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PROFILE OF STUDENTS' MATHEMATICAL LITERACY BASED ON LEVEL OF MATHEMATICAL CONNECTION ABILITY

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ABSTRACT

The purpose of this study was to describe students' mathematical literacy abilities based on the level of mathematical connection ability using a qualitative descriptive approach. The researcher as the main instrument was assisted by test questions to measure the ability to connect mathematics and mathematical literacy, as well as interviews. The research subjects were 3 class IX students of SMP Islam Pakis. Subject selection was made based on high, medium, and low levels of mathematical connection ability. The results showed: The selection of research subjects was carried out by purposive sampling technique based on high, medium, and low levels of mathematical connection ability. The results of the data analysis obtained: (1) students at a high level of mathematical connection succeeded in achieving all indicators of mathematical literacy ability, such as being able to identify the information contained in the problem, make mathematical models, do reasoning, use symbols, design and implement appropriate problem strategies, summarizing the results, as well as conducting evaluations; (2) students who are categorized in the moderate level of mathematical connection ability are able to achieve five of the seven indicator components contained in mathematical literacy ability; (3) students who belong to a low level of mathematical connection ability are only able to achieve three of the seven indicator components needed in literacy skills.

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1. INTRODUCTION

The ability to be literate in mathematics is very important for students to have in order to be able to help solve mathematical problems related to everyday life (Colwell & Enderson, 2016; Stacey & Turner, 2015; Wijaya, 2016). This is because if students have good mathematical literacy skills, then students are able to understand, compile, and implement mathematical principles in a variety of different contexts (Sari & Wijaya, 2017). In addition, mathematical literacy will provide students with understanding and awareness regarding the role of mathematics in the modern world (Astafieva et al., 2020). Mathematical literacy skills contain three main thought processes, namely formulating, using, and interpreting mathematics in various contextual problem solving effectively (Luo, 2018). Thus, mathematical literacy is important to be taught to students, in order to be able to apply mathematical knowledge in solving everyday problems.

However, various research results still show that the mathematical literacy of students in Indonesia is still relatively low. The ability of students' mathematical literacy is relatively low, especially in the use of communication tools, mathematization components, and when making mathematical representations (Widdah & Faradiba, 2022). Furthermore, the results of research conducted by Novak & Tassell (2017) concluded that the mathematical literacy skills of students in the geometry content domain are in a very low category. In the geometry content domain, it contains congruence and congruence material. Research conducted by Ilmiyah & Setiawan (2020); Nuranjani et al., (2022); Setiawan (2020)produced important findings related to geometry which not only requires knowledge related to content, but also requires knowledge related to comparison, equivalence, and algebraic operations. The difficulties faced by students when solving problems include the ability to read and understand sentences, mathematics, students' lack of understanding of previous material, and difficulties in formulating implementation strategies and drawing conclusions. Furthermore, Wijaya (2016) argues that there is a rejection of the use of real-life contexts related to mathematical literacy based on disinterest in the context itself or the inability to connect mathematics with real-life situations (Abidin et al., 2023; Faradiba et al., 2023).

The results of research conducted by Chin & Pierce (2019); Mann et al., (2017); Son & Lee (2020) related to the teacher's conception of the obstacles to the development of mathematical literacy with research results that can be categorized into: (i) conceptual challenges (What is mathematical literacy?); (ii) educational challenges (How can we develop mathematical literacy?); and (iii) systemic challenges (Where is mathematical literacy (to be) located?). Furthermore, the results of the study Mamolo (2021) show that the views of mathematics subject teachers regarding mathematical literacy can be categorized into 5 competencies: 1) abilities related to problems in people's daily lives, 2) communicating using concepts and characteristics mathematics, 3) interpreting mathematical sentences into everyday language or vice versa, 4) activities related to reading and writing about mathematics, 5) basic knowledge of mathematics. However, teachers still have difficulty carrying out learning related to developing students' competencies in mathematical literacy(Nasikah et al., 2024; Rahmah et al., 2023; Sobirin et al., 2024).

The problem of students' mathematical literacy is of concern to various researchers. Previous research conducted by Hong et al. (2020) shows that interest in mathematics, as well as curiosity about the use of mathematics in everyday life may be factors in achieving the level of mathematical literacy ability. The results of the study Yang et al. (2020) show that in order to develop mathematical literacy skills, teachers should pay attention to students' learning styles and adjust the methods used. In addition, in terms of solving mathematical literacy problems, students can apply the steps in the correct order and

calculation and can review the answers that have been done and write conclusions (Ilmi et al., 2022; Sunismi et al., 2023; Wedastuti et al., 2022).

Mathematical literacy skills are basically abilities that include communication skills, representation, reasoning, connections, and problem-solving skills in mathematics (Sumirattana et al., 2017). However, previous studies have not conducted research on mathematical literacy skills in solving problems related to congruence and congruence by linking topics in mathematics, hereinafter referred to as mathematical connection skills. Rodríguez-Nieto et al. (2022) defines the ability to connect mathematics as a mathematical ability which includes interrelated relationships between concepts, ideas, principles, content, processes, mathematical theorems. Mathematical connections have a very important role not only in studying mathematics and solving mathematical problems, but also in other sciences and in everyday life. By mastering the ability to connect mathematics, students will view mathematics as a science whose topics are interrelated and useful in other lessons and in real-life contexts (Hasanah & Setiawan, 2023; Nor et al., 2023; Wedastuti, 2023; Widdah & Setiawan, 2023).

However, in learning mathematics it is not uncommon to find mathematical connection errors made by students in the form of being unable to use mathematics in everyday life, concretely in the form of being unable to digest information on contextual mathematical problems (Petrican, 2017). The lack of students' ability to write down everyday life problems in the form of mathematical sentences, write down mathematical concepts that underlie answers, and write down relationships between objects and mathematical concepts is the cause of low mathematical literacy based on students' mathematical connections (Alfarizi & Fuady, 2023; Cahyaningrum et al., 2023; Khasanah et al., 2023; Rumiati et al., 2023; Tsabitah & Sunismi, 2023). This indicates that learning mathematics in schools should place more emphasis on the relationship between mathematical concepts and real-life problems in order to improve students' abilities in mathematical literacy. Therefore it is important to look at mathematical literacy skills based on mathematical connections through solving contextual problems(Amhar et al., 2023; Azizah & Sunismi, 2023; Sobirin et al., 2023; Wedastuti et al., 2023; Wedastuti & Faradiba, 2023).

Thus the purpose of this study was to describe the mathematical literacy abilities of students based on the level of mathematical connection ability in solving contextual problems related to congruence and congruence material in class IX at SMP Islam Pakis, this was done because no one had done this research. This research can provide information on students' mathematical literacy profiles based on students' mathematical connection abilities at high, medium, and low levels. The results of this study can be used by teachers in order to develop students' mathematical literacy according to their level of mathematical connection.

2. METHOD

This research is a type of descriptive qualitative research. The research was conducted in the even semester of 2022/2023 in January 2023 for two weeks. The population in this study were 45 students of class IX at SMP Islam Pakis. The procedure for selecting research subjects used a purposive sampling technique.

