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Students' Self-efficacy in Solving Mathematical Literacy-Based Summative Assessment Problems

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Abstract

Self-efficacy is an essential skill that students must develop to excel in mathematics. This study aims to describe students' self-efficacy in solving mathematical literacy-based summative assessment problems. Conducted as qualitative descriptive research, the study employed tests and questionnaires for data collection. The sample of this study consisted of 34 male junior high school students. The data obtained were analyzed using descriptive statistical techniques. The results showed that students' self-efficacy was in the medium category with a percentage of 55.88%, and student learning outcomes based on the students' mathematical literacy-based summative assessment tests were mostly in the poor category with a percentage of 44.11%. The percentages of students who can formulate, use, and interpret mathematical concepts are 78%, 45%, and 59%, respectively. Consequently, students with high levels of self-efficacy outperform those with intermediate or low levels of mathematical literacy. Medium-level individuals demonstrated superior mathematical literacy abilities compared to students with low self-efficacy. Enhancing self-efficacy in addressing mathematical literacy-based summative assessment challenges is crucial for advancing mathematics education research, enabling educators to implement effective pedagogical strategies, and fostering students' confidence to approach complex problem-solving tasks.

Keywords: Mathematics Learning, Mathematics Literacy, Self-efficacy, Summative Assessment

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INTRODUCTION

Mathematics education plays a crucial role in preparing junior high school students to excel in international assessments like PISA by fostering structured and systematic thinking alongside cognitive and critical thinking skills (Thanheiser, 2023; Susanto et al, 2024). Developing mathematical literacy is a key educational objective, as it equips students to understand, apply, and communicate mathematical concepts effectively in real-world contexts, aligning with PISA's focus on real-life problem-solving (Meryansumayeka et al., 2021; Maslihah et al., 2020). The Program for International Student Assessment (PISA) results for reading, science, and mathematics literacy were released in December 2023, underscoring the importance of mathematical literacy. Indonesia achieved an average score of 366, ranking 70th out of 81 countries (OECD, 2023). This indicates that a significant proportion of Indonesian students still struggle with basic mathematical competencies. According to the PISA 2022 report, only around 18% of Indonesian students achieved at least proficiency level 2 in mathematics, which is considered the minimum standard for demonstrating basic skills. The majority of students scored below this level, indicating difficulties in performing simple tasks such as basic arithmetic and recognizing patterns (OECD, 2023).

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Mathematical literacy skills are crucial in forming 21st-century skills (Rivai et al., 2022; Rizki & Priatna, 2019; Sumirattana et al., 2017). Rivai et al. (2020) emphasizes that mathematical literacy fosters critical thinking and problem-solving, which are essential for adapting to technological advancements in the modern era. On the other hand, Rizki and Priatna (2019) highlight the role of mathematical literacy in enhancing decision-making processes and logical reasoning, especially in real-world contexts. These differing perspectives demonstrate that mathematical literacy plays a multifaceted role, not only in technical aspects but also in the development of strategic skills relevant to the 21st century.

The PISA mathematics framework identifies three key indicators of mathematical literacy: the ability to formulate real-world problems (*formulate*); apply concepts, facts, procedures, and mathematical reasoning (*employ*); and interpret, apply, and evaluate mathematical results (*interpret*) (OECD, 2023). It enables students to make informed judgments and decisions, equipping them to be responsible and active citizens in the twenty-first century (OECD, 2023). Through mathematical literacy, students can apply mathematical concepts in their daily activities to solve problems (Kolar & Hodnik, 2021). Ultimately, fostering these skills is crucial for preparing the next generation to navigate the complexities of the modern world, so it is important for teachers to prioritize this aspect of classroom learning.

Mathematical literacy enables students to apply mathematical concepts in solving real-life problems, which is closely tied to their self-efficacy in tackling such tasks. Lestari and Putri (2020) highlight that incorporating local contexts enhances mathematical literacy, while Miftah et al. (2021) emphasized the role of cognitive styles in shaping students' problem-solving processes. Addressing errors and misconceptions, as suggested by Mubarokah and Amir (2024), is crucial for fostering both mathematical literacy and confidence, particularly in summative assessments.

According to AlAli & Wardat (2024), mathematical literacy significantly influences students' self-efficacy. Hiller et al. (2022) emphasize that mathematical literacy not only enhances problem-solving skills and academic confidence but also positively impacts self-efficacy. Several studies have shown a strong reciprocal relationship between mathematical literacy and self-efficacy (Katranci & Şengül, 2019; Kurniawati & Mahmudi, 2019). This highlights the importance of addressing students' psychological aspects alongside improving their mathematical literacy. Self-efficacy, a key skill developed in mathematics education, reflects the belief in one's ability to manage thoughts, emotions, and actions (Aswin & Herman, 2022). For junior high school students, self-efficacy plays a vital role in motivating them to solve mathematical problems requiring literacy skills (Zakariya, 2022). Understanding students' self-efficacy helps educators identify factors that support or hinder their ability to tackle math tasks involving literacy concepts (Zakariya et al., 2022).

