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Mathematical Literacy Skills in Rational Number Material Class VII Reviewed from Learning Motivation

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Abstract

This study examines the mathematical literacy skills of seventh-grade students at State Junior High School (SMP) 1 Tanjungsari and their relationship with learning motivation. The objective of this research is to analyze the impact of students' learning motivation on their mathematical literacy abilities. This study employs a descriptive qualitative method, involving 34 students from class VII-H in the first semester of the 2024/2025 academic year. Data collection methods include a three-item descriptive test, a learning motivation questionnaire, and interviews with selected students. The results indicate that the average mathematical literacy score was 29.26 (out of 100), with 1.02% of students categorized as having high literacy, 1.70% as medium, and 79.41% as low. Learning motivation levels were classified as high (17.65%), medium (61.76%), and low (20.58%). In conclusion, students with high motivation and literacy demonstrated proficiency in all mathematical literacy indicators, whereas students with low motivation exhibited weaker literacy skills and failed to meet all indicators. Notably, even students with moderate motivation displayed low literacy skills and did not achieve all expected indicators.
Keywords: rational numbers, mathematical literacy, learning motivation

Abstrak

Penelitian ini mengkaji kemampuan literasi matematika siswa kelas VII SMP Negeri 1 Tanjungsari dan kaitannya dengan motivasi belajar. Tujuan penelitian ini adalah menganalisis pengaruh motivasi belajar siswa terhadap kemampuan literasi matematika. Penelitian ini menggunakan metode deskriptif kualitatif dengan melibatkan 34 siswa kelas VII-H semester ganjil tahun ajaran 2024/2025. Metode pengumpulan data menggunakan tes deskriptif tiga butir, angket motivasi belajar, dan wawancara dengan siswa terpilih. Hasil penelitian menunjukkan bahwa rata-rata skor literasi matematika adalah 29,26 (dari 100), dengan 1,02% siswa berkategori literasi tinggi, 1,70% berkategori sedang, dan 79,41% berkategori rendah. Tingkat motivasi belajar diklasifikasikan sebagai tinggi (17,65%), sedang (61,76%), dan rendah (20,58%). Kesimpulannya, siswa dengan motivasi dan literasi tinggi menunjukkan kemahiran dalam semua indikator literasi matematika, sedangkan siswa dengan motivasi rendah menunjukkan keterampilan literasi yang lebih lemah dan gagal memenuhi semua indikator. Khususnya, bahkan siswa dengan motivasi sedang menunjukkan keterampilan literasi yang rendah dan tidak mencapai semua indikator yang diharapkan.
Kata kunci: bilangan rasional, literasi matematika, motivasi belajar

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INTRODUCTION

The Industrial Revolution 4.0 has significantly transformed the educational landscape, particularly in mathematics learning, by presenting both opportunities and challenges for developing relevant skills in the digital era. Mathematical literacy, recognized as a 21st-century competency, plays a crucial role in everyday life and problem-solving. It encompasses not only numeracy skills but also the analysis and application of mathematical concepts in real-life contexts (OECD, 2013) ;(Stacey, 2011). Mastery of mathematical literacy enables individuals to comprehend mathematical functions in daily situations and make logical decisions (Herman et al., 2023). Despite the evolution of traditional literacy, numeracy skills remain essential (Apriliana & Nindita, 2023).

The importance of mathematical literacy extends to enhancing the quality of human resources, allowing individuals to integrate information and draw informed conclusions (Masjaya & Wardono, 2018). However, students' achievements in mathematical literacy are influenced by various factors, including personal, instructional, and environmental elements (Wulandari & Azka, 2018).

Recent data from the Programme for International Student Assessment (PISA) indicates that Indonesia's performance in mathematical literacy requires significant improvement. The average scores for Indonesian students in mathematics have shown a decline, as illustrated in the table below:

Table 1. Average PISA Indonesia score

	Year				Average
	2012	2015	2018	2022	
Read	396	397	371	359	374
Mathematics	375	386	379	366	370
Science	382	402	397	391	391

This decline highlights persistent challenges in mathematical literacy within the Indonesian education system. Research conducted by Ade Sriwahyuni (2019)(Suciawati et al., 2023) revealed low mathematical literacy levels among students at Sekolah Menengah Pertama (SMP) Negeri 2 Sedong, emphasizing the need for targeted interventions.

