decisions. The results of this study indicate that the numeracy literacy skills of fifth-grade elementary school students are in the good category. The following are the overall results of students' numeracy literacy skills presented in the table.

Table 1. Numeracy literacy skills of students S and J

Students	NLI 1	NLI 2	NLI 3	Description
S	×	√	√	Not thorough in understanding the context of the story problem as a whole
J	√	√	√	Has high numeracy literacy skills

Student J met all ILN's because they worked on the Math Story Problems (MSP) smoothly and accurately, from converting the reading into mathematical notation to solving the problems, even though they had difficulty understanding and analyzing the stories presented. Meanwhile, student S did not meet NLI 1 because the reading analysis process was not accurate, which affected the MSP solution process. The following is a description of the MSP answers from students S and J.

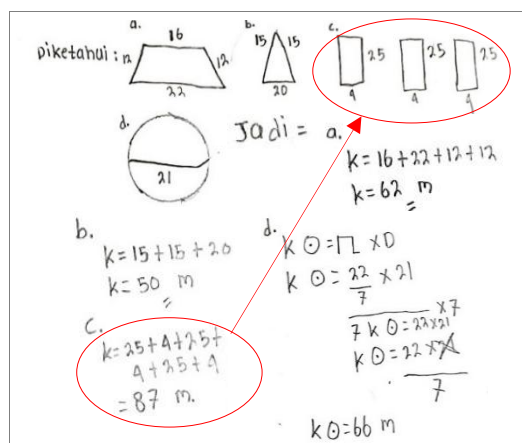
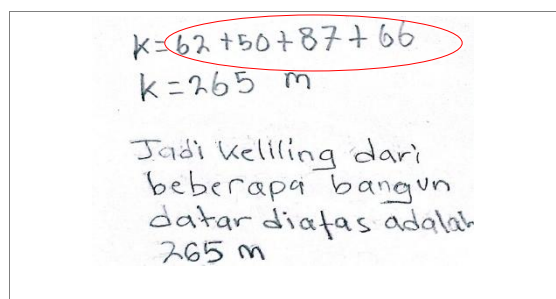


Figure 1. Completion of MSP 1 by student S

Based on student S's solution to MSP 1, it is evident that student S is able to interpret the problem narrative into mathematical notation through the strategy of grouping the flat shapes mentioned in the problem, then drawing them first to facilitate the solution process. Thus, student S has fulfilled NLI 2 and NLI 3 related to the use of mathematical concepts in problem solving and decision making. However, fulfillment of NLI 1, namely the ability to analyze information, is still less than optimal. This can be seen from the student's carelessness in the final calculation, particularly in the part of the question that states, "There are 3 rectangular paths, each 25 meters long and 4 meters wide." Student S did not add the lengths of the other two sides

of each rectangle drawn, so the perimeter of the flat shape calculated was incomplete. In calculating the perimeter of a rectangle, students only added two sides (length and width) without multiplying by two or adding the other pair of sides. As a result, the answer was incorrect. The perimeter of one rectangle should be 58 meters, so the total perimeter of the three rectangles is 174 meters.



$$k = 62 + 50 + 87 + 66$$

$$k = 265 \text{ m}$$

Jadi keliling dari
beberapa bangun
datar diatas adalah
265 m

Figure 2. final results of MSP 1 student S

Another error was found in the final results and conclusions, where the question only asked students to state the shape and perimeter of each flat figure. However, student S added up the total perimeter of all known flat figures, resulting in an incorrect final answer.

After the test was completed, the researcher explored student S's numeracy literacy skills in greater depth by conducting an interview. The dialogue between the researcher and student S was as follows:

- PN : What was that question about?
- S : It was about the school grounds, sir. We were asked to find the perimeter of several flat shapes that the school staff were going to fence in.
- PN : So what part of the math curriculum was that question about?
- S : The perimeter of flat shapes, sir, trapezoids, triangles, rectangles, and circles.
- PN : If there are more difficult questions, for example, I change the numbers to be larger or there are more flat shapes?
- S : Yes, sir, I like challenging questions.
- PN : Do you like to work on questions alone or in a group? Are you active when working in a group?
- S : I prefer working in groups, sir. In a group, I'm active, sir. I like working with my friends. Sometimes I'm the one who finds the answers, or if a friend asks a question, we often exchange opinions.

