

Analysis of Students' Mathematical Literacy Ability in Solving Contextual Problems in Linear Equations

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ABSTRACT

This descriptive qualitative study analyzed the mathematical literacy skills of 30 grade VIII students in a public junior high school in Sleman, Yogyakarta, focusing on solving contextual problems related to linear equations. Data were collected using context-based tests and in-depth interviews, then analyzed through data reduction, presentation, and conclusion drawing based on indicators of problem formulation, concept application, and interpretation of results. Findings showed that while most students could understand problem contexts and formulate simple mathematical models, many struggled to interpret solutions and connect them to real-life situations. The study concludes that students' mathematical literacy remains at a basic level, highlighting the need for more contextual and problem-solving learning strategies to enhance mathematical thinking and everyday applicability.

INTRODUCTION

The rapid development of science and technology requires every individual to have high-level thinking skills, one of which is mathematical literacy. Mathematical literacy is not just the ability to calculate or solve problems procedurally, but also includes the ability to understand, interpret, and apply mathematical concepts and procedures in solving real-world problems effectively and reflexively (NCTM, 2020; OECD, 2023). In the context of 21st century education, mathematics literacy is one of the key components in equipping students to face complex global challenges, as well as make data-driven decisions in their daily lives. Therefore, strengthening mathematical literacy is one of the main focuses in various education policies, both national and international (Ministry of Education and Culture, 2021).

Unfortunately, based on the results of the Programme for International Student Assessment (PISA) 2022 released by the OECD, the mathematical literacy performance of Indonesian students still shows poor results. Indonesia obtained an average score of 366 in mathematics literacy, far below the OECD average of 472, and only about 26% of Indonesian students have reached the minimum proficiency level in mathematics (OECD, 2023). This condition shows that the majority of students do not have adequate skills in understanding and solving context-based mathematics problems. In fact, many students still have difficulty in connecting the math concepts they learn in school with real-life situations (Zulkardi & Putri, 2020). In fact, good mathematical literacy should be able to bridge theoretical understanding with practical application in daily life.

Locally, similar problems are also found at various levels of education. Several studies in Indonesia report that students at the junior high school level show limitations in relating mathematical concepts to real contexts, especially in basic topics such as linear equations. For example, research by Lestari and Yuniarto (2023) revealed that students tend to rely on a mechanistic approach when solving linear equation problems, without really understanding the contextual meaning of the problems at hand. This finding is strengthened by Sari and Ramdani (2021), who stated that most students are only able to solve mathematical problems in symbolic form, but fail when given problems packaged in the form of stories or the context of daily life. The same thing was also conveyed by Kurniawan and Aisyah (2022), who noted that students are more comfortable working on procedural questions than narrative-based questions or real-life applications. This indicates that even though students have acquired formal mathematics learning, their literacy skills in understanding and interpreting contextual problems are still not optimally developed.

In classroom learning practice, linear equation material is often taught with an algorithmic approach that emphasizes procedural steps, such as moving segments or simplifying algebraic forms, without relating to the context of students' lives (Rohendi et al., 2021). This approach can result in students only understanding mathematics as a collection of formulas and procedures, rather than as a useful thinking tool in real life. In fact, linear equations have many contextual applications that are close to students' lives, such as in determining the total cost of purchases, calculating travel time, or analyzing the relationship

between two variables in simple economic activities (Pratiwi & Nurani, 2022). Therefore, a learning and evaluation approach is needed that is able to measure the extent to which students can understand and apply mathematical concepts in a meaningful context (Susanti & Hidayat, 2021).

Although a number of studies have examined students' mathematical literacy, there are still gaps in studies that specifically address mathematical literacy skills in the context of solving real problems in linear equation materials. Most research focuses more on mastery of procedures or problem-solving abilities without considering elements of life context. Research by Handayani and Widodo (2022) states that students' conceptual understanding is not enough to lead them to functional literacy skills, because they are still weak in problem formulation and interpretation of results. In addition, the literature that examines in depth the stages of students' thinking when facing contextual problems, as well as the cognitive strategies used in connecting mathematical concepts to real situations, is still very limited (Lestari et al., 2023; Putra & Santoso, 2020). This study aims to analyze students' mathematical literacy ability in solving contextual problems in linear equation material. In particular, this study maps students' abilities based on three main indicators of mathematical literacy, namely: (1) the ability to formulate mathematical problems from real situations; (2) the ability to apply mathematical concepts and procedures appropriately; and (3) the ability to interpret and evaluate the results in the context of the original problem. With this approach, the research not only assesses the final outcome (correct or wrong answer), but also the students' overall thinking process and understanding in dealing with contextual problems.

