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Students' mathematical literacy skills in solving higher-order thinking skills problems

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Abstract
Higher-order thinking (HOTS) problems are a learning assessment system applied to the curriculum in 2013 to improve students' higher-level thinking skills. However, teachers still familiarize students to solve problems with low-level thinking, which lower the Indonesian students' mathematical literacy. This descriptive research with a qualitative approach aimed to explore junior high school students' mathematical literacy skills in Kotapinang in solving HOTS problems applied to the curriculum 2013. Four students were selected as research subjects. Research instruments consisted of mathematical skills tests, literacy tests, and interviews. The researchers applied the triangulation techniques with Miles and Huberman's model as the data analysis technique. The analysis showed that students' mathematical literacy skills in Kotapinang were poor. The researchers recommend applying technology-based learning models, such as blended learning that is suitable for limited face-to-face learning to support the improvement of mathematics literacy skills of junior high school students in solving HOTS problems in the curriculum 2013.

INTRODUCTION

Mathematics is a valuable subject for students to develop and improve their logical, critical, and creative thinking. In the educational curriculum, mathematics is placed as a subject that must be mastered by students, ranging from elementary education to college (Nursalam et al., 2018). Mathematics is one of the subjects evaluated by the Ministry of Education and Culture (Kemdikbud) through national examinations (UN) (Fointuna et al., 2020). Then, mathematics is an essential component in the learning process in schools that requires students to not only be skilled in applying mathematics but understand mathematical problems to make it easier for them to solve problems in real life (Ariyanti & Santoso, 2020; Milaturrahmah et al., 2017). Therefore, students can make extensive use of mathematics in education.

Mathematics learning in Indonesia has not been appropriately realized. The reason is based on a report from a junior high school in Kotapinang that the national examinations (UN) in mathematics were only 3.83. The score was lower than any other subjects. In short, students' mathematical skills were poor. Besides, there are eight student problems in the classroom, namely (1) passive during learning, (2) 1 out of 15 students cannot read fluently, (3) students have difficulty in doing different exercise problems, (4) the application of basic mathematics concepts is still low so that students have difficulty in solving given problems, such as applying the concept of multiplication and division, (5) the students cannot link one concept with another concept, (6) the students cannot solve HOTS mathematics problems, (7) the students cannot identify, formulate, and write answers appropriately, and (8) the students' level of mathematical calculations accuracy is incorrect. This argument is reinforced by several

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previous studies that state that teachers still use conventional learning, which causes students to become less active, and learning tends to be more teacher-centered, thus, impacting student mathematics learning outcomes to be low (Ariyanti & Santoso, 2020).

On the other hand, students find it challenging to predict answers and assess solutions appropriately. Students' lack of reading comprehension and general cognitive skills can affect incorrect mathematical calculations (Lailiyah, 2017). Thus, students must improve their mathematical skills to solve problems appropriately. One of these skills is solving issues closely related to mathematical literacy skills (Kurniawati & Mahmudi, 2019).

Mathematical literacy is a student's skill to formulate, apply, and interpret mathematical problems in real-life contexts. Mathematical literacy aims to help students understand the role or usefulness of mathematics in real life and make informed decisions (Manoy & Purbaningrum, 2021). Mathematical literacy is also one of the components that must be owned individually or personally in education in the 21st-century (Rizki & Priatna, 2019). Machaba (2018) states that the indicators of mathematical literacy consist of five elements, namely (1) mathematical literacy using mathematical content, (2) mathematical literacy using authentic real-life contexts, (3) mathematical literacy using problem-solving skills associated with previously unknown concepts, (4) mathematical literacy using mathematical communication in decision making, and (5) mathematical literacy using content and skills integrated with problem-solving.

However, hope and reality have not been reflected in mathematics literacy in Indonesia because the mathematical literacy skills of students and adults in Indonesia belong to the low category. Based on several previous studies, students are still accustomed to solving contextual problems, causing them to find it challenging to solve context-based mathematical literacy problems, causing low mathematical literacy in Indonesia (Fointuna et al., 2020; Annisavitri et al. 2020). The Programme for International Student Assessment (PISA) shows that Indonesia was ranked 72nd out of 78th participating countries (Manoy & Purbaningrum, 2021). Furthermore, the trends in the International Mathematics and Science Study (TIMSS) state that Indonesia ranks 45th out of 50th TIMSS participating countries (Santia, 2018). Then, PIAAC assessed that the skills of adult mathematics literacy put Indonesia at the rank of 34th out of 34th countries (Annisavitri et al., 2020). The findings of TIMSS and PISA were confirmed by Lailiyah et al. (2018) that Indonesian students have mathematical skills but are inadequate in solving problems related to manipulating mathematical forms and problem-solving strategies in mathematics. Thus, learning assessments that aim to improve students' mathematical literacy skills are needed. The learning assessment is higher-order thinking (HOTS) which seeks to train students' skills to solve HOTS-oriented questions (Santoso & Setyaningsih, 2020).

Higher-order thinking (HOTS) is a problem-solving skill that links new and old experiences by connecting several related concepts, manipulating, changing, and using them simultaneously to obtain new solutions (Nursalam et al., 2018). After Bloom's taxonomy was revised by Anderson & Krathwohl in 2001, every cognitive level in Bloom's taxonomy changed. Therefore, the cognitive level in higher-order thinking skills (HOTS) consists of analyzing (C_4), evaluating (C_5), and creating (C_6) (Baskoro & Retnawati, 2019). The three indicators are benchmarks in the preparation of questions. According to Abdullah et al. (2017), the establishment of HOTS in teaching and learning mathematics is essential to change people's thinking about the difficulty of mathematics. HOTS can also attract students' learning interests

to increase their learning passion. Also, HOTS helps create sustainable learning and instill creativity among individuals. On the other hand, the application of HOTS questions can measure students' learning achievements in the classroom, making it easier for teachers to assess learning in the curriculum of 2013 (Retnawati et al., 2016).