Based on the interview results, it was found that student S has a high interest in mathematics and demonstrates a good ability to understand the material. Student S also expressed enjoyment in working on story-based problems (MSP) and demonstrated an active attitude during the learning process, particularly in discussions and group work. In addition, Student S is categorized as a student who enjoys challenges and has an interest in exploring new things in the learning process.

The results of triangulation between test data, observations, and interviews show that student S has met NLI 2 and NLI 3. However, student S has not fully met NLI 1. There are several misconceptions that arise when students analyze the storyline in the question, which affects the

accuracy of the solution process. This carelessness affects the final result. Student S's main weakness lies in the aspects of accuracy and focus in analyzing information from the MSP.

Based on observations of student J in the process of completing the MSP, it was found that student J tended to experience difficulties in the early stages, particularly in understanding the content of the reading passage in the questions. However, after successfully understanding the overall storyline, student J did not appear to experience any significant obstacles in completing the questions. The observation shows that student J is able to achieve and fulfill NLI 2 and NLI 3. The achievement of these indicators can be seen from student J's success in interpreting mathematical information and using mathematical reasoning to solve the problems given.

Figure 3. Completion of MSP 2 students J

Based on the analysis of student J's answers on MSP 2, it can be seen that student J was able to convert the question narrative into mathematical notation containing a combination of two flat shapes, namely a rectangle and a semicircle. The solution provided by student J was organized and structured. Student J's level of accuracy was also good, as evidenced by the absence of errors from the beginning to the end of the assignment. Student J's mathematical decision-making was also considered appropriate, starting from analyzing the combined flat shapes, then focusing on calculating the outer sides, which were an important part of the question. Although there were several challenges in the question, such as having to calculate the diameter of the semicircle and only calculating the outer part of the wall magazine (mading), student J was able to overcome these obstacles well and produce a correct and accurate answer.

Figure 4. Preliminary conclusions of MSP 2 students J

The initial conclusion formulated by student J demonstrates a proper understanding of the information provided in the question, including the use of appropriate units of length. This greatly facilitates the calculation process in the final stage of the solution and reflects the student's ability to plan a logical and efficient strategy for solving mathematical problems.

Persegi panjang & harga pita
 Perimeter
 $= 5,6m \times 10.000,00$
 $= Rp 56.000,00$
 biaya yang harus di keluarkan
 untuk pita pinggir adalah
 Rp 56.000,00

Figure 5. Final results of MSP 2 students J

In the final stage of MSP 2, student J demonstrated an excellent understanding of the storyline and context of the question. Student J's level of accuracy was also high, as evidenced by the conversion of units from centimeters to meters when calculating the cost of decorating the wall magazine. The final conclusion written by student J was also accurate and clearly represented the calculation results in accordance with the context of the problem given in the question. From the MSP 2 answers, it was found that student J achieved and fulfilled all NLI's (NLI₁, NLI₂, and NLI₃).

After completing the MSP, the researcher explored more in-depth data on Student J's numeracy literacy skills in completing the MSP by conducting an interview. The following is a dialogue between the researcher and Student J:

- PN : What was the question about?
 J : The question was about a wall magazine competition, sir. Axel and his friends wanted to make a wall magazine. The wall magazine was rectangular and semicircular in shape. We were asked to find the price of gold ribbon to decorate the edges of the wall magazine.
 PN : So what math topic was the question about?
 J : It's about the perimeter of flat shapes, sir, rectangles and semicircles.
 PN : If there are more difficult questions, for example, if I change the numbers to hundreds of thousands or more?
 J : I'm sure I can do it, sir, but it usually takes a while to understand the question.
 PN : Do you like to work on questions alone or in a group? Are you active when working in a group?
 J : I prefer working in groups, sir. When working in groups, I can talk with my friends, think together, and joke around, but I still do the work and participate actively.