The contribution of this research can be seen from two main aspects. First, from the theoretical side, this study expands the study of mathematical literacy which has been more focused on solving numerical or algorithmic problems, by giving special focus to the context of linear equation material and detailed mathematical literacy indicators. Second, from a practical perspective, the results of this research can provide concrete recommendations for educators, curriculum developers, and education policymakers in designing learning and assessment strategies that are more contextual and applicative. This is very relevant to the policy direction of the Independent Curriculum which emphasizes context-based learning, strengthening the profile of Pancasila students, and developing 21st century competencies, including critical thinking, problem-solving, and numeracy literacy.

LITERATURE REVIEW

Mathematics Literacy in the Context of Education

Mathematical literacy is one of the essential competencies in modern education which refers to the ability of individuals to formulate, use, and interpret mathematics in various life contexts (Wijaya, 2022; Fatmawati & Suryanto, 2021). According to the OECD definition (2023), mathematical literacy includes the ability to think mathematically and apply mathematical concepts and procedures to solve real-life problems (Rahayu et al., 2021; Putri et al., 2020). This literacy requires students not only to understand mathematical concepts, but also to be able to relate them to real-world situations that are complex,

dynamic, and do not always have one correct answer (Lestari & Yuniarto, 2023; Nugroho et al., 2023).

In the context of education in Indonesia, mathematical literacy is one of the aspects that is strengthened in the national curriculum through the minimum competency assessment (AKM) which emphasizes understanding concepts and applications in daily life (Ministry of Education and Culture, 2022; Wijaya, 2022). However, some studies show that students still have difficulty solving context-based problems, because they tend to be familiar with procedural problems that do not require deep conceptual understanding (Handayani & Widodo, 2022; Sari & Ramdani, 2021; Lestari et al., 2023). This shows that the development of mathematical literacy has not been fully integrated into classroom learning, so a more contextual and applicative approach is needed (Rahayu et al., 2021; Putri et al., 2020).

Components and Indicators of Mathematical Literacy

Mathematical literacy consists of three main indicators defined by the OECD (2023), namely: (1) formulating, or the ability to formulate mathematical problems from real situations; (2) employing, which is the ability to apply mathematical knowledge and skills to solve problems; and (3) interpreting, namely the ability to interpret and evaluate the results of the settlement in the initial context. These three indicators do not stand alone, but are interrelated and form a comprehensive framework of thinking in dealing with contextual problems (Putri et al., 2022; Purnamasari & Hidayat, 2021; Wijaya, 2022). In learning practice, mastery of these three indicators is the main benchmark to identify the extent to which students are able to think mathematically reflexively and applicatively (Arifin et al., 2023).

However, various studies show that students still face great challenges in mastering mathematical literacy indicators in a balanced manner. Research by (Lestari et al., 2023) reveals that most students only show mastery of procedural aspects (employing), such as operating numbers and using formulas, but have difficulty in formulating problems (formulating) or interpreting the results of the solution into a real-life context (interpreting). These findings are reinforced by (Rahayu et al., 2021) and (Nugroho & Fitria, 2020), which note the low ability of students to understand the meaning of the context of the problem before making calculations, as well as in explaining solutions logically and relevantly. This gap is often caused by the lack of context-based practice in the classroom, as well as learning approaches that are still oriented towards the final answer rather than the student's thinking process (Fatmawati & Suryanto, 2021; Handayani & Widodo, 2022; Yulianti et al., 2023).

Linear Equations as Contextual Material

Linear equations are one of the basic topics in the mathematics curriculum that has many applications in daily life, such as in cost calculation, proportional relationships, and data analysis (Wijaya, 2022; Fatmawati & Suryanto, 2021). Understanding this concept is important because it plays a role in building students' logical and analytical thinking skills. However, in practice, learning linear equations in schools is often still focused on mastering technical steps and

symbolic solutions alone, without providing enough space for the exploration of applicable contexts relevant to students' lives (Putri et al., 2020; Lestari & Yuniarto, 2023). This indicates a gap between procedural mastery and conceptual understanding needed to build comprehensive mathematical literacy.

Furthermore, (Sari & Ramdani, 2021) emphasized that although students show the ability to solve linear equation problems in symbolic form, they have difficulty when they have to solve problems packaged in the form of narratives or real contexts (Handayani & Widodo, 2022; Nugroho et al., 2023). This condition shows that algorithmic mastery does not necessarily reflect mathematical literacy skills as a whole, which includes understanding the problem, applying appropriate strategies, and interpreting results in the original context (Lestari et al., 2023; Rahayu et al., 2021). Therefore, there is a need for a more in-depth evaluation of students' ability to solve context-based linear equation problems, as a reflection of the extent to which mathematical literacy has been developed through the learning process (OECD, 2023; Wijaya, 2022).