The instruments used in this study were math connection test questions, math literacy test questions, and interview guidelines. The data analysis techniques used in this study are triangulation, member checking, and reflexivity which is used as the validity and reliability of the data. Mathematical connection test questions and math literacy test questions adapted

from (Subchan, Mufid, Fahim, & Syaifudin, 2018). The math connection test questions tested on students are as follows.

It is known that the ABCD trapezoid and the FEHG trapezoid are congruent. If the sides AD=12 cm, DC=13 cm, and EF=22 cm, then:

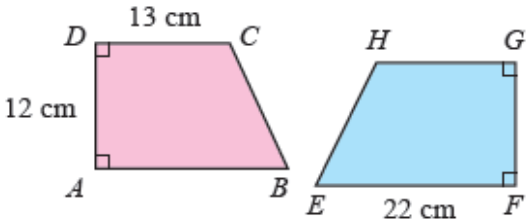

Figure 1. Mathematical Connection Test

a. *Determine the length of the EH!*
b. *What formula did you use to solve the problem?*
c. *The shape above is one application of transformation geometry, what transformation is used?"*

The math literacy test questions tested on students are as follows.

1. *A photo is placed on a piece of cardboard measuring 50 cm×40 cm, before being placed in the frame. On the left, right, top and bottom of the photo are spaced as shown in the picture. The photo and the carton are congruent*

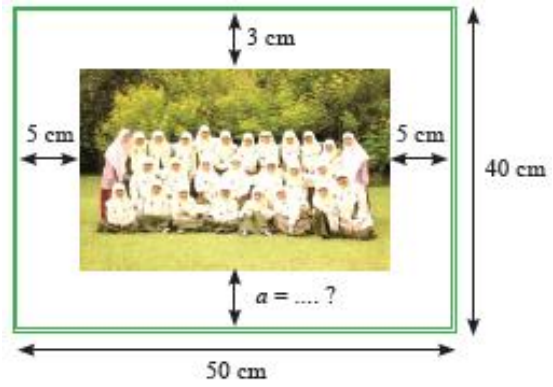

Figure 2. Mathematical Literacy Test

   a. *How wide is the bottom of the cardboard that is not covered by the photo?*
   b. *What is the ratio of the area of the photo and the area of the cardboard?*

2. *"Pak Husein and Pak Hasan have congruent rectangular fields. If the length of Pak Husein's rice field is* $(4x + 2)$ *meters and the width is* $(2x + 1)$ *meters.*
   a. *What is the area of Pak Hasan's rice field if it is known that the circumference of the rice field is 150 m!*
   b. *Determine the area of Pak Hasan's rice field!*

Data analysis used in this study used the Miles & Hubberman model which consisted of 4 stages, including: data collection stage, data reduction stage, data presentation stage,

conclusion drawing stage (Creswell & Guetterman, 2019). These stages are described as follows.

The first stage is data collection. The data collection technique in this study was that as many as 45 class IX students were given math connection test questions (see Figure 1), then corrected the students' answers according to the math connection indicator. The indicators of mathematical connection ability used in this study refer to the indicators as follows: a) understand the relationship between various representations of concepts and procedures, and understand the relationship between mathematical topics; b) understanding the equivalent representation of the same concept, looking for connections from one procedure to another in an equivalent representation; c) look for relationships between various representations of concepts and procedures.

The ability of students' mathematical literacy can be determined based on their ability to connect mathematics when these students can solve contextual problems using mathematics by linking topics in mathematics, representing equivalent concepts of the same concept, and fulfilling the component indicators of mathematical literacy skills. Through the ability to connect mathematics, the concepts of thinking and students' insights will be more open to mathematics, not only focused on certain topics, so that it will lead to a positive attitude towards mathematics itself. With good mathematical connection skills, it will help students to be able to find out the relationship between various concepts in mathematics and apply mathematics in everyday life (Abid, 2019; Firmanti & Reflina, 2022; García-García & Dolores-Flores, 2020, 2021; Kusuma et al., 2019; Rodríguez-Nieto et al., 2022).

The second stage is data reduction. After the data has been collected, the next step is data reduction. Unnecessary data can be discarded by the researcher, so the researcher will select the essential and relevant information that is deemed important and focused on the research only, then organize the data that will be used. Important and focused data required for the research will be sorted through this data reduction process. The selected data will be repeatedly checked to ensure they meet the intended research objectives. The chosen data will include all information related to the research focus, which is mathematical literacy (Colwell & Enderson, 2016; Gabriel, 2020; Rosa & Orey, 2015; Sari & Wijaya, 2017; Stacey & Turner, 2015; Sumirattana et al., 2017; Wijaya, 2016; Yang et al., 2020).

The third stage is data presentation. After the data is organized, the next step is data presentation to make the data easily readable and understandable. Following the data reduction process, the researcher will present the data in the form of graphs, tables, or narratives. The results of data reduction in this study are derived from the completion of the mathematical literacy test by students with different levels of mathematical connection ability. These results will then be presented in a narrative form, aligned with the indicators used as references to measure the extent of students' mathematical literacy abilities. Table 1 below contains the indicators used as references to measure the components of mathematical literacy in this research as follows.

Table 1. Indicators of Mathematical Literacy Components

No.	Components of Mathematical Literacy	Indicators of Mathematical Literacy Components
1.	Mathematical Communication	Conveying ideas/concepts by writing and mentioning the information provided in the problem.
2.	Mathematization	Formulating mathematical problems and their solutions by creating mathematical models.

3.	Representation	Solving mathematical problems by applying relevant mathematical ideas.
4.	Reasoning	Can think and argue logically, as well as convey ideas clearly through speaking, writing, drawings, and draw conclusions from the topics of congruence and similarity.
5.	Designing Strategies	Designing strategies to solve problems related to congruence and similarity topics.
6.	Using mathematical symbols or notation.	Using symbols or mathematical notation to express mathematical ideas that are easily understandable.
7.	Writing conclusions and evaluations.	Drawing conclusions from the solutions obtained in the problem-solving process.

The fourth stage is drawing conclusions. The process of drawing conclusions is based on the data analysis from the information presented in the previous stages. Drawing conclusions is done after data analysis based on the indicators of mathematical literacy components has been conducted.

3. RESULTS AND DISCUSSION

3.1 Result

After correcting students' answers related to the math connection test questions, 9 students got correct answers but were not quite right when mentioning material related to the questions given in point C (Figure 1), 17 students who got incorrect answers, but still tried relate the problem to previously studied mathematical material, and 19 other students answered incorrectly and did not match the mathematical connection indicator. Then grouping students based on different levels of mathematical connection ability with the following categorization.

Table 2. Categorization of Students' Levels of Mathematical Connection Ability

No.	Levels of Mathematical Connection Ability	Skor
1.	High	$80 \leq \text{Skor} \leq 100$
2.	Moderate	$60 \leq \text{Skor} < 80$
3.	Low	$0 \leq \text{Skor} < 60$

After categorizing the students based on their levels of mathematical connection ability, one student will be selected to represent each group: high, moderate, and low levels of mathematical connection ability. The selected students will be asked to complete a test measuring their mathematical literacy skills. After completing the test, an interview will be conducted with each student to further explore the information related to the steps taken in solving the previously completed mathematical literacy test.