One of the topics studied by junior high school students is linear equations and inequalities in one variable (PLSV and PtLSV). This material is compulsory in mathematics at the junior high school level. It encompasses both abstract equations and contextual story problems. Students' ability to solve one-variable linear equations including their ability to solve mathematical problem situations by

applying various algorithms they have learned (Sibgatullin et al., 2022). Unfortunately, many junior high school students still struggle to learn algebra, leading to low self-efficacy in mastering this material. As a result, they are more likely to avoid math assignments and experience difficulties when confronted with challenges (Sugiarti & Retnawati, 2019).

The researcher's observations at a school in Yogyakarta indicate that many students tend to give up easily when encountering questions, they consider problematic, particularly in mathematics related to algebra. Ayllón, et al. (2019) note that students' self-efficacy in mathematics is heavily influenced by the involvement of teachers in the learning process. Without adequate teacher support, students often lack the confidence needed to tackle challenging subjects like algebra, leading them to avoid difficult problems. This lack of confidence is further exacerbated by anxiety, as Bergqvist (2024) explains, stating that students who perceive mathematics as difficult are more likely to experience anxiety, which lowers their self-efficacy and makes them hesitant to engage with unfamiliar problems. Additionally, Puozzo & Audrin (2021) highlight that students with low self-efficacy in mathematics tend to focus more on memorization than on understanding the underlying concepts, which leads to confusion when trying to apply the knowledge to solve problems. These combined factors contribute to students' difficulties in algebra, as they are more concerned with finding the final answer than with understanding the problem-solving process.

Previous studies have shown that students' perception of mathematics as a complex subject is often reinforced when they encounter difficulties and choose to remain silent rather than seek clarification on challenging concepts (Li & Schoenfeld, 2019; Mazana et al., 2018). In this context, both mathematical literacy and self-efficacy have been central themes in prior research, with many studies examining the relationship between students' confidence in solving mathematical problems and their ability to complete tasks involving mathematical literacy. However, despite a considerable amount of research focusing on self-efficacy in mathematical literacy, there is still a gap in studies specifically exploring junior high school students' self-efficacy in solving summative assessment problems based on mathematical literacy, particularly in algebraic content such as PLSV and PtLSV. Therefore, this study aims to describe junior high school students' self-efficacy in solving mathematical literacy-based summative assessment problems related to the material of PLSV and PtLSV, which constitutes the novelty of this research.

METHODS

Research Design

The research approach employed in this study is qualitative, explicitly using a descriptive qualitative design. Since qualitative techniques enable a thorough comprehension of the issues under investigation, the researcher decided to utilize it to describe junior high school students' self-efficacy in

solving mathematical literacy-based summative assessment problems (Busetto et al., 2020; Tomaszewski et al., 2020). Researchers use a qualitative approach to explore students' experiences, perceptions, and challenges when interacting with mathematical problems, thereby identifying factors influencing their self-efficacy in completing the tasks.

Research Subject

The subjects of this study are seventh-grade students at a school in Yogyakarta during the odd semester of the 2023/2024 academic year. Seventh grade consists of 11 classes, but the researcher selected one class using purposive sampling for this study, as it was chosen based on the recommendation of the school's mathematics teacher. The criteria for purposive sampling were based on the diverse mathematical literacy abilities of the students, and the data were obtained from the mathematics teacher at the school. Consequently, class VII K, consisting of 34 male students, was chosen as the research sample based on the teacher's evaluation data and interviews conducted by the researcher with the teacher.

Data Collection

The data collection methods used in this study include a test to gauge students' mathematical literacy and a questionnaire for student self-efficacy. The test is used to measure students' mathematical literacy through a summative assessment, while the questionnaire is used to assess students' self-efficacy. These two data collection techniques help provide a comprehensive understanding of both mathematical literacy and self-efficacy in the context of the study. The blueprint for the self-efficacy questionnaire is presented in Table 1.

Table 1. The blueprint of self-efficacy questionnaires

Dimensions	Indicators	Item Number		Total Item
		Positive	Negative	
Level	Confidence in completing tasks or problems according to varying levels of difficulty	2, 4, 6, and 10	1, 3, and 5	7
Strength	Strong confidence that individuals have in facing challenges or obstacles in learning mathematics	8, 14,16, and 18	7, 9, 11, and 13	8
Generality	Self-confidence in facing various situations or conditions that are broader when studying mathematics	12, 20, and 17	15 and 19	5
	Total	11	9	20

Table 1 shows that the self-efficacy questionnaire includes both positive statements and negative statements using the Likert scale, namely Strongly Agree (SS), Agree (S), Hesitate (RR), Disagree (TS),

and Strongly Disagree (STS). Positive statements are scored, namely SS=5, S=4, RR=3, TS=2, STS=1. Meanwhile, negative statements are scored, namely SS=1, S=2, RR=3, TS=4, STS=5. The link to the questionnaire is as follows: https://bit.ly/Instrumenangketself-efficacy.

As for the test instrument, the blueprint of the summative assessment test questions, which are based on mathematical literacy, can be found in Table 2 and at the following link https://bit.ly/Soaltesasesmensumatif.