one area of concern is the understanding of rational numbers, which can be expressed as a/b (where a and b are integers, and $b \neq 0$). Many junior high school students struggle with rational numbers, particularly in solving story problems (Kania, 2018, in (Apriliana & Nindita, 2023). These difficulties often stem from challenges in understanding rational number operations and the necessity for strong reading and critical thinking skills. Factors contributing to these challenges include a lack of attention, ineffective teaching methods, and insufficient practice (Renaldie et al., 2023)

To effectively solve problems involving rational numbers, students must develop both cognitive and affective aspects, particularly learning motivation, which serves as a primary driver in the learning proces (Sadirman,2018, in Apriliana & Nindita, 2023). Learning motivation, influenced by both internal and external factors, significantly affects student behavior and engagement in learning (Uno,2014,in Naibaho et al., 2021). Intrinsic motivation, stemming from personal desires, is particularly influenced by teachers' roles in fostering enthusiasm for learning (Sitepu & Lumban Gaol, 2024). Strong motivation can lead to increased diligence and enthusiasm among students, ultimately resulting in improved learning quality and achievement (Tella et al., 2024).

Several studies have explored the relationship between learning motivation and mathematical literacy. For instance, research by Matondang, Saragih, & Daulay (2023) highlighted the critical role of motivation in students' mathematical performance. Similarly, Suciawati, Anggiana, & Hermawan (2023) found that students with higher motivation demonstrate better problem-solving skills in mathematics. However, despite these findings, there remains a gap in understanding how learning motivation specifically impacts mathematical literacy in the context of rational number problems.

This study aims to analyze the mathematical literacy skills of seventh-grade students at SMP Negeri 1 Tanjungsari, focusing on their learning motivation as a determining factor. Unlike previous studies that addressed general mathematical abilities, this research emphasizes the specific domain of rational numbers, identifying key challenges students face in developing literacy within this topic. The novelty of this study lies in its detailed exploration of the relationship between motivation levels and literacy achievement in rational number problems, which has not been extensively studied in prior research.

By investigating how well students master mathematical literacy and the factors influencing it, this research seeks to provide insights that can guide efforts to enhance students' mathematical literacy skills through increased learning motivation. Ultimately, this study contributes to the ongoing discourse on mathematical literacy development and offers practical recommendations for educators aiming to improve students' problem-solving capabilities in mathematics.

METHOD

This study uses a descriptive qualitative method to analyze the mathematical literacy ability of 7th grade junior high school students on rational number material, based on their learning motivation. This approach was chosen to provide an accurate and detailed picture of students' mathematical literacy abilities without manipulating variables.

Data collection was carried out by providing 3 mathematical literacy questions to 7th grade students, consisting of 1 class with a total of 34 students. The selection of this subject is based on the consideration of the teaching schedule and the students have quite diverse abilities (heterogeneous). In addition, data collection was also carried out through the provision of a learning motivation questionnaire before students took a literacy test and interviews with 2 people in the low and medium categories of mathematical literacy. This step is taken to assess and verify the accuracy of the information obtained at different times and methods.

The ability of students to understand and solve problems related to rational numbers. Indicators used (Apriliana & Nindita, 2023) and developed by researchers including 1). The existence of desire and desire to succeed, 2). There is an encouragement and need in learning, 3). The existence of future hopes and ideals in the form of learning awards, 4). The existence of a conducive learning environment, and 5). There are interesting activities in learning. The data used are the results of student tests consisting of three questions on Ability Mathematical Literacy, with indicators can be seen in table 2.

Table 2. Indicators of Mathematical Literacy Proficiency Test

Ability Indicators	Competency Indicators
Formulating a situation mathematically (formulate)	Identify aspects and variables of mathematics by recognizing the mathematical structure, such as the regularity, relationships, and patterns of a problem located in a real-world context.
	Translate and present problems into mathematical language to recognize aspects of problems that correspond to known problems, concepts, facts, or mathematical procedures.

Apply concepts, facts, procedures and mathematical reasoning (employe)	Develop and implement strategies to find mathematical solutions.
	Apply facts, information to find solutions.
Interpreting, applying, and evaluating mathematical results (interprete)	Interpret mathematical results, evaluate completion results and apply them in everyday life.