The interview results indicate that student J has good proficiency in mathematics, particularly in mastering concepts. However, student J still has difficulty analyzing descriptive information, such as reading comprehension in math story problems. Student J also shows interest in using mathematical reasoning, especially when faced with problems that are considered different from those usually studied, such as in MSP. This tendency reflects that Student J often uses higher-order thinking skills in problem solving. Indirectly, working on MSP has contributed to the improvement of Student J's higher-order cognitive abilities. Student J also shows an interest in collaborative work. Student J feels more comfortable and motivated when working on tasks together. This not only supports the development of cognitive skills but also has a positive impact on students' social skills.

The results of the analysis obtained through triangulation techniques, namely combining data from tests, observations, and interviews, show that J students successfully achieved and

fulfilled all NLI's (NLI 1, NLI 2, and NLI 3). J students demonstrated proficiency in problem solving and mathematical decision making in MSP. Although Student J took a relatively longer time to examine and analyze descriptive information in the reading, this did not prevent him from completing the questions correctly and accurately. Overall, Student J has high numeracy literacy skills, especially in understanding context, managing quantitative information, and making decisions to solve problems.

Discussion

The results of the study indicate that students' numeracy literacy skills in solving mathematical word problems do not only depend on their calculation skills, but are also influenced by their understanding of the context of the problem, their logical thinking skills, their management of numerical information, and their integrated application of mathematical concepts. The findings of this study indicate that students' numeracy literacy skills in solving mathematical story problems vary greatly, depending on how students respond to the problems presented.

One pattern that is clearly visible is the importance of understanding the context of the problem, as indicated in NLI 1, namely the ability to analyze the information presented as the basis for the solution process. Even if they have numerical or conceptual abilities, when students are unable to grasp the meaning of the problem as a whole, the results of their solutions will still be less than optimal (Wasiah et al., 2020). Proficiency in one indicator does not guarantee students' success in solving math word problems if the other indicators are not met. Numeracy literacy helps students understand how mathematics plays a role in solving everyday problems (Winarni et al., 2021). There is a close relationship between the three indicators of numeracy literacy, whereby if one indicator is not met, especially NLI 1, the problem-solving process becomes ineffective, even if the other indicators show mastery. Therefore, the completion of mathematical story problems shows a close relationship between the aspects of contextual understanding and numerical ability.

Students with high numeracy literacy abilities are able to consistently meet all three indicators and demonstrate independence in higher-level thinking and more structured problem solving. This reinforces the view that numeracy literacy is interrelated between its components. Students who demonstrate high abilities in all three numeracy literacy indicators tend to be able to think logically and systematically (Sesanti et al., 2023). Numeracy literacy includes the skills of applying number concepts and mathematical operations in everyday situations and the ability to interpret numerical information around us (Rohim, 2021). High numeracy literacy skills require attention not only to technical aspects of mathematics but also to contextual understanding, logical thinking, and the ability to develop integrated problem-solving strategies.

Students who have not successfully met the three indicators show difficulties in managing information, both narrative and numerical, contained in mathematical story problems. Numeracy literacy learning is structured contextually with various mathematical content domains through personal, socio-cultural, and scientific aspects that require students' analytical skills in problem solving (Nurrahmawati et al., 2023). The implications of these findings point to the need for a more contextual and comprehensive learning approach, especially in mathematics education. Mathematics education in elementary schools needs to be designed not only to

develop numeracy skills, but also the ability to understand context, think critically, and relate mathematics to everyday life.