Table 2. The blueprint of mathematical literacy skills test question

No.	Indicators	Question Form	Question Number
1.	Students can solve problems related to one variable linear equations and inequalities using mathematical literacy skills indicators, namely: a. Formulate problems in real (*formulate*). b. Apply concepts, facts, procedures, and reasoning in mathematics (*employ*). c. Interpret, apply, and evaluate mathematical results (*interpret*).	Multiple Choice	1, 2, 3, 4, 5
2.	Students can solve story problems related to one variable linear equations and inequalities using mathematical literacy skills indicators, namely: a. Formulate problems in real (*formulate*). b. Apply concepts, facts, procedures, and reasoning in mathematics *(employ*). c. Interpret, apply, and evaluate mathematical results (*interpret*).	Essay	1, 2, 3, 4, 5

Based on Table 2, the plan for the mathematics literacy test on students' self-efficacy, aligned with the competency standards in mathematical literacy, consists of 10 questions. These include five multiple-choice questions and five essay questions. The questions are designed to assess cognitive levels C2 to C4, covering the topics of linear equations in one variable (PLSV) and systems of linear equations in two variables (PtLSV). The questions are framed within a social context, involving real-life scenarios such as resource allocation, community planning, and decision-making in everyday situations.

Data Analysis

In this study, the data were analyzed using descriptive analysis, specifically by calculating the average score of the questionnaire and the percentage. The self-efficacy questionnaire scores were then classified as shown in Table 3.

Table 3. Classification of self-efficacy questionnaire category

No.	Score	Categories
1	$x \geq M_i + Sb_i$	High
2	$M_i - Sb_i \leq x < M_i + Sb_i$	Medium
3	$x < M_i - Sb_i$	Low

(Source: Medyasari et al., 2021)

Table 3 shows the classification of the student self-efficacy questionnaire category, with the classification method adapted from Medyasari et al. (2021), where s represents the standard deviation, M_i is the average of all student scores, and x is the total scores of students to-i, where $x = 1, 2, 3, ...$ Meanwhile, The classification results can be calculated using the following formula:

$$Percentage\ of\ score = \frac{average\ score}{ideal\ score}\ x\ 100\%$$

Additionally, scoring guidelines, adopted from QUASAR General Rubric (Medyasari et al., 2021), can be used as an example to evaluate students' answers. The final value calculation method is as follows:

$$N = \frac{Total\ Score}{Max\ Score}\ x\ 10$$

This analysis will reveal the predicate of student learning outcomes in solving summative assessment questions on the material PLSV and PtLSV.

RESULTS AND DISCUSSION

The preliminary findings of a study on the self-efficacy of 34 seventh-grade students at a Yogyakarta school during the 2023–2024 academic year indicate that the majority of students' self-efficacy is categorized as medium. Meanwhile, students' learning outcomes predominantly are primarily classified as poor based on their performance in solving mathematical literacy-based summative assessment tasks related to PLSV. A more detailed description of the findings is provided as below.

Description of Self-efficacy

The self-efficacy questionnaire comprised 20 statements. Data from the questionnaire was analysed using SPSS 24.0 for Windows. The descriptive statistical results are shown in Table 4.

Table 4. Descriptive statistics for self-efficacy questionnaire

Description	Score
Maximum Value	86
Minimum Value	42
Ideal Average	64
Standart Deviation (SD)	10,059
Mode	68
Median	65,5

Table 4 shows the variation in scores from the self-efficacy questionnaire. The maximum value (86) and minimum value (42) indicate a wide range of scores, while the ideal average (64) represents the expected benchmark. The mode (68) represents the most frequent score, and the median (65.5) splits the data into two equal parts. The standard deviation (10.059) indicates considerable variability in the results, meaning the students' scores are widely dispersed around the average. Overall, this shows a varied distribution of scores, with most students having scores in the range of 65–68. Additionally, the results of students' self-efficacy in completing summative assessment questions based on mathematical literacy are shown in Figure 1.

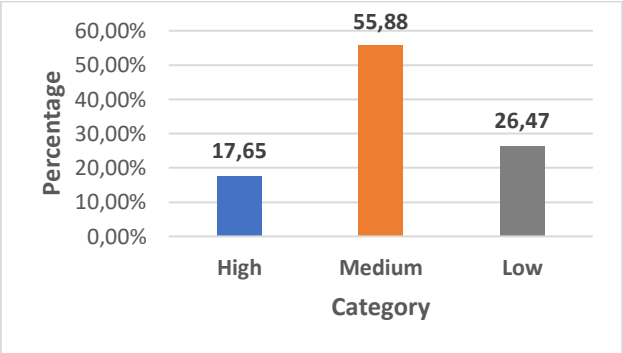


Figure 1. Percentage of students' self-efficacy level

The data from Figure 1 indicate that most students have a medium level of self-efficacy, with over half of the students demonstrating average confidence in their abilities. However, a notable portion (26.47%) exhibits low self-efficacy, suggesting that these students may struggle with confidence and could benefit from targeted interventions to boost their belief in their capabilities. Conversely, 17.65% of students with high self-efficacy exhibit strong confidence in their abilities, which could serve as a positive example for the rest of the class. The distribution highlights the importance of providing support to increase self-efficacy, particularly for those in the low category, to help students develop greater confidence in their skills.