Based on Table 2 indicators of mathematical literacy ability according to (OECD 2019) in (Umbara et al., 2021) consists of three components of mathematical literacy. In this study, the indicator serves to measure mathematical literacy skills. Some of the questions given to the subject are as follows.

1. Dunia Fantasi or more popularly known as Dufan, was first opened to the public on August 29, 1985. one of the rides in Dufan is the Ferris wheel. No visit to Dufan is complete without enjoying the Ferris wheel, a large Ferris wheel that is ready to take you to an altitude of ± 30 meters above sea level. The Ferris Wheel (rainbow) was first built by Ferris Wheel from the United States.
A Ferris wheel in Dufan has 45 passenger cabins. Each full spin of the Ferris wheel takes 15 minutes. on Sundays, the Ferris wheel operates for a full 8 hours during the operation. Ferris wheel cabins are only filled from passenger capacity due to social restrictions. The ticket price for one person is Rp. 20,000,-. And each cabin can accommodate a maximum of 4 people.$\frac{3}{4}$

Based on the information above, calculate:

a. How many full laps does the Ferris wheel do on that Sunday?
b. How many passengers ride the Ferris wheel in a day taking into account social distancing?
c. What is the total revenue from ticket sales for one day?
d. Whether the income obtained is sufficient if the minimum daily income target is Rp. 50,000,000,-

Figure 1. Literacy Test Questions Number 1

2. Mrs. Lina opens a coffee shop in the market every Monday-Friday with a capital of IDR 300,000.00 per day. one cup of coffee is sold at a price of Rp 8,000.00 and a piece of cake is sold at a price of Rp 5,000.00. From Monday to Thursday, Mrs. Lina sets aside 15% of her profits to help her neighbors in need. Meanwhile, on Friday, all the profits obtained by Mrs. Lina were donated. If on a Wednesday Mrs. Lina managed to sell 70 cups of coffee and 40 pieces of cakes, how much donation did Mrs. Lina give that day?
Pak Aman has an area of 4,800. From the land, part is planted with corn and part is planted with cassava. Mr. Aman plans to plant tobacco 70% of the remaining land that has been used. Count the area of Pak Aman's land planted with Tobacco!m^2 $\frac{1}{10}\frac{1}{8}$

Figure 3. Literacy Test Question No. 3

The results of the Mathematical Literacy Ability test of students on quantitative data were analyzed using the assessment rubric as shown in Table 3.

Table 3. Mathematical Literacy Ability Assessment Rubric

Ability Indicators	Competency Indicators	Score
Formulating a situation mathematically (formulate)	Able to identify by recognizing the mathematical structure and patterns of a problem located in a real-world context	25
	Able to translate and present problems into mathematical language to recognize aspects of problems that correspond to known problems, concepts, facts, or mathematical procedures.	25
Apply concepts, facts, procedures and Mathematical reasoning (employe)	Able to compile and apply strategies to find mathematical solutions.	15
	Apply facts, information to find solutions.	10
Interpreting, applying, and evaluating mathematical results (interprete)	Interpreting math results	15
	Evaluate the outcome of the settlement	5
	Applying in daily life	5

$$Score = \frac{score\ obtained\ for\ all\ question\ items}{maximum\ score} \times 100 \qquad (1)$$

Learning motivation is categorized into low, medium, and high (Fatchurrohman, Mulyono, & Rosyida, 2022, in Apriliana & Nindita, 2023). The analysis of student responses uses classical theory, including difficulty index, discriminating power, question reliability, and distribution of answer choices.

Table 4. Reference for the Classification of Learning Motivation

Range Subcategories	Categories
$X < \mu - \sigma$	Low
$\mu - \sigma \leq X < \mu + \sigma$	Keep
$\mu + \sigma \leq X$	Tall

Information: μ : Mean (average)

σ : Standard deviation

X: Student Score

According to Pratama Mahiuddin et al. (2019) in (Apriliana & Nindita, 2023) The categorization of students' mathematical literacy can be seen with the 100 scale criteria in the following table.

Table 5. Reference for the Learning Literacy Catalog

Range of Subcategories	Category
score < 60	Low
60 ≤ score < 80	Keep
score ≥ 80	Tall

RESULT AND DISCUSS

Result

Before students are given an ability test Mathematical Literacy, students are given a learning motivation questionnaire. After that, students give a test Mathematical Literacy A total of three questions in the form of essays were adopted and validated from (Apriliana & Nindita, 2023).