Various mathematical literacy studies have been conducted. Some of these studies have been conducted in several countries, such as research in America which examines the perception of pre-employment teachers (PSTs) related to mathematics, literacy, and factors related to their teacher's research education program at public universities that can influence this perception (Colwell & Enderson, 2016). Furthermore, researchers in South Africa examine the perspective of teachers and facilitators of learning towards strategies or approaches to mathematics learning and mathematical literacy (ML) (Machaba, 2018). Finally, research in Israel examines mathematical ideas needed to understand the pandemic conditions and predict their spread through mathematical media (Heyd-Metzuyanim et al., 2021).

Research on higher-order thinking skills (HOTS) has been conducted in several countries. Research in Malaysia examines the identification and analysis of student errors in solving problems involving HOTS on fractional topics (Abdullah et al., 2015). Furthermore, research in Thailand examines the development of mathematical learning innovations to improve high-level thinking skills at the junior high school level (Kwangmuang et al., 2021). Then, researchers in the United States examine the HOTS levels in mathematics classes to explore the potential use of clickers to train the reasoning process in thinking (Rubin & Rajakaruna, 2015). However, research on mathematical literacy in solving HOTS problems has never been done, which serves as the basis of consideration in conducting this research.

On the other hand, several studies in Indonesia have also been conducted. Researchers in Yogyakarta examine students' information literacy from the perspective of mathematical literacy (Wijaya, 2016). Research in Sidoarjo examines the mathematical literacy of high school students in solving ethnomathematics problems related to batik Sidoarjo (Manoy & Purbaningrum, 2021). Research in Pekalongan examines the identification of mathematical literacy in terms of learning independence in the Blended-learning model with the Moodle-assisted PjBL approach (Angreanisita et al., 2021). Research in Tangerang examines the literacy of high school students in solving PISA mathematics problems contents (Fadillah & Ni'mah, 2019). Lastly, research in Lombok examines the mathematical literacy of junior high school students (Ahyan et al., 2019).

Furthermore, research on solving HOTS problems applied to the curriculum 2013 in Indonesia has also been carried out. First, research in Yogyakarta examines the types of mistakes made by vocational students in solving problems involving high-level thinking skills based on Newman (Baskoro & Retnawati, 2019). Second, research in Makassar examines the procedures and assesses the quality of instrument development tests to measure the high-level thinking skills of junior high school students in mathematics (Nursalam et al., 2018). Third, research in Jakarta examines students' high-level thinking skills in solving HOTS-oriented problems in instructional evaluation courses (Yuliati & Lestari, 2018). Fourth, research in Denpasar examines (1) the understanding and knowledge that teachers have about the characteristics and concepts of HOTS assessment in-depth and (2) the development of the skills of teachers in HOTS assessment (Widana, 2017). Fifth, research in Malang examines how male and female mathematics teachers make decisions in HOTS-based learning processors (Sadijah

et al., 2021). In line with the information above, research on junior high school students' mathematical literacy skills in Kotapinang in solving HOTS problems has never been done. Therefore, this research explores the junior high school students' mathematical literacy skills in Kotapinang in solving HOTS problems applied to the curriculum 2013. This research measures students' mathematical literacy skills using HOTS problems to assess learning outcomes in curriculum 2013. Besides, the findings obtained can be used as a basis for development research conducted in mathematics learning. The results can also develop HOTS problems in supporting mathematical literacy in Indonesia through real-life contexts.

METHODS

This research is descriptive research with a qualitative approach to explore the junior high school students' mathematical literacy skills in Kotapinang in solving HOTS problems in the curriculum 2013 (Annisavitri et al., 2020). This research was conducted from 4 to 19 February 2022. The junior high school in Kotapinang was chosen as a research location because it had a strategic location and was easy to reach. The research population was the seventh-grade students of junior high school in Kotapinang. There were seven classes in seventh grade. So, the researchers chose class VII-6 with 32 students as a research sample. Furthermore, four students were selected as research subjects based on five specific considerations, i.e., 1) aged 12 to 15 years, (2) had studied number matter, set, algebraic form, and equations & linear inequality of one variable, (3) scored more than 80 on mathematical skills test, (4) wanted to be involved from the beginning to the end of the research, and (5) communicated well and had high loyalty during the research.

The researchers collected the data through participatory observations, interviews, and documentation. The activities were conducted simultaneously so that the data collected could provide accurate information (Sugiyono, 2021). Then, the data collection procedures can be described as follows: (1) constructing research instruments, (2) validating the research instruments, (3) administrating the instruments in the field, (4) conducting mathematical skills tests, and (5) mathematical literacy tests, (6) interviewing the subjects, and (7) documenting and (8) writing reports.

The researchers analyzed the data using the Miles and Huberman model, namely (1) data collection done by collecting the data through mathematical skills test, literacy test, and interview; (2) data reduction done after examining the results of the mathematical skills test and literacy test; (3) data display by interpreting the data to narrative text and Microsoft Excel to create graphic images; (4) conclusion done to answer the purpose of the research based on data obtained through mathematical literacy test and interview (Sugiyono, 2021). The detail of the research flow can be described through the flowchart shown in Figure 1.