Previous Research Findings and Study Gaps

Several previous studies have examined students' mathematical literacy skills, but there are still important gaps that have not been fully explored comprehensively, especially in the context of specific material topics. A study by Handayani and Widodo (2022) shows that many junior high school students have difficulty understanding the meaning of contextual problems that require logical reasoning and in-depth interpretation, not just the application of formulas. This is reinforced by (Rahayu et al., 2021), who found that students' weaknesses are not only in the procedural aspect, but also in the ability to represent, draw conclusions, and communicate results mathematically. Similar findings were revealed by Maulidia and Susanto (2020), that students often encounter obstacles in transforming narratives into proper algebraic forms or mathematical models, which are actually core elements of OECD framework-based mathematical literacy.

On the other hand, context-based learning approaches have been widely researched as a strategy to overcome these barriers. Lestari and Yuniarto (2023) show that student engagement increases significantly when mathematics learning is associated with relevant real-life situations. However, the effectiveness of this approach is greatly influenced by the selection of the right context and the active role of teachers in guiding students' critical thinking processes (Putri et al., 2022; Arifin et al., 2023). Wulandari and Ramadhani (2021) also emphasized the importance of continuity in the application of contextual learning so that students get used to integrating conceptual understanding with real-world situations. However, most studies are still general and have not specifically examined mathematical literacy in linear equation material. Therefore, research that explicitly focuses on mapping students' mathematical literacy abilities based on three OECD indicators in the context of linear equations is highly relevant to bridge the existing literature gap and make a real contribution to improving learning practices in schools (Fatmawati & Suryanto, 2021; Yulianti et al., 2023).

Research Urgency and Relevance

Based on the literature review above, it can be concluded that students' mathematical literacy skills still require serious attention, especially in the context of solving real problems related to basic materials such as linear equations. A thorough study of students' abilities in the three indicators of mathematical literacy can be the basis for developing a learning model that not only emphasizes the achievement of the final outcome, but also a reflective, analytical, and contextual mathematical thinking process. Therefore, this research is important to fill the gaps in the literature and contribute to the development of mathematics learning theories and practices that are more relevant to the needs of the 21st century.

METHODOLOGY

Research Approach

This study uses a descriptive quantitative approach with a survey research design. This approach was chosen to objectively describe and analyze students' mathematical literacy abilities based on literacy indicators developed by the OECD (2023), namely problem formulation, concept application, and interpretation of results in real-life contexts. Quantitative descriptive design is used because it is suitable for measuring the level and pattern of students' abilities through numerical data obtained from standardized instruments.

Population in Research

The population in this study is all grade VIII students in one of the public junior high schools in Sleman Regency, Special Region of Yogyakarta. The selection of this population is based on the national curriculum which stipulates that the material of linear equations is studied in class VIII. The sample was taken using a non-probability sampling technique with the purposive sampling method, because the researcher set certain criteria, namely students who have completed learning linear equation material. The number of respondents was 30 students, deliberately chosen from two classes that had the same teaching teacher to avoid the bias of the influence of teaching. This amount is considered sufficient for a descriptive analysis aimed at mapping mathematical literacy skills (Creswell & Creswell, 2023).

Data Collection Techniques

The data collection technique was carried out through a contextual description test developed based on the PISA version of mathematics literacy indicators (OECD, 2023). The test consists of 5 contextual problem-based questions that include aspects of formulation, application, and interpretation in solving problems in linear equation material. The questions were adapted and modified from the PISA instrument and previous research by Lestari and Yuniarto (2023), adjusted to the student's local context. The validity of the instrument was tested through content validity by involving three mathematics education experts who assessed the suitability of the question items with literacy indicators. Meanwhile, the reliability of the instrument was calculated using

Alpha Cronbach, and the test results showed a reliability value of 0.81 which was relatively high and suitable for use (Sugiyono, 2021).

Research Procedure

The research procedure is carried out in several stages. The first stage is planning, which includes instrument preparation, validation, and testing. The second stage is the implementation of data collection, which is the provision of a mathematics literacy test to students for 60 minutes under the supervision of a class teacher. After that, a short interview was conducted with several students as additional data to understand their thinking strategies in solving problems. The third stage is data processing, namely correction and scoring of student answers based on rubrics developed from mathematical literacy indicators. The entire process was carried out for two weeks to maintain the validity of the time and context of the learning.