The results of this research will be presented according to the research stages. The first stage is data collection. The data collection process begins with the administration of a test that serves as a tool to measure the level of mathematical connection ability of ninth-grade students.

Table 3. Categories of Students' Mathematical Connection Ability Levels.

No.	Levels of Mathematical Connection Ability.	The quantity of students.	Skor	% students
1.	High	9	$80 \leq$ Skor ≤ 100	20%
2.	Moderate	17	$60 \leq$ Skor < 80	37,78%
3.	Low	19	$0 \leq$ Skor < 60	42,22%

From the test results, the researcher will select three students to be the research subjects, each belonging to one of the three categories of mathematical connection ability: high, moderate, and low. After that, a mathematical literacy test will be administered to these three students, and in the next stage, they will be interviewed by the researcher.

The second stage is data reduction. After collecting the data, the researcher will select the students as research subjects. One student from each level of mathematical connection ability will be chosen as participants for this research. Therefore, the research subjects consist of three students, namely:

The Subject With A High Level of Mathematical Connection Ability (S1)

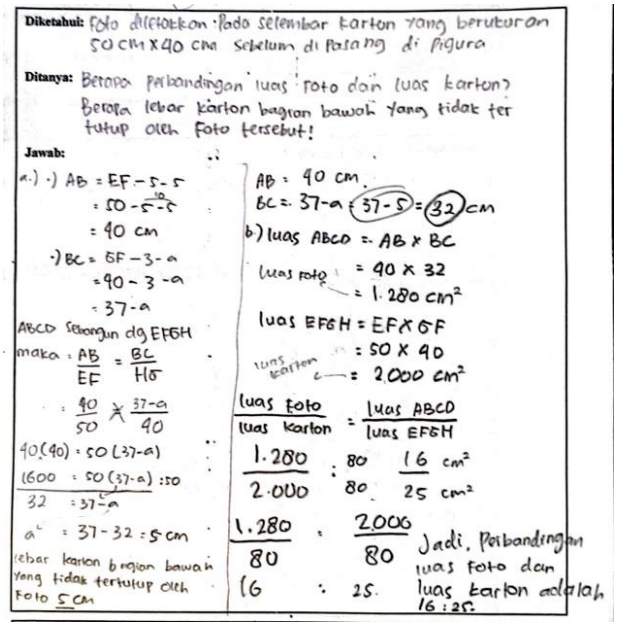

Figure 3. Mathematical Literacy Ability Test Results for Student 1, Question No. 1.

In the previous mathematical connection ability test, student S1 obtained a score of 90, indicating a high level of mathematical connection ability. The analysis of the mathematical literacy ability test, as shown in Image 3, revealed the following findings. S1 was able to comprehend the purpose and request of Question No. 1 and effectively identified, wrote, and mentioned the information contained in the problem. To represent the mathematical situation, S1 used appropriate symbols, such as using "a" to indicate the width of the bottom part of the cardboard not covered by the photo. S1 also added point names for angles to facilitate problem-solving. The following excerpt from the interview demonstrates this:
Researcher: "Why did you name the points of the angles on the photo paper and cardboard?"

S1: "I did that to make it easier for me to determine the corresponding sides when making comparisons between the cardboard and the photo paper, Ma'am."

Based on the interview excerpt, S1 employed reasoning using the similarity of two congruent figures to determine the width of the bottom part of the cardboard not covered by the photo. When finding the value of "a," S1 was not misled by the width of the top part of the cardboard. The following interview excerpt addresses this:

Researcher: "Why did you choose to use the method of comparison? Wasn't it known that the width of the top part of the cardboard not covered by the photo is 3 cm, so the width of the bottom part not covered by the photo should also be 3 cm?"

S1: "Actually, at first, I thought the width of the bottom part of the cardboard not covered by the photo was also 3 cm, Ma'am. That's why I tried to verify using the method of comparison. It turns out that after using the comparison method, I obtained a width of 5 cm for the bottom part of the cardboard."

Based on the interview excerpt, S1 was able to formulate the problem by creating a mathematical model using the concept of similarity to verify the previous estimate of the answer. However, S1 obtained a different result when using the comparison method. This also fulfills the next component indicator, as S1 can design and implement problem-solving strategies effectively, resulting in a correct answer. S1 also provided a conclusion and evaluation at the end of the answer based on the problem-solving result obtained. It can be said that S1 accomplished all the indicators required for mathematical literacy abilities during the problem-solving process for this question. In Question No. 2, S1 solved the problem effectively and met all the indicators of mathematical literacy ability, as supported by the interview. The results of S1's work for Question No. 2 are shown in Figure 4 below.

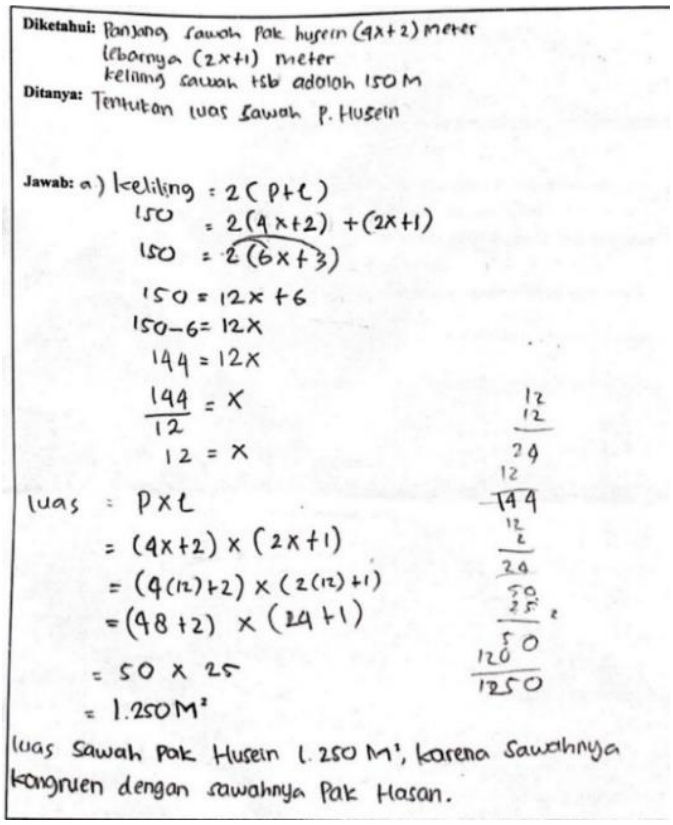

Figure 4. Mathematical Literacy Ability Test Results for Student 1, Question No. 2.