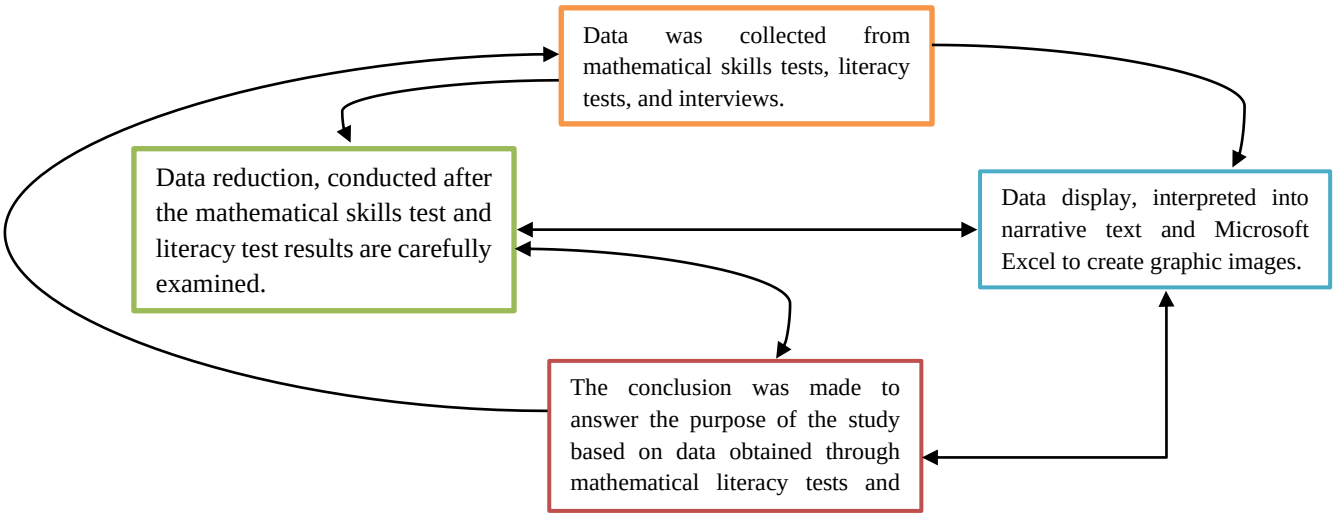

Figure 1. Flowchart of Research

Research instruments consist of primary and secondary instruments. The primary instruments are researchers. While for secondary instruments, use a mathematical literacy test and interview guidelines. The mathematical skills test consists of 10 (ten) multiple-choice questions and 5 (five) essay questions using cognitive levels of C_1-C_3. This test is used to classify students' mathematical skills levels based on modified categories of Rizqiani & Hayuhantika (2019), i.e. (1) a grade range between 80 to 100 belongs to the category of high mathematical skills, a range of grades between 65 to 79 belongs to the medium category mathematical skills. Grades less than 65 belong to the low mathematical skills category. Then, the mathematical literacy test problems consist of 4 (four) modified essay questions from Genta (2020) using the cognitive level of C_4-C_6. The materials used in each test are integers, sets, algebraic forms, equations & linear inequalities of one variable. Furthermore, Manoy & Purbaningrum (2021) stated that interviews are conducted individually and alternately to obtain accurate information about the results of student work. In addition, research instruments have been validated by 2 (two) lecturers in mathematics education and 1 (one) mathematics teacher.

After knowing the mathematical literacy test, then we can describe the mathematical literacy indicators based on the OECD (2015) shown in Table 1.

Table 1. Indicators of Mathematical Literacy

Stages of Mathematical Process	Indicators of Mathematical Literacy
Formulating the Problem (FP)	- Simplifying real situations by interpreting problems according to a proper understanding. - Think of an initial idea to solve the problem. - Formulate problems that are given to mathematical models.
Applying the Concepts (AC)	- Design a problem-solving strategy directly. - Use mathematical concepts, facts, procedures, and reasoning. - Solve the problem correctly.
Interpreting the Result (ISR)	- Interpret the results of the solution in an authentic context. - Conclude the most appropriate problem-solving outcome.

Based on mathematical literacy indicators in Table 1, then we can create a category of mathematical literacy based on the categorization of Manoy & Purbaningrum (2021) will be shown in Table 2.

Table 2. Category of Mathematical Literacy

Category	Indicators
Good	Fluently answering questions, appropriate calculations, and developing ideas are optimal.
Moderate	Fluently answering questions, making appropriate calculations, and developing ideas are not optimal.
Bad	Fluently answering questions, improper calculations, and developing ideas is not optimal.

RESULTS AND DISCUSSION

The researchers used three instruments: mathematics skills tests, literacy tests, and interviews. After analyzing the results of the mathematics skills test, we can classify student's mathematical skills to three categories based on modifications from Rizqiani & Hayuhantika (2019), i.e., (1) a grade range between 80 to 100 belongs to the category of high mathematical skills, a range of grades between 65 to 79 belonging to the category of medium mathematical skills, and grades less than 65 belong to the category of low mathematical skills. For more information, see Figure 2.

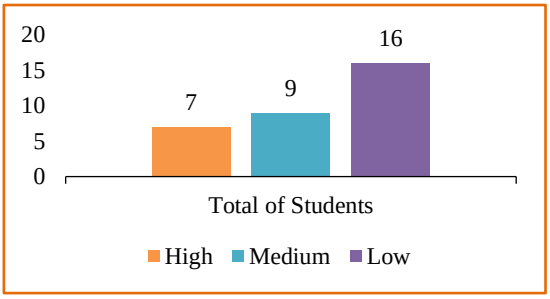

Diagram 1. Result of Mathematical Skills Test

Based on Figure 2, students with high mathematics skills category as many as 7 (seven) students, students with medium mathematics skills category as many as 9 (nine) students, and students with low mathematics skills category as many as 16 students. This happens because the government in Indonesia has set out to open schools but by doing limited face-to-face learning to prevent the spread of COVID-19 in the school environment (Onde et al., 2021). According to Setyaningsih & Ekayanti (2019), one of the main factors of low student mathematics skills is the skills to operate mathematical calculations so that students find it challenging to solve a given problem. Therefore, students with low mathematics skills categories became the most participants in this test. Jailani & Wulandari (2017) show that 48% of students are categorized as students with low mathematical skills. So, this test is taken through 2 (two) sessions in class VII-6, with each session being 16 students.