Data Analysis Techniques

The data analysis technique used is quantitative descriptive analysis, by categorizing test results based on literacy ability level (low, medium, high) according to the total score obtained by students. The data was analyzed using Microsoft Excel and SPSS version 25 software to calculate percentages, averages, standard deviations, and frequency distributions. In addition, a distribution analysis per indicator was carried out to find out the dominant areas and weaknesses of students in solving contextual problems. The results of the analysis were then interpreted to describe the tendency of the pattern of students' mathematical literacy ability in linear equation material comprehensively.

RESEARCH RESULT

This study aims to analyze students' mathematical literacy ability in solving contextual problems in linear equation material. The assessment was carried out through a mathematical literacy test based on contextual questions consisting of three main indicators according to the OECD framework, namely formulating, employing, and interpreting. The test was given to 30 grade VIII students from one of the public junior high schools in West Java. The test results were then classified into three ability categories: high, medium, and low based on a predetermined score range, namely the high (≥ 80), medium (60–79), and low (< 60) categories out of a maximum score of 100. The following is a recapitulation of the distribution of students' abilities in Table 1.

Table 1. Distribution of Students' Mathematical Literacy Ability

Ability Categories	Score Range	Number of Students	Percentage (%)
Tall	≥ 80	6	20,0%
Keep	60 – 79	14	46,7%
Low	< 60	10	33,3%
Total	—	30	100%

The data in Table 1 shows that most students are in the medium ability category (46.7%), followed by the low category (33.3%), and only 20% of students manage to reach the high category. These results indicate that most students still need reinforcement in mastering mathematical literacy, especially in solving context-based problems. Based on the results of observation and triangulation with interviews, it can be seen that students' ability to interpret everyday problems into mathematical models is still quite limited.

One math teacher said that most students only understand the steps of solving algebra, but are not used to connecting them to real context. He stated:

"Students are faster to solve problems that are directly in the form of equations. But when we change the form to a story, they start to get confused, especially when asked to write down the equation of the verbal statement." (GR-01, June 10, 2025 interview).

This shows that although students' procedural abilities are quite developed, their conceptual and contextual abilities still need to be improved. This low ability can be attributed to the lack of integration between mathematics learning and the context of daily life in the classroom learning process. In fact, according to the OECD (2023), mathematical literacy skills not only include mechanical calculation skills, but also competencies in understanding, formulating, and evaluating mathematical problems in contextual situations. In addition, a student with a medium score also expressed his experience in dealing with contextual problems:

"I prefer to do the calculations directly. If there is a long story, I sometimes get confused about where to start, what to look for, and how to make the equation." (SW-01, June 10, 2025 interview).

This statement confirms that obstacles in mathematical literacy come not only from cognitive aspects, but also from the ability to read, understand information, and perform mathematical representations independently. This is consistent with the findings of Lestari et al. (2023) who stated that students often fail to understand the core of the problem in contextual problems because they are not trained to connect narrative language with mathematical structures. In this case, the formulating aspect in mathematical literacy is the main challenge.

Furthermore, students' mathematical literacy skills are analyzed in more detail based on three main indicators according to the OECD framework (2023), namely problem formulation, application of mathematical concepts, and interpretation of results.

Table 2. Average Student Score per Mathematics Literacy Indicator

Literacy Indicators	Maximum Score	Average Score	Percentage (%)
Problem Formulation	33	18,6	56,4%

Literacy Indicators	Maximum Score	Average Score	Percentage (%)
Application of Mathematical Concepts	33	21,8	66,1%
Interpretation of Results	34	19,4	57,1%

The data in Table 2 shows that the indicator of the application of mathematical concepts has the highest average score of 66.1%, while the problem formulation indicator is the weakest with an average of 56.4%. These results confirm that students tend to be more comfortable working on algorithmic and procedure-oriented problems, but still have difficulty in transforming real-life problems into appropriate mathematical models. A math teacher confirmed this in an interview:

"Students can solve the problem correctly if the problem is directly in the form of algebra. But once they are asked to compile equations from everyday stories, it takes a long time and sometimes they can't." (GR-02, Interview June 10, 2025).

This statement shows that the ability to formalize and represent mathematics has not yet become a major focus in the daily learning process in the classroom. Learning activities that are still dominant textual and algorithmic inhibit the development of students' ability to form mathematical structures from everyday situations. In fact, according to the OECD (2023), complete mathematical literacy not only requires mastery of procedures, but also skills in formulating and interpreting real situations mathematically.