Low student achievement in numeracy literacy indicators can be a signal for teachers to review the strategies used in learning and matters related to its implementation, including cognitive abilities, constructivism, and students' social learning abilities. Lev Vygotsky's cognitive theory states that children's cognitive development must be adjusted to their level of development, which can be aided by language and children's interaction with their environment (Wardani et al., 2023). Learning to write, read, and count also requires guidance from adults or experts. Experts and language contribute greatly to children's cognitive development (Boiliu, 2022). For example, a teacher says a dozen glasses. In the students' view, a dozen is an abstract concept, so they will ask, "How many glasses are in a dozen?" Of course, the answer refers to a number. Therefore, students need a companion who is able to explain and develop their understanding of a concept.

Constructivism focuses on students as active learners (Suryandari, 2023). Students are no longer positioned as passive recipients of information, but as subjects who actively construct knowledge through exploration, direct experience, and social interaction. Constructivism theory views that each student has different speeds, learning styles, and interests (Fitriyana & Dewi Nirmala, 2024). In practice, this approach requires teachers to design a learning environment that allows students to construct their own meaning, based on their prior knowledge and interactions with new material. Learning is often carried out in social contexts such as student collaboration, group discussions, and cooperative learning. Albert Bandura states that humans learn through selective observation and changes in their own behavior and that of others (Lesilolo, 2019). In the context of literacy, students can observe how others read and understand texts or information. Similarly, in the context of numeracy, students can also observe how others solve mathematical problems. From the many observations made by students, they can sort, select, and analyze various ways and abilities of others in dealing with and solving problems related to mathematical concepts.

A positive learning environment greatly supports student learning and growth (Habsy et al., 2023). A classroom environment that encourages active observation, reflection, and imitation of productive behavior will support the formation of conceptual understanding and problem-solving skills in elementary school students. Teachers need to create a classroom atmosphere that encourages students to participate and share their thoughts without fear of making mistakes (Permatasari et al., 2023). Numeracy literacy learning is not just about teaching numbers and mathematical operations, but also includes conceptual understanding, application in real contexts, and critical thinking skills.

The learning model used also influences the success of the learning itself (Permatasari et al., 2023). This is especially true in numeracy literacy learning, for example, the contextual learning model. The contextual learning model or Contextual Teaching and Learning (CTL) is a learning strategy that fully involves students in connecting the material they are learning with real-life situations (Kusumasari et al., 2020). This model links mathematical material to real-life situations, encouraging students to apply it in their daily lives and social interactions. For example, when teaching fractions, teachers can use examples from buying and selling, exchanging money, and even applying discounts. Through this learning model, students not only understand the concept in theory but are also able to apply it in real life.

Regarding evaluation, teachers need to develop assessment instruments that not only measure arithmetic skills but also the ability to understand and interpret problems in complex contexts. One evaluation tool that teachers can use to measure and improve students' numeracy skills is through math story problems. Through mathematical story problems, students are able to understand and apply mathematical concepts in their daily lives (Amalia et al., 2019). The advantage of math story problems for researchers is that they serve as a testing tool to measure students' numeracy literacy skills because the concepts presented in math story problems can be applied to real-life situations. Math story problems are useful for measuring students' abilities, whether in terms of their understanding of the material or their mastery of mathematical concepts, especially their numeracy literacy skills.

Conclusion

The numeracy literacy skills of fifth-grade elementary school students are in the good category in solving mathematical word problems, although there are some errors in their solutions. The purpose of this study is to describe the numeracy literacy skills of fifth-grade elementary school students as measured from the context of students in solving mathematical word problems. The results of this study are based on three indicators of numeracy literacy skills (NLI 1, NLI 2, and NLI 3). In NLI 1, only student J met this indicator, while student S did not meet it because there were several misunderstandings in analyzing the instructions and reading the MSP. In NLI 2, students S and J met this indicator because of their high mathematical abilities. Students S and J met NLI 3 because they could make decisions from the interpretation of the answers in solving the MSP. Students need high numeracy literacy skills to help them solve real-life mathematical problems, which can be trained by giving them mathematical story problems. Several parties, especially teachers, need to take action to make developments in the field of education, especially in the scope of mathematics, particularly in improving students' numeracy literacy skills through several actions such as improving the quality of teaching, methods, and learning models for mathematics learning.

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Authors' Note

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