Referring to Figure 2, the researchers selected 7 (seven) students with high-level mathematics skills. After 7 (seven) students took the mathematical literacy test, the researcher selected 4 (four) students as a research subject through 5 (five) specific things that have been set.

After the test is conducted, the researcher analyzes the mathematical literacy test and interviews to validate the required data. Based on the results of the mathematical literacy test, 4 (four) selected students are given the codes MLS1, MLS2, MLS3, and MLS4, which will be explained in full through the results of the interview analysis below:

Mathematical Literacy of Subject 1 (MLS1)

The work result of MLS1 is illustrated in Figure 3.

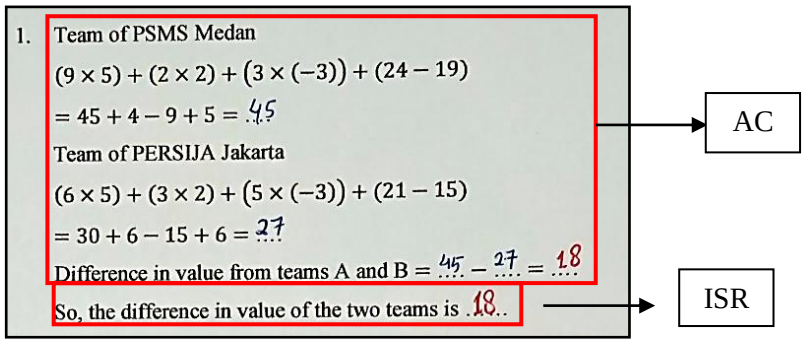

Figure 2. Work Result of MLS1 in Question Number 1

When formulating the problem (FP), subject MLS1 can understand the problem by mentioning the known and asking about the issue (Muzaki & Masjudin, 2019). However, to find such information must be dug deeper. In addition, subject MLS1 can precisely formulate problems to mathematical models (Ulfah et al., 2020). Thus, subject MLS1 belongs to the good category because he/she can satisfy three indicators of mathematical literacy. This is confirmed from the interview excerpt below:

R : What do you know about this problem?
MLS1 : Average score of each team.
R : Are you sure? Here we look for the difference in value instead of the average score.
MLS1 : No, it's wrong.
R : So, what's the truth?
MLS1 : Each team values winning, series, losing, and entering goals by conceding goals. Then, the team's score of wins, series, and losses.
R : Good. Besides, what do you ask about this problem?
MLS1 : Difference in value and calculates the number of values of both teams.
R : Good. Can you formulate the problem to a mathematical model?
MLS1 : I can. The scores of the winning, series and losing teams are multiplied by determining the values that win, series, and lose. Then, reduce the score of entering the goal by conceding a goal. After getting the answer, then sum it all up. The same goes for getting results on the next team.
R : Excellent.

Next is the stage of applying the concept (AC). Subject MLS1 can design problem-solving strategies and use mathematical concepts precisely so that the subject MLS1 can take steps to solve problems correctly (Santoso & Setyaningsih, 2020). In addition, subject MLS1 has no difficulty because it has thoroughly understood the problem's context (Manoy & Purbaningrum,

2021). Thus, subject MLS1 at this stage belongs to the good category. This is confirmed from the interview excerpt below:

R : What strategies do you use to solve this problem?
MLS1: Strategies to understand issues, calculate the amount of value between the two teams, and analyze the difference in weight.
R : What formula do you use to solve this problem?
MLS1 : Multiplication, subtraction, and addition.
R : Do you explain the steps you take to solve the problem?
MLS1 : Understand the problem first. Just start to arrange which values of each team. Then, to calculate the number of deals, I have to multiply the value of the team wins, series, and loses by the team's score that succeeds, series, and fails. Then, less include a lot of goals by conceding goals. After getting the results, less the PSMS Medan value with PERSIJA Jakarta. Then came the difference in value between the two teams.
R : Good answer.

Finally, in the stage of interpreting settlement results (ISR), subject MLS1 can interpret the results of the solution in a real context and conclude the problem correctly (Prabawati, 2018). Thus, subject MLS1 can satisfy this stage with a good category. This is confirmed from the interview excerpt below:

R : Is the calculation you doing right? Try checking back!
MLS1 : Already.
R : What can you conclude from this problem?
MLS1 : Looking for the difference in value between the two teams.
R : Good.

Mathematical Literacy of Subject 2 (MLS2)

The work result of MLS1 is illustrated in Figure 4.

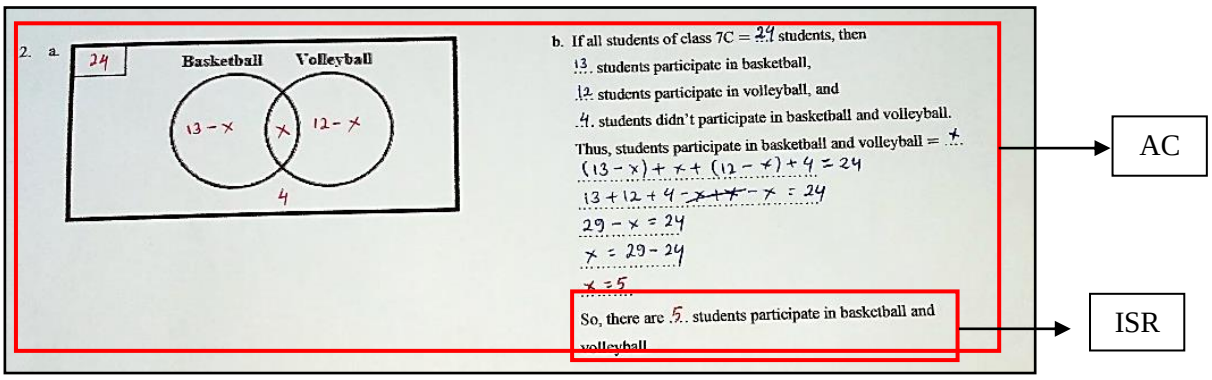

Figure 3. Work Result of MLS2 in Question Number 2

When formulating a problem (FP), subject MLS2 can mention what is known and ask about the problem completely and correctly (Santoso & Setyaningsih, 2020). Furthermore, subject MLS2 cannot formulate problems to mathematical models precisely because he/she won't understand the intent of the problem well, making it difficult to simplify the problem (Fointuna et al., 2020).