Based on the results of the research, data was obtained regarding the results of the Mathematical Literacy Ability test for 7th grade students of SMP NEGERI 1 Tanjungsari which is presented in the following table 6.

Table 6. Mathematical Literacy Test Results for Students

Subject	Value	Subject	Value	Subject	Value	Subject	Value
S-1	5,00	S-11	30,00	S-21	65,00	S-31	5,00
S-2	95,00	S-12	20,00	S-22	5,00	S-32	10,00
S-3	75,00	S-13	70,00	S-23	100,00	S-33	90,00
S-4	5,00	S-14	5,00	S-24	40,00	S-34	10,00
S-5	5,00	S-15	5,00	S-25	55,00		
S-6	5,00	S-16	70,00	S-26	45,00		
S-7	5,00	S-17	5,00	S-27	50,00		
S-8	30,00	S-18	5,00	S-28	5,00		
S-9	5,00	S-19	5,00	S-29	20,00		
S-10	5,00	S-20	40,00	S-30	5,00		

Table 7. Data on the Results of the Mathematical Literacy Test

Category	Number of Students
Low	27
Keep	4
Tall	3

Based on the data listed in Table 6, it can be seen that the mathematical literacy ability in grade VII H SMP NEGERI 1 Tanjungsari is divided into three categories. A total of 8.82% of students are included in the category of high mathematical literacy skills, 11.76% of students are in the medium category, and 79.41% of students are in the low category. The most frequent are found in the low category

Table 6. Data on the results of the Student Learning Motivation Questionnaire

No	Categories Learning Motivation	Number of Students
1.	Low	7
2.	Keep	21
3.	Tall	6

Based on the data listed in Table 6, it can be seen that the learning motivation of students in class VII H SMP NEGERI 1 Tanjungsari is divided into three categories. A total of 17.65% of students are included in the category of high learning motivation, 61.76% of students are in the category of

medium learning motivation, and 20.59% of students are included in the category of low learning motivation. The highest frequency was in the medium category, with a total of 21 students.

Table 7. Data on Mathematical Literacy Test Results Reviewed from Learning Motivation

Learning Motivation	Mathematical Literacy Skills		
	Low	Keep	Tall
Low	6	1	0
Keep	18	3	0
Tall	3	0	3

Mathematical Literacy Skills with Low Motivation

Students who have low motivation to learn show low to moderate mathematical literacy skills. This can be seen from the results of their work in the exam, especially in S-9 and S-10 students. According to Sadirman (2018) in (Apriliana & Nindita, 2023), these students lack the desire to be involved in learning activities, so they are only able to understand problems without being able to analyze data and information effectively. As a result, the learning strategies applied are not appropriate, and their mathematical skills are still at a fairly low level.

1. Subject 1 : S-9 Students

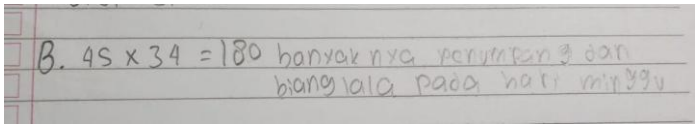

Figure 4. Results of S-9 Students' Work

The analysis of question number 1 shows that S-9 students have difficulty formulating problems systematically. He failed to identify problems, build mathematical models, and draw conclusions, despite attempting to implement faulty mathematical operations.

2. Subject 2 : S-10 Students

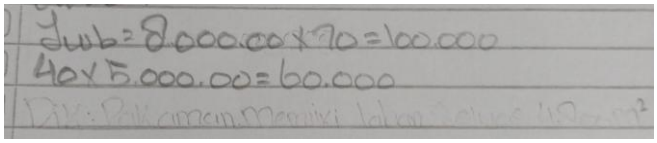

Figure 5. Results of S-10 Student Work

Based on the analysis of the solution of question number 2, it can be seen that S-10 students do not formulate problems systematically. This student did not write down the operational steps and mathematical reasoning in a straight line, as seen from the numbers 8,000.00 × 70 whose origin is unclear. From the results of the work of S-9 and S-10 students, it can be concluded that both are included in the category of low learning motivation and ability. They are only able to understand the problem but cannot analyze data and information effectively. As a result, the learning strategies applied are not appropriate, and students cannot draw conclusions from the problems given.