After analyzing the results obtained from the mathematical literacy ability test in Image 4 and the interview with S1 regarding Question No. 2, the following analysis results are

obtained. S1 was able to identify, write, and mention the information provided in the problem, which involved solving a congruence problem using similarity ratios. S1 also comprehended and identified the information requested or inquired in both parts (a) and (b) of Question No. 2. S1 effectively created a mathematical model and used symbols and variables in part (a) of Question No. 2. S1 designed and applied problem-solving strategies effectively. S1 demonstrated reasoning skills when drawing conclusions based on the similarities. S1 also made conclusions and evaluations of the final answers obtained. Based on the analysis results, it can be stated that S1 successfully achieved all the indicators present in mathematical literacy abilities.

The Subject With A Moderate Level of Mathematical Connection Ability (S2)

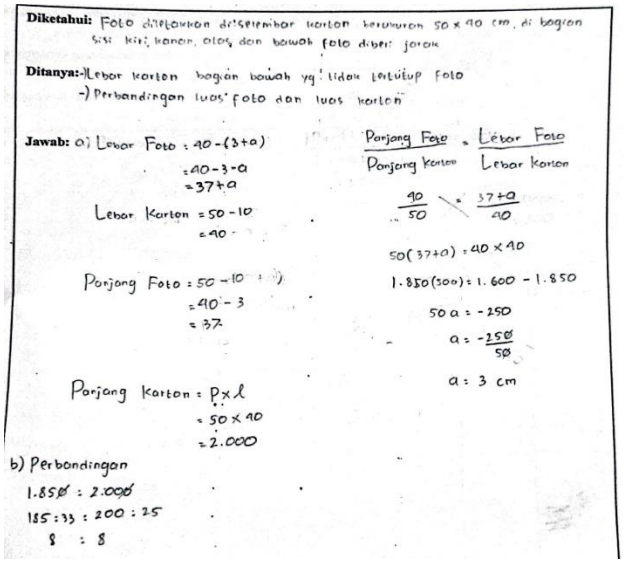

Figure 5. Mathematical Literacy Ability Test Results for Student 2 (S2), Question No. 1.

In the previous mathematical connection ability test, S2 obtained a score of 78, indicating a moderate level of mathematical connection ability. After analyzing the results of the mathematical literacy ability test for Question No. 1 and conducting an interview with S2, the following findings were obtained. Question No. 1 indicates that S2 has the ability to comprehend the intended information in the problem, write relevant information in detail, and use appropriate mathematical symbols to facilitate the problem-solving process. This is reflected in how S2 solved the problem, such as using the symbol "a" to find the measurement of the bottom part of the cardboard not covered by the photo. S2 can formulate the problem by creating a mathematical model to solve the given problem. S2 demonstrated mathematical representation by creating equations or mathematical expressions to facilitate problem-solving. S2 can reason using the similarity of two congruent figures to determine the width of the bottom part of the cardboard not covered by the photo. S2 was also able to apply problem-solving strategies that were previously designed effectively.

As seen in Image 5 from the provided answer, S2 did not mention important information that was crucial, namely the area unit and length unit. When interviewed, S2 admitted to forgetting to include them. When applying similarity ratios, S2 made a mistake by not dividing the area of the cardboard and the area of the photo by the same number, resulting in an inaccurate final answer.

Researcher: How did you obtain the final result of the comparison between the area of the cardboard and the area of the photo?

S2: I divided them by a number that would make the final result of the comparison the same, Ma'am.
Researcher: Are you sure that the method you used is correct?
S2: Yes, Ma'am, that's how I remember doing it.
Researcher: Shouldn't both the area of the cardboard and the area of the photo be divided by the same number to obtain the final result of the comparison?
S2: Oh, is that so, Ma'am?
Researcher: When you divide them by different numbers, like in your answer, you were thinking of getting the same comparison result. Does that mean 1,850 cm^2 is the same as 2,000 cm^2?
S2: Oh, yes, you're right, Ma'am. They are different. Does that mean my approach was not accurate?
Researcher: Yes, that's correct.

Based on the interview excerpt, this is unfortunate because the problem-solving strategy steps were good, but there was a lack of precision in the final step. Additionally, S2 did not evaluate the final result obtained. It can be concluded that S2 has not successfully achieved all the indicators present in mathematical literacy abilities. S2 only fulfills six out of the eight component indicators of mathematical literacy. In Question No. 2, S2 solved the problem well but did not meet all the indicators of mathematical literacy ability. The results of S2's work for Question No. 2 are shown in Figure 6 below.

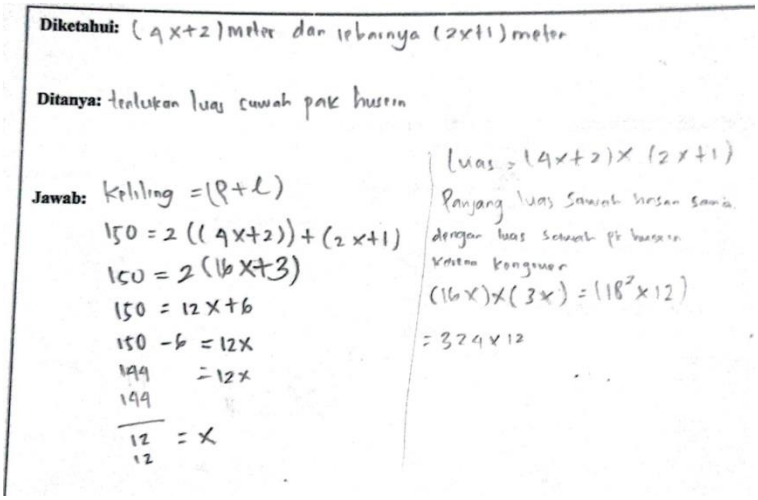

Figure 6. Mathematical Literacy Ability Test Results for Student 2 (S2), Question 2.

After conducting the mathematical literacy ability test and interview, it was found that in Question No. 2, S2 was able to write and identify the information related to similarity ratios in solving the congruence problem. However, S2 did not fully understand the question or problem posed in part (a) of Question No. 2. S2 could use the appropriate mathematical symbols and variables, as well as create a mathematical model for part (a) and perform reasoning for part (b). However, when trying to find the area of the field using the formula for the area of a rectangle, S2 encountered difficulties and did not obtain the correct final answer.
Researcher: When finding the area of the field owned by Mr. Hasan, what method did you use?
S2: I used the formula for the area of a rectangle, Ma'am.
Researcher: Okay, then why didn't you continue the calculation?

S2: Because the length and width involve "x," I was thinking of using algebraic multiplication, but I forgot how to do it.
Researcher: Indeed, the area of Mr. Hasan's field can be found using algebraic multiplication, but there is another method as well. Previously, you obtained the value of "x" that you were looking for through the perimeter formula. That "x" value could also be used as a starting point to find the area of Mr. Hasan's field without involving algebraic multiplication.
S2: Oh, I see, Ma'am. I didn't think of using the "x" value first.

Based on the interview excerpt, S2 is actually able to design and apply problem-solving strategies effectively, even though the final correct answer was not reached. Additionally, S2 did not draw a conclusion in the final answer. It can be concluded that S2 has not successfully achieved all the indicators of mathematical literacy ability. Figure 4 below shows the results of S2's work for Question No. 2.