Thus, subject MLS2 belongs to the moderate category because he/she can only satisfy two of the three indicators of mathematical literacy. This is confirmed from the interview excerpt below:

R : What is known about the problem?
MLS2 : Class 7C consists of 24 students, with 13 students participate in basketball, 12 students participate in volleyball, and four students not participate in basketball and volleyball.
R : What is asked of the question?
MLS2 : Create a Venn diagram and count the number of students who participate in basketball and volleyball.
R : True. Can you formulate problems to mathematical models?
MLS2 : I don't know.

Then, at the stage of applying the concept (AC). Subject MLS2 can design problem-solving strategies precisely, use mathematical concepts precisely, and solve problems with the right calculations to connect the context of the problem with real-life (Samsul & Djafar, 2018). Thus, subject MLS2 belongs to the good category because he/she can satisfy three indicators of mathematical literacy. This is confirmed from the interview excerpt below:

R : What strategies do you use to solve this problem?
MLS2 : Quick and precise thinking strategy.
R : What formula do you use to solve this problem?
MLS2 : The formula looks for the value of slices in the set.
R : After getting the formula, what is the next step you take?
MLS2 : Create a Venn diagram and look for the number of students who play basketball and volleyball.
R : Try to explain the steps you took to solve the problem?
MLS2 : For the first question, I drew a Venn diagram by observing and understanding the given problem. Next, for the second question, I reduced the total of class 7C with the variables on the Venn diagram. I found the number of students who participated in basketball and volleyball, namely set slices.
R : Good, proper problem-solving.

Finally, when interpreting the completion result (ISR), subject MLS2 can interpret the results of solutions there is real context and conclude the problem-solving results appropriately (Santoso & Setyaningsih, 2020). Thus, subject MLS2 belongs to the good category because he/she can satisfy two indicators of mathematical literacy. This is confirmed from the interview excerpt below:

R : Is the calculation you doing right? Try checking back!
MLS2: Yes, it's right to do the calculations.
R : What can you conclude from that?
MLS2 : Five students participating in basketball and volleyball is five students.
R : Good answer.

Mathematical Literacy of Subject 3 (MLS3)

The work result of MLS1 is illustrated in Figure 5.

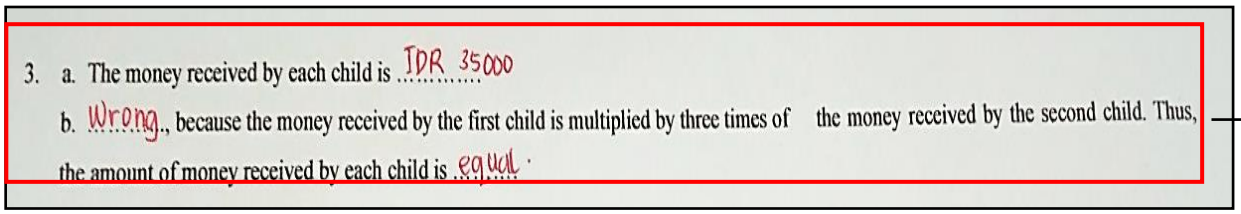

Figure 4. Work Result of MLS3 in Question Number 3

When formulating the problem (FP), subject MLS3 cannot mention what is known about the problem, but this subject can precisely mention what is asked in the question. In addition, subject MLS3 cannot formulate problems to mathematical models because he/she does not understand these instructions (Hasanah & Rakhmawati, 2018). Thus, subject MLS3 belongs to the bad category because he/she can only satisfy one of the three indicators of mathematical literacy. This is confirmed from the interview excerpt below:

R : What is known about the problem?
MLS3 : Mr. Faiz has IDR 105000 which will be shared with his three children.
R : Not exactly. Moreover?
MLS3 : I don't know, I don't understand.
R : What is asked of the question?
MLS3 : What amount of money does each of Mr. Faiz's children receive, and is the difference in money that the first child receives from the third child greater than the amount of money the second child receives? Explain your answer!
R : Good. Can you formulate problems to mathematical models?
MLS3 : No, I don't understand.

Then, at the stage of applying the concept (AC). Subject MLS3 cannot design problem-solving strategies, use mathematical concepts, and solve problems precisely because students cannot yet understand the intent of the problem (Bete, 2019). Thus, subject MLS3 belongs to the bad category because he/she cannot satisfy the three indicators of mathematical literacy. This is confirmed from the interview excerpt below:

R : What strategies do you use to solve this problem?
MLS3 : Strategy to get the formula first.
R : Besides, is there more?
MLS3 : Don't know.
R : What formula do you use to solve this problem?
MLS3 : Division formula.
R : Not exactly. Besides, is there more?
MLS3 : Don't know.
R : After getting the formula, what is the next step you take?
MLS3 : Looking for the money received by each of Mr. Faiz's children.
Q : Try to explain the steps you took to solve the problem?
MLS3 : For the first question, I divide IDR 105000 by 3, then the result is IDR 35000. So, each child receives IDR 35000. Furthermore, in the second question, I

answered wrong because the amount of money received by each child is the same, which is IDR 35000.

R : Good understanding of this problem, but your calculations are wrong.