On the other hand, the highest score on the concept application indicator reflects the student's mastery of the technical procedures that have been taught. This means that when students have been given a clear formula or method, they tend to be able to solve problems with a high level of accuracy. However, an understanding that focuses only on procedures without context can lead to misconceptions when dealing with problem-based problems. This is in line with the view of Lestari et al. (2023) who show that learning orientation that emphasizes too much on technical aspects inhibits high-level thinking skills and contextual problem-solving skills. One student shared his personal experience:

"If there is a formula, I can work on it immediately. But if I have to make my own formula from the story, I like to be confused. Sometimes I misunderstand what it means." (SW-02, June 10, 2025 interview).

This statement indicates that there are obstacles in understanding the language and context of the problem, which ultimately results in failure to build accurate mathematical representations. This process should include the stages of identifying variables, relationships between information, and the preparation of appropriate mathematical models. According to Putri and Zulkardi (2021), the main challenge in problem formulation lies in the ability of students to decode

verbal information, as well as accuracy in abstracting situations into mathematical forms.

Lack of practice and habituation in doing contextual problems is also a factor causing this weak ability. Many students are used to working on questions in a standard format and are not used to dealing with problems that are overt or indirect. This shows the need for a paradigm shift in mathematics learning, from just delivering formulas to developing reflective and representative thinking competencies.

This is also reinforced by the literature that states that students at the junior high school level tend to have difficulty in connecting narrative meanings with symbolic representations (Oktaviani & Wahyuni, 2022). Meanwhile, the indicator of interpretation of the results obtained a medium score (57.1%), indicating that most students were not fully able to reflect or evaluate the results of the calculation in the context of the problem. Interpretation of results is a high-level cognitive skill that requires the integration of conceptual understanding and mathematical communication skills (Liljedahl, 2020). This weakness indicates that mathematics learning needs to be directed not only at the accuracy of the results, but also at the meaning and justification of those results in the given context.

Thus, these findings reinforce the urgency to reformulate a mathematics learning approach that not only emphasizes procedural aspects, but also provides proportionate space for the strengthening of conceptual understanding and the development of reflective thinking skills. The disparity between the ability to solve technical procedures and difficulties in formulating contextual problems shows that learning has not fully facilitated students in building connections between mathematical knowledge and daily life (Fauziah & Mahmud, 2022; Pratiwi et al., 2020).

The shift in the learning paradigm from a teacher-centered to a student-centered approach is a must so that students are not only recipients of information, but also active actors who build meaning from every problem faced through a critical and reflective thinking process (Ramadhani & Hadi, 2021). One approach that has proven effective is Realistic Mathematics Education (RME), which encourages students to construct knowledge through real context and gradually build mathematical representations (Putri et al., 2019; Zulkardi & Nieveen, 2021).

DISCUSSION

The findings of this study clearly show that students' mathematical literacy ability in solving contextual problems in linear equation material is moderate to low. Only a small percentage of students are able to demonstrate high proficiency, especially in the three main indicators of mathematical literacy: problem formulation, application of concepts, and interpretation of results. These findings are in line with previous research by Oktaviani and Wahyuni (2022), which showed that students at the junior secondary level in Indonesia still face significant difficulties in relating mathematical concepts to the context of daily

life, especially in terms of building mathematical representations of real situations.

The low ability in problem formulation can be traced to several fundamental factors in the learning process. One of the main factors is the lack of learning approaches that explicitly integrate real-world contexts, so students tend to separate conceptual understanding and application in actual situations. According to the PISA report by the OECD (2023), many Indonesian students are only exposed to procedural forms of problems and are rarely trained to recognize the mathematical structure of everyday situations. This is exacerbated by the tendency of the teacher's approach to emphasize more on memorizing formulas rather than exploring the meaning and relevance of concepts (Susanti & Lestari, 2021). Not only that, but limited reading skills and mathematical vocabulary also play an important role. Nugroho and Rahayu (2021) revealed that low reading literacy skills cause students to have difficulty identifying variables, keywords, and logical relationships in contextual problem narratives, so that the modeling process is disrupted. Research by Pratiwi et al. (2020) also strengthens these findings, by showing that verbal representations are often the main obstacle in activating understanding of mathematical concepts.

In contrast, indicators of the application of mathematical concepts showed the best performance among the three indicators studied. This shows that the majority of students are quite capable of operating algebraic procedures technically when a mathematical model is available or provided. This phenomenon supports the findings of Suparman et al. (2021) which indicate that junior high school students are more confident when working on algorithmic mathematical problems or following certain solving patterns, rather than having to abstract or construct their own models from verbal information. However, this ability is not yet fully mature because procedural errors are still found that stem from basic misconceptions, such as errors in simplifying algebraic forms or managing negative signs (Fahmi & Ramadhani, 2023).