The Subject With A Low Level of Mathematical Connection Ability (S3)

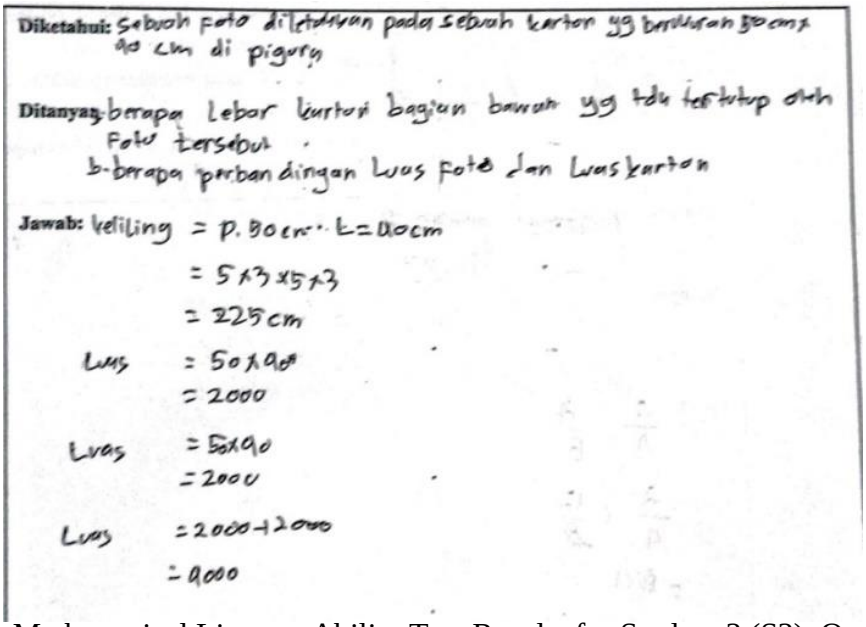

Figure 7. Mathematical Literacy Ability Test Results for Student 3 (S3), Question No. 1.

After analyzing the results of the mathematical literacy ability test and conducting an interview with S3, the following findings were obtained. S3 has the ability to understand the question in Question No. 1 and was able to identify, write, and state the given information accurately.
Researcher: What information do you know from the question?
S3: There is a photo placed on top of a cardboard. The cardboard's length is 50 cm, and its width is 40 cm.
Researcher: Is that the only information you can gather from the question?
S3: The width on the right and left sides of the cardboard that is not covered by the photo is 5 cm, and the width on the top and bottom of the cardboard that is not covered by the photo is 3 cm.

Based on the interview excerpt with S3, it can be observed that S3 was misled by equating the unknown width at the bottom of the cardboard with the known width at the top of the cardboard, which is 3 cm. Additionally, in representing the mathematical situation to show the width of the cardboard, S3 did not use the appropriate symbols. S3 also did not

create a mathematical model using similarity ratios and did not apply problem-solving strategies effectively, leading to incorrect steps and an inability to solve the problem. It can be concluded that S3 only fulfilled the first indicator present in mathematical literacy ability. Similarly, in solving Question No. 2, S3 was unable to formulate a correct problem-solving strategy, resulting in the inability to meet all indicators of mathematical literacy ability. The results of S3's work for Question No. 2 are shown in Figure 8.

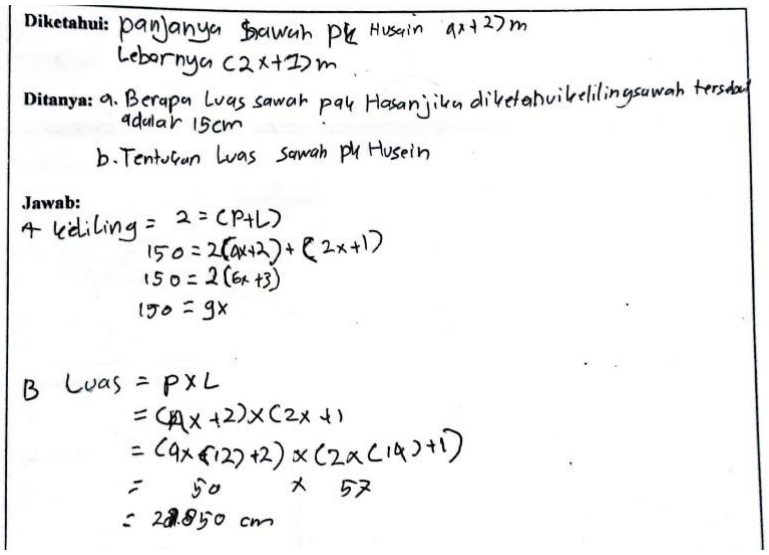

Figure 8. Mathematical Literacy Ability Test Results for Question 2, Subject S3.

After analyzing the test results conducted to measure mathematical literacy ability and conducting an interview with S3, it was found that S3 was able to understand the questions asked in Question No. 2, both for point (a) and point (b). S3 could write down and state the given information regarding solving the congruence problem. S3 was able to use symbols and variables to represent a length, denoted as x. S3 could also formulate the problem by creating a mathematical model. Additionally, S3 was able to perform mathematical representation by creating equations or mathematical expressions to facilitate problem-solving. However, S3's problem-solving was not accurate, both for Question No. 2, point (a), and point (b). Furthermore, S3 did not demonstrate reasoning in solving Question No. 2. S3 also lacked the ability to design and apply problem-solving strategies effectively, and did not draw conclusions or evaluate the results obtained from the solutions. It can be concluded that S3 only fulfilled three indicators present in mathematical literacy ability.

Table 3. Mathematics Literacy Profile Based on the Level of Mathematical Connection Ability

Mathematics Literacy Profile Based on the Level of Mathematical Connection Ability.		
High	**Moderate**	**Low**
1. Able to write and state the known information in the problem. 2. Can formulate the problem by creating	1. Capable of writing and stating the known information in the problem. 2. Able to formulate the problem by creating a mathematical model.	1. Capable of writing and stating the known information in the problem. 2. Able to formulate the problem by

Mathematics Literacy Profile Based on the Level of Mathematical Connection Ability.		
High	**Moderate**	**Low**
a mathematical model. 3. Adds point names to facilitate problem-solving. 4. Engages in reasoning by using proportionality between two similar figures to determine the width of the bottom part of the cardboard not covered by the photo. 5. Capable of designing and implementing problem-solving strategies effectively, resulting in correct answers. 6. Able to use symbols in problem-solving. 7. Writes conclusions and conducts evaluations.	3. Performs mathematical representation by creating equations or mathematical expressions to facilitate problem-solving. 4. Engages in reasoning by using proportionality between two similar figures to determine the width of 5. 6. the bottom part of the cardboard not covered by the photo. 7. Capable of designing and implementing problem-solving strategies effectively, but makes an error in the final step by not dividing with the same number, resulting in a less accurate final answer. 8. Able to use symbols in problem-solving. 9. Does not write conclusions and conduct evaluations.	creating a mathematical model in question number 2. 3. Performs mathematical representation by creating equations or mathematical expressions to facilitate problem-solving. 4. Does not engage in reasoning. 5. Not yet capable of designing and implementing problem-solving strategies. 6. Does not use symbols in problem-solving. 7. Does not write conclusions and conduct evaluations.