Description of Mathematical Literacy Skills

Data on students' mathematical literacy skills was gathered through summative assessment test instruments. The tests included multiple-choice questions and essays related to the material on linear

equations and inequalities in one variable. The descriptive statistical results of the 34 students who participated as samples in this study are presented in Table 5.

Table 5. Descriptive statistics for mathematical literacy-based summative assessment

Description	Score
Mean	66,37
Lowest Value	26,67
Highest Value	96,67
Absorption capacity	66,4%
Standard deviation	16,28

Based on Table 5, students' performance on the mathematical literacy-based assessment is generally categorized as medium. However, the wide range of scores and high variability indicate disparities in understanding among students. This suggests the need for targeted interventions to support those struggling, while also offering enrichment opportunities for high achievers to maximize their potential. The percentage of students' mathematical literacy skill scores in each category is illustrated in Figure 2.

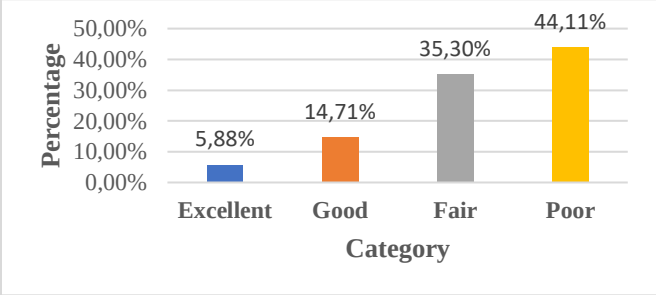


Figure 2. Percentage of mathematical literacy-based summative assessment results

Based on the data in Figure 2, it is evident that many students' mathematical literacy skills fall into the low category. Most students are classified as "Poor," indicating that a significant number struggle to understand and apply mathematical concepts. Additionally, several students fall into the "Fair" category, reflecting average performance but still requiring further improvement. Only a small portion of students achieved the "Good" category, indicating above-average ability, while very few students attained the "Excellent" category, representing very high mathematical literacy. These results highlight the need for more effective teaching strategies to improve mathematical literacy, especially for students in the low category. Furthermore, Table 6 below illustrates the achievements for each indicator of students' mathematical literacy skills.

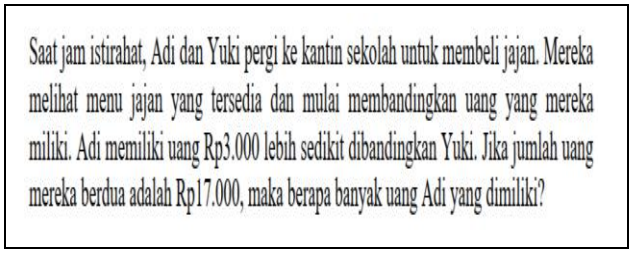
Table 6. Achievement per indicator of mathematical literacy skills

Indicators	Number of Scores	Max Score	Percentage
Formulate	132	170	78%
Employ	107	238	45%
Interpret	144	272	53%

Based on Table 6, the analysis of the three indicators of mathematical literacy—Formulate, Employ, and Interpret—shows varying levels of student performance. For the formulate indicator, students scored 132 out of 170 (78%), demonstrating strong capabilities in translating real-world problems into mathematical terms. In contrast, the Employ indicator received a score of 107 out of 238 (45%), indicating a struggle in applying mathematical concepts and procedures effectively. The Interpret indicator had a score of 144 out of 272 (53%), showing a moderate level of competency in interpreting mathematical outcomes, but with room for improvement. This suggests that while students excel at formulating problems, their ability to apply and interpret mathematical concepts requires further attention.

Description of Mathematical Literacy-Based Summative Assessment

The following is one of the questions provided to students to assess their mathematical literacy, as shown in Figure 3.



English version:

Adi and Yuki went to the school canteen during the break to buy snacks. They looked at the snack menu and started comparing their money. Adi has Rp3,000 less than Yuki. If their total money is Rp17,000, how much does Adi have?

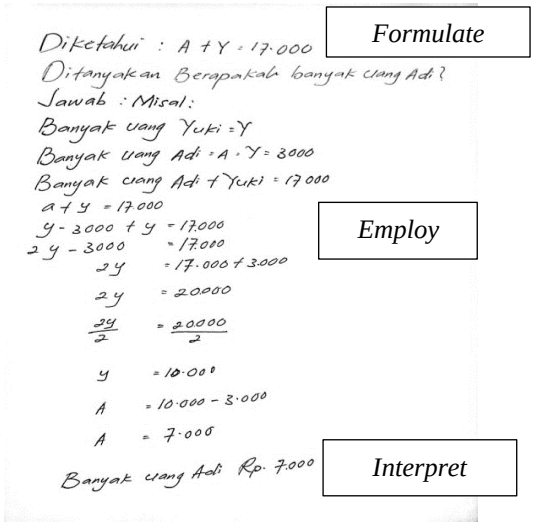
Figure 3. One of the questions in the mathematical literacy-based summative assessment

The problem shown in Figure 3 represents one of the essay-format summative assessment items designed to evaluate students' proficiency in mathematical literacy. The question is presented as a story involving two characters, Adi and Yuki, who are shopping at the school canteen. In this context, they are expected to formulate equations based on the information and perform the necessary calculations to determine the correct answer. Additionally, this question represents the "*formulate*" indicator, which requires students to express problems mathematically. It is set in a daily context relevant to students' lives, making it easier for them to understand and relate to. In this question, students must apply algebraic concepts, particularly in formulating and solving linear equations. The difficulty level of this question falls into the moderate category.