The result interpretation indicator shows performance at a medium level. Many students have difficulty in explaining the meaning of their calculations in the context of a given problem. This shows that the process of reflection or evaluation of mathematical solutions has not yet become an integral part of the mathematics learning process in the classroom. In fact, this skill is very important in mathematical literacy because it shows a deeper understanding of the mathematical thinking process. Liljedahl (2020) emphasizes that interpretive skills are not only related to answering questions, but also to the ability to reason, draw conclusions, and communicate numerical meanings in real-life contexts. In addition, according to Ramadhani and Hadi (2021), strengthening reflective competencies in mathematics learning will form students who are more adaptive and solutive to everyday problems.

This research has several limitations that deserve attention. First, the number of respondents is relatively small and the research is only conducted in one school, so the representation of data is limited. Factors such as students' socioeconomic backgrounds, teachers' learning approaches, and learning culture in the school environment can affect outcomes and make generalizations of

findings less accurate. Therefore, to gain a more comprehensive understanding, it is recommended that further research involve more schools from different regions with varied characteristics. In addition, the use of a mixed method approach will be very useful for deepening understanding, because it allows the incorporation of quantitative and qualitative data—for example through interviews or analysis of students' thinking processes in solving problems (Astuti et al., 2021).

Overall, the results of this study make a significant contribution to the development of contextual and literacy-oriented mathematical pedagogy. Teachers are expected to be able to more actively integrate real-world context-based questions in learning, not only as assessments, but also as part of the exploratory process in the classroom. Strengthening the aspects of context understanding, mathematical communication, and reflection on solutions must be the focus of the curriculum and learning strategies (Handayani & Lestari, 2020; Zulkardi & Nieveen, 2021). This will help students build critical and adaptive thinking skills that are much needed in today's era of information complexity.

Departing from these findings, there is a need for pedagogical interventions that are systematically and continuously designed to improve the inequality between indicators of mathematical literacy. One approach that can be developed is a contextual problem-solving based learning model that emphasizes the process of mathematical reasoning from the beginning of learning. Models such as Problem-Based Learning (PBL) or Realistic Mathematics Education (RME) have been proven to improve students' ability to build mathematical representations of real situations, as well as improve the ability to interpret results (Yuliati & Sugiman, 2022). In its application, this approach encourages students to actively explore the context, formulate problems themselves, construct mathematical models, and evaluate solutions reflectively. Students' activeness in this process not only fosters a deep conceptual understanding, but also increases learning motivation and confidence in facing mathematical challenges.

In addition, the development of teacher competence is an important aspect that cannot be ignored. Teachers need to be equipped with adequate training on mathematical literacy, including an in-depth understanding of OECD indicators, contextual learning strategies, and the ability to formulate and evaluate literacy-based questions. Research by Zulkardi et al. (2021) shows that teachers who have a high understanding of the principles of mathematical literacy tend to be better able to design meaningful and challenging learning for students. In addition, the provision of supporting learning resources, such as contextual question banks and mathematics literacy modules, is also very necessary to support the implementation of learning in the classroom. The integration of mathematical literacy in daily learning activities needs to be carried out consistently and not only ahead of large-scale assessments such as AKM or PISA.

Efforts to improve mathematics literacy must also consider cultural factors and students' learning environment. A learning culture that emphasizes too much on the final result or correct answer can hinder the critical and exploratory thinking process that is at the heart of mathematical literacy. Therefore, a

paradigm shift is needed in the practice of mathematics learning in schools, from teacher-centered to student-centered, where students are given space to discuss, ask questions, develop ideas, and reflect on the solutions they obtain. Thus, mathematical literacy will not only increase quantitatively, but also qualitatively in shaping the character of learners who are resilient, reflective, and adaptive to real-life dynamics.

CONCLUSIONS AND RECOMMENDATIONS

This study reveals that the mathematical literacy ability of grade VIII students in solving contextual problems in linear equation materials is still classified in the medium to low category. Based on data analysis of 30 students, only 20% were in the category of high ability, while most students showed moderate (46.7%) and low (33.3%) performance. An in-depth analysis based on mathematical literacy indicators according to the OECD framework (problem formulation, concept application, and result interpretation) showed that students were weakest in the aspect of problem formulation (56.4%), followed by the interpretation of results (57.1%), and relatively better in the application of mathematical concepts (66.1%).