Mathematical Literacy Ability of Students with Medium Learning Motivation

Students who have moderate learning motivation show varying mathematical literacy skills, between low to moderate, as seen in S-20 and S-24 students. According to Sadirman (2018) in (Apriliana & Nindita, 2023), these students have enough desire to participate in learning activities.

1. Subject 3 : S-20 Students

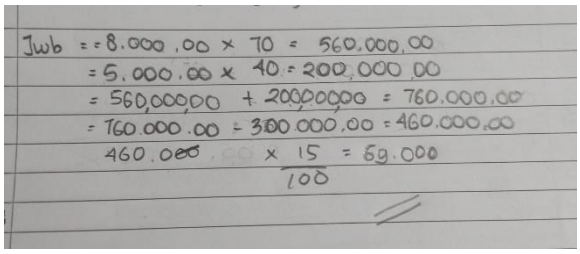

Figure 6. Results of S-20 Student Work

The results of the analysis of the work on question number 2 show that S-20 students have not formulated the problem in a systematic way. This student has not identified the problem and has not described it in the form of a mathematical model. However, in applying mathematical concepts, operations, and reasoning, S-20 has begun to find patterns, and is able to process data and information correctly when applying mathematical operations. In terms of evaluating the results, this student has done an evaluation, but still has not included the conclusions of his thoughts.

2. Subject 4 : Student S -24

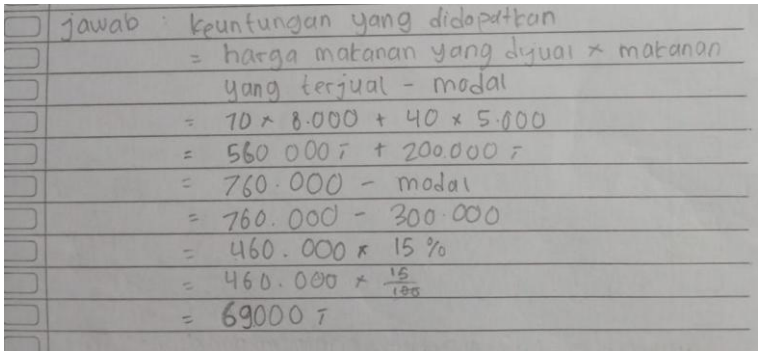

Figure 7. Results of S-24 Student Work

Based on the results of the analysis of the work on question number 2, S-24 students showed the ability to formulate problems systematically. This student has identified the problem, although has not explained it in clear order. In addition, the S-24 has also succeeded in creating mathematical models and devising strategies to determine solutions. However, even though they have evaluated the solution steps taken, this student still has not concluded the problem given.

Mathematical Literacy Ability of Highly Motivated Students

Students who have high learning motivation show varying mathematical literacy skills, ranging from low to high, as seen in S-2 and S-23 students. According to Sadirman (2018) in (Apriliana

& Nindita, 2023), these students have a strong drive to learn, which can support the continuity of the learning process and provide clear direction to achieve the desired goals in learning.

1. Subject 5 : S-2 Students.

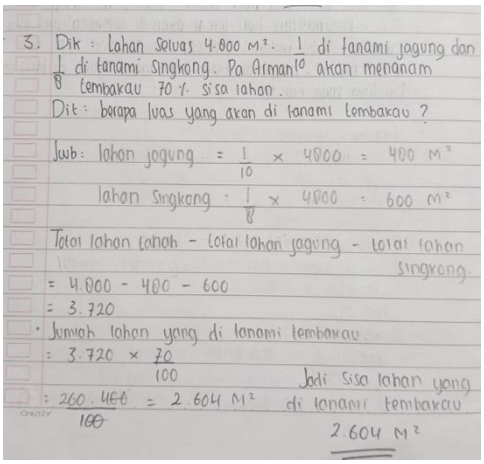

Figure 8. Results of S-2 Students' Work

The analysis of the solution of problem number 5 by the S-2 student shows that he has formulated the problem in a systematic way, which includes identifying the problem, making a mathematical model, and designing a strategy to find a solution. S-2 students also managed to find patterns, process data and information, and apply operations correctly in determining the solution. In addition, he has written down the conclusion of the problem and evaluated the results of the solution.