Finally, when interpreting the completion result (ISR), subject MLS3 cannot interpret the results of the solution in a real context and conclude the outcome of the problem resolution appropriately (Fointuna et al., 2020). According to Ahyan et al. (2019), most students have difficulty interpreting, applying, and evaluating completion outcomes, as they are the highest skills in Bloom's taxonomy. Thus, subject MLS3 belongs to the bad category because he/she cannot satisfy two indicators of mathematical literacy. This is confirmed from the interview excerpt below:

R : Is the calculation you doing right? Try checking back!

MLS3 : My calculations are not correct.

R : What can you conclude from that?

MLS3 : For the first question, the answer is IDR 35000 money received by each child. Furthermore, on the second question, I answered incorrectly because the money received by each child is equal.

R : Both of your answers are wrong. Try to correct your answers again.

Mathematical Literacy of Subject 4 (MLS4)

The work result of MLS1 is illustrated in Figure 6.

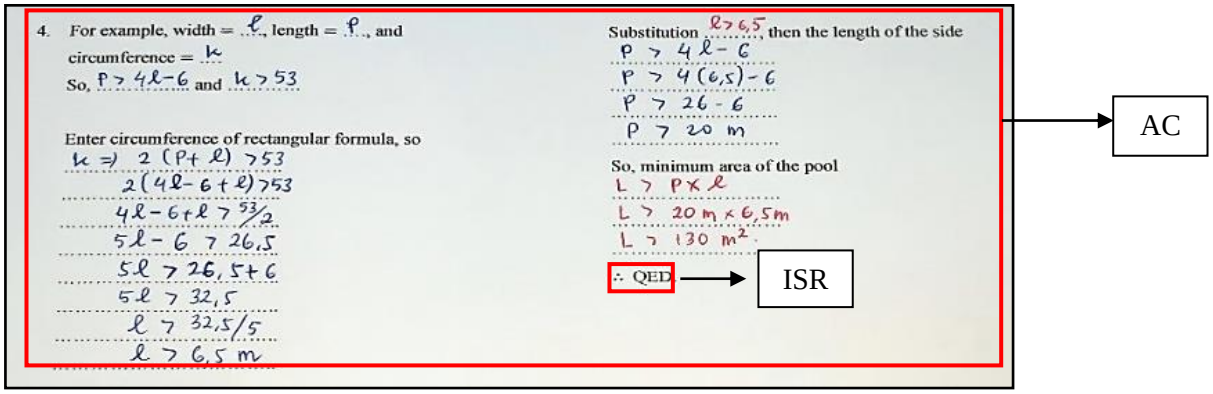

Figure 5. Work Result of MLS4 in Question Number 4

When formulating the problem (FP), subject MLS4 cannot mention what is known in the problem completely, but this subject can mention what is asked in the question precisely. In addition, subject MLS4 can formulate problems to a complete mathematical model to communicate the required problems (Prabawati, 2018). Thus, subject MLS4 belongs to the moderate category because he/she can only satisfy two of the three indicators of mathematical literacy. This is confirmed from the interview excerpt below:

R : What do you know about this problem?

MLS4 : The circumference of the pool is larger than 53 m.

R : Not exactly. Besides, Is there more?

MLS4 : No, I didn't find it.

R : What is asked of the question?

MLS4 : Looking for evidence of a minimum area of a swimming pool larger than 130 m^2.
R : Exactly. Can you formulate problems to mathematical models? If so, let's explain!
MLS4 : I can. Suppose, width= l; length= $4l - 6$; and circumference> 53.
R : Good answer.

Then, at the stage of applying the concept (AC). Subject MLS4 can design problem-solving strategies in a sequence, use mathematical concepts precisely, and solve problems with the right calculations (Manoy & Purbaningrum, 2021). Thus, subject MLS4 belongs to the good category because he/she can satisfy three indicators of mathematical literacy. This is confirmed from the interview excerpt below:

Q : What strategies do you use to solve this problem?
MLS4 : First, I look at the problem. Second, I look for problems with the problem. Third, I solved the problem given.
R : Good. Furthermore, what formula do you use to solve the problem?
MLS4 : Search for rectangular circumference and rectangular area.
Q : After getting the formula, what is the next step you take?
MLS4 : I immediately solved the problem.
R : Try to explain what steps you take to prove the minimum area of the pool!
MLS4 : In the first step, I formulated the problem to a mathematical model. After that, I entered the rectangular circumference formula. Then, look for the value of the length and width of the rectangle. Finally, I entered the rectangular area formula to get the minimum area of the swimming pool.
R : Good, you answered sequentially and completely.

Finally, at the stage of interpreting the completion result (ISR), subject MLS4 can interpret the solution results in a real context and conclude the problem using logical language (Ovan et al., 2018). Thus, subject MLS4 belongs to the good category because he/she can satisfy two indicators of mathematical literacy. This is confirmed from the interview excerpt below:

R : Is the calculation you doing right? Try checking back!
MLS4 : It's right.
R : What can you conclude from that?
MLS4 : The conclusion is to find proof that the minimum area of the swimming pool is greater than 130m^2.
R : Good answer.

A summary of students' mathematical literacy test results of junior high school in Kotapinang in solving HOTS problems applied to the curriculum 2013 shows in Table 3.