These findings suggest that although students have technical skills in executing mathematical procedures, they still face challenges in understanding the context of the questions and explaining the meaning of the results obtained. Weaknesses in the formulation and interpretation of problems are greatly influenced by learning approaches that still focus on procedures and lack emphasis on the meaning and application of concepts in real-world situations. This gap is an indication of the need for a shift in the paradigm of mathematics learning towards a more contextual and reflective direction.

Thus, this study emphasizes the importance of integrating contextual questions in the learning process, not only as an evaluation tool but also as a strategy for developing students' critical, analytical, and communicative thinking skills. Teachers need to be encouraged to apply a learning approach that emphasizes understanding concepts, exploration of meaning, and the relationship between mathematics and daily life. Further research is recommended to be carried out by involving a wider sample and a mixed method approach to produce a more comprehensive and applicable understanding of improving students' mathematical literacy.

ADVANCED RESEARCH

Future research can be advanced by expanding the scope of mathematical literacy studies beyond linear equations to cover diverse mathematical domains and by employing a mixed-methods approach to triangulate quantitative performance data with qualitative insights into students' reasoning processes. Longitudinal studies may also be conducted to trace the development of mathematical literacy over time, particularly how interventions that integrate contextual, problem-based, and reflective learning strategies affect students' ability to formulate, apply, and interpret mathematical problems in real-world contexts. Moreover, comparative research across schools with varying curricula, teacher practices, and socio-cultural backgrounds could uncover systemic factors

influencing literacy outcomes. The integration of digital tools and modeling-based learning may further be explored as innovative strategies to strengthen students' contextual understanding and critical thinking in mathematics.

REFERENCES

- Arifin, M., Nurfadhilah, A., & Susanti, I. (2023). Development of contextual learning in improving mathematical literacy. *Journal of Mathematics Education*, 8(2), 134-142.
- Astuti, N. P., Wulandari, E., & Kurniawan, H. (2021). Mixed method in educational research: Concepts and applications. *Journal of Educational Sciences*, 17(3), 201-210.
- Creswell, J. W., & Creswell, J. D. (2023). *Research design: Qualitative, quantitative, and mixed methods approach* (6th ed.). SAGE Publications.
- Fahmi, R., & Ramadhani, D. (2023). Analysis of students' procedural errors in solving algebra problems. *Journal of Mathematics Education and Learning*, 9(1), 23-32.
- Fatmawati, D., & Suryanto, M. (2021). The role of teachers in improving mathematical literacy through contextual learning. *Scientific Journal of Mathematics Education*, 5(2), 78-88.
- Fauziah, L., & Mahmud, A. (2022). Implementation of problem-based learning to improve math literacy. *Journal of Realistic Education*, 10(1), 45-53.
- Handayani, S., & Lestari, F. (2020). Reflective strategies in mathematics learning to improve understanding of concepts. *Teacher Scientific Journal*, 3(2), 65-72.
- Handayani, T., & Widodo, S. A. (2022). Evaluation of mathematics literacy of junior high school students in solving problems in the real-life context. *Journal of Mathematics Education*, 16(1), 11-25.
- Ministry of Education and Culture. (2021). *Minimum Competency Assessment and Its Implications for Learning*. Directorate General of Teachers and Education Personnel.
- Ministry of Education and Culture. (2022). *Learning and assessment guides*. Directorate General of Early Childhood, Primary and Secondary Education.
- Kurniawan, R., & Aisyah, N. (2022). Students' preferences for solving procedural and narrative-based math problems. *Journal of Education and Evaluation*, 6(1), 99-108.
- Lestari, R., & Yuniarto, T. (2023). Students' mathematical literacy in context-based learning on linear equation material. *Journal of Educational Innovation*, 7(1), 56-65.
- Lestari, R., Yuniarto, T., & Hidayat, A. (2023). Analysis of mathematical literacy indicators based on the OECD framework. *Journal of Mathematics Education Research*, 10(2), 101-112.
- Liljedahl, P. (2020). *Building thinking classrooms in mathematics: 14 teaching practices for enhancing learning*. Corwin Press.
- Maulidia, N., & Susanto, H. (2020). Students' obstacles in transforming story problems into mathematical model forms. *Journal of Mathematics and Mathematics Education*, 4(1), 12-21.