3.2 Discussion

The conclusion drawn based on the explanations above is that students who successfully complete the test of mathematical literacy have demonstrated their ability to formulate problems related to real-life events, as indicated by their ability to state the information contained in the questions, use mathematical symbols, engage in reasoning, develop problem-solving strategies, and provide conclusions by evaluating the obtained solutions. Such students belong to the group with a high level of mathematical ability in making connections between mathematical concepts and real-world problems. This aligns with the statement by Sumirattana et al. (2017) that students' mathematical literacy is considered good if they can write and interpret relevant information from mathematical questions, formulate mathematical models, use logic to solve problems, use mathematical symbols appropriately, develop and apply effective strategies in problem-solving, and provide conclusions and evaluations of the results achieved. By possessing high mathematical literacy skills, individuals can reflect mathematical logic in problem-solving related to daily life (Masjaya & Wardono, 2018).

On the other hand, students with moderate-level mathematical connections have not yet achieved all the indicators in mathematical literacy. This is consistent with statement that students are not successful in meeting good mathematical literacy indicators because they

do not fulfill the third and fourth indicators by failing to interpret the solutions back into real-life and not evaluating the results in solving question number 2. There are two factors contributing to the students' mistakes in problem-solving, namely the inability to apply concepts when solving problems and lack of precision in solving the given questions, as well as lacking the ability to manipulate problem-solving steps. Other factors include lack of motivation and interest in learning the material provided during the learning process (Locke & Braver, 2008; Müller, 2019). This is consistent with the findings of Liljedahl et al. (2016) regarding the factors causing students' mistakes in solving mathematical literacy problems, including misunderstanding the questions, lack of problem-solving skills, and rushing to answer, resulting in less accurate answers.

Students who are likely to have insufficient understanding of the purpose of the problem and encounter difficulties in solving mathematical literacy problems can be concluded to belong to the group of students with low mathematical connections because they have not achieved all the indicators contained in mathematical literacy. This is in line with the opinion presented by Siregar & Panjaitan (2022), indicating that the low mathematical literacy ability of students is influenced by several factors, including difficulty in solving problems that measure the extent of mathematical literacy ability and the inability to interpret given contextual problems, as well as the inability of students to design and apply problem-solving strategies accurately. Similar statements have also been made by (Levels et al., 2017), stating that the low level of mathematical literacy among students is due to a lack of experience in practicing contextual mathematical problems related to real-world and practical issues that require logical reasoning. This aligns with the research findings of Yang et al. (2020) which states that students' mistakes in solving mathematical literacy problems include making incorrect assumptions about the question's purpose, which results in students being able to read the question well but not being able to interpret the sentences in the question.

Teachers should provide more non-routine problem-solving materials to improve students' reasoning and address the low mathematical literacy ability among students (Öztürk, 2020). The low level of mathematical literacy is also caused by students not being familiar with problems that require logical, critical thinking and applicative solutions, as they tend to solve problems with procedural and concrete answers (Lenz et al., 2020).

4. CONCLUSION

From the results and discussion regarding students' mathematical literacy skills based on their level of mathematical connections, the following findings were obtained: (1) students classified in the group with a high level of mathematical connections were able to achieve all the required indicators in mathematical literacy, as evidenced by their skilled ability to solve contextual problems; (2) students categorized in the moderate level of mathematical connections were able to achieve five out of seven components of indicators in mathematical literacy; (3) students classified in the low level of mathematical connections were only able to achieve three out of seven components of indicators required in mathematical literacy. This research is beneficial in understanding the extent of mathematical literacy skills among students based on their level of mathematical connections in different levels. It is hoped that teachers can provide more variations of mathematical literacy problems so that students become accustomed to solving non-routine contextual problems.

REFERENCES

Abid, G. (2019). Deflating inflation: The connection (or lack thereof) between decisional and metacognitive processes and visual phenomenology. *Neuroscience of Consciousness*, *2019*(1). https://doi.org/10.1093/nc/niz015

Abidin, Z., Susanti, E., Sari Faradiba, S., & Kunci GeoGebra Pelatihan Persamaan Garis Lurus, K. (2023). Pelatihan Aplikasi GeoGebra pada Materi Persamaan Garis Lurus. *PengabdianMu: Jurnal Ilmiah Pengabdian Kepada Masyarakat*, *8*(3), 477–488. https://doi.org/10.33084/PENGABDIANMU.V8I3.4607

Alfarizi, M., & Fuady, A. (2023). Analisis Efektivitas Pembelajaran Berbasis STEM dalam Meningkatkan Pemahaman Konsep Matematis. *HISTOGRAM: Jurnal Pendidikan Matematika*, *7*(2), 173–184. https://doi.org/10.31100/HISTOGRAM.V7I2.3308

Amhar, Y., Faradiba, S. S., & Abidin, Z. (2023). ANALISIS TINGKAT KEBERHASILAN: HASIL VALIDASI BUKU TANGKAS MATEMATIKA 14 LEVEL. *HISTOGRAM: Jurnal Pendidikan Matematika*, *7*(2), 133–141. https://doi.org/10.31100/HISTOGRAM.V7I2.3306

Astafieva, M., Bodnenko, D., Lytvyn, O., Proshkin, V., & Zhyltsov, O. (2020). Mathematical preparation of students for their professional self-realization in modern innovative society. *SHS Web of Conferences*, *75*, 04010. https://doi.org/10.1051/SHSCONF/20207504010

Azizah, N. L., & Sunismi, S. (2023). PENGARUH PERILAKU ASERTIF TERHADAP TIPE KEPRIBADIAN SISWA DALAM PEMBELAJARAN MATEMATIKA. *HISTOGRAM: Jurnal Pendidikan Matematika*, *7*(2), 185–196. https://doi.org/10.31100/HISTOGRAM.V7I2.3307

Cahyaningrum, I. Y., Fuady, A., & Faradiba, S. S. (2023). Karakterisasi Representasi Matematis Visual dan Simbolik Siswa Kelas IX pada Materi Transformasi. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *7*(3), 2646–2659. https://doi.org/10.31004/CENDEKIA.V7I3.1944

Chin, K. E., & Pierce, R. (2019). University Students' Conceptions of Mathematical Symbols and Expressions. *EURASIA Journal of Mathematics, Science and Technology Education*, *15*(9). https://doi.org/10.29333/EJMSTE/103736

Colwell, J., & Enderson, M. C. (2016). When I hear literacy: Using pre-service teachers' perceptions of mathematical literacy to inform program changes in teacher education. *Teaching and Teacher Education*, *53*, 63–74. https://doi.org/10.1016/J.TATE.2015.11.001

Creswell, J. W., & Guetterman, T. C. (2019). *Educational research : planning, conducting, and evaluating quantitative and qualitative research*. Pearson.