2. Subject 6 : S-23 Students

Based on the analysis of the results of working on question number 2 by S-23 students, it can be concluded that the students have formulated the problem systematically, including identifying problems, making mathematical models, and designing strategies to find solutions. S-23 students also succeeded in applying mathematical concepts, operations, and reasoning correctly, as well as writing conclusions and evaluating the results obtained.

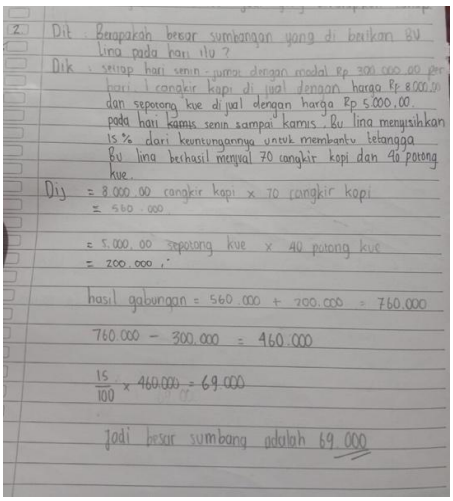

Figure 9. Results of S-23 Student Work

Discuss

The analysis of the results reveals a strong correlation between students' learning motivation and their mathematical literacy skills. Students with high motivation demonstrated better mathematical literacy and met all mathematical literacy indicators. Conversely, students with low motivation exhibited lower literacy skills and did not meet all indicators. Interestingly, even students with moderate motivation showed low literacy skills and had not achieved all expected indicators.

These findings align with previous research (Matondang et al., 2023); (Suciawati et al., 2023), which emphasizes the role of motivation in mathematical performance. However, this study extends the discussion by focusing specifically on rational number problems. Unlike general mathematical abilities, rational numbers require specific cognitive strategies and problem-solving skills, which students with low motivation struggle to develop.

Further analysis indicates that students with moderate motivation tend to face difficulties in formulating and interpreting mathematical problems despite their willingness to learn. This suggests that motivation alone is not sufficient; instructional strategies and effective teaching methods must be incorporated to enhance students' mathematical literacy.

In contrast, the findings of this study differ from those presented by (Apriliana & Nindita, 2023), which stated that high student motivation correlates with high mathematical literacy skills. This study found that some students with high learning motivation still exhibited low mathematical literacy skills. This discrepancy can be attributed to several factors, including the inability of some students to formulate problems, a lack of understanding of the strategies that must be applied, and difficulties in applying concepts and evaluating results to achieve desired outcomes. Despite these challenges, their enthusiasm and eagerness to learn remained high.

The researchers concluded that teachers need to pay special attention to this stage to ensure that highly motivated students can also improve their mathematical literacy skills. Interviews revealed that students struggled to understand mathematical literacy in the context of daily life and felt confused about determining the first steps to solve problems correctly. Therefore, it is crucial to incorporate more frequent applicative questions into the curriculum, allowing students to become accustomed to solving real-world problems they encounter.

In conclusion, these findings highlight the importance of structured interventions to boost mathematical literacy skills, particularly in rational number problems. The results suggest that enhancing motivation should be accompanied by targeted instructional methods to help students bridge the gap between motivation and literacy performance. By addressing both motivational and instructional aspects, educators can better support students in developing the necessary skills to succeed in mathematics.

CONCLUSION

The analysis of the mathematical literacy ability of 34 grade VII students of SMP Negeri 1 Tanjungsari showed an average of 29.26 (the highest score of 100, the lowest score of 5). Most students (79.41%) are in the low category, while only a small part are in the medium (1.70%) and high (1.02%) categories. The analysis of learning motivation showed a different distribution: 17.65% of students were highly motivated, 61.76% were moderate, and 20.58% were low. The results showed a positive correlation between high learning motivation and good mathematical literacy skills (meeting all indicators). In contrast, low motivation correlates with low literacy ability (not meeting all indicators), as well as moderate motivation.

This finding is different from previous research which showed that there were highly motivated students but had low mathematical literacy skills. This indicates the need for further research to identify the factors that hinder the improvement of mathematical literacy skills in highly motivated students. In class VII H SMP Negeri 1 Tanjungsari, the majority of students (79.41%) had low mathematical literacy skills, while most (61.78%) showed moderate motivation to learn. These findings underscore the importance of teacher support and student awareness in improving mathematical literacy skills.

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