Analyzing or rechecking students' mathematical literacy skills is essential after administering the test and evaluating the results. The indicators of mathematical literacy skills, particularly in the context of linear equations and inequalities in one variable, are the main focus of this analysis, which aims to assess mathematical literacy abilities through summative evaluation after the learning process. The findings from the study are categorized into three levels: high, medium, and low. Subsequently, three subjects were selected, considering their ability to communicate their answers effectively. The selected subjects include AFA, IAM, and KNF. The results of further analysis of the three subjects, with high, medium, and low abilities, are explained as follows.

Student with High Mathematical Literacy Skills

The student-coded AFA demonstrates high mathematical literacy skills. AFA can identify key information and apply symbols, as well as formal and mathematical language. AFA is also capable of using mathematical operations appropriately to formulate problems mathematically by defining variables, identifying the given and unknown elements, and planning strategies according to the steps in solving the problems correctly and coherently. This includes using mathematics in concepts, procedures, facts, and reasoning, as well as solving the problems. Figure 4 below illustrates the outcomes of students' high mathematical literacy skills.



English version:

Given: $A + Y = 17.000$
Question: How much money does Adi have?
Solution:

Yuki's money	= Y
Adi's money	= X
Yuki + Adi	= 17,000
A + Y	= 17,000
Y − 3,000 + Y	= 17,000
2Y − 3.000	= 17.000
2Y	= 17.000 + 3.000
2Y	= 20.000
Y	= 10.000
A	= 10.000 − 3.000
A	= 7.000

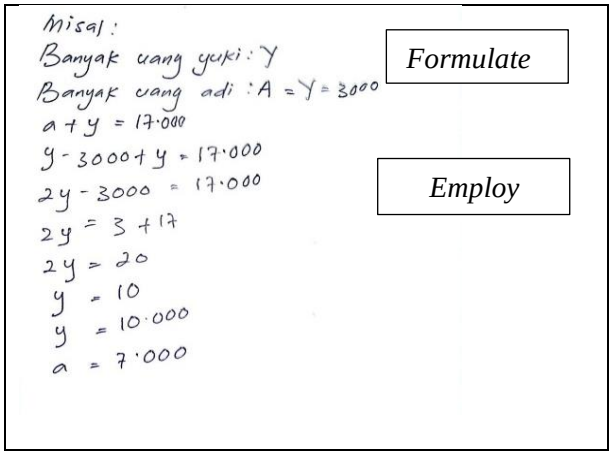
The total amount of Adi's money is IDR 7.000

Figure 4. AFA's answer to question number 1 with high mathematical literacy skills

Based on Figure 4 subject AFA is categorized as a student with high mathematical literacy skills, as evidenced by successfully meeting the criteria for all three indicators: formulate, employ, and interpret. AFA can formulate mathematical problems effectively, utilize appropriate strategies to solve them, and interpret the results while explaining the processes involved. These competencies reflect AFA's grasp of mathematical concepts and ability to apply them to diverse contexts, showcasing a high level of understanding and critical thinking, as aligned with the findings of Kolar & Hodnik (2021).

Student with Medium Mathematical Literacy Skills

Student-coded IAM is categorized as having a moderate category for mathematical literacy skills because the student has answered correctly but does not meet the criteria of every indicator, namely formulate, employ, and interpret. Specifically, IAM omits critical information in the question, which may lead to partial or inaccurate responses, ultimately affecting the quality and comprehensiveness of the work. It is crucial for students to carefully read and incorporate all relevant details from the questions to ensure a comprehensive understanding and response. In addition, IAM also does not provide a clear conclusion or interpretation of the results, as illustrated in Figure 5.



English version:

e.g:

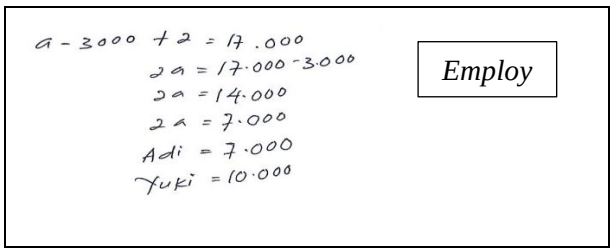
Yuki's money	= Y
Adi's money	= A
Y = 3.000	
A + Y	= 17,000
Y – 3.000 + Y	= 17,000
2Y – 3.000	= 17.000
2Y	= 3 + 17
2Y	= 20
Y	= 10
Y	= 10.000
A	= 7.000

Figure 5. IAM's answer to question number 1 with medium mathematical literacy skills

Figure 5 shows that IAM falls into the medium category of mathematical literacy. This classification is due to IAM's omission of key information from the question and the inability to conclude. Additionally, there were shortcomings in interpreting IAM's answers. These factors indicate that while the student has some understanding of the material, there is a significant scope for improvement in effectively communicating and analyzing mathematical concepts, as aligned with the findings of Rizki & Priatna (2019).