Faradiba, S. S., Negara, F. P., & Abidin, Z. (2023). WORKSHOP PEMBUATAN MEDIA PEMBELAJARAN MATEMATIKA (BANGUN RUANG) PADA KOMUNITAS EKSTRAKURIKULER OLIMPIADE MATEMATIKA. *Martabe : Jurnal Pengabdian Kepada Masyarakat*, *6*(5), 1696–1706. https://doi.org/10.31604/JPM.V6I5.1696-1706

Firmanti, P., & Reflina, R. (2022). The Connection between Algebraic Ability and Self-Efficacy in Senior High School Student. *Kreano, Jurnal Matematika Kreatif-Inovatif*, *13*(2), 319–327. https://doi.org/10.15294/KREANO.V13I2.38098

Gabriel, F. (2020). The impact of mathematics anxiety on self-regulated learning and mathematical literacy. *Australian Journal of Education*, *64*(3), 227–242. https://doi.org/10.1177/0004944120947881

García-García, J., & Dolores-Flores, C. (2020). Exploring pre-university students' mathematical connections when solving Calculus application problems.

Https://Doi.Org/10.1080/0020739X.2020.1729429, *52*(6), 912–936. https://doi.org/10.1080/0020739X.2020.1729429

García-García, J., & Dolores-Flores, C. (2021). Pre-university students' mathematical connections when sketching the graph of derivative and antiderivative functions. *Mathematics Education Research Journal*, *33*(1), 1–22. https://doi.org/10.1007/S13394-019-00286-X/METRICS

Hasanah, F. R., & Setiawan, Y. E. (2023). MATH ANXIETY DAN METACOGNITIVE AWARENESS INVENTORY SISWA SMP. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *12*(3), 3038–3047. https://doi.org/10.24127/ajpm.v12i3.7203

Hong, J., Thakuriah, P. (Vonu), Mason, P., & Lido, C. (2020). The role of numeracy and financial literacy skills in the relationship between information and communication technology use and travel behaviour. *Travel Behaviour and Society*, *21*, 257–264. https://doi.org/10.1016/J.TBS.2020.07.007

Ilmi, S., Setiawan, Y. E., Faradiba, S. S., Sailaja Teeside, S. V, Zoker, M., Vitor, P., & Santiago, S. (2022). Analisys of Students Mathematical Communication in Solving Pythagorean Theorem Problems Based on Level of Ability. *Numerical: Jurnal Matematika Dan Pendidikan Matematika*, *6*(2), 249–260. https://doi.org/10.25217/NUMERICAL.V6I2.3856

Ilmiyah, S., & Setiawan, A. R. (2020). *Students' Worksheet for Distance Learning Based on Scientific Literacy in the Topic Coronavirus Disease 2019 (COVID-19)*. https://doi.org/10.31237/OSF.IO/FPG4J

Khasanah, I., Abidin, Z., Faradiba, S. S., Pascasarjana, P., & Matematika, P. (2023). Analisis Kesalahan Siswa dalam Menyelesaikan Soal Dimensi Tiga Menggunakan Kriteria Watson Ditinjau dari Gaya Belajar dan Perbedaan Gender. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *7*(2), 1976–1987. https://doi.org/10.31004/CENDEKIA.V7I2.1923

Kusuma, D. A., Suryadi, D., & Dahlan, J. A. (2019). Improving external mathematical connections and students' activity using ethnomathematics. *Journal of Physics: Conference Series*, *1157*(3). https://doi.org/10.1088/1742-6596/1157/3/032120

Lenz, K., Dreher, A., Holzäpfel, L., & Wittmann, G. (2020). Are conceptual knowledge and procedural knowledge empirically separable? The case of fractions. *British Journal of Educational Psychology*, *90*(3), 809–829. https://doi.org/10.1111/BJEP.12333

Levels, M., Dronkers, J., & Jencks, C. (2017). Contextual explanations for numeracy and literacy skill disparities between native and foreign-born adults in western countries. *PLOS ONE*, *12*(3), e0172087. https://doi.org/10.1371/JOURNAL.PONE.0172087

Liljedahl, P., Santos-Trigo, M., Malaspina, U., & Bruder, R. (2016). *Problem Solving in Mathematics Education*. 1–39. https://doi.org/10.1007/978-3-319-40730-2_1

Locke, H. S., & Braver, T. S. (2008). Motivational influences on cognitive control: Behavior, brain activation, and individual differences. *Cognitive, Affective and Behavioral Neuroscience*, *8*(1), 99–112. https://doi.org/10.3758/CABN.8.1.99/METRICS

Luo, S. (2018). A Case Study on Intermediate CSL Learners' Word Recognition Processes and Strategies in Contextual Reading Settings. *Chinese Journal of Applied Linguistics*, *41*(3), 288–305. https://doi.org/10.1515/cjal-2018-0023

Mamolo, L. A. (2021). Development of an Achievement Test to Measure Students' Competency in General Mathematics. *Anatolian Journal of Education*, *6*(1), 79–90. https://doi.org/10.29333/AJE.2021.616A

Mann, E. L., Chamberlin, S. A., & K. Graefe, A. (2017). *The Prominence of Affect in Creativity: Expanding the Conception of Creativity in Mathematical Problem Solving*. 57–73. https://doi.org/10.1007/978-3-319-38840-3_5

Müller, T. (2019). Motivational fatigue: A neurocognitive framework for the impact of effortful exertion on subsequent motivation. *Neuropsychologia*, *123*, 141–151. https://doi.org/10.1016/j.neuropsychologia.2018.04.030

Nasikah, F., Sunismi, & Setiawan, Y. E. (2024). HUBUNGAN HABITS OF MIND DAN RASA PERCAYA DIRI TERHADAP HASIL BELAJAR PESERTA DIDIK SMAN 1 LAWANG. *EUCLID*, *11*(1), 81–88. https://doi.org/10.33603/E7HMA072

Nor, S., Atuni, J., Setiawan, Y. E., Faradiba, S. S., Sailaja Teeside, S. V, Zoker, M., Vitor, P., & Santiago, S. (2023). The Process of Students' Mathematical Literacy in Solving System of Two Variables Linear Equation Based on Level of Ability. *Numerical: Jurnal Matematika Dan Pendidikan Matematika*, *7*(2), 333–344. https://doi.org/10.25217/NUMERICAL.V6I2.3859

Novak, E., & Tassell, J. L. (2017). Studying preservice teacher math anxiety and mathematics performance in geometry, word, and non-word problem solving. *Learning and Individual Differences*, *54*, 20–29. https://doi.org/10.1016/J.LINDIF.2017.01.005

Nuranjani, N., Widiada, I. K., & Setiawan, H. (2022). Profil Kemampuan Literasi Membaca Peserta Didik Kelas III SDN 2 Kuta. *Jurnal Ilmiah Profesi Pendidikan*, *7*(2), 387–393. https://doi.org/10.29303/JIPP.V7I2.511

Öztürk, M. (2020). Reading comprehension, Mathematics self-efficacy perception, and Mathematics attitude as correlates of students' non-routine Mathematics problem-solving skills in Turkey. *International Journal of Mathematical Education in Science and Technology*, *51*(7), 1042–1058. https://doi.org/10.1080/0020739X.2019.1648893