Table 3. Mathematical Literacy Skills Analysis of the MLS1, MLS2, MLS3, MLS4

Stage of the Mathematical Process	Category of Mathematical Literacy							
	MLS1				MLS2			
	1	2	3	4	1	2	3	4
Formulating the Problem (FP)	Good	Good	Bad	Good	Good	Moderate	Moderate	Bad
Applying the Concepts (AC)	Good	Good	Bad	Moderate	Moderate	Good	Bad	Bad
Interpreting Settlement Results (ISR)	Good	Good	Bad	Bad	Bad	Good	Bad	Bad
Stage of the Mathematical Process	Category of Mathematical Literacy							
	MLS3				MLS4			
	1	2	3	4	1	2	3	4
Formulating the Problem (FP)	Bad	Bad	Bad	Bad	Bad	Moderate	Bad	Moderate
Applying the Concepts (AC)	Bad	Bad	Bad	Bad	Bad	Good	Bad	Good
Interpreting Settlement Results (ISR)	Bad	Bad	Bad	Bad	Bad	Good	Bad	Good

When formulating the problem (FP), subject MLS1 can mention what is known and asked in questions number 1, 2, and 4 correctly and completely (Muzaki & Masjudin, 2019). However, subject MLS1 cannot mention what is known and asked in question number 3 completely. Furthermore, subject MLS1 can formulate problems to mathematical models on questions number 1, 2, and 4 precisely (Manoy & Purbaningrum, 2021). However, subject MLS 1 cannot formulate the problem to the mathematical model on problem number 3 precisely because he/she cannot understand the instructions of the problem well (Hapsari, 2019). Thus, questions number 1, 2, and 4 belong to the category both because he/she can satisfy three indicators of mathematical literacy. However, problem number 3 belongs to the bad category because he/she cannot satisfy three indicators of mathematical literacy.

According to Wati et al. (2019), subject MLS2 has not been able to identify known variables and is asked questions. Furthermore, subject MLS2 can mention what is known and asked in questions number 1, 2, and 3 completely. However, subject MLS2 cannot mention what is known and asked in question number 4 precisely because he/she has difficulty understanding the problem. In addition, subject MSL2 can precisely formulate problems to mathematical models on problem number 1, but subject MLS2 cannot formulate problems to mathematical models on questions 2, 3, and 4. According to Hasanah & Rakhmawati (2018), the main cause of this problem is the student's error in understanding the given problem. Therefore, question number 1 belongs to the good category because he/she can satisfy three indicators of mathematical literacy. Next, questions number 2 and 3 belong to the moderate category because subject MLS2 satisfies two of the three indicators of mathematical literacy. Then, problem number 4 belongs to the bad category because he/she cannot satisfy three indicators of mathematical literacy.

Then, subject MLS3 cannot mention anything known on all four questions completely and concisely. Furthermore, subject MLS3 can mention exactly what is asked in questions 1 and 3, but this subject cannot mention what is asked in questions number 2 and 4 exactly. In addition,

the subject MLS3 cannot formulate the problem to mathematical models on all four problems precisely since the arguments used do not correspond to the mathematical results obtained (Kurniawati & Mahmudi, 2019). Thus, the four questions belong to the bad category because he/she cannot satisfy three indicators of mathematical literacy.

Finally, subject MLS4 cannot mention what is known and asked in questions number 1 and 3 correctly and completely (Manoy & Purbaningrum, 2021). And in question number 2, subject MLS4 can mention anything known and ask about the question correctly and completely. Furthermore, subject MLS4 cannot mention what is known in question number 4 completely, but he/she can mention what is asked in the question precisely. In addition, subject MLS4 cannot formulate problems to mathematical models on questions number 1 and 2 precisely. However, the subject can precisely formulate problems to mathematical models on questions number 3 and 4 (Rifai & Wutsqa, 2017). Thus, problem number 1 belongs to the bad category because he/she cannot satisfy the three indicators of mathematical literacy. In contrast to number 3, subject MLS4 belongs to the bad category because he/she can only satisfy one of the three indicators of mathematical literacy. After that, questions number 2 and 4 belong to the moderate category because he/she can only satisfy two of the three indicators of mathematical literacy.

At the stage of applying the concept (AC), subject MLS1 can design problem-solving strategies, use mathematical concepts, and solve problems in questions number 1 and 2 appropriately (Ovan et al., 2018). Then, the subject MLS1 can design a problem-solving strategy and precisely use the mathematical concept of the number 4. Still, he/she cannot solve the problem precisely because the calculations it does are wrong (Hapsari, 2019). Furthermore, subject MLS1 cannot design problem-solving strategies, use mathematical concepts, and solve problem number 3 appropriately. Thus, questions number 1 and 2 belongs to the category of good because he/she can satisfy three indicators of mathematical literacy. However, problem number 3 belongs to the bad category because he/she cannot satisfy three indicators of mathematical literacy. Furthermore, problem number 4 belongs to the moderate category because he/she can only satisfy two of the three indicators of mathematical literacy.

Furthermore, subject MLS2 can design problem-solving strategies, use mathematical concepts, and solve problems on problem number 2 appropriately. Please note that subject MLS2 admitted to choosing other alternative solutions that he thought were easier without having to follow standard algorithms or procedural methods (Setyaningsih & Ekayanti, 2019). For problem number 1, subject MLS2 can design a problem-solving strategy and use mathematical concepts precisely. Still, it cannot solve the problem precisely because he/she is less thorough in determining the problem's solution, so the calculation is wrong (Rifai & Wutsqa, 2017). Furthermore, in questions 3 and 4, subject MLS2 cannot design problem-solving strategies, use mathematical concepts, and solve problems precisely. According to Abdullah et al. (2015), subject MSL2 has difficulty connecting information and implementing strategies to solve problems using higher-order thinking (HOTS). Thus, problem number 2 belongs to the good category because subject MLS2 can satisfy three indicators of mathematical literacy. Next, problem number 1 belongs to the moderate category because he/she can only satisfy two of the three indicators of mathematical literacy. Then, questions number 3 and 4 belong to the bad category because he/she cannot satisfy three indicators of mathematical literacy.

Then, subject MLS3 cannot design problem-solving strategies, use mathematical concepts, and solve problems on all four problems precisely. According to Fointuna et al. (2020), the stage

of using mathematical concepts, facts, procedures, and reasoning belongs to the low category. Therefore, the four questions belong to the bad category because he/she cannot satisfy the three indicators of mathematical literacy.