Student with Low Mathematical Literacy Skills

Student-coded KNF is categorized as having low mathematics literacy skills. Figure 6 below shows that KNF can write the correct answer with less coherent artistry. This lack of clarity suggests that while KNF understands the fundamental concepts, there is difficulty in articulating the thought process effectively.



English version:

A – 3.000 + 2	= 17.000
2A	= 17.000 – 3.000
2A	= 14.000
A	= 7.000
Adi	= 7.000
Yuki	= 10.000

Figure 6. KNF's answer to question number 1 with low mathematical literacy skills

Figure 6 illustrates that the student-coded KNF is included in the low mathematical literacy skills category, as it does not meet the formulate, employ, and interpret indicators' criteria. While KNF has been able to answer the questions with the right results, the response is incomplete and lacks essential information about the problem. Additionally, the response does not include a complete or appropriate example, such as using variables and mathematical models, as aligned with the findings of Luo et al. (2023).

From the findings outlined above, it can be concluded that mathematical literacy, particularly in the context of summative exams, is strongly influenced by self-efficacy, which refers to an individual's

belief in their capacity to complete tasks. Mathematics literacy-based summative assessment, designed to evaluate students' understanding and abilities after a learning period, requires sufficient skills and confidence to achieve successful outcomes. Research findings indicate that students with high self-efficacy tend to perform better in completing summative assessment tasks because they believe they can overcome their challenges. This aligns with the research by Özcan and Kültür (2021), which states that good self-efficacy can support and encourage students to learn more optimally, allowing them to achieve better results. Furthermore, high self-efficacy can positively influence students' attitudes and behaviors, fostering positive changes that can enhance their goal achievement and future aspirations (Luo et al., 2023; Puozzo & Audrin, 2021), enabling them to become better learners.

Compared to their counterparts with moderate self-efficacy, students with significant self-efficacy frequently have superior mathematical literacy skills. This is supported by AlAli and Wardat (2024) and Hiller et al. (2022), which demonstrates that higher self-efficacy levels positively impact their mathematical literacy outcomes. Students with high self-efficacy have greater confidence in their abilities and are more likely to actively engage in the learning process, work harder, and persevere when facing challenges. This behavior contributes to better mastery of mathematical concepts, as the students can make connections between ideas and apply more advanced strategies when solving problems.

However, when compared to students with low self-efficacy, individuals with moderate self-efficacy also demonstrate superior mathematical literacy skills. While these students may lack the confidence levels of their high-performing peers, they are aware of the need to try and learn from their mistakes. Wu et al. (2024) explain that this openness to learning and growing is valuable, enabling them to continue improving despite difficulties. In this context, creating a supportive learning environment is essential where students feel safe to take risks and are encouraged to participate (Aswin & Herman, 2022).

Students with moderate self-efficacy generally achieve satisfactory results in mathematical literacy, though they may not perform as strongly as those with high self-efficacy. They have enough confidence to tackle most problems but often feel uncertain when they encounter more complex or unfamiliar tasks (Muhtadi et al., 2022). Research by Ayllón et al. (2019) indicates that teachers' support and a positive learning environment can help these students boost their self-confidence, which can affect their performance in summative assessments. Therefore, it is important to provide constructive feedback and foster an atmosphere that promotes active engagement and growth (AlAli & Wardat, 2024).

Conversely, students with low self-efficacy encounter significant difficulties in achieving satisfactory results on summative assessments. These students often feel incapable or fear failure, which leads them to avoid challenging tasks (AlAli, & Wardat, 2024). Research shows that students with low self-efficacy not only struggle to solve mathematical problems but are also more susceptible to academic stress and anxiety (Bergqvist, 2024). These factors adversely affect their mathematical literacy outcomes, typically resulting in poor or inadequate performance. Thus, analyzing the results provides valuable insights into how self-efficacy shapes learning outcomes. This highlights

opportunities for educators to design more specific interventions, such as support programs to enhance students' self-efficacy through social skills development, collaborative learning, and positive reinforcement-focused learning strategies (Katranci & Şengül, 2019).

By understanding the intricate relationship between self-efficacy, mathematical literacy, and assessment outcomes, educators can create a more holistic approach to learning, helping all students, especially those struggling with self-confidence—reach their full potential in mathematics (Zakariya, 2022). Integrating these aspects into teaching and assessment practices improves mathematical literacy and develops students' character and resilience in learning (Puozzo & Audrin, 2021). Recognizing the pivotal role of self-efficacy in students' success, educators are encouraged to design strategies that can enhance students' confidence in their mathematical abilities. Teachers can implement interventions such as creating a supportive learning environment and providing positive feedback to foster better self-efficacy among students (Ayllón, et al., 2019). Strengthening self-efficacy is expected to lead to better performance in summative assessments, thereby improving their overall mathematical literacy.