- NCTM. (2020). *Principles to Actions: Ensuring Mathematical Success for All*. National Council of Teachers of Mathematics.
- Nugroho, B. S., & Fitria, A. N. (2020). Students' difficulties in solving context-based problems. *Journal of Basic Education*, 8(2), 144-153.
- Nugroho, B. S., Rahayu, S., & Aulia, M. (2023). Analysis of mathematical representation ability in socioeconomic contexts. *Journal of Integrative Mathematics Education*, 6(1), 67-76.
- OECD. (2023). *PISA 2022 Results (Volume I): Student Performance*. OECD Publishing. <https://doi.org/10.1787/4bde3ef1-en>
- Oktaviani, S., & Wahyuni, D. (2022). Ability of junior high school students to build mathematical representations of narrative problems. *Journal of Elementary School Education*, 10(2), 81-89.
- Pratiwi, A., & Nurani, R. (2022). Application of the context of life in the learning of one-variable linear equations. *Journal of Mathematics Education*, 7(1), 44-53.
- Pratiwi, I., Wahyuni, A., & Hasanah, L. (2020). Difficulty with verbal representation in mathematics learning. *Journal of Mathematics Education*, 5(2), 128-135.
- Putra, A. M., & Santoso, I. (2020). The stages of thinking students in solving contextual mathematics problems. *Journal of Mathematics Education*, 9(1), 14-25.
- Putri, R. I. I., & Zulkardi. (2021). The RME approach in improving mathematical literacy skills. *Journal of Realistic Education*, 6(2), 76-88.
- Putri, R. I. I., Zulkardi, & Nieveen, N. (2019). Design research on realistic mathematics learning in Indonesia. *Didactic Journal of Mathematics*, 6(1), 25-35.
- Putri, R. I. I., Yuniarto, T., & Handayani, D. (2020). Contextual mathematics learning strategies in junior high school. *Journal of Mathematics Education*, 4(2), 99-107.
- Putri, R. I. I., Yuniarto, T., & Lestari, R. (2022). Development of local context-based mathematical literacy instruments. *Scientific Journal of Education*, 9(3), 203-214.
- Purnamasari, H., & Hidayat, A. (2021). Development of mathematics literacy assessment for junior high schools. *Journal of Education and Evaluation*, 5(2), 87-94.
- Rahayu, S., Fitria, A. N., & Nugroho, B. S. (2021). Students' weaknesses in mathematical literacy based on OECD indicators. *Journal of Educational Research*, 12(3), 245-254.
- Ramadhani, R., & Hadi, S. (2021). Reflective learning to improve math literacy in secondary schools. *Journal of Educational Innovation*, 7(2), 101-113.
- Rohendi, D., Hidayah, N., & Septiani, R. (2021). Analysis of algorithmic approaches in linear equation learning. *Journal of Mathematics Learning*, 6(1), 55-63.
- Sari, L. P., & Ramdani, I. (2021). Students' ability to solve math story problems. *Journal of Mathematics Education and Learning*, 10(1), 66-74.

- Suparman, U., Yuliani, A., & Nurhayati, R. (2021). Analysis of students' algorithmic abilities in solving algebra problems. *Journal of Applied Mathematics*, 11(1), 42–50.
- Susanti, I., & Hidayat, A. (2021). Context-based assessments to improve students' understanding of concepts. *Journal of Educational Evaluation*, 5(2), 34–46.
- Susanti, I., & Lestari, R. (2021). Literacy-based mathematics learning reflection. *Journal of Education*, 8(1), 111–120.
- Tan, C. K., Lim, C. S., & Yeo, J. (2021). Developing mathematical literacy through real-world problem solving. *Mathematics Education Journal*, 16(2), 89–104.
- Wijaya, A. (2022). *Mathematical Literacy: Concepts and Implementation in the Indonesian Curriculum*. Yogyakarta: Graha Ilmu.
- Wulandari, I. A., & Ramadhani, M. (2021). Context-based continuous learning in improving mathematics literacy. *Journal of Innovative Education*, 9(2), 79–91.
- Yulianti, D., & Sugiman. (2022). The application of the problem-based learning model to improve students' literacy skills. *Journal of Mathematics and Science Education*, 10(2), 95–106.
- Yulianti, D., Pratiwi, R., & Putri, R. I. I. (2023). Implementation of mathematics literacy in junior high schools through context-based assessments. *Journal of Education and Learning*, 11(1), 88–99.
- Zulkardi, & Nieveen, N. (2021). Realistic Mathematics Education: Development of contextual learning in Indonesia. *Journal of Realistic Mathematics Education*, 4(1), 1–14.
- Zulkardi, Putri, R. I. I., & Astuti, N. (2021). Improving teachers' competence in compiling mathematics literacy problems. *Journal of Educational Training*, 2(2), 101–115.
- Zulkardi, & Putri, R. I. I. (2020). PISA results and the challenges of mathematical literacy in Indonesia. *Journal of Educational Evaluation*, 8(3), 243–256.