Finally, subject MLS4 can design problem-solving strategies, use mathematical concepts, and solve problems on questions number 2 and 4 appropriately. In applying mathematical concepts at number 2, subject MLS4 also admitted to choosing other alternative solutions that he thought were easier without having to follow standard algorithms or procedural methods (Setyaningsih & Ekayanti, 2019). The interview results stated that subject MLS4 used this method to save time in solving problems, which proved effective in its application. Furthermore, for problem number 1, subject MLS4 can design problem-solving strategies precisely but cannot use mathematical concepts and solve problems precisely. According to Bete (2019), subject MLS4 doesn't understand the material and lacks thoroughness in solving problems resulting in students making mistakes.

Furthermore, problem number 3, subject MLS4, cannot design problem-solving strategies, use mathematical concepts, and solve problems appropriately because this problem is a problem with a cognitive level of evaluating (C_5), which is a high-level of cognitive level in Bloom taxonomy, so subject MLS4 cannot solve the problem precisely. This is in line with the research of Rahayuningsih & Jayanti (2019) stated that the evaluating aspect (C_5) has the lowest value or score than other indicators, such as analyzing (C_4), which has the highest value because it is the aspect with the lowest level of HOTS skills. Thus, questions number 2 and 4 belong to the good category because he/she can satisfy three indicators of mathematical literacy. Furthermore, problem number 1 belongs to the bad category because he/she can only satisfy one of the three indicators of mathematical literacy. Still, problem number 3 belongs to the bad category because he/she cannot satisfy three indicators of mathematical literacy.

When interpreting the completion result (ISR), subject MLS1 can interpret the settlement results in real context and conclude the problem-solving results appropriately at numbers 1 and 2. This is in line with Dewantara et al. (2015) stated that students could interpret the results of the solution well through the mathematical calculations they do by thinking the solution back to the context of the problem. However, subject MLS1 cannot interpret the outcome of the solution in a real context and conclude the results of solving the problem on questions number 3 and 4 precisely (Rifai & Wutsqa, 2017). Thus, questions number 1 and 2 belongs to the category of good because he/she can satisfy two indicators of mathematical literacy. However, questions number 3 and 4 belong to the bad category because he/she cannot satisfy two indicators of mathematical literacy.

Furthermore, subject MLS2 can interpret the results of the solution in a real context and conclude the result of solving the problem in question number 2 (Lailiyah, 2017). However, subject MLS2 cannot interpret the results of the solution in a real context and conclude the results of solving the problem on questions number 1, 3, and 4. Thus, problem number 2 belongs to the good category because he/she can satisfy two indicators of mathematical literacy. However, questions 1, 3, and 4 belong to the bad category because he/she cannot satisfy two indicators of mathematical literacy. According to Wati et al. (2019), subject MSL2 hasn't been maximal in applying this stage because he/she did not reinforce the results of his calculations.

Then, subject MLS3 cannot interpret the settlement results in a real context and conclude the results of solving the problem on all four problems appropriately because he feels confused

in making decisions (Santoso & Setyaningsih, 2020). Therefore, the four questions belong to the bad category because he/she cannot satisfy two indicators of mathematical literacy.

Finally, subject MLS4 can interpret the solution results in a real context and conclude the results of solving the problem in questions 2 and 4 appropriately. According to Muzaki & Masjudin (2019), subject MLS4 can provide simple and clear conclusions. However, subject MLS4 cannot interpret the solution results in a real context and conclude the results of solving the problem on questions number 1 and 3. According to Putra et al. (2016), the error of subject MLS4 is that it cannot develop mathematical communication in interpreting problem solving, so it is constrained in making conclusions. Thus, questions number 2 and 4 belongs to the category of good because he/she can satisfy two indicators of mathematical literacy. However, questions number 1 and 3 belong to the bad category because he/she cannot satisfy two indicators of mathematical literacy.

Based on the analysis results above, information was obtained that students' mathematical literacy skills in junior high school in Kotapinang in solving HOTS problems applied to the curriculum 2013 were included in the bad category. This is confirmed through Table 3. which states the categorization of mathematical literacy on subjects MLS1, MLS2, MLS3, and MLS4 against 4 (four) essay questions given, namely: 1) subject MLS1 gets four bad categories, one category is moderate, and seven categories are good; (2) subject MLS2 get six bad categories, three moderate categories, and three good categories; (3) subject MLS3 get twelve bad categories, in the absence of moderate and good category; and (4) subject MLS4 get six bad categories, two moderate categories, and four good categories.

This finding is in line with Fointuna et al. (2020) and Ahyan et al. (2019) stated that students' mathematical literacy skills at the junior high school level are generally low. The interview results showed that students had not been able to solve the problem using high-level reasoning. This is in line with Santoso & Setyaningsih (2020) research, which states that students still do not have a good understanding of answering HOTS-oriented questions because students are not used to answering questions using high-level reasoning. In addition, students lack an understanding of mathematical literacy and explore experience in solving problems that require high-level reasoning (Manoy & Purbaningrum, 2021).

CONCLUSIONS

From the results and discussion above, it was concluded that the mathematical literacy skills of junior high school students in Kotapinang in solving HOTS problems applied to the curriculum 2013 belong to the poor category. Three out of four subjects stated that the total of bad categories at three stages of the mathematical process tended to be more numerous than in other categories.

For further research, we recommend applying technology-based learning models, such as blended learning, suitable for the limited face-to-face learning process that has now been applied to educational institutions, ranging from elementary school, junior high school, and senior high school to college. Thus, it can support the improvement of students' mathematical literacy skills in solving HOTS problems applied to the curriculum 2013.

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AUTHOR CONTRIBUTIONS STATEMENT

The first author is a researcher who plays a role in preparing ideas, choosing research topics, compiling learning tools, determining research locations, processing research data, and compiling articles. Meanwhile, the second researcher acts as a field guidance lecturer and is tasked with guiding the first author from the beginning to the end of the study.

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