CONCLUSION

Students' mathematical literacy skills still require improvement, as many struggle with solving simple problems and face significant challenges when confronted with more complex situations. The findings indicate that students with high levels of self-efficacy can effectively develop, apply, and comprehend mathematical concepts across various contexts. In contrast, students with moderate self-efficacy did not demonstrate the same characteristics in mathematical literacy tests. Similarly, students with low self-efficacy showed difficulties in solving problems that required mathematical thinking across different contexts, although they were able to formulate mathematical concepts but struggled to interpret them effectively. The implications of this research emphasize the importance of enhancing students' self-efficacy to strengthen their mathematical literacy skills. Effective teaching approaches that promote students' confidence in solving math problems, such as group-based learning, positive feedback, and an emphasis on conceptual understanding, are recommended. Future research should investigate more specific teaching approaches or models aimed at developing students' self-efficacy and mathematical literacy further. Additionally, examining other factors influencing mathematical literacy, such as motivation and metacognitive strategies, is essential to gain a more comprehensive understanding of how to improve students' mathematical literacy development.

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Author Contribution : DEL: Conceptualization, Writing Original Draft, and Developing Instruments.
DBW: Validation and Supervision.
AS: Data Analysis and Editing Manuscript.
KH: Validation and Supervision.

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REFERENCES

AlAli, R., & Wardat, Y. (2024). Exploring students' mathematical literacy: The role of Self-efficacy and learning environment. *Environment and Social Psychology*, *9*(8). https://doi.org/10.59429/esp.v9i8.2838

Aswin, A., & Herman, T. (2022). Self-efficacy in mathematics learning and efforts to improve it. *Hipotenusa : Journal of Mathematical Society*, *4*(2), 185–198. https://doi.org/10.18326/hipotenusa.v4i2.8095

Ayllón, S., Alsina, Á., & Colomer, J. (2019). Teachers' involvement and students' self-efficacy: Keys to achievement in higher education. *PLoS ONE*, *14*(5), 1–11. https://doi.org/10.1371/journal.pone.0216865

Bergqvist, E. (2024). Relations between mathematics self-efficacy and anxiety beliefs: When multicollinearity matters. *Journal of Experimental Education*, 1–21. https://doi.org/10.1080/00220973.2024.2338545

Busetto, L., Wick, W., & Gumbinger, C. (2020). How to use and assess qualitative research methods. *Neurological Research and Practice*, *2*(14), 1-10. https://doi.org/10.1186/s42466-020-00059-z

Hiller, S. E., Kitsantas, A., Cheema, J. E., & Poulou, M. (2022). Mathematics anxiety and self-efficacy as predictors of mathematics literacy. *International Journal of Mathematical Education in*

Science and Technology, *53*(8), 2133–2151. https://doi.org/10.1080/0020739X.2020.1868589

Katranci, Y., & Şengül, S. (2019). The relationship between mathematical literacy and visual math literacy self-efficacy perceptions of middle school students. *Pegem Egitim ve Ogretim Dergisi*, *9*(4), 1113–1138. https://doi.org/10.14527/pegegog.2019.036

Kolar, V. M., & Hodnik, T. (2021). Mathematical literacy from the perspective of solving contextual problems. *European Journal of Educational Research*, *10*(1), 467–483. https://doi.org/10.12973/EU-JER.10.1.467

Kurniawati, N. D. L., & Mahmudi, A. (2019). Analysis of mathematical literacy skills and mathematics self-efficacy of junior high school students. *Journal of Physics: Conference Series*, *1320*(1), 012053. https://doi.org/10.1088/1742-6596/1320/1/012053

Lestari, N., & Putri, R. I. I. (2020). Using the Palembang's local context in PISA-like mathematics problem for analyze mathematics literacy ability of students. *Jurnal Pendidikan Matematika*, *14*(2), 169–182. https://doi.org/10.22342/jpm.14.2.6708.169-182

Li, Y., & Schoenfeld, A. H. (2019). Problematizing teaching and learning mathematics as "given" in STEM education. *International Journal of STEM Education*, *6*(1). https://doi.org/10.1186/s40594-019-0197-9

Luo, Q., Chen, L., Yu, D., & Zhang, K. (2023). The Mediating role of learning engagement between self-efficacy and academic achievement among Chinese college students. *Psychology Research and Behavior Management*, *16*, 1533–1543. https://doi.org/10.2147/PRBM.S401145

Maslihah, S., Waluya, S. B., Rochmad, & Suyitno, A. (2020). The role of mathematical literacy is to improve high-order thinking skills. *Journal of Physics: Conference Series*, *1539*(1), 012085. https://doi.org/10.1088/1742-6596/1539/1/012085

Mazana, M. Y., Montero, C. S., & Casmir, R. O. (2018). Investigating students' attitude towards learning mathematics. *International Electronic Journal of Mathematics Education*, *14*(1), 207–231. https://doi.org/10.29333/iejme/3997