Petrican, R. (2017). Contextual and developmental differences in the neural architecture of cognitive control. *Journal of Neuroscience*, *37*(32), 7711–7726. https://doi.org/10.1523/JNEUROSCI.0667-17.2017

Rahmah, J., Sari, R., & Faradiba, S. S. (2023). Pelatihan Aplikasi Geogebra Pada Materi Transformasi Geometri Pada Siswa Smp Assa'idiyyah Kepanjen. *Jurnal Pengabdian Masyarakat Dan Riset Pendidikan*, *1*(3), 132–139. https://doi.org/10.31004/JERKIN.V1I3.29

Rodríguez-Nieto, C. A., Font Moll, V., Borji, V., & Rodríguez-Vásquez, F. M. (2022). Mathematical connections from a networking of theories between extended theory of mathematical connections and onto-semiotic approach. *International Journal of Mathematical Education in Science and Technology*. https://doi.org/10.1080/0020739X.2021.1875071

Rosa, M., & Orey, D. C. (2015). A trivium curriculum for mathematics based on literacy, matheracy, and technoracy: an ethnomathematics perspective. *ZDM - International Journal on Mathematics Education*, *47*(4), 587–598. https://doi.org/10.1007/S11858-015-0688-1

Rumiati, L., Surahmat, S., Sunismi, S., & Walida, S. El. (2023). PENGARUH KECERDASAN LOGIS MATEMATIS TERHADAP KEMAMPUAN LITERASI NUMERASI SISWA SMP BERBANTUAN E-MODUL. *HISTOGRAM: Jurnal Pendidikan Matematika*, *7*(2), 10–22. https://doi.org/10.31100/HISTOGRAM.V7I2.3225

Sari, R. H. N., & Wijaya, A. (2017). Mathematical literacy of senior high school students in Yogyakarta. *Jurnal Riset Pendidikan Matematika*, *4*(1), 100–107. https://doi.org/10.21831/JRPM.V4I1.10649

Setiawan, A. R. (2020). *Scientific Literacy Worksheets for Distance Learning in the Topic of Coronavirus 2019 (COVID-19)*. https://doi.org/10.35542/OSF.IO/SWJMK

Siregar, H. N. I., & Panjaitan, A. (2022). A Systematic Literature Review : the Role of Classical Test Theory and Item Response Theory in Item Analysis to Determine the

Quality of Mathematics Tests. *Jurnal Fibonaci: Jurnal Pendidikan Matematika*, *2*(2), 29. https://doi.org/10.24114/JFI.V2I2.31056

Sobirin, J. H., Ma', S., Rumiati, L., Setiawan, Y. E., Bilingual, S., & Krian, T. (2024). PENDAMPINGAN PENYUSUNAN PROPOSAL PENELITIAN DENGAN PEMANFAATAN TEKNOLOGI INFORMASI PADA MAHASISWA S1. *Jurnal Pengabdian Kepada Masyarakat Bersinergi Inovatif* , *1*(2), 73–79. https://doi.org/10.61674/JPKMBI.V1I2.148

Sobirin, J. H., Setiawan, Y. E., & Faradiba, S. S. (2023). Mathematical Representations Based on Field-Dependent and Field-Independent Cognitive Styles. *JME (Journal of Mathematics Education)*, *8*(2), 137–149. https://doi.org/10.31327/JME.V8I2.1981

Son, J.-W., & Lee, M. Y. (2020). Exploring the Relationship Between Preservice Teachers' Conceptions of Problem Solving and Their Problem-Solving Performances. *International Journal of Science and Mathematics Education 2020 19:1*, *19*(1), 129–150. https://doi.org/10.1007/S10763-019-10045-W

Stacey, K., & Turner, R. (2015). Assessing mathematical literacy: The PISA experience. *Assessing Mathematical Literacy: The PISA Experience*, 1–321. https://doi.org/10.1007/978-3-319-10121-7

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

Sunismi, S., Wedastuti, N. K., & Faradiba, S. S. (2023). WORKSHOP PEMBUATAN MEDIA PEMBELAJARAN MATEMATIKA MENGGUNAKAN APLIKASI GEOGEBRA PADA MATERI VOLUME KERUCUT. *JMM (Jurnal Masyarakat Mandiri)*, *7*(1), 713–721. https://doi.org/10.31764/JMM.V7I1.12629

Tsabitah, I., & Sunismi, S. (2023). VALIDITAS LKPD DIGITAL INTERAKTIF DENGAN AUGMENTED REALITY PADA MATERI VEKTOR DIMENSI 3. *HISTOGRAM: Jurnal Pendidikan Matematika*, *7*(2), 124–132. https://doi.org/10.31100/HISTOGRAM.V7I2.3304

Wedastuti, N. K. (2023). *Ethnomathematic Exploration on Cassava Leaf Painting Batik*. 42–52. https://doi.org/10.2991/978-2-38476-044-2_6

Wedastuti, N. K., & Faradiba, S. S. (2023). Analysis of student's mathematical thinking in solving HOTs problems viewed from mathematics anxiety. *International Journal of Trends in Mathematics Education Research*, *6*(1), 33–40. https://doi.org/10.33122/IJTMER.V6I1.173

Wedastuti, N. K., fuady, A., & Sunismi, S. (2023). Analisis Kualitas Soal Ujian Akhir Semester Dengan Menggunakan Aplikasi Program Anates. *JIPM (Jurnal Ilmiah Pendidikan Matematika)*, *12*(1), 1–11. https://doi.org/10.25273/JIPM.V12I1.15413

Wedastuti, N. K., Sunismi, S., & Faradiba, S. (2022). Scaffolding in Mathematics Learning Social Arithmetic Material to Improve Students' Mathematical Thinking. *QALAMUNA: Jurnal Pendidikan, Sosial, Dan Agama*, *14*(2), 455–470. https://doi.org/10.37680/QALAMUNA.V14I2.3421

Widdah, H., & Faradiba, S. S. (2022). Analisis Literasi Matematika Pada Pembelajaran Matriks Menggunakan Mind Mapping. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *6*(2), 1670–1681. https://doi.org/10.31004/CENDEKIA.V6I2.1374

Widdah, H., & Setiawan, Y. E. (2023). ANALISIS KEMAMPUAN PEMECAHAN MASALAH MATEMATIS DITINJAU DARI MOTIVASI BELAJAR MATEMATIKA SISWA. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *12*(2), 2641–2650. https://doi.org/10.24127/ajpm.v12i2.7113

Wijaya, A. (2016). Students' information literacy: A perspective from mathematical literacy. *Journal on Mathematics Education*, *7*(2), 73–82. https://doi.org/10.22342/JOME.V7I2.3532

Yang, X., Kuo, L. J., & Jiang, L. (2020). Connecting Theory and Practice: a Systematic Review of K-5 Science and Math Literacy Instruction. *International Journal of Science and Mathematics Education*, *18*(2), 203–219. https://doi.org/10.1007/S10763-019-09957-4