Medyasari, L. T., Zaenuri, & Dewi, N. R. (2021). The measurement of self-efficacy students in mathematics lesson tenth students of senior high school. *Journal of Physics: Conference Series*, *1918*(4), 042128. https://doi.org/10.1088/1742-6596/1918/4/042128

Meryansumayeka, Zulkardi, Putri, R. I. I., & Hiltrimartin, C. (2021). Students' strategies in solving PISA mathematical problems reviewed from problem-solving strategies. *Jurnal Pendidikan Matematika*, *15*(1), 37–48. https://doi.org/10.22342/jpm.15.1.10405.37-48

Miftah, R., Herman, T., & Kurniawati, L. (2021). Students' thinking process in solving mathematical literacy problem based on cognitive style. *Advances in Mathematics: Scientific Journal*, *10*(4), 1857–1869. https://doi.org/10.37418/amsj.10.4.2

Mubarokah, A. A. L., & Amir, M. F. (2024). Primary students' errors in solving mathematical literacy problems based on Newman analysis. *Jurnal Pendidikan Matematika*, *18*(2), 217–230. https://doi.org/10.22342/jpm.v18i2.pp217-230

Muhtadi, A., Assagaf, G., & Hukom, J. (2022). Self-efficacy and students' mathematics learning ability in Indonesia: A meta-analysis study. *International Journal of Instruction*, *15*(3), 1131–1146. https://doi.org/10.29333/iji.2022.15360a

OECD. (2023). *PISA 2022 Result (Volume I): The State of Learning and Equity in Education: Vol. I*. Paris: OECD Publishing.

Özcan, B., & Kültür, Y. Z. (2021). The relationship between sources of mathematics self-efficacy and mathematics test and course achievement in high school seniors. *SAGE Open*, *11*(3). https://doi.org/10.1177/21582440211040124

Puozzo, I. C., & Audrin, C. (2021). Improving self-efficacy and creative self-efficacy to foster creativity and learning in schools. *Thinking Skills and Creativity*, *42*, 100966. https://doi.org/10.1016/j.tsc.2021.100966

Rizki, L. M., & Priatna, N. (2019). Mathematical literacy as the 21st century skill. *Journal of Physics: Conference Series*, *1157*(4), 042088. https://doi.org/10.1088/1742-6596/1157/4/042088

Rivai, A., Lestari, A., Munir, N. P., & Anas, A. (2022). Students' mathematical literacy in solving pisa problems observed by learning styles. *Jurnal Pendidikan Matematika*, *17*(1), 121–134. https://doi.org/10.22342/jpm.17.1.19905.121-134

Sibgatullin, I. R., Korzhuev, A. V., Khairullina, E. R., Sadykova, A. R., Baturina, R. V., & Chauzova, V. (2022). A systematic review on algebraic thinking in education. *Eurasia Journal of Mathematics, Science and Technology Education*, *18*(1), 1–15. https://doi.org/10.29333/EJMSTE/11486

Sugiarti, L., & Retnawati, H. (2019). Analysis of student difficulties on algebra problem solving in junior high school. *Journal of Physics: Conference Series*, *1320*(1), 012103. https://doi.org/10.1088/1742-6596/1320/1/012103

Susanto, E., Susanta, A., Rahaimah, S., & Ali, B. (2024). Developing STEAM-teaching module in supporting students' literacy ability in elementary school. *Jurnal Pendidikan Matematika*, *18*(3), 349–366. https://doi.org/10.22342/jpm.v18i3.pp349-366

Sumirattana, S., Makanong, A., & Thipkong, S. (2017). Using realistic mathematics education and the DAPIC problem-solving process to enhance secondary school students' mathematical literacy. *Kasetsart Journal of Social Sciences*, *38*(3), 307–315. https://doi.org/10.1016/j.kjss.2016.06.001

Thanheiser, E. (2023). What is the mathematics in mathematics education?. *Journal of Mathematical Behavior*, *70*, 101033. https://doi.org/10.1016/j.jmathb.2023.101033

Tomaszewski, L. E., Zarestky, J., & Gonzalez, E. (2020). Planning qualitative research: Design and decision making for new researchers. *International Journal of Qualitative Methods*, *19*, 1–7. https://doi.org/10.1177/1609406920967174

Wu, T. T., Silitonga, L. M., Dharmawan, B., & Murti, A. T. (2024). Empowering students to thrive: the role of CT and self-efficacy in building academic resilience. *Journal of Educational Computing Research*, *62*(3), 816–845. https://doi.org/10.1177/07356331231225468

Zakariya, Y. F. (2022). Improving students' mathematics self-efficacy: A systematic review of intervention studies. *Frontiers in Psychology*, *13*. https://doi.org/10.3389/fpsyg.2022.986622

Zakariya, Y. F., Nilsen, H. K., Goodchild, S., & Bjørkestøl, K. (2022). Self-efficacy and approaches to learning mathematics among engineering students: empirical evidence for potential causal relations. *International Journal of Mathematical Education in Science and Technology*, *53*(4), 827–841. https://doi.org/10.1080/0020739X.2